Cambridge Assessment International Education

Cambridge IGCSE™

MATHEMATICS **0580/41**

Paper 4 (Extended) **May/June 2023**

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the May/June 2023 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

[Turn over

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

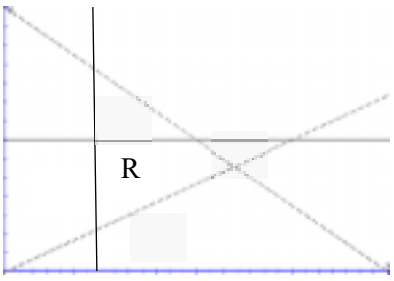
cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

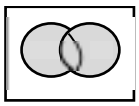
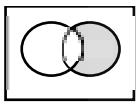
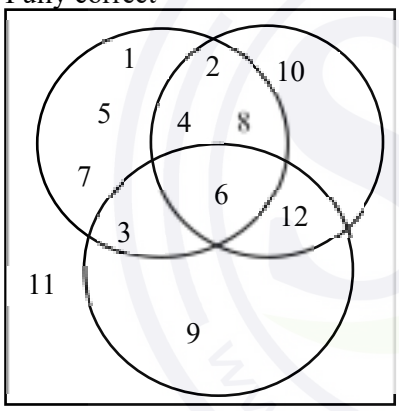
Question	Answer	Marks	Partial Marks
1(a)(i)	600	**2**	**M1** for $\frac{1250}{12+9+4}\times k$ where k = 1, 4, 9, 12 oe
1(a)(ii)	80	**2**	**M1** for 1250 × 64 [÷ 1000]
1(a)(iii)	60	**2**	**M1** for $x\times\left(1-\frac{10}{100}\right)=54$ oe
1(a)(iv)	1000	**2**	**M1** for 1250 – (1250 ÷ 5) oe or **B1** for 250
1(b)(i)	3.52	**2**	**M1** for [10 –] 12 × 0.54 or **B1** for 6.48
1(b)(ii)	0.08	**3**	**B2** for 0.077[4...] or **M1** for 0.51 ÷ 0.826 If 0 or 1 scored award instead **SC2** for 0.93 final answer OR If 0 scored **SC1** for 0.06 as answer
2(a)	[sin =] $\frac{145}{\frac{1}{2}\times 6.4\times 5.7\times 15}$	**M2**	**M1** for 145 = $\frac{1}{2}\times 6.4\times 5.7\times\sin x\times 15$ oe or for $\frac{1}{2}\times 6.4\times h\times 15=145$ and $\sin x=\frac{h}{5.7}$
	32.0[0]	**A1**	If M0, **SC1** for 145 = $0.5\times 6.4\times 5.7\times sin32\times 15$ oe
2(b)	3.4[0] or 3.402 to 3.403 nfww	**3**	**M2** for $\sqrt{6.4^2+5.7^2-2\times 6.4\times 5.7\times\cos(32)}$ OR **M1** for $6.4^2+5.7^2-2\times 6.4\times 5.7\times\cos(32)$ **A1** for 11.6 or 11.57 to 11.58
2(c)	3.02 or 3.020 to 3.021	**3**	**M2** for $\sin(32)=\frac{x}{5.7}$ $\sqrt{80^2+50^2-2\times 80\times 50\times\cos 75}$ or **M1** for recognition that the line from E is perpendicular to AB e.g. right angle seen or $\frac{1}{2}\times 6.4\times h$

Question	Answer	Marks	Partial Marks
2(d)	10.8 or 10.9 or 10.84 to 10.85...	**4**	**M3** for [sin =] $\frac{their\,(c)}{\sqrt{15^2+5.7^2}}$ or $\left[\tan =\right]\frac{their\,(c)}{\sqrt{\left(5.7\times cos32\right)^2+15^2}}$ or **M2** for $15^2+5.7^2$ or $\left(5.7\times\cos 32\right)^2+15^2$ oe or **M1** for recognition of correct angle
2(e)	136 or 136.0...	**3**	**M2** for $938\times145\times\frac{1000}{1000000}$ oe or **M1** for figs 136 or 13601
3(a)(i)	55.87	**4**	**M1** for midpoints soi **M1** for use of $\sum fm$ where m is in the correct interval including boundaries **M1** (dep on 2nd M1) for $\sum fm \div 1000$
3(a)(ii)	$\frac{177}{500}$ cao	**2**	**M1** for $\frac{154+200}{1000}$ oe
3(b)(i)	25000	**1**	
3(b)(ii)	2.473×10^4	**1**	
3(c)(i)	166 650 or 165816 nfww	**3**	**M2** for (500 + 5) × '320 to 340' or '500 to 510' × (320 + 10) or **M1** for 500 − 5 or 500 + 5 or 320 −10 or 320 +10 Alternative method **M2** for 504 × '320 to 340' or '500 to 510' × 329 or **M1** for 504 or 329
3(c)(ii)	285 or 286 nfww	**2**	**M1** for 800 −10
4(a)(i)	96	**2**	**M1** for $\frac{1}{2}\times24\times8$
4(a)(ii)	18.4 or 18.43...	**2**	**M1** for $\tan\left[x\right]=\frac{8}{24}$ oe

Question	Answer	Marks	Partial Marks
4(b)	622 or 622.0 to 622.1....	**2**	**M1** for $[\frac{1}{2}\times]\ \pi\times 6^2\times 11$ or $\frac{1}{2}\times\pi\times 6^2[\times 11]$
4(c)(i)	246 or 246.2 to 246.3...	**5**	**M4** for $15\times 20-4\times 4-\frac{270}{360}\times\pi\times 4^2$ oe OR **M2** for $\frac{270}{360}\times\pi\times 4^2$ oe or **M1** for $k\times\pi\times 4^2$, where $k\leq 1$ **M1** for 15×20 or 4×4 oe
4(c)(ii)	80.8 or 80.9 or 80.84 to 80.85...	**3**	**M1** for $15+20+11+16$ oe **M1** for $\frac{3}{4}\times 2\times\pi\times 4$ oe
5(a)(i)(a)	25	**1**	
5(a)(i)(b)	17 to 18	**1**	
5(a)(i)(c)	12	**2**	**B1** for 148 seen
5(a)(i)(d)	30	**2**	**B1** for 104 seen
5(a)(ii)(a)	correct diagram or correct for *their* median and LQ	**3**	**B1** for whiskers at 1 **and** at 70 **B1** for with median **and** LQ at *their* **(a)(i)(a)** and **(a)(i)(b)** **B1** for UQ at 34 Maximum 2 marks if diagram incorrect If 0 scored **SC1** for *their* 5 correct ages plotted
5(a)(ii)(b)	50	**1**	
5(b)	correct histogram	**3**	**B1** for each correct block width 10 height 3.7 width 20 height 1.2 width 30 height 2 If 0 scored **SC1** for correct frequency densities 3.7, 1.2, 2 oe

Question	Answer	Marks	Partial Marks
6(a)	(5, 2) (2, − 2)	**4**	**B3** for 3 correct values or answers for *C* and *D* reversed or correct coordinates given on diagram wrongly labelled or **B2** for one correct coordinate pair correctly labelled or **M2** for *A*,*B*,*C* and *D* correctly plotted or **M1** for *A* and *B* correctly plotted If 0 or 1 scored instead award **SC2** for answers (–3, 8) and (–6, 4) or answers (1.5,1.5) and (–2.5, 4.5)
6(b)(i)	(2.5, 3.5) oe	**2**	**B1** for each
6(b)(ii)	7.07 or 7.071...	**3**	**M2** for $(6--1)^2+(4-3)^2$ oe or **M1** for $(6--1)$ or $(4-3)$ oe
6(b)(iii)	$\frac{1}{7}$	**2**	**M1** for $\frac{4-3}{6--1}$ oe
6(b)(iv)	$y=\frac{1}{7}x-\frac{2}{7}$ or $7y=x-2$ oe final answer	**3**	**M1** for gradient = *their* **(iii)** **M1dep** for substituting (2, 0) in a linear equation with their *m* allow if (2,0) satisfies y=(*their***(b)(iii)** gradient)*x*+c
7(a)(i)	$3(3y-1)(3y+1)$ final answer	**3**	**B2** for $(9y-3)(3y+1)$ or $(3y-1)(9y+3)$ or or **M1** for $3(9y^2-1)$ or [...]$(3y-1)(3y+1)$ if 0 scored **SC1** for an otherwise correctly completely factorised expression but with fractions within the brackets
7(a)(ii)	$(2-p)(m+k)$ final answer	**2**	**M1** for $2(m+k)-p(m+k)$ or $m(2-p)+k(2-p)$
7(b)	$-\frac{1}{2}$ oe nfww	**5**	**B4** $-8x=+4$ oe nfww or **B3** for $\frac{x^2-8x-5}{(x-1)(x+1)}=1$ or better OR **B2** x^2-8x-5 or **M1** for $(x-1)(x-1)-6(x+1)$ or better **B1** $(x-1)(x+1)$ as full denominator or on the right hand side

Question	Answer	Marks	Partial Marks
7(c)	$\frac{-(-3)\pm\sqrt{(-3)^2-4(4)(-2)}}{2\times 4}$ oe or $\frac{3}{8}\pm\sqrt{\left(\frac{3}{8}\right)^2+\frac{2}{4}}$ oe	**M2**	**M1** for $\sqrt{(-3)^2-4(4)(-2)}$ or for $\frac{-(-3)+\sqrt{q}}{2(4)}$ or $\frac{-(-3)-\sqrt{q}}{2(4)}$ or for [4]$\left(x-\frac{3}{8}\right)^2$
	−0.43 and 1.18 final ans cao	**A2**	**B1** for each **SC1** for −0.4 ,–0.42 or −0.425.... and 1.2 or 1.17 or 1.175.... or answers 0.43 and –1.18 or −0.43 and 1.18 seen in working
7(d)	$k=\frac{4m}{1-pm}$ or $k=\frac{-4m}{pm-1}$ final answer	**4**	**M1** for clearing fractions **M1** for collecting terms in k **M1** for factorising **M1** for dividing by bracket Maximum 3 marks if answer incorrect
8(a)	$y\leqslant 7$ oe $x+y<14$ oe $y>\frac{2}{3}x$ oe	**3**	**B1** for each
8(b)	$x=4$ solid $y=7$ solid $x+y=14$ dashed $y=\frac{2}{3}x$ dashed	**M4**	**B1** for each
	correct shading everywhere but region R 	**A2**	**M1dep** (dependent on M4 or B1B1B1B0 where the only error is wrong use of solid/dashed lines) for shading the correct side of 3 of the 4 lines.

Question	Answer	Marks	Partial Marks
8(c)	4 dresses and 3 shirts	**1**	
8(d)	106	**2**	**M1** for $10x + 6y$ evaluated for (x, y) in *their* region R or **B1** for (7, 6) After 0 scored, **SC1** for answer 112 or 116
9(a)(i)	*r, l, t, e, a*	**1**	
9(a)(ii)	2	**1**	
9(b)		**1**	
		**1**	
9(c)(i)	Fully correct 	**3**	**B2** for 7, 6, or 5 sections correct or **B1** for 4, 3 or 2 sections correct
9(c)(ii)	5	**1FT**	strict FT from their diagram
10(a)(i)	−7	**1**	
10(a)(ii)	$\frac{x-5}{2}$ oe final answer	**2**	**M1** for correct first step e.g. $x = 2y + 5$ or $2x = y - 5$ or $\frac{y}{2} = x + \frac{5}{2}$
10(a)(iii)	$2x^3 - 11x^2 - 8x + 80$ final answer	**4**	**M1** for $(x-4)(2x+5)(x-4)$ oe **B2** for $2x^3 - 8x^2 - 8x^2 + 5x^2 - 20x - 20x + 32x + 80$ or for simplified 4 term expression of the correct form with 3 terms correct in final answer or **B1** for 3 terms correct out of 4 from $x^2 - 4x - 4x + 16$ or $2x^2 - 8x + 5x - 20$

Question	Answer	Marks	Partial Marks
10(b)	0	**2**	**M1** for g(− 2) or $2(x - 4) + 5$ oe or $3^x = 1$ or $g(f(2)) = 1$

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Abbreviations

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isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

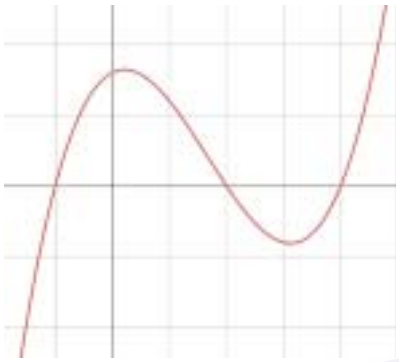
Question	Answer	Marks	Partial Marks
1(a)	111	**3**	**M2** for $180 - \frac{180-42}{2}$ oe or $42 + \frac{180-42}{2}$ oe or **M1** for $\frac{180-42}{2}$ oe
1(b)	150	**3**	**M1** for $k \div (3 + 4 + 5)$ [$\times p$] where $p = 1, 3, 4$ or 5 or $\frac{5}{12}$ oe **B1** for 360 used
1(c)	$\frac{3}{5}$ cao nfww	**4**	**B3** for $\frac{72}{120}$ or **B2** for [d =] 72 or [h =] 120 or **M1** for $360 \div 5$ oe isw or $180 - (360 \div 6)$ isw or for $(6 - 2) \times 180$ [$\div 6$]
1(d)	$x + 2x - 5 + x + 20 + 3x - 40 = 360$	**M1**	Accept equivalent equation e.g. $7x - 25 = 360$
	$7x = 360 + 5 - 20 + 40$ or better	**M1**	**FT** *their* equation, accept e.g. $7x = 385$
	$x = 55$	**B1**	
	55 and 125 or 105 and 75	**B1dep**	**Dep on M1M1B1** Accept $55 + 3 \times 55 - 40 = 180$ or $2 \times 55 - 5 + 55 + 20 = 180$ If B0 scored, **SC1** for 55, 75, 105 and 125
	Opposite angles sum to 180 oe [so $PQRS$ is a cyclic quadrilateral]	**A1**	**Dep on M1M1B1B1**
1(e)	48.7 or 48.69 to 48.70…	**3**	**M2** for $\frac{360-50}{360} \times 2 \times \pi \times 9$ oe or **M1** for $\frac{50}{360} \times 2 \times \pi \times 9$ oe
2(a)	249.98 to 250[.0…]	**3**	**M2** for $830 - 500 \times 1.16$ or **M1** for 500×1.16 OR **M1** for $830 \div 1.16$ **M1** for (*their* 715.5… $- 500$) $\times 1.16$

Question	Answer	Marks	Partial Marks
2(b)(i)	33.5 or 33.51…	**2**	**M1** for $\frac{12400}{37000}$ [×100] oe If 0 scored, **SC1** for answer 66.5 or 66.48 to 66.49
2(b)(ii)	38 184 cao	**2**	**M1** for 37 000 × $\left(1+\frac{3.2}{100}\right)$ oe or **B1** for 1184
2(c)(i)	441 or 440.6 or 440.64 to 440.65	**3**	**B2** for answer 3941 or 3940.6 or 3940.64 to 3940.65 or **M2** for 3500 × $\left(1+\frac{2.4}{100}\right)^5$ – 3500 or **M1** for 3500 × $\left(1+\frac{2.4}{100}\right)^5$ oe isw
2(c)(ii)	16	**3**	**B2** for 15[.0] nfww to 15.1 or **M2** for 3500 × $\left(1+\frac{2.4}{100}\right)^{15}$ oe seen or 3500 × $\left(1+\frac{2.4}{100}\right)^{16}$ oe seen or **M1** for (3500 or *their* 3941) × $\left(1+\frac{2.4}{100}\right)^n$ associated with 5000 oe
3(a)(i)	$\frac{(x+3)(2x+5)}{2}=60$	**M1**	Accept $(x + 3)(2x + 5) = 2 \times 60$ or 120 Accept e.g. $(x + 3)(x + 2.5) = 60$ without division by 2 shown for M1 (but not A1)
	$2x^2 + 6x + 5x + 15$ seen	**B1**	Accept $2x^2 + 11x + 15$ seen
	$2x^2 + 11x – 105 = 0$	**A1**	Correct completion after M1B1 with the fraction seen removed with no errors or omissions seen
3(a)(ii)	$(2x + 21)(x – 5)$ [= 0]	**M2**	**M1** for partial factors $2x(x – 5) + 21(x – 5)$ [= 0] or $x(2x + 21) – 5(2x + 21)$ [= 0] OR $(2x + a)(x + b)$ [= 0] where $ab = – 105$ or $2b + a = 11$
	–10.5 and 5	**B1**	

Question	Answer	Marks	Partial Marks
3(a)(iii)	61.9 or 61.92 to 61.93	**3**	**M2** for tan = $\frac{2\times \textit{their}\,5+5}{\textit{their}\,5+3}$ oe or **B1FT** for 2 × *their* 5 + 5 and *their* 5 + 3
3(b)(i)	28.1 or 28.07 to 28.08	**1**	**FT** *their* 90 – *their* **(a)(iii)** unless *their* **(a)(iii)** < 45, in which case FT *their* **(a)(iii)**
3(b)(ii)	10	**3**	**M2** for $(\textit{their}\,5+3)\times\sqrt{\frac{93.75}{60}}$ oe or **M1** for $\sqrt{\frac{93.75}{60}}$ or $\sqrt{\frac{60}{93.75}}$ oe seen or $\left(\frac{\textit{their}5+3}{x}\right)^2=\frac{60}{93.75}$ oe
4(a)(i)	$1.65 < h \leq 1.8$	**1**	
4(a)(ii)	1.63875	**4**	**M1** for midpoints **soi** **M1** for use of $\sum fh$ with h in correct interval including both boundaries **M1dep on 2nd M1** for $\sum fh \div 80$
4(b)(i)	$\frac{1}{40}$ oe	**1**	
4(b)(ii)	$\frac{63}{395}$ oe	**3**	**M2** for $\frac{56}{80}\times\frac{9}{79}$[×2] oe or **B1** for $\frac{56}{80}$ or $\frac{9}{79}$ or $\frac{9}{80}$ or $\frac{56}{79}$ oe seen If 0 or B1 scored, instead award **SC2** for answer $\frac{117}{632}$ oe or **SC1** for answer $\frac{63}{400}$ oe
4(c)(i)	15, 39, 71, 80	**2**	**B1** for 3 correct or **M1** for 1 error in addition with other values then consistent

Question	Answer	Marks	Partial Marks
4(c)(ii)	Correct curve	**3**	**B1** for correct horizontal placement for 5 plots **B1FT** for correct vertical placement for 5 plots **B1FT dep on at least B1** for reasonable increasing curve or polygon through *their* 5 points If 0 scored **SC1 FT** for 4 out of 5 points correctly plotted
4(d)(i)	Strict FT *their* UQ – *their* LQ	**2dep**	**B1dep** for *their* UQ or *their* LQ seen Dep on increasing curve/polygon for 2 marks or B1
4(d)(ii)	Strict FT *their* reading at 48	**2dep**	**B1** for 48 written
5(a)(i)	251 or 251.3 to 251.4	**2**	**M1** for $\frac{1}{3}\times\pi\times4^2\times15$ oe
5(a)(ii)	79.5 or 79.51…	**5**	**M3** for $\pi\times4\times\sqrt{4^2+15^2}$ oe or **M2** for $\sqrt{15^2+4^2}$ oe or **M1** for $[l^2=]\ 4^2+15^2$ oe or $\pi\times4\times$ *their* l **M1** for $\frac{\textit{their}\text{ curved surface area}}{\textit{their}\text{ curved surface area}+\pi\times4^2}[\times100]$ oe
5(b)(i)	13 min 20 sec	**3**	**B2** for 800 or $\frac{40}{3}$ oe seen or **M1** for figs 3 ÷ figs 375 or figs 3 ÷ 22 500
5(b)(ii)	0.472 or 0.4715 to 0.4716…	**3**	**M2** for $\pi\times0.45^2\times h=0.3$ or $\pi\times45^2\times h=300\,000$ oe or **M1** for $\pi\times\text{figs}45^2\times h=\text{figs}3$ oe
6(a)(i)	$\frac{1}{5}$, $\frac{2}{7}$, $\frac{3}{9}$ final answer	**2**	**B1** for 2 correct terms isw or for 0.2 and (0.286 or 0.2857…) and 0.333…
6(a)(ii)	36	**2**	**M1** for $k=\frac{12(2k+3)}{25}$ or better

Question	Answer	Marks	Partial Marks
6(b)(i)	$n^3 + 5$ oe final answer	**2**	**B1** for any cubic or common third differences of 6 (at least 2) or for correct answer seen and spoilt
6(b)(ii)	$100 \times 2^{1-n}$ oe final answer	**2**	**B1** for $2^{-n\,[+k]}$ oe or $\left(\frac{1}{2}\right)^{n[+k]}$ oe in answer or for correct answer seen and spoilt
7(a)	Angle $CAB = 52$	**B1**	
	$180 - 52 - \sin^{-1}\left(\frac{60\sin \textit{their}\,52}{87}\right)$	**M3**	**M2** for $[\sin[...]=]\ \frac{60\sin \textit{their}52}{87}$ oe or **M1** for $\frac{60}{\sin B} = \frac{87}{\sin \textit{their}52}$ oe
	95.08…	**A1**	
7(b)	77.1 or 77.08 to 77.11	**6**	**B4** for dist travelled = 256.9 to 257[.0…] or **B3** for [AB =] 109.9 to 110[.0…] or **M3** for $60 + 87 + \sqrt{60^2 + 87^2 - 2\times60\times87\times\cos 95.1}$ oe or **M2** for $\sqrt{60^2 + 87^2 - 2\times60\times87\times\cos 95.1}$ oe or $AB^2 = 12093.\ldots$ to $12097.\ldots$ or $\frac{87\sin 95.1}{\sin \textit{their}52}$ oe or **M1** for $AB^2 = 60^2 + 87^2 - 2 \times 60 \times 87 \times \cos 95.1$ oe or $\frac{\sin 95.1}{AB} = \frac{\sin \textit{their}52}{87}$ oe **M1** for *their* total distance ÷ $3\frac{20}{60}$ oe
8(a)(i)	Correct expansion of a pair of brackets $x^2 - 4x + [1]x - 4$ or $x^2 - 4x - 2x + 8$ or $x^2 + [1]x - 2x - 2$	**M1**	accept $x^2 - 3x - 4$ or $x^2 - 6x + 8$ or $x^2 - [1]x - 2$
	$x^3 - 4x^2 + x^2 - 4x - 2x^2 + 8x - 2x + 8$ leading to and stating $[y =]\ x^3 - 5x^2 + 2x + 8$	**A1**	Accept $x^3 - 3x^2 - 4x - 2x^2 + 6x + 8$ or $x^3 - 6x^2 + [1]\ x^2 + 8x - 6x + 8$ or $x^3 - [1]\ x^2 - 2x - 4x^2 + 4x + 8$ leading to and stating $[y =]\ x^3 - 5x^2 + 2x + 8$

Question	Answer	Marks	Partial Marks
8(a)(ii)	Correct labelled sketch positive cubic Crossing x-axis at –1, 2 and 4 only Crossing y – axis at 8 only 	**4**	**B1** for positive cubic **B2** for three intercepts only with x -axis labelled at – 1, 2 and 4 or **B1** for 1 or 2 correctly labelled x – intercepts **B1** for a single intercept on y-axis labelled at 8 but not if line $y = 8$
8(b)	$3x^2 - 10x - 8$ [= 0]	**M3**	**B2** for derivative = $3x^2 - 10x + 2$ isw OR **B1** for derivative with $3x^2$ or $-10x$ given in expression isw **M1dep on B1** for *their* first derivative = 10
	$x = 4$ and $x = -\frac{2}{3}$	**B1**	
	(4, 0) and $\left(-\frac{2}{3}, \frac{112}{27}\right)$ oe	**B1**	
	$[y =]\ 10x - 40$ and $[y =]\ 10x + \frac{292}{27}$	**B2**	**B1** for each or for two different equations of the form $[y =]\ 10x + c$ (c must be numeric) or for $c = -40$ and $\frac{292}{27}$
9(a)(i)	$27x^6y^{12}$ final answer	**2**	**B1** for two terms correct in answer e.g. $27x^6y^k$ or $27x^ky^{12}$ or kx^6y^{12} or for correct answer seen then spoilt

Question	Answer	Marks	Partial Marks
9(a)(ii)	$\frac{x^{24}y^{12}}{64}$ final answer	**3**	**B2** for final answer with two correct elements or final answer $\frac{64}{x^{24}y^{12}}$ or $\frac{64^{-1}}{x^{-24}y^{-12}}$ or better or for correct answer seen or **B1** for 64 or x^{24} or y^{12} seen in final answer or final answer $\frac{k}{x^{-24}y^{-12}}$ or **M1** for first correct step seen eg $\left(\frac{x^{16}y^{8}}{16}\right)^{\left[\frac{3}{2}\right]}$ or $\left(\frac{4}{x^{8}y^{4}}\right)^{[-3]}$ or $\left(\frac{4096}{x^{48}y^{24}}\right)^{\left[-\frac{1}{2}\right]}$
9(b)(i)	$(x + 3)(x – 3)$ final answer	**1**	
9(b)(ii)	$\frac{x+3}{2y+5}$ final answer	**3**	**M2** for $(x – 3)(2y + 5)$ or **M1** for $2y(x – 3) + 5(x – 3)$ or $x(2y + 5) – 3(2y + 5)$
9(c)	$5x^2 + 4x – 20$ [= 0] oe or $5y^2 – 78y + 221$ [= 0] oe	**M2**	**M1** for $7 – 2x = 5x^2 + 2x – 13$ oe seen or $y = 5\left(\frac{7-y}{2}\right)^2 + 2\left(\frac{7-y}{2}\right) – 13$ oe seen
	$\frac{-4 \pm \sqrt{(4)^2 – 4(5)(–20)}}{2(5)}$ oe or $-\frac{4}{10} \pm \sqrt{4 + \left(\frac{4}{10}\right)^2}$ oe	**M2**	**FT** *their* 3-term quadratic or **M1** for $\sqrt{(4)^2 – 4(5)(–20)}$ or better or for $\frac{-4+\sqrt{q}}{2\times5}$ or $\frac{-4-\sqrt{q}}{2\times5}$ or for $\left(x + \frac{4}{10}\right)^2$ oe
	$x = 1.64$ $y = 3.72$ and $x = – 2.44$ $y = 11.88$	**B2**	**B1** for one correct pair or both x-values correct or both y – values correct

Question	Answer	Marks	Partial Marks
10(a)	13.9 or 13.85 to 13.86	**4**	**M3** for $2x^2 = 28^2 - 20^2$ or better or $x = \left(\sqrt{28^2 - 20^2}\right)\sin 45$ oe or **M2** for $x^2 + x^2 + 20^2 = 28^2$ oe or $\sin 45 = \frac{x}{\sqrt{28^2 - 20^2})}$ or **M1** for any correct Pythag in 2D or *their AC* × sin 45 oe dep on trig/Pythagoras attempt for *AC*
10(b)	51.9 or 51.87 to 51.88	**4**	**M3** for sin = $\frac{29 \text{ to } 30}{37 + 0.5}$ or $\frac{30 - 0.5}{37 \text{ to } 38}$ oe or **M2** for correct trig statement for correct angle with values in range 29 to 31 and 36 to 38 or **M1** for 30 + 0.5 or 30 – 0.5 or 37 + 0.5 or 37 – 0.5 seen or for identifying correct angle *RKM*

Cambridge Assessment International Education

Cambridge IGCSE™

MATHEMATICS **0580/43**

Paper 4 (Extended) **May/June 2023**

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the May/June 2023 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

[Turn over

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

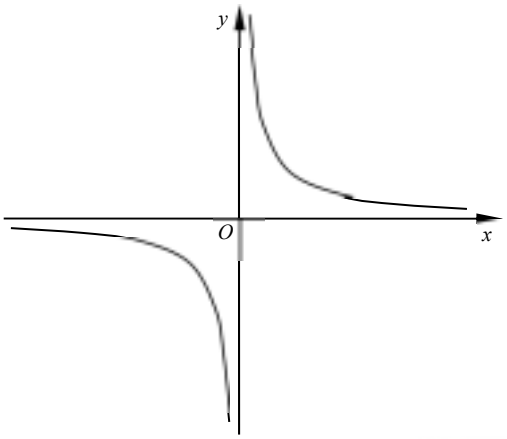
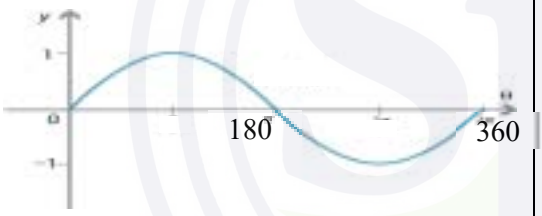
cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)(i)	22.5	**2**	**M1** for $\frac{9}{14+17+9}$ [×100]
1(a)(ii)	238	**2**	**FT** *their* 14 + 17 + 9 = *N* seen in **(a)(i)** **M1** for $\frac{560}{\textit{their}\ (14+17+9)} \times k$, where k = 1, 9, 14 or 17
1(a)(iii)	METHOD 1 1.25 × 195 oe	**M2**	**M1** for $\frac{25}{100} \times 195$
	243[.75] and No oe	**A1**	Strict **FT** yes if *their* **(a)(ii)** > 243.75 If M0 scored, then **SC1** for 243.75 and a correct conclusion.
	METHOD 2 $\frac{\textit{their}\ 238}{195} - 1 = 0.22\ldots$ oe	**(M2)**	**M1** for $\frac{\textit{their}\ 238}{195} = 1.22\ldots$ oe
	22[%] (or better) and No oe	**(A1)**	Strict **FT** yes if *their* **(a)(ii)** gives answer > 25 If M0 scored, then **SC1** for 22.05 and a correct conclusion.
	METHOD 3 195 × 0.25 = 48.75 oe **and** *their* 238 – 195 = 43	**(M2)**	**M1** for 0.25 × 195
	43 **and** 48.75 and NO	**(A1)**	Strict **FT** yes if *their* **(a)(ii)** gives profit > 48.75 If M0 scored, then **SC1** for 43 and 48.75 and a correct conclusion.
	METHOD 4 $\frac{\textit{their}\ 238}{125} \times 100$	**(M2)**	**M1** for $x \times \left(1+\frac{25}{100}\right) = \textit{their}\ 238$
	190.4 and NO	**(A1)**	Strict **FT** yes if *their* **(a)(ii)** gives answer > 195 If M0 scored then **SC1** for 190.4 and a correct conclusion.
1(b)	56.55	**2**	**M1** for $\frac{725 \times 1.3[\times 6]}{100}$ oe

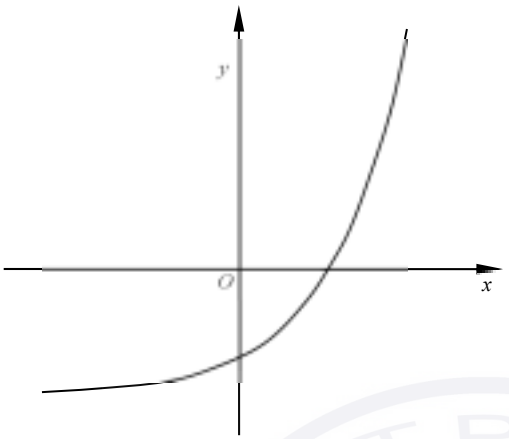
Question	Answer	Marks	Partial Marks
1(c)	48.5[0]	**2**	**M1** for $x \times \left(1-\frac{24}{100}\right) = 36.86$ oe
2(a)(i)	1 | 3 5 7 8 2 | 1 1 2 7 8 9 3 | 1 1 1 8 1 | 7 represents 17 [messages]	**3**	**B2** for fully correct stem-and-leaf diagram OR **B1** for two rows correct or for fully correct unordered stem-and-leaf diagram or for a correct diagram with one error or omission **B1** for correct key
2(a)(ii)	24.5	**1**	
2(a)(iii)	31	**1**	
2(a)(iv)	25	**1**	
2(b)	$\frac{14}{33}$ oe	**2**	**M1** for $\frac{8}{12}\times\frac{7}{11}$
3(a)(i)	118	**1**	
3(a)(ii)	X is 8.3 cm from B	**2**	**M1** for (332 ÷ 200) × 5 oe
3(a)(iii)	1 : 4000	**2**	**M1** for 200 ÷ 5 or 200 × 100, both soi
3(b)	1.13 or 1.128 to 1.129	**5**	**M4** for $4.5 \times \sqrt[3]{\frac{0.385\times 8000}{195200}}$ oe or $\sqrt[3]{\frac{4.5^3\times 0.385\times 8000}{195200}}$ oe or **M3** for $\sqrt[3]{\frac{0.385}{their 24.4}}$ or $\sqrt[3]{\frac{their 3080}{195200}}$ or $\frac{0.385}{their 24.4}=\frac{l^3}{4.5^3}$ oe or **M2** for $\frac{their 24.4}{0.385}$ or $\frac{0.385}{their 24.4}$ oe or **B2** for 24.4 or 3080 seen or **M1** for 195 200 ÷ 8000 or for 0.385 × 8000

Question	Answer	Marks	Partial Marks
4(a)	246	**3**	**B2** for *BCS*(outh) = 66 or *BCA* = 48 **and** *ACN*(orth) = 66 or *BCW*(est) = 24 or *ACS*(outh) = 114 or **B1** for *ABC* = 66 or *BAC* = 66 or *BCA* = 48 or *ACN*(orth) = 66
4(b)(i)	58	**1**	
4(b)(ii)	106	**1**	
4(b)(iii)	47	**2**	**B1** for *PRQ* = 27 or **B1FT** for *SPR*, either = 48 or = 106 – *their* **(b)(i)** or **B1FT** for *RPQ* = *their* **(b)(i)** – 11
4(c)	Radius perpendicular to tangent	**1**	
	Tangents to circle from a/same point oe	**1**	
	RHS	**1**	
	68 angles on a [straight] line add up/sum to 180 oe	**1**	
	56 [base angles of] isosceles triangle	**1**	
	OBC = *BOT* Alternate angles	**1**	Angles and reason required and dependent on *OBC* and *BOT* correct
5(a)(i)	2[.00] or 2.002 to 2.003 nfww	**3**	**M2** for $\sqrt{4.8^2 + 5.6^2 - 2 \times 4.8 \times 5.6 \times \cos 20.4}$ OR **M1** for $4.8^2 + 5.6^2 - 2 \times 4.8 \times 5.6 \times \cos 20.4$ **A1** for 4.01[17…] or 4.012
5(a)(ii)	4.1[0] or 4.11 or 4.100 to 4.107 cao	**2**	**M1** for $\tan 64 = \frac{AX}{\textit{their}\ \textbf{(a)(i)}}$ or for $\frac{AX}{\sin 64} = \frac{\textit{their}\ \textbf{(a)(i)}}{\sin(90-64)}$ oe
5(a)(iii)	6.96	**2**	**M1** for $\frac{1}{2} \times 4.8 \times 2.9$ oe

Question	Answer	Marks	Partial Marks
5(b)	11.3 or 11.31..	**5**	**M4** for $2\times\frac{8}{\sin(45)}\times\sin 30$ or **B4** for *PM* = 5.65[685...] or 5.66 or better OR **B1** for *angle RPM* = 45° **M2** for $\frac{8}{\sin(their\ 45)}\times\sin 30$ or **M1** for implicit form
6(a)(i)	Correct curve	**3**	**B1** for correct horizontal placement for 6 plots **B1** for correct vertical placement for 6 plots **B1 dep on at least B1** for reasonable increasing curve through *their* 6 points If 0 scored, **SC1** for 4 out of 6 points correctly plotted
6(a)(ii)(a)	87 to 89.5	**1**	
6(a)(ii)(b)	12.5 to 14	**2**	**B1** for [LQ =] 80.5 to 81.5 or [UQ =] 94 to 94.5
6(a)(ii)(c)	Strict FT, 200 – *their* cumul freq reading from *their* graph at 110 given to nearest integer	**2**	**B1FT** for correct cumul freq at 110 seen or for non-integer answer
6(b)(i)	3576	**4**	**M1** for midpoints soi **M1** for use of $\sum fx$ where x is in the correct interval including boundaries **M1** (dep on 2nd **M1**) for $\sum fx \div 50$
6(b)(ii)	5 3.2 3	**3**	**B1** for each If 0 scored, **SC1** for 3 frequency densities $\frac{12}{600}, \frac{15}{900}, \frac{16}{1500}, \frac{7}{700}$ seen oe to 3sf or better or multiplier 3 or 300
7(a)	Cubic	**1**	

Question	Answer	Marks	Partial Marks
7(b)(i)	Correct sketch 	**2**	**B1** for one branch correct or an attempt at the correct shape Maximum 1 mark if sketch crosses *x*-axis or *y*-axis
7(b)(ii)	$\pm\frac{1}{2}$ **nfww**	**2**	**M1** for $4x^2 = 1$ oe or **B1** for $\frac{1}{2}$ or $-\frac{1}{2}$ nfww
7(c)(i)	Correct sketch through (0, 0) (180, 0) and (360, 0) with max and min at 1 and –1 resp. 	**2**	**B1** for correct sine curve shape, starting at the origin, with minimum of 1 cycle.
7(c)(ii)	199.5 or 199.47... and 340.5...	**3**	**B2** for one correct or **M1** for $\sin x = -\frac{1}{3}$ oe If 0 scored, **SC1** for two reflex angles with a sum of 540 or 2 non-reflex angles with a sum of 180
8(a)	$4x + 3(x + 27) = 194.75$ or $4x + 3x + 81 = 194.75$	**M1**	
	16.25 cao	**B2**	**M1** for $7x = k$ where $k < 194.75$ or **B1** for answer 16.3
8(b)	$x^2 - 20x - 69 [= 0]$ oe or $y^2 + 116y - 861 [= 0]$ oe	**M2**	**M1** for $x^2 + 4(-8 - 5x) = 37$ oe or for $37 - 4y = \left(\frac{-8 - y}{5}\right)^2$ oe or for $x^2 + 4y = 37$ and $20x + 4y = -32$ subtracted with no more than one error

Question	Answer	Marks	Partial Marks
	$(x + 3)(x – 23)$ [= 0] oe or $(y – 7)(y + 123)$ [= 0] oe	**M1**	correct method to solve *their* quadratic e.g. $x = \frac{-(-20) \pm \sqrt{(-20)^2 - 4 \times 1 \times (-69)}}{2 \times 1}$ or $x – 10 = \pm 13$ or $x – 10 = \pm\sqrt{169}$
	$x = -3$ $y = 7$ $x = 23$ $y = -123$ final answer	**B2**	**B1** for one correct pair or two correct x values or two correct y values
8(c)	$2\pi x \times 6x + 2\pi x^2$ or $2\pi x(6x + x)$	**M2**	or **M1** for $2\pi x \times 6x$ or $2\pi x^2$
	Their $(2\pi x \times 6x + 2\pi x^2) = 4\pi r^2$	**M1**	Dep on at least on M1 earned *Their* LHS must be an area in terms of x only
	At least one further stage of working leading to $r^2 = \frac{7}{2}x^2$	**A1**	with no error seen
9(a)(i)	311 or 311.0 to 311.1	**3**	**M2** for $11 \times 11 + 2 \times \frac{1}{4} \times \pi \times 11^2$ oe or **M1** for [2 ×] $\frac{1}{4} \times \pi \times 11^2$ or 11×11 oe
9(a)(ii)	78.6 or 78.55 to 78.56...	**3**	**M2** for $4 \times 11 + 2 \times \frac{1}{4} \times 2 \times \pi \times 11$ oe or **M1** for [2 ×] $\frac{1}{4} \times 2 \times \pi \times 11$ or 4×11 oe
9(b)	35.2 or 35.3 or 35.239… to 35.28	**4**	**M3** for [tan =] $\frac{7}{\sqrt{7^2 + 7^2}}$ or [sin =] $\frac{7}{\sqrt{7^2 + 7^2 + 7^2}}$ or [cos =] $\frac{\sqrt{7^2 + 7^2}}{\sqrt{7^2 + 7^2 + 7^2}}$ OR **M2** for $AG = \sqrt{7^2 + 7^2 + 7^2}$ or for $\sqrt{7^2 + \left(\frac{7}{\sin 45}\right)^2}$ oe or for $AC = \sqrt{7^2 + 7^2}$ or $\frac{7}{\sin 45}$ oe OR **M1** for $7^2 + 7^2$ or for implicit trigonometry or identifying correct angle

Question	Answer	Marks	Partial Marks
10(a)	–2.5 –2 –1	**3**	**B1** for each
10(b)	Correct curve 	**4**	**B3 FT** for 8 or 7 correct plots **B2 FT** for 6 or 5 correct plots **B1 FT** for 4 or 3 correct plots
10(c)	2.3 to 2.4	**1**	
10(d)	ruled line $y = x - 1.5$	**M2**	**M1** for $y = x - 1.5$ soi or for $2^x - 3 = x - 1.5$ seen. or $y = x + k$ or $y = kx - 1.5$ drawn Do not accept $y = -1.5$
	–1 and 1.55 to 1.7	**A2**	**A1** for each
11(a)	10	**3**	**M2** for $(1 - -7)^2 + (4 - -2)^2$ oe or **M1** for $(1 - -7)$ or $(4 - -2)$ oe
11(b)	$\frac{4}{3}$ or $\frac{8}{6}$	**2**	**M1** for $\frac{1 - -7}{4 - -2}$ oe
11(c)	$y = -\frac{3}{4}x - \frac{9}{4}$ or $4y + 3x + 9 = 0$ oe **final answers**	**4**	**B3** for $-\frac{3}{4}x - \frac{9}{4}$ OR **B1** for midpoint $(1, -3)$ **M1** for gradient $-\frac{3}{4}$ or $-\frac{1}{\textit{their}\ \textbf{(b)}}$ **M1** for substituting *their* $(1, -3)$ into $y = (\textit{their}\ m)x + c$ or for *their* $m = \frac{y - -3}{x - 1}$ oe
12(a)	$4x^3 - 16x$ cao	**2**	**M1** for $4x^3 + kx$ or $kx^3 - 16x$ or $4x^3 - 16x + k$ or $4x^3 - 16$ as final answers

Question	Answer	Marks	Partial Marks
12b	*Their* $\frac{dy}{dx} = 0$ or stating $\frac{dy}{dx} = 0$	**B1**	
	Correct method to solve *their* $4x^3 - 16x = 0$	**M1**	e.g. $4x(x^2 - 4)$ or $4x(x - 2)(x + 2)$ oe
	$[x =]$ 0, –2, 2	**A1**	Or **B1** for (–2, –11) and (2, –11)
	(0, 5) (–2, –11) (2, –11)	**A1**	
12(c)	(0, 5) with correct reasoning	**2**	**M1** for any of • correct use of 2nd derivative $12x^2 - 16$ • evaluates correctly both values of y on either side • evaluates correctly the gradient on either side • reasonable correct sketch

Cambridge Assessment International Education

Cambridge IGCSE™

MATHEMATICS **0580/42**

Paper 4 (Extended) **February/March 2023**

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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[Turn over

PUBLISHED

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

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6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)(i)	$\frac{750}{8+7}\times 8$ [= 400]	**M1**	
1(a)(ii)(a)	37.5	**1**	
1(a)(ii)(b)	275	**3**	**M2** for $250 + \frac{250\times 2\times 5}{100}$ oe or **M1** for $\frac{250\times 2\times 5}{100}$ oe
1(a)(iii)	407[.00] cao nfww	**3**	**B2** for 406.5 to 406.7 or **M1** for $350\times\left(1+\frac{0.25}{100}\right)^{60}$ oe isw If 0 scored **SC1** for answer 354 or answer 406
1(b)	24	**2**	**M1** for [C : D =] 6 : 10 oe and [C : E =] 6 : 9 oe or for $\frac{6}{6+10+9}[\times 100]$ oe

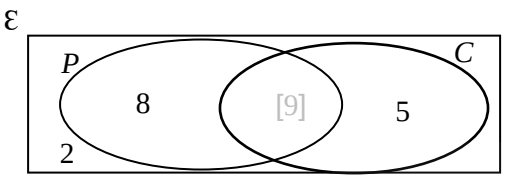
Question	Answer	Marks	Partial Marks
1(c)	56 000 nfww	**3**	**M2** for $60564 \div \left(1+\frac{3}{100}\right) \div \left(1+\frac{5}{100}\right)$ oe or **M1** for $[x\times]\left(1+\frac{3}{100}\right)\times\left(1+\frac{5}{100}\right)$ or for $60564 \div \left(1+\frac{3}{100}\right)$ oe or $60564 \div \left(1+\frac{5}{100}\right)$ If 0 scored, **SC1** for answer 65499 to 65500
1(d)	2.5[0] or 2.499...	**3**	**M2** for $\sqrt[8]{\frac{609.20}{500}}$ oe or **M1** for $500\times(...)^8 = 609.2[0]$ oe
2(a)(i)	7	**1**	
2(a)(ii)	8	**1**	
2(a)(iii)	8.31	**3**	**M1** for 3×6 + 32×7 + 19×8 + 29×9 + 11×10 + 6×11 oe **M1dep on M1** for $\frac{\sum fx}{100}$
2(a)(iv)	$\frac{23}{110}$ oe	**2**	**M1** for $\frac{k}{100}\times\frac{k-1}{99}$ oe, $k < 100$ or **B1** for $\frac{46}{100}$ and $\frac{45}{99}$
2(b)(i)	53	**1**	
2(b)(ii)	20	**1**	

Question	Answer	Marks	Partial Marks
2(c)(i)	151.975	**4**	**M1** for 80, 155, 250 soi **M1** for $\sum fx$ where x is in correct interval including boundaries **M1 dep** for $\frac{\sum fx}{200}$ dep on second M1
2(c)(ii)	Correct histogram completed with widths 110 to 200 and 200 to 300 and heights 1.1 and 0.41	**2**	**B1** for one correct block If 0 scored, **SC1** for 1.1 and 0.41 seen
3(a)	[h =] $\frac{\frac{1}{2}\times\frac{4}{3}\times\pi\times3^3}{\pi\times12^2}$ oe leading to 0.125 or $3-\frac{\pi\times12^2\times3-\frac{1}{2}\times\frac{4}{3}\times\pi\times3^3}{\pi\times12^2}$ oe leading to 0.125	**M3**	**M2** for $\pi\times12^2\times h=\frac{1}{2}\times\frac{4}{3}\times\pi\times3^3$ oe or for $\pi\times12^2\times3=\pi\times12^2\times x+\frac{2}{3}\times\pi\times3^3$ oe or for $\frac{\frac{1}{2}\times\frac{4}{3}\times\pi\times3^3}{\pi\times12^2\times3}=\frac{h}{3}$ oe or **M1** for $\pi\times12^2\times h$ or $\frac{1}{2}\times\frac{4}{3}\times\pi\times3^3$ oe or $\pi\times12^2\times3$

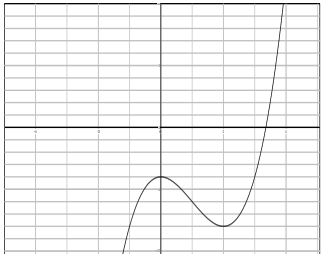
Question	Answer	Marks	Partial Marks
3(b)	4.8[0] or 4.795 to 4.796	**3**	**M2** for $\pi \times 12^2 \times (3 - 0.125) = \pi \times R^2 \times 18$ oe or $\pi \times 12^2 \times 3 - \frac{2}{3} \times \pi \times 3^3 = \pi \times R^2 \times 18$ or **B1** for $3 - 0.125$ or for 414π oe
3(c)	10.5 or 10.47 to 10.49	**3**	**M2** for $\dfrac{\frac{4}{3} \times \pi \times 3^3 - 30 \times 1.5^3}{\frac{4}{3} \times \pi \times 3^3}$ or $\dfrac{30 \times 1.5^3}{\frac{4}{3} \times \pi \times 3^3} \times 100$ oe or **M1** for $\frac{4}{3} \times \pi \times 3^3 - 30 \times 1.5^3$ or $\dfrac{30 \times 1.5^3}{\frac{4}{3} \times \pi \times 3^3}$ oe
4(a)(i)	Triangle at (3, –1), (9, –1), (9, 2)	**2**	**B1** for correct shape, size and orientation or for correct plots but no triangle
4(a)(ii)(a)	Triangle at (3, 3), (4, 3), (3, 5)	**2**	**B1** for correct shape size and orientation or for rotation about (4, 2) 90˚ anticlockwise or for correct plots but no triangle
4(a)(ii)(b)	Triangle at (4, 3), (5, 3), (5, 5)	**3**	**B2** for correct shape size and orientation or for correct plots but no triangle or **M1** for $x + y = 6$ drawn
4(a)(ii)(c)	Reflection $x = 4$	**2**	**B1** for each

Question	Answer	Marks	Partial Marks
4(b)	$\frac{5}{7}\mathbf{a} + \frac{2}{7}\mathbf{b}$ final answer	**3**	**B2** for correct unsimplified answer OR **M2** for $\overrightarrow{HZ} = \frac{2}{7}(\mathbf{b}-\mathbf{a})$ or $\overrightarrow{KZ} = \frac{5}{7}(\mathbf{a}-\mathbf{b})$ oe or **M1** for $\overrightarrow{HK} = -\mathbf{a} + \mathbf{b}$ or $\overrightarrow{KH} = -\mathbf{b} + \mathbf{a}$ or for a correct route
5(a)	$6p^4 - 13p^2 + 6$ final answer	**2**	**B1** for three of $6p^4 - 9p^2 - 4p^2 + 6$ seen
5(b)(i)	175	**2**	**M1** for $\frac{1}{2}(20+30)\times 7$ oe
5(b)(ii)	$\frac{2s-ut}{t}$ or $\frac{2s}{t} - u$ final answer	**3**	**B2** for correct answer but unsimplified e.g. $\frac{s \div t}{0.5} - u$, $\frac{s}{\frac{1}{2}t} - u$, $\frac{s}{0.5t} - u$ **OR** **M1** for correct multiplication by 2 or division by 0.5 **M1** for correctly rearranging terms to isolate term in v **M1** for correct division by t Max 2 marks if final answer incorrect
5(c)(i)	$(2q-3)(t+2)$ final answer	**2**	**B1** for $t(2q-3)+2(2q-3)$ or $2q(t+2)-3(t+2)$

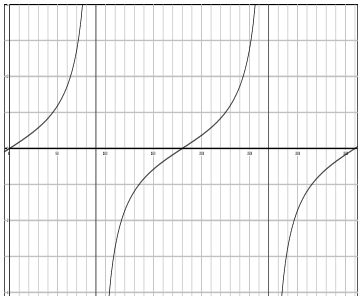
Question	Answer	Marks	Partial Marks
5(c)(ii)	$x(x+5)(x-5)$ final answer	**3**	**B2** for $(x^2-5x)(x+5)$ or $(x^2+5x)(x-5)$ or for correct answer seen then spoiled or **B1** for $x(x^2-25)$
6(a)	$y = 4$ oe	**1**	
6(b)	$[y =] -\frac{1}{2}x + 4$ final answer	**2**	**B1** for grad = $-\frac{4}{8}$ oe soi or $[y =]kx + 4$
6(c)(i)	Gradient = $\frac{-1}{\textit{their}\text{ gradient in }(b)}$	**M1**	Accept e.g. $2 \times -\frac{1}{2} = -1$ oe or states negative reciprocal of $-\frac{1}{2} = 2$
	Substituting (2, 3) in *their* equation.	**M1**	$3 = 2 \times$ *their* $m + c$
	leading to $y = 2x - 1$	**A1**	No errors or omissions
6(c)(ii)	3.35 or 3.354...	**5**	**B2** for $\left(\frac{1}{2}, 0\right)$ soi or x-coordinate of $D = \frac{1}{2}$ or **M1** for $2x - 1 = 0$ **M2** for $(2-\textit{their}\,\frac{1}{2})^2 + (3-\textit{their}\,0)^2$ oe or **M1** for $(2-\textit{their}\,\frac{1}{2})$ and $(3-\textit{their}\,0)$ oe

Question	Answer	Marks	Partial Marks
7(a)	Completed Venn diagram.  	**2**	**B1** for two correct values
7(b)(i)	8	**1**	**FT** *their* **(a)** *their* 8 dep < 24
7(b)(ii)	19	**1**	**FT** *their* **(a)** 24 – *their* 5 dep on positive answer
7(c)	$\frac{15}{92}$ oe	**3**	**M2** for $[2\times]\frac{9}{24}\times\frac{their\,5}{23}$ oe or **M1** for $\frac{9}{24}$ and $\frac{their\,5}{23}$ **or** $\frac{their\,5}{24}$ and $\frac{9}{23}$ If 0 scored **SC1** for answer $\frac{5}{32}$ oe
7(d)	$\frac{9}{34}$ oe	**2**	**B1** for $\frac{9}{17}$ seen
8(a)	54	**2**	**M1** for $\frac{1}{2}\times12\times9$

Question	Answer	Marks	Partial Marks
8(b)	$2x^2+13x-85\,[=0]$	**B3**	**M1** for $\frac{1}{2}(2x+3)(x+5)\ [=50]$ oe **B1** for $2x^2+10x+3x+15$
	$\frac{-13\pm\sqrt{13^2-4(2)(-85)}}{2(2)}$ oe or $-\frac{13}{4}\pm\sqrt{\frac{85}{2}+\left(\frac{13}{4}\right)^2}$ oe	**M2**	**M1** for $\sqrt{13^2-4\times2\times-85}$ oe or for $\frac{-13+\text{or}-\sqrt{p}}{2(2)}$ oe or for $[2]\left(x+\frac{13}{4}\right)^2$
	4.03 cao	**B1**	
9(a)	–3	**3**	**B2** for $3x^2-6x$ or **B1** for $3x^2-kx$ or for kx^2-6x or for $3x^2-6x+c$
9(b)	(0, –4) and (2, –8)	**4**	**B3** for $x = 0$ and 2 or for (2, –8) OR **M1** for *their* $3x^2-6x=0$ or stating $\frac{dy}{dx}=0$ oe **M1** for correct method to solve *their* $3x^2-6x=0$

Question	Answer	Marks	Partial Marks
9(c)	Correct sketch 	**2**	Max on negative *y*-axis and min in correct quadrant and extends into first quadrant **B1** for positive cubic graph and two turning points
10(a)	$\cos 31 = \frac{AB}{12.3}$ oe	**M1**	
	10.543...	**A1**	
10(b)	$\cos = \frac{12.3}{16.5}$ oe	**M1**	
	41.801 to 41.802	**A1**	
10(c)	16.7 or 16.8 or 16.74 to 16.75…	**3**	**M2** for $\sqrt{10.54^2 + 16.5^2 - 2\times 10.54\times 16.5\times\cos(31+41.8)}$ or for $\sqrt{6.33^2 + 11^2 - 2\times 6.33\times 11\times\cos(180-31)}$ OR **M1** for $10.54^2 + 16.5^2 - 2\times 10.54\times 16.5\times\cos(31+41.8)$ or for $6.33^2 + 11^2 - 2\times 6.33\times 11\times\cos(90+90-31)$ oe **A1** for 280 or 281 or 280.4 to 280.6

Question	Answer	Marks	Partial Marks
10(d)	18.9 to 20.7… nfww	**4**	**M1** for $\sin 31 = \frac{BC}{12.3}$ oe or better and sin 41.8[0] = $\frac{CD}{16.5}$ oe **M2dep on M1** for cos [*DBC*] = $\frac{their(c)^2 + 6.34^2 - 10.998^2}{2 \times their(c) \times 6.34}$ or **M1dep on M1** for 10.998^2 = *their* **(c)**^{2} +6.34^2 – 2 × *their* **(c)** ×6.34 × cos *DBC*
10(e)	2.05 to 2.24… nfww	**4**	**M1** for $\sin 31 = \frac{BC}{12.3}$ oe or better or sin 41.8[0] = $\frac{CD}{16.5}$ oe **M2dep on M1** for $\frac{\text{dist}}{their BC} = \sin(their \text{ angle } CBD)$ or $\frac{\text{dist}}{their CD} = \sin(their \text{ angle } CDB)$ or **M1** for recognition of shortest distance
11(a)	1	**1**	
11(b)	$-\frac{1}{5}$ or –0.2	**2**	**M1** for $2x - 1 + 3x + 2 = 0$ oe isw
11(c)	$9x + 8$ final answer	**2**	**M1** for $3(3x + 2) + 2$

Question	Answer	Marks	Partial Marks
11(d)	$\frac{4x^2+5x-3}{x(2x-1)}$ final answer	**4**	**M1** for $\frac{1}{2x-1}$ and $3\left(\frac{1}{x}\right)+2$ oe **B1** for $x+3(2x-1)+2x(2x-1)$ oe or better isw **B1** for common denominator = $x(2x-1)$ isw If 0 scored, **SC1** for answer $\frac{4x^2+9x+3}{x(2x+1)}$
11(e)	h(x) indicated	**1**	
12(a)	Correct sketch 	**2**	Condone curve touching asymptotes but not crossing **B1** for one section correct or for 3 sections in correct part of graph but with incorrect curvature and no other sections in incorrect part of graph
12(b)	30 **and** 210 final answer	**2**	**B1** for each If 0 scored **SC1** for two answers (one acute and one reflex) with a difference of 180

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MATHEMATICS **0580/41**

Paper 4 Extended **October/November 2022**

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soi	seen or implied

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1(a)(i)	1580 or 1583 to 1584	**2**	**M1** for $\pi \times 6^2 \times 14$
1(a)(ii)	452 or 452.3 to 452.4...	**2**	**M1** for $\left[\frac{1}{2}\right] \times \frac{4}{3} \times \pi \times 6^3$
1(b)(i)	7.85 ÷ 1000 [= 0.00785]	**M1**	
1(b)(ii)	16[.0] or 15.95 to 15.99	**2**	**FT {*their* (a)(i) + *their* (a)(ii)}** × 0.00785 evaluated to 3 sig fig or better **M1** for (*their* **(a)(i)** + *their* **(a)(ii)**) × 0.00785
1(c)(i)	16.2 or 16.21 to 16.23	**3**	**M2** for $\frac{2000 - 50 \times \frac{4}{3} \times \pi \times 2^3}{2000} [\times 100]$ or for $\frac{50 \times \frac{4}{3} \times \pi \times 2^3}{2000} \times 100$ or **M1** for $\frac{50 \times \frac{4}{3} \times \pi \times 2^3}{2000}$
1(c)(ii)	6.87 or 6.870 to 6.872	**1**	FT $\sqrt[3]{2000 - \textit{their}\left(50 \times \frac{4}{3} \times \pi \times 2^3\right)}$ evaluated to 3sf or better
1(d)	$\frac{2}{3}$ oe	**4**	**M1** for $[\pi](3R)^2 + [\pi]3R \times 9R$ oe **M1** for $2[\pi]x^2 + 2[\pi]x \times 7x$ oe **M1** for *their* area of cone = *their* area of cylinder seen
2(a)(i)	2990 cao	**1**	
2(a)(ii)	1.0 cao	**1**	
2(a)(iii)	2100 cao	**1**	
2(b)	97	**1**	
2(c)	$\frac{1}{64}$ final answer	**1**	
2(d)	$7.01[0] \times 10^{-3}$	**1**	
2(e)	1.65×10^x	**2**	**M1** for final answer figs 165 or for $15 \times 10^{x-1}$ seen or for 0.15×10^x seen

Question	Answer	Marks	Partial Marks
2(f)	37.7... – 3.7... [= 34] oe	**M1**	
	$\frac{34}{90}$ oe fraction	**B1**	
3(a)	$-2 < x \leqslant 4$ oe	**1**	
3(b)(i)	$-3 \leqslant x < 3$ final answer	**3**	**M2** for $-3 \leq x < k$ or for $k \leqslant x < 3$ or for $-6 \leqslant 2x < 6$ or for $-\frac{3}{2} - \frac{3}{2} \leqslant x < \frac{9}{2} - \frac{3}{2}$ or **M1** for $-3 - 3 \leqslant 2x < 9 - 3$ or for $-\frac{3}{2} \leqslant x + \frac{3}{2} < \frac{9}{2}$ After 0 scored SC1 for $-3 \leqslant x$ or for $x < 3$
3(b)(ii)	–3, –2, –1, 0, 1, 2 final answer	**2**	**FT** *their* **(i)** as long as negative and positive values **B1FT** for one error or omission
3(c)(i)	$\frac{36}{17}$ oe	**4**	**B3** for $-15x - 2x = 5 + 4 - 45$ or better OR **B2** for $45 - 15x - 2x - 4 = 5$ oe OR **M1** for correct removal of fraction or **M1** for correct removal of brackets
3(c)(ii)	–8	**3**	**B2** for $5x - 3x = 9 - 25$ or better or **M1** for $5(x + 5) = 3(x + 3)$ oe or better
4(a)(i)	550 nfww	**3**	**M2** for $\frac{500 \times 2 \times 5}{100} + 500$ oe or **M1** for $\frac{500 \times 2 \times 5}{100}$ oe
4(a)(ii)	546.65	**2**	**M1** for $500 \times \left(1 + \frac{1.8}{100}\right)^5$ oe
4(a)(iii)	8 nfww	**3**	**B2** for final answer 13 OR **M2** for trials correctly comparing both investments to 7 and 8 more years or **M1** for at least two trials correctly comparing both investments

Question	Answer	Marks	Partial Marks
4(b)	1476 cao	**3**	**B2** for 1480 or 1476.2 ... OR **M1** for $2500\times\left(1-\frac{10}{100}\right)^5$ oe **B1** for their more accurate answer seen correctly rounded to the nearest dollar.
4(c)	3.2[0] or 3.200 to 3.201	**3**	**M2** for (...) = $\sqrt[22]{2}$ oe isw or **M1** for $[N]\times(...)^{22} = 2[N]$
5(a)(i)	9.4	**1**	
5(a)(ii)	2.4	**2**	**B1** for [uq =] 10.4 or [lq =] 8 but not as final answer
5(a)(iii)	18	**2**	**B1** for 82 seen
5(b)(i)	34.65 or $34\frac{13}{20}$	**4**	**M1** for midpoints 10, 25, 32.5, 40, 52.5 soi **M1** for Σfx where values of x are in interval or on boundary **M1 dep on second M** for $\frac{\Sigma fx}{150}$
5(b)(ii)	0.3, 5.7, ..., 7.95, 1.5	**3**	**B2** for any two correct or **B1** for one correct or for at least three frequency densities seen 0.2, 3.8, 8, 5.3, 1 oe or **M1** for [factor] 1.5
5(b)(iii)	$\frac{7}{745}$ oe	**2**	**M1** for $\frac{15}{150}\times\frac{14}{149}$
6(a)(i)	$\begin{pmatrix}-3\\3\end{pmatrix}$	**1**	
6(a)(ii)	$\begin{pmatrix}3\\2\end{pmatrix}$	**1**	
6(a)(iii)	3.61 or 3.605 to 3.606	**2**	**M1** for $2^2 + 3^2$ oe
6(b)	(6, 1)	**2**	**B1** for each

Question	Answer	Marks	Partial Marks
6(c)	$\frac{2}{7}\mathbf{g} + \frac{3}{14}\mathbf{h}$	**4**	**B3** for correct unsimplified expression for $\overrightarrow{MK}$ or **B2** for $[\overrightarrow{MK} =] \frac{2}{7}\mathbf{g} + k\mathbf{h}$ or $[\overrightarrow{MK} =] k\mathbf{g} + \frac{3}{14}\mathbf{h}$ or $\overrightarrow{HK} = \frac{2}{7}(\mathbf{g} - \mathbf{h})$ oe or $\overrightarrow{GK} = \frac{5}{7}(\mathbf{h} - \mathbf{g})$ oe or **M1** for correct route for $\overrightarrow{MK}$
7(a)(i)	4	**1**	
7(a)(ii)	16	**1**	**FT** $2^{their\,4}$
7(b)	3	**1**	
7(c)	$\frac{1}{4}$ oe	**2**	**M1** for $\frac{2}{x} = 2^3$ or better
7(d)	$\frac{5-x}{2}$ oe final answer	**2**	**M1** for $x = 5 - 2y$ or $y + 2x = 5$ oe or $\frac{y}{2} = \frac{5}{2} - x$ oe
7(e)	$\frac{11x - x^2 + 2}{x}$ final answer	**3**	**B2** for $\frac{x(10-x)+2+x}{x}$ oe single fraction or **B1** for $x(10 - x) + 2 + x$ oe or **M1** for $10 - x + \frac{2}{x} + 1$
7(f)	$[a =] 1$ $[b =] -21$ $[c =] 100$	**4**	**B3** for $x^2 - 21x + 100$ OR **M1** for $(10-x)^2 - (10-(10-x))$ oe or better **B2** for $[(10-x)^2] = 100 - 10x - 10x + x^2$ or **B1** for three out of four terms of $[(10-x)^2] = 100 - 10x - 10x + x^2$ correct
7(g)	1024	**2**	**M1** for $[x =]$ h(10) oe or better
8(a)	$[\cos =] \frac{15^2 + 8^2 - 20^2}{2.15.8}$	**M2**	**M1** for $20^2 = 15^2 + 8^2 - 2.15.8\cos(\quad)$
	117.54 to 117.55	**A2**	**A1** for $-\frac{37}{80}$ or $-\frac{111}{240}$ or –[0].4625

Question	Answer	Marks	Partial Marks
8(b)	53.2 or 53.19 to 53.23	**2**	**M1** for $0.5 \times 8 \times 15 \times \sin(117.5)$ oe
8(c)	15.5 or 15.52 to 15.53	**2**	**M1** for $15^2 + 4^2$ oe
8(d)	7.1 or 7.13 or 7.125 to 7.126	**3**	**M2** for tan [P]= $\frac{4-3}{8}$ oe or for 7.1 or 7.13 or 7.125 to 7.126 seen or **M1** for vertical line = 4 – 3 soi After 0 scored **SC1** for correct angle identified
8(e)	11.5 nfww or 11.48 to 11.49...	**5**	**B1** for height of 3.5 soi **M2** for $15^2 + 4^2 - 2.15.4\cos(117.5)$ or **M1** for $\cos 117.5 = \frac{15^2 + 4^2 - (...)^2}{2.15.4}$ **M1** for tan = $\frac{3.5}{\textit{their}\ 17.216...}$ oe After M0 scored **SC1** for correct angle identified
9(a)(i)	$x(3x+4)+2(x-1)[=20]$	**M1**	Correct expression with brackets unexpanded
	Leading to $3x^2 + 6x - 22 = 0$ with no errors or omissions	**A1**	Must see equated to 20 and brackets expanded first to award A1
9(a)(ii)	$\frac{-6 \pm \sqrt{6^2 - 4(3)(-22)}}{2.3}$ oe or for $= -1 \pm \sqrt{1 + \frac{22}{3}}$ oe	**B2**	**B1** for $\sqrt{6^2 - 4(3)(-22)}$ or $\frac{-6 + \text{or} - \sqrt{k}}{2.3}$ or $(x+1)^2 = k$ oe
	–3.887 and 1.887 cao	**B2**	**B1** for one correct answer or for answers –3.89 or – 3.88 or -3.886 or –3.8868 to –3.8867 and 1.88 or 1.89 or 1.886 or 1.8867 to 1.8868 or correct answers seen in working or –1.887 and 3.887 answers
9(a)(iii)	5.77 or 5.773 to 5.774	**1**	**FTdep** 2(positive x +1) evaluated to 3 sig. fig. or more, dep on $x > 1$

Question	Answer	Marks	Partial Marks
9(b)	$y^2+3y-40[=0]$ oe	**B4**	Oe 3 term quadratic **M3** for $15y-20(y-2)=y(y-2)$ oe Or **M2** for $\frac{15}{y-2}-\frac{20}{y}=1$ oe Or **M1** for $H(y-2)=15$ or $hy=20$ soi
	$(y+8)(y-5)$ [= 0] oe	**B2**	**Strict FT** a three term quadratic **B1FT** for $(y+a)(y+b)$ where $ab=-40$ or $a+b=3$ or y(y – 5) + 8 (y – 5) or $y(y+8)-5(y+8)$
	5	**B1**	
10(a)(i)	4 or 5 or 7 or 8 or 9	**1**	
10(a)(ii)	[a =] 3, [b =] 10	**2**	**B1** for each or for a and b transposed
10(b)	$6x^5-30x^4$	**B2**	**B1** for $6x^5$ or $-30x^4$
	their derivative = 0.	**M1**	
	(0, 0) and (5, –3125)	**B2**	**B1** for (5, –3125) or for $x=0$ and $x=5$

Cambridge Assessment International Education

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MATHEMATICS **0580/42**

Paper 4 (Extended) **October/November 2022**

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2022 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

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PUBLISHED

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)(i)	75	**2**	**M1** for $\frac{45}{3}$ [× *k*] where *k* is 1, 5 or 8
1(a)(ii)	2.332 oe	**2**	**M1** for 2.65 [million] × $\left(1-\frac{12}{100}\right)$ oe or **B1** for 0.318[million] seen
1(a)(iii)	23 280 cao	**2**	**M1** for $\frac{6.25}{100}\times x = 1455$ or better
1(a)(iv)	1450 or 1449 to 1450	**3**	**M2** for 1631 = $k\left(1+\frac{4}{100}\right)^3$ oe or better or **B1** for $\left(1+\frac{4}{100}\right)^3$ oe seen or **M1** for 1631 = $k\left(1+\frac{4}{100}\right)^n$, $n > 0$ oe
1(b)(i)	$\frac{7x}{2}$ oe	**1**	
1(b)(ii)	$x + 12$ $\frac{7x}{2} - 26$ oe final answer	**2**	**FT** *their* **(b)(i)** **B1** for $x + 12$ **B1** for *their* $\frac{7x}{2} - 26$

Question	Answer	Marks	Partial Marks
1(b)(iii)	$\frac{7x}{2} - 26 = 3(x + 12)$ oe leading to 124	**4**	**M1dep** for *their* $\left(\frac{7x}{2} - 26\right) = 3 \times$ *their* $(x + 12)$ oe **M2dep** for isolating x terms, dep on eqn with term in x and constant on each side and with a bracket **or** fraction. or **M1dep** for correctly removing brackets or dealing with fractions, dep on eqn with term in x and constant on each side and with a bracket **or** fraction.
2(a)(i)	28	**1**	
2(a)(ii)	Correct curve	**4**	**B3FT** for 9 or 10 correct points or **B2FT** for 7 or 8 correct points or **B1FT** for 5 or 6 correct points
2(a)(iii)	2.5 to 2.8 8.2 to 8.5	**2**	**B1** for each value
2(b)(i)	$2x^2 + 4x(9 - x)$ oe	**M1**	Accept the sum of individual areas if done in smaller parts
	$2x^2 + 36x - 4x^2$ oe Leading to $36x - 2x^2$	**A1**	With intermediate step shown and brackets removed with no errors or omissions
2(b)(ii)	144	**3**	**B1** for $x = 6$ identified from graph or using calculus **M1** for $36 \times$ *their*$6 - 2 \times$ (*their* $6)^2$

Question	Answer	Marks	Partial Marks
3(a)(i)	211.275	**4**	**M1** for mid-points **soi** (90, 125, 175, 250, 350) **M1** for use of Σfm with m in correct interval including both boundaries **M1** for (dep on 2nd M1) for $\Sigma fm \div 200$
3(a)(ii)	$32 \times 350 - 32 \times 330$ oe or better, or the reverse of this	**M1**	
	3.2 or – 3.2 final answer	**B1**	
3(a)(iii)	1.75 7.6 1.6	**3**	**B2** for two correct heights or **B1** for one correct height or 3 correct frequency densities or **M1** for scale factor of 5 or 0.2
3(b)	$\frac{4}{25}$ oe	**1**	
3(c)(i)	$\frac{39}{995}$ oe	**2**	**M1** for $\frac{40}{200} \times \frac{39}{199}$ oe
3(c)(ii)	$\frac{147}{4975}$ oe	**3**	**M2** for [2×] $\frac{84}{200} \times \frac{7}{199}$ oe or **B1** for $\frac{84}{200}$ and $\frac{7}{199}$ or $\frac{84}{199}$ and $\frac{7}{200}$ oe If 0 scored, **SC1** for answer $\frac{147}{5000}$ oe

Question	Answer	Marks	Partial Marks
4(a)(i)	Translation $\begin{pmatrix} 7 \\ -8 \end{pmatrix}$ oe	**2**	**B1** for each
4(a)(ii)	Rotation 90° [anticlockwise] oe (0, 8)	**3**	**B1** for each
4(a)(iii)	Enlargement [sf] $\frac{1}{2}$ oe [centre] (–1, –4)	**3**	**B1** for each
4(b)	Image at (–4, 4) (–3, 4) (–2, 5) (–2, 3) (–4, 3)	**2**	**B1** for the line $y = x + 8$ drawn soi long enough to be fit for purpose or correct size and orientation but wrong position

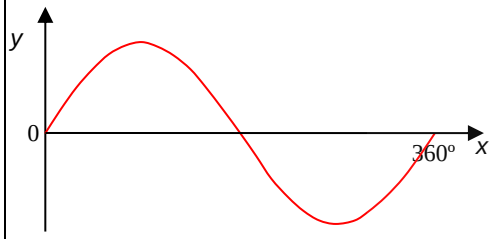
Question	Answer	Marks	Partial Marks
5(a)(i)	$\frac{14}{18}$ oe	**1**	
5(a)(ii)	17.5	**4**	**M3** for $\frac{1}{2}(10+24)18+22\times24\ -134 = 40v$ oe or **M2** for $\frac{1}{2}(10+24)18+22\times24$ oe or **B2** for [distance covered by bus =] 700 or **M1** for correct method for any partial area for the car or for $40v$
5(b)	92.8 or $92\frac{4}{5}$	**3**	**M1** for $\frac{figs162[4]}{their10\,\text{min}30\,\text{sec}}$ oe **M1** for correct conversion to km/h, e.g. $\times\frac{60}{1000}$

Question	Answer	Marks	Partial Marks
6(a)	-1.5 or $-1\frac{1}{2}$ or $-\frac{3}{2}$	**2**	**M1** for $4x = 9 - 15$ or $x + \frac{15}{4} = \frac{9}{4}$
6(b)	$(a - 3)(a + 3)$ final answer	**1**	
6(c)	$\frac{8c}{3d}$ final answer	**3**	**B2** for $\frac{8ac}{3ad}$ or $\frac{40c}{15d}$ or $\frac{4}{1}\times\frac{2c}{3d}$ seen or for correct answer seen then spoiled or **M1** for $\frac{4a}{5}\times\frac{10c}{3ad}$ or $\frac{8ac}{10c}\div\frac{3ad}{10c}$ oe
6(d)	$n + 1$ final answer	**2**	**M1** for 5×5^n or 5^{n+1} seen
6(e)	$(2x - 1)(2x + 5)$ [= 0] oe	**B2**	**M1** for $2x(2x + 5) - [1](2x + 5)$ [= 0] or $2x(2x - 1) + 5(2x - 1)$ [= 0] or for $(2x + m)(2x + n)$ [= 0] with and $mn = -5$ or $n + m = 4$
	$\frac{1}{2}$ or 0.5 and -2.5 or $-2\frac{1}{2}$ or $-\frac{5}{2}$	**B1**	
6(f)(i)	7	**3**	**M1** for $y = k(x + 3)^3$ or better **M1** for $108 =$ *their* $k(x + 3)^3$
6(f)(ii)	4	**2**	**M1** for $\left(\frac{1}{2}\right)^2$ oe or $\frac{k}{\frac{1}{4}d^2}$ oe seen or better

Question	Answer	Marks	Partial Marks
6(g)	$2x^3 + 7x^2 - 9$ final answer	**3**	**B2** for correct expansion unsimplified or for simplified 4 term expression of correct form with 3 terms correct or **B1** for one pair of brackets expanded with at least 3 terms out of 4 correct
6(h)	$6x + 4$	**2**	**B1** for $6x$ or 4 or $6x + 4$ with one extra term seen

Question	Answer	Marks	Partial Marks
7(a)(i)	52.[0] or 52.01…	**4**	**M2** for [cos$P$ =] $\frac{39.4^2 + 46.5^2 - 38.2^2}{2 \times 39.4 \times 46.5}$ oe or **M1** for $38.2^2 = 39.4^2 + 46.5^2 - 2 \times 39.4 \times 46.5 \times \cos P$ oe **A1** for 0.616 or 0.6155…
7(a)(ii)	36.6 or 36.64 to 36.65	**3**	**M2** for $\frac{d}{46.5} = \sin(\textit{their}\ 52.01)$ oe or **M1** for recognition that the line from Q is perpendicular to PR
7(b)(i)	41[.0] or 41.01… nfww	**3**	**M2** for $29^2 + 21^2 + 20^2$ oe or better or **M1** for $29^2 + 21^2$ oe or $29^2 + 20^2$ oe or $21^2 + 20^2$ oe or better
7(b)(ii)	29.2 or 29.18 to 29.2	**3**	**M2** for sin[GAC] = $\frac{20}{\textit{their}\ AG}$ oe or **M1** for angle GAC identified
7(c)	bearing 286	**B2**	**B1** for angle MLK = 49 or for angle MKL = 35 correctly identified or angle from North to ML = 106
	distance 64.6 or 64.59…	**B3**	**M2** for $\frac{112 \times \sin(\textit{their}35)}{\sin(96)}$ oe or **M1** for the implicit form

Question	Answer	Marks	Partial Marks
8(a)	(22, 11)	**2**	**B1** for each value
8(b)	$\frac{their 11-3}{their 22-2}$ oe or better	**M1**	
	$-\frac{1}{their\ m}$	**M1**	
	Substitution of (12, 7) into $y = (their\ m)x + c$	**M1**	Accept $y - 7 = their\ m(x - 12)$ oe
	leading to $2y + 5x = 74$ final answer	**A1**	Without error or omission
8(c)	32	**1**	
8(d)	145	**2**	**M1** for $\frac{1}{2} \times (their\ 32 - 3) \times 10$ oe or $\frac{1}{2} \times \sqrt{(7-3)^2 + (12-2)^2} \times \sqrt{(their 32-7)^2 + (2-12)^2}$ oe

Question	Answer	Marks	Partial Marks
9(a)	Correct sketch to go through (0, 0), and (360, 0) 	**2**	**M1** for correct sine curve shape through the origin or for almost correct sketch fitting all tramlines but with an omission at either end or incorrect curvature in one place only
9(b)	233.1 or 233.13… and 306.9 or 306.86 to 306.87	**3**	**B2** for one correct angle or **M1** for $\sin x = -0.8$ oe If 0 scored **SC1** for 2 reflex angles that add to 540 or two non-reflex angles that add to 180
10(a)	42.05 final answer	**2**	**M1** for 11.4 + 0.05 oe or 14.8 + 0.05 oe or 15.7 + 0.05 oe
10(b)	319 or 318.5 to 318.6	**2**	**M1** for $\frac{150}{360} \times \pi \times 15.6^2$ oe
10(c)	$\frac{360-x}{360} \times 2\pi r + 2r = 3\left(\frac{x}{360} \times 2\pi r + 2r\right)$ oe	**M2**	**M1** for $\frac{x}{360} \times 2\pi r$ oe seen or $\frac{360-x}{360} \times 2\pi r$ oe seen
	$\frac{4x}{360} \times 2\pi[r] = 2\pi[r] - 4[r]$ oe	**M1**	i.e. M mark for isolating and collecting terms in x
	Leading to $\frac{90(\pi-2)}{\pi}$	**A1**	With no errors or omissions

Question	Answer	Marks	Partial Marks
11(a)	2.5 and – 2.5 oe	**3**	**M2** for $1681m^2 = \frac{42025}{4}$ oe or **M1** for $(9m)^2 + (40m)^2$ oe
11(b)(i)(a)	**c** – **a** final answer	**1**	
11(b)(i)(b)	$\frac{3}{4}$ **a** final answer	**1**	
11(b)(i)(c)	**c** + $\frac{3}{4}$ **a** final answer	**1**	**FT c** + *their* **(b)(i)(b)**, must be a vector in terms of **a** and/or **c** in its simplest form
11(b)(ii)	**a** + $\frac{4}{3}$ **c** oe	**2**	**B1** for [$\overrightarrow{BQ}$ =] $\frac{1}{3}$ **c** or [$\overrightarrow{AQ}$ =] $\frac{4}{3}$ **c** or **M1** for a correct route or for answer **a** + *k***c** oe**,** where $k > 1$

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MATHEMATICS **0580/43**

Paper 4 (Extended) **October/November 2022**

MARK SCHEME

Maximum Mark: 130

Published

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- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

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Abbreviations

cao	correct answer only
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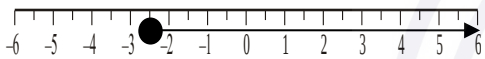
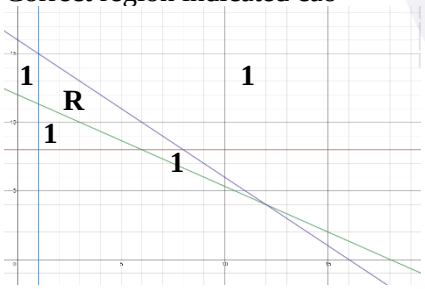
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)(i)	60.9 or 60.86 to 60.87	**1**	
1(a)(ii)	375	**2**	**M1** for $\frac{250}{12}$ [× 18] oe
1(a)(iii)	30 nfww	**3**	**M1** for figs2200 ÷ 800 [× 12]oe **M1** for 1500 ÷ 600 [× 12] oe
1(b)(i)	1.92	**2**	**M1** for $k \times \left(1+\frac{25}{100}\right) = 2.4[0]$ oe or better
1(b)(ii)	43.75 or $43\frac{3}{4}$	**3**	**M2** for $\left(\left(1+\frac{25}{100}\right)\times\left(1+\frac{15}{100}\right)[-1]\right)[\times 100]$ oe or $\left(1+\frac{25}{100}\right)\times\left(1+\frac{15}{100}\right)\times 100$ [–100] or for $\frac{2.40\times\left(1+\frac{15}{100}\right)}{\textit{their}\textbf{(b)(i)}}\times 100$ [– 100] oe or **M1** for $2.40\times\left(1+\frac{15}{100}\right)$ or $\left(1+\frac{25}{100}\right)\times\left(1+\frac{15}{100}\right)$ oe
1(c)	18 nfww	**3**	**M2** for $\frac{200 \text{ to } 210}{11.5-0.25}$ or $\frac{200+5}{11 \text{ to } 11.5}$ oe or **M1** for 200 + 5, 200 – 5, 11.5 + 0.25 or 11.5 – 0.25

Question	Answer	Marks	Partial Marks
2(a)(i)	p^{14} final answer	**1**	
2(a)(ii)	$6m^4$ final answer	**2**	**B1** for $6m^k$ or km^4 in final answer or correct answer seen and spoilt
2(a)(iii)	$\frac{4}{3x^3y^9}$ or $\frac{4x^{-3}y^{-9}}{3}$ final answer	**3**	**B2** for correct answer seen and spoilt or 2 correct elements in final answer or **B1** for one of $\frac{4}{3}$ or $\frac{3}{4}$ oe or $\boldsymbol{x^3}$ **or** $\boldsymbol{y^9}$ seen
2(b)	3, 12, 27	**2**	**B1** for 12 or 27
2(c)(i)	$3n + 10$ oe final answer	**2**	**B1** for $3n + k$ oe or $jn + 10$ oe ($j \neq 0$) or for correct expression shown in working and then spoilt
2(c)(ii)	$2n^3 + 1$ oe final answer	**2**	**B1** for 3rd diff = 12 (both needed) or for cubic answer or for correct expression shown in working and then spoilt
2(d)	38	**3**	**M2** for $3x = 4 \times 23 + 22$ or **M1** for $3x - 22 = 4 \times 23$ or for $\frac{3x}{4} = 23 + \frac{22}{4}$ oe
2(e)	$\frac{-8 \pm \sqrt{8^2 - 4(3)(-20)}}{2 \times 3}$ or $\frac{-8}{2\times3} \pm \sqrt{\frac{8^2}{4\times3^2} - \frac{(-20)}{3}}$ or better	**B2**	**B1** for $\sqrt{8^2 - 4(3)(-20)}$ oe or $\frac{-8+\sqrt{q}}{2\times3}$ oe or $\frac{-8-\sqrt{q}}{2\times3}$ oe or both
	– 4.24, 1.57 final answers	**B2**	**B1** for each If **B0, SC1** for answers – 4.2 or –4.23 or –4.240 to – 4.239 **and** 1.6 or 1.572 to 1.573 or – 4.24 **and** 1.57 seen in working or for –1.57 and 4.24 as final answer

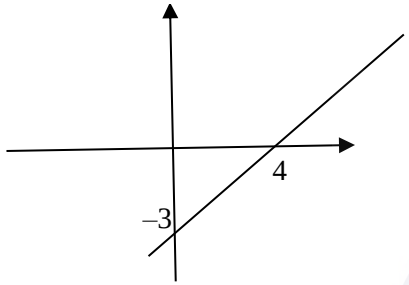
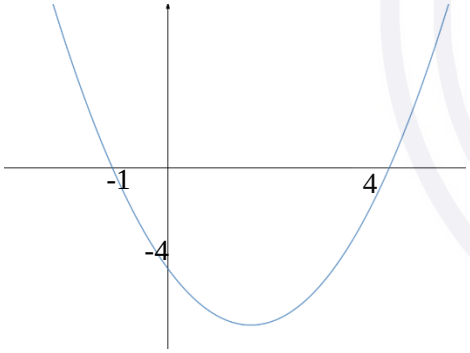
Question	Answer	Marks	Partial Marks
3(a)	Correct histogram	**3**	**B1** for each correct block If 0 scored, **SC1** for two of $\frac{28}{15}$, $\frac{33}{20}$, $\frac{13}{10}$ or 1.87 or 1.866 to 1.867, 1.65, 1.3
3(b)	38.65	**4**	**M1** for 12.5, 20, 32.5, 50, 65 soi **M1** for $\sum fx$ where x is in the correct interval including boundaries **M1dep** for $\sum fx \div 100$
4(a)	Triangle drawn at (1, – 5), (1, – 7), (5, – 5)	**2**	**B1** for reflection in any horizontal line If 0 scored, **SC1** for reflection in $x = -2$
4(b)	Triangle drawn at (– 2, 0), (– 2, – 1), (0, – 1)	**2**	**B1** for correct size and orientation but wrong position
4(c)	Rotation 90 [anticlockwise] oe [centre] (– 1, 0)	**3**	**B1** for each

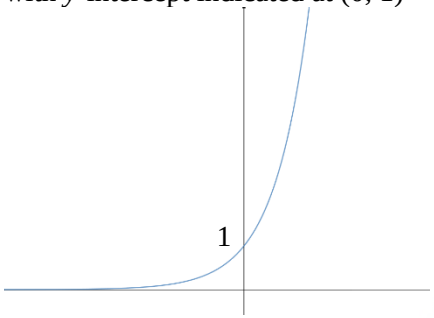
Question	Answer	Marks	Partial Marks
5(a)	$\left(\frac{(36+50)\times 40}{2}\right)\times 120$ oe or $\left(\frac{(0.36+0.5)\times 0.4}{2}\right)\times 1.2$ oe	**M2**	**M1** for $\frac{(36+50)\times 40}{2}$ oe or $\frac{(0.36+0.5)\times 0.4}{2}$ oe
	206400 ÷ 1000 = 206.4 or 0.2064 × 1000 = 206.4 nfww	**A1**	Must see an explicit conversion
5(b)	5 [minutes] 44 seconds	**3**	**B2** for 344 [seconds] oe 5.73…[mins] or **M1** for figs206.4 ÷ figs 6 oe
5(c)(i)	28[.0] or 27.96 to 27.97	**3**	**M2** for $[r^2=]\ \frac{\text{figs } 2064}{(figs84)\pi}$ or **M1** for $\pi r^2 \times figs84 = \text{figs } 2064$
5(c)(ii)	140 cao	**2**	**M1** for $0.6h = 84$ oe ALT method **M1** for $\pi\times(their\ \textbf{(c)(i)})^2\times h = figs206400\div 0.6$ oe
5(d)	128 or 127.7 to 127.8	**4**	**B3** for $40^2+120^2+18^2$ oe OR **B1** for horizontal length 18 soi **M1** for any correct attempt at 2-dimensional Pythagoras' $18^2 + 120^2$, $120^2 + 40^2$, $18^2 + 40^2$

Question	Answer	Marks	Partial Marks
6(a)(i)	38	**2**	**M1** for $5 \times 3^2 - 7$ oe
6(a)(ii)	$[\pm]\sqrt{\frac{P+7}{5}}$ oe final answer	**3**	**M1** for $P + 7 = 5k^2$ or $\frac{P}{5} = k^2 - \frac{7}{5}$ **M1** for k^2 = ……. FT *their* first step **M1** for square root to final answer Max M2 for incorrect answer
6(b)(i)	$x \geqslant -2.5$ final answer	**2**	**M1** for $-4x \leqslant 7 + 3$ or better
6(b)(ii)		**1**	**FT** *their* inequality in **(b)(i)**
6(c)(i)	$x = 2$ broken line	**B1**	
	$y = 32 - x$ solid line	**B1**	
	$2x + 3y = 72$ solid line	**B2**	**B1** for line passing through (0, 24) or (36, 0)
	Correct region indicated cao 	**B2**	**B1** for region satisfying 3 of the inequalities
6(c)(ii)	(16, 16)	**2**	**M1** for substitution into $2x + y$ for any integer point in *their* region

Question	Answer	Marks	Partial Marks
7(a)(i)	$\frac{1}{15}$ oe	**3**	**M2** for $2\times\frac{1}{6}\times\frac{1}{5}$ oe or **M1** for $\frac{1}{6}\times\frac{1}{5}$ oe or list or indication of 2 correct pairs If 0 scored, **SC1** for answer $\frac{1}{18}$ oe
7(a)(ii)	$\frac{7}{15}$ oe	**3**	**M2** for $\left(\frac{4}{6}\times\frac{3}{5}\right)+2\left(\frac{1}{6}\times\frac{1}{5}\right)$ oe or $14\left(\frac{1}{6}\times\frac{1}{5}\right)$ oe or $1-2\left(\frac{2}{6}\times\frac{4}{5}\right)$ or **M1** for $\left(\frac{4}{6}\times\frac{3}{5}\right)$ or $2\left(\frac{1}{6}\times\frac{1}{5}\right)$ oe or $2\left(\frac{2}{6}\times\frac{4}{5}\right)$ or correct identification of 14 pairs If 0 scored, **SC1** for answer $\frac{5}{9}$
7(b)	$\frac{1}{10}$ oe nfww	**4**	**M3** for $6\left(\frac{1}{6}\times\frac{1}{5}\times\frac{1}{4}\right)+6\left(\frac{1}{6}\times\frac{1}{5}\times\frac{1}{4}\right)$ oe or **M2** for $6\left(\frac{1}{6}\times\frac{1}{5}\times\frac{1}{4}\right)$ oe or $2\left(\frac{1}{6}\times\frac{1}{5}\times\frac{1}{4}\right)$ oe or **M1** for $k\left(\frac{1}{6}\times\frac{1}{5}\times\frac{1}{4}\right)$ where k is an integer and $1 \leqslant k \leqslant 12$ but not $k = 2$ or $k = 6$ or identifies –2, 2 and 5 or –3, 3 and 5 as the 3 cards needed If 0 scored, **SC1** for answer $\frac{1}{18}$

Question	Answer	Marks	Partial Marks
8(a)	[cos B =] $\frac{9.5^2 + 7.7^2 - 10^2}{2 \times 9.5 \times 7.7}$ oe	**M2**	**M1** for $10^2 = 9.5^2 + 7.7^2 - 2\times9.5\times7.7\cos B$ oe or better
	70.206 to 70.207 or 70.21 to 70.22	**A2**	**A1** for $\frac{2477}{7315}$ oe or 0.339 or 0.3386….
8(b)(i)	140.4	**1**	
8(b)(ii)	19.8	**1**	**FT** (180 – *their* **(b)(i)**) ÷ 2
8(b)(iii)	70.2	**1**	**FT** 90 – *their* **(b)(ii)**
8(c)	5.31 or 5.314 to 5.315	**3**	**M2** for $\frac{5}{\cos\ \textit{their}\,\textbf{(b)(ii)}}$ oe or **M1** for $\frac{5}{r} = \cos(\textit{their}\,\textbf{(b)(ii)})$ oe
8(d)	38.8 or 38.9 or 38.78 to 38.85	**4**	**M3** for $\frac{0.5\times9.5\times7.7\times\sin 70.2}{\pi\times(\textit{their}\,\textbf{(c)})^2}$ [×100] OR **M1** for 0.5 × 9.5 × 7.7 × sin70.2 **M1** for $\pi\times(\textit{their}\,\textbf{(c)})^2$

Question	Answer	Marks	Partial Marks
9(a)(i)	Correct sketch of $3x - 4y = 12$ with $y = -3$ and $x = 4$ indicated on axes  	**2**	**B1** for line with positive gradient
9(a)(ii)	Correct sketch of $y = x^2 - 3x - 4$ with (0, – 4) indicated as y – intercept and $x = -1$ and $x = 4$ indicated as roots  Minimum in fourth quadrant, not at $x = 0$	**4**	**B3** for correct sketch with one value omitted or incorrect or for a poor sketch with all 3 intercepts correct. or **B2** for roots $x = -1$ and $x = 4$ soi with no extra roots or for correct shape with $y = -4$ indicated or **B1** for correct shape or for $(x - 4)(x + 1)$ shown or for incorrect sketch with (0, – 4) indicated as y – intercept

Question	Answer	Marks	Partial Marks
9(a)(iii)	Correct sketch of $y = 6^x$ with y-intercept indicated at (0, 1)  	**2**	**B1** for increasing exponential graph seen on both sides of the y-axis.
9(b)(i)	$8 - 4x^2$ [+ 0]	**2**	**B1** for two terms correct and one extra incorrect term or for one of two terms correct or for correct answer seen and spoilt
9(b)(ii)	4	**2**	**M1** for substitution of $x = -1$ into *their* **(b)(i)**
9(b)(iii)	(3, –7) and (–3, 17)	**5**	**B4** for (3, –7) or (–3, 17) or **B3** for $x = \pm 3$ or **M2** for $x^2 = 9$ or $k(x - 3)(x + 3) = 0$ oe or for correct method for solving *their* **(b)(i)** = – 28 or **M1** for *their* **(b)(i)** = – 28

Question	Answer	Marks	Partial Marks
10(a)(i)	2**a** drawn correctly with direction arrow	**1**	
10(a)(ii)	**a** − **b** drawn correctly with direction arrow	**2**	**B1** for $\begin{pmatrix} 4 \\ -3 \end{pmatrix}$ seen or implied or **M1** for correctly drawing *their* **a** – **b** with an arrow
10(b)(i)(a)	$\mathbf{q} + \frac{3}{4}\mathbf{p}$ final answer	**1**	
10(b)(i)(b)	$\mathbf{q} - \frac{1}{4}\mathbf{p}$ final answer	**2**	**M1** for a correct route
10(b)(i)(c)	$\frac{13}{24}\mathbf{p} - \frac{2}{3}\mathbf{q}$ final answer	**3**	**M2** for $\frac{3}{8}\mathbf{p} - \frac{2}{3}$ (*their* **(b)(i)(b)**) oe or for $-\frac{3}{8}\mathbf{p} - \mathbf{q} + \mathbf{p} + \frac{1}{3}$ (*their* **(b)(i)(b)**) oe or **M1** for a correct route or for $[\overrightarrow{BN} =] -\frac{2}{3}$ (*their* **(b)(i)(b)**) or $[\overrightarrow{AN} =] \frac{1}{3}$ (*their* **(b)(i)(b)**) or final answer $k\mathbf{p} - \frac{2}{3}\mathbf{q}$ oe or $\frac{13}{24}\mathbf{p} - k\mathbf{q}$ oe
10(b)(ii)	$\frac{19}{16}\mathbf{p}$ oe final answer	**2**	**M1** for $\overrightarrow{AG} = \frac{3}{8}\mathbf{p} \div 2$ soi or for answer $k\mathbf{p}$ oe

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MATHEMATICS **0580/41**

Paper 4 (Extended) **May/June 2022**

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the May/June 2022 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

This document consists of **13** printed pages.

PUBLISHED

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

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ABBREVIATIONS IN MARK SCHEME

Abbreviation	Meaning
M	Method marks - for a correct method applied to appropriate numbers.
A	Accuracy marks – depend on M marks. Hence M0 A1 is not possible.
B	Independent of method marks – for a correct final answer, a partially correct answer or a correct intermediate stage.
SC	Marks given in special cases only when indicated in mark scheme.
FT	Work can be followed through after an error.
isw	Ignore subsequent working (after correct answer obtained)
cao	Correct answer only
nfww	Not from wrong working
oe	Or equivalent
soi	Seen or implied
eeo	Each error or omission
dep	Dependent on the previous mark(s)

Question	Answer	Marks	Partial Marks
1(a)(i)	1 | 7 7 8 8 9 9 2 | 1 1 1 1 2 3 3 4 5	2	**B1** for one row correctly ordered or for fully correct unordered stem-and-leaf diagram or for a correct diagram with one error or omission
1(a)(ii)	21	1	
1(a)(iii)	23	1	
1(a)(iv)	48	2	**M1** for $\frac{2}{15}[\times 360]$ or $\frac{360}{15}[\times 2]$
1(b)(i)	120	1	
1(b)(ii)	130	1	
1(b)(iii)	60	1	
1(c)(i)	93.4	4	**M1** for mid-values soi **M1** for Σfx **M1 dep on second M** for $\Sigma fx \div 200$
1(c)(ii)	19	2	**M1** for $\frac{86}{50}$ or $\frac{114}{60}$

Question	Answer	Marks	Partial Marks
2(a)	42	2	**M1** for $12 \div 2$ or better
2(b)(i)	5.72	2	**M1** for $\frac{100-12}{100} \times 6.50$ oe or **B1** for 0.88 oe
2(b)(ii)	12.5[0]	2	**M1** for $\frac{100-12}{100} \times x = 11$ or better oe

Question	Answer	Marks	Partial Marks
2(c)	4	**2**	**M1** for $\frac{100+2.5}{100}\times[...]=\frac{100+6.6}{100}$ oe
2(d)(i)	72.3 or 72.31...	**2**	**M1** for $80\times\left(\frac{100-2}{100}\right)^5$ oe
2(d)(ii)	4 nfww	**3**	**B2** for answer 9 nfww or **M2** for correct trials with values giving either side of 67 or **M1** for $80\times\left(\frac{100-2}{100}\right)^n=67$ or $\textit{their}(i)\times\left(\frac{100-2}{100}\right)^k=67$ or an evaluated trial with $n \geqslant 6$ or $k \geqslant 1$

Question	Answer	Marks	Partial Marks
3(a)(i)	6	**3**	**B2** for $4x + 6 = 30$ or better or **M1** for $x + x + 7 + 2x - 1$ [= 30]
3(a)(ii)	21	**3**	**M2** for (555 – *their* $x \times 15$ – *their* $(x + 7) \times 18) \div$ *their* $(2x - 1)$ or **M1** for *their* $x \times 15$ or *their* $(x + 7) \times 18$
3(b)(i)	8	**2**	**M1** for isolating the term in w or correctly removing all fractions e.g. $\frac{3w}{16}=1+\frac{1}{2}$ or better or 3w – 16 = 8
3(b)(ii)	–3	**2**	**M1** for $2^{-y}=8$ or $2^{y}=\frac{1}{8}$ or $2^{-y}=\textit{their}\,w$ or better

Question	Answer	Marks	Partial Marks
3(c)(i)	$[p =] \frac{1}{2}$ oe $[q =] 1$	**2**	**B1** for each If zero scored, **SC1** for 2 values satisfying one of the original equations
3(c)(ii)	$[u =]$ 30 and 150 $[v =]$ 0 and 360	**4**	**B1** for each OR **SC1** for sin u = *their* p and cos v = *their* q **SC1** if their two different angles for u sum to 180 or if their different two angles for v sum to 360

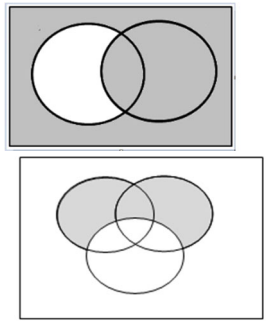
Question	Answer	Marks	Partial Marks
4(a)(i)	3	**1**	
4(a)(ii)	7	**1**	**FT** *their* (i) 3×*their* (i) –2
4(b)	$\frac{x+2}{3}$ oe final answer	**2**	**M1** for $y + 2 = 3x$ or $\frac{y}{3} = x - \frac{2}{3}$ or $x = 3y - 2$
4(c)	25	**2**	**M1** for $\frac{1}{x} = 5^{-2}$ oe
4(d)	$\frac{2x^2 - x - 1}{x}$ final answer	**2**	**M1** for $2x - 1 - \frac{1}{x}$
4(e)	2.98×10^{17} or $2.980... \times 10^{17}$	**1**	
4(f)	625	**2**	**M1** for x = j(4)

Question	Answer	Marks	Partial Marks
5(a)(i)(a)	$\frac{(8-2)\times 180}{8\times 2}$ oe	**M2**	**M1** for $\frac{(8-2)\times 180}{8}$ or $\frac{360}{8}$ or $\frac{(2\times 8-4)\times 90}{8}$
5(a)(i)(b)	174 or 173.8....	**4**	**M3** for $\frac{1}{2}\times 6\times OM$ oe or $\frac{1}{2}\times (OA)^2\times \sin 45$ oe or $\frac{1}{2}\times 6\times OA\times sin67.5$ oe where OA and OM are as in the **M2** or **M2** for $OM = 3\times \tan 67.5$ oe or for $OA = \left(\frac{3}{cos67.5}\right)$ or $\frac{6\times sin67.5}{sin45}$ oe or **M1** for $\frac{OM}{3} = \tan 67.5$ oe or for $\frac{3}{OA} = cos67.5$ oe or for $\frac{sin45}{6} = \frac{sin67.5}{OA}$ oe
5(a)(ii)	193 or 193.0 to 193.1	**3**	**M2** for $\pi\times\left(\frac{3}{cos67.5}\right)^2$ oe or **M1** for $\frac{3}{r} = cos67.5$ or $\frac{sin45}{6} = \frac{sin67.5}{r}$

Question	Answer	Marks	Partial Marks
5(b)(i)	1.27 or 1.272 to 1.273	**2**	**M1** for $\left[\frac{1}{2}\times\right]\pi\times0.45^2\times4$ or $\frac{1}{2}\times\pi\times0.45^2[\times4]$
5(b)(ii)	742 or 743	**6**	**M5** for a method leading to the volume of water e.g. $4\times\{2\times\frac{invcos\left(\frac{0.15}{0.45}\right)}{360}\times\pi\times0.45^2$ $-\frac{1}{2}\times0.45^2\times\sin\left(2\,invcos\left(\frac{0.15}{0.45}\right)\right)\}$ oe **OR** **M2** $[2\times]\frac{invcos\left(\frac{0.15}{0.45}\right)}{360}\times\pi\times0.45^2$ oe or $[2\times]\frac{90-invcos\left(\frac{0.15}{0.45}\right)}{360}\times\pi\times0.45^2$ oe or **M1** for use of $\frac{\theta}{360}\times\pi\times0.45^2$ oe **M2** for $\frac{1}{2}\times0.45^2\times\sin\left(2\,invcos\left(\frac{0.15}{0.45}\right)\right)$ oe or $\frac{1}{2}\times0.15\times0.45\times\sin\left(invcos\left(\frac{0.15}{0.45}\right)\right)[\times2]$ oe

Question	Answer	Marks	Partial Marks
5(b)(ii)			**or M1 for use of** $\frac{1}{2}\times 0.45^2$ **× sinθ oe** **or** $[2\times]\frac{1}{2}\times 0.15\times 0.45\times \sin\beta$ **oe** **If 0 scored,** **SC1 for *inv*cos** $\left(\frac{0.15}{0.45}\right)$ **or *inv*sin** $\left(\frac{0.15}{0.45}\right)$ **or** $\sqrt{0.45^2-0.15^2}$ **soi**
6(a)(i)	–3	**1**	
6(a)(ii)	–1 1.55 to 1.6 4.4 to 4.45	**3**	**B1** for each
6(a)(iii)	–8	**1**	
6(a)(iv)	Ruled line through origin intersecting curve once	**2**	**B1** for ruled line through origin
6(b)(i)	18	**3**	**B2** for $6x - 12$ or **B1** for $6x$ or -12
6(b)(ii)	(2, –5)	**2**	**B1** for each. If 0 scored, **M1** for *their* $6x - 12 = 0$ or states $\frac{dy}{dx} = 0$
6(c)	[p =] 7 [q =] 3	**2**	**B1** for each

Question	Answer	Marks	Partial Marks
7(a)	39.6 or 39.57....	**4**	**M2** for [cos =] $\frac{14^2+12^2-9^2}{2\times14\times12}$ or **M1** for $9^2 = 14^2 + 12^2 - 2 \times 14 \times 12 \times \cos ACD$ **A1** for 0.7708... or 0.771 or $\frac{37}{48}$ oe
7(b)	$\frac{14\sin 25}{\sin 123}$	**M2**	**M1** for $\frac{\sin 123}{14} = \frac{\sin 25}{BC}$ oe
	7.054…	**A1**	
7(c)	3.74 or 3.735 to 3.739	**3**	**M2** for $7.05 \times \sin 32$ or **M1** for recognition that the line from B is perpendicular to AC
7(d)	11.8 or 11.83 to 11.85	**4**	**M1** for $32 +$ *their*(a) soi **M2** for $12^2 + 7.05^2 - 2\times12\times7.05\times\cos(their(a)+32)$ or **M1** for $\cos(their(a)+32) = \frac{12^2+7.05^2-BD^2}{2\times12\times7.05}$
7(e)	309.6 or 309.57...	**2**	**FT** 270 + *their(a)* **M1** for 270 + *their(a)* oe

Question	Answer	Marks	Partial Marks
8(a)(i)	$A \cap B$	**1**	
8(a)(ii)		**2**	**B1** for each
8(b)(i)	$\frac{9}{11}$	**1**	
8(b)(ii)	$\frac{36}{121}$ oe	**3**	**M2** for $2 \times \frac{2}{11} \times \frac{9}{11}$ oe or **M1** for $\frac{2}{11} \times \frac{9}{11}$ oe If 0 scored **SC1** for $\frac{36}{110}$
8(c)(i)	3, 5, 28, 14 correctly placed	**2**	**B1** for 28 in the intersection
8(c)(ii)	$\frac{28}{50}$ oe	**1**	**FT** *their* 28 where *their* $28 < 50$
8(c)(iii)	$\frac{123}{175}$ oe	**2**	**M1** for $\frac{42}{50} \times \frac{41}{49}$
8(c)(iv)	$\frac{63}{88}$ oe	**2**	FT *their* 28 **M1** for $\frac{their28}{33} \times \frac{their28-1}{32}$

Question	Answer	Marks	Partial Marks
9(a)	$x^2 - x - 30[=0]$	**B3**	**M1** for $(2x+1)(x-1) - x^2 = 29$ oe **B1** for $(2x+1)(x-1) = 2x^2 - 2x + x - 1$ oe soi
	$(x-6)(x+5)$ oe	**M1**	or correct factors for *their* 3 term quadratic equation or for correct substitution into quadratic formula or correctly completing the square for *their* 3 term quadratic equation
	$x = 6$ cao	**B1**	
	12 or 2 × *their x* evaluated or $k = 2x$ stated	**B1 FT**	
9(b)(i)	$(y+1)^3 - y^3 = 5$ oe	**M1**	
	$(y+1)^3 = y^3 + 3y^2 + 3y + 1$ soi	**B2**	**B1** for $(y+1)^2 = y^2 + y + y + 1$ oe soi
	Completion to $3y^2 + 3y - 4 = 0$	**A1**	With no errors or omissions
9(b)(ii)	$\frac{-3 \pm \sqrt{3^2 - 4(3)(-4)}}{2 \times 3}$	**B2**	or **B1** for $\sqrt{3^2 - 4(3)(-4)}$ or for $\frac{-3 + \sqrt{...}}{2 \times 3}$ or $\frac{-3 - \sqrt{...}}{2 \times 3}$
	0.44	**B2**	**B1** for 0.758 or 0.7583...

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MATHEMATICS **0580/42**

Paper 4 (Extended) **May/June 2022**

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the May/June 2022 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

[Turn over

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

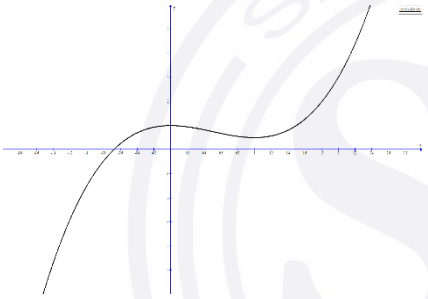
Question	Answer	Marks	Partial Marks
1(a)	150	**2**	**B1** for answer $150k$ or **M1** for prime factors of 30 or 75 seen or a list of multiples of both 30 and 75 with at least 3 of each or for $\frac{30\times 75}{15}$ oe or for answer $2 \times 3 \times 5^2$
1(b)	152 190 266	**3**	Accept in any order **B2** for two correct answers or **M1** for $\frac{608}{4+5+7}\times k$ oe where k =1, 4, 5, 7
1(c)	2.61×10^{-2} 2.61×10^{-2} or $2.608\ldots \times 10^{-2}$	**2**	**B1** for figs 2608 or 261 seen If 0 scored, **SC1** for answer $2.6[0] \times 10^{-2}$ without more accurate value in standard form seen
1(d)	$\frac{27}{99}$ oe fraction	**1**	
1(e)	2.8	**1**	
	g/cm^3 or $g\ cm^{-3}$	**1**	
2(a)	PQR = 90 angle in semi-circle	**B1**	
	PRQ = 61 angle sum of triangle [= 180]	**B1**	
	PSQ = 61 angle in same segment	**B1**	If 0 scored **SC1** for $PSQ = PRQ$ [= 61] soi
2(b)	57	**4**	**B1** for ABT = 98 **B1** for TAB or ATB = 41 **B1** for BTC = 41 or TBC = 82 or ATC =82 soi
3(a)	8.25 or 8.246…	**3**	**M2** for $(3--5)^2+(2-4)^2$ oe or better or **M1** for $(3--5)$ and $(2-4)$ oe seen
3(b)	$[y =] 4x + 7$	**5**	**B1** for [midpoint] (− 1, 3) soi **M1** for [gradient of l =] $\frac{4-2}{-5-3}$ oe **M1** for gradient -1 / *their* $\left(-\frac{1}{4}\right)$ **M1dep on at least M1** for *their* (− 1, 3) substituted into y = *their* $m \times x + c$ oe

Question	Answer	Marks	Partial Marks
3(c)	(0, − 8) and (0, 16)	**4**	**B3** for (0, −8) or (0, 16) or for –8 and 16 OR **B2** for distance = [±]12 soi or **M1** for $13^2 - (5[-0])^2$ oe **B1** for both answers (0, *k*), $k \neq 0$ or 4 **ALT METHOD** **B3** for (0, −8) or (0 , 16) or for – 8 and 16 OR **M2** for $y^2 - 8y - 128$ [= 0] or for $(y - 4)^2 = 144$ or better or **M1** for $13^2 = (-5 - 0)^2 + (4 - y)^2$ oe **B1** for both answers (0, *k*), $k \neq 0$ or 4
4(a)	7.06 or 7.058… or 7.059	**3**	**M2** for $\sqrt{6.4^2 + 10.9^2 - 2 \times 6.4 \times 10.9 \times \cos 38}$ oe OR **M1** for $6.4^2 + 10.9^2 - 2 \times 6.4 \times 10.9 \times \cos 38$ oe **A1**= 49.8...
4(b)(i)	97	**1**	
4(b)(ii)	15.3[0…]	**3**	**M2** for $[AB =] \dfrac{10.9 \times \sin \textit{their } 97}{\sin 45}$ or **M1** for $\dfrac{\sin \textit{their } 97}{AB} = \dfrac{\sin 45}{10.9}$ oe
4(c)	72.8 to 72.81…	**3**	**M2** for $\frac{1}{2}(6.4) \times 10.9 \times \sin 38 + \frac{1}{2} \textit{their } 15.3 \times 10.9 \times \sin 38$ oe or **M1** for $\frac{1}{2} \times 6.4 \times 10.9 \times \sin 38$ oe or $\frac{1}{2} \times \textit{their} 15.3 \times 10.9 \times \sin 38$ oe or **M1** for height =10.9 × sin38 oe
5(a)	Correct lines drawn	**2**	**B1** for one correct with no incorrect lines
5(b)(i)(a)	Translation or translate $\begin{pmatrix} -1 \\ 4 \end{pmatrix}$ oe	**2**	**B1** for each
5(b)(i)(b)	Rotation or rotate 90 [anticlockwise] oe [centre] (2, 1)	**3**	**B1** for each
5(b)(ii)(a)	Triangle at (– 5, 6) (– 2, 6) (– 2, 5)	**2**	**B1** for reflection in $y = k$

Question	Answer	Marks	Partial Marks
5(b)(ii)(b)	Triangle at (1, 5) (1, 7) (7, 7)	**2**	**B1** for correct size and orientation, wrong position
6(a)	42 028	**2**	**M1** for $\frac{380}{500}$ oe soi isw
6(b)	$\frac{47}{66}$ oe	**4**	0.712[1…] **M3** for $2\left(\frac{5}{12}\times\frac{4}{11}\right)+2\left(\frac{4}{12}\times\frac{3}{11}\right)+2\left(\frac{5}{12}\times\frac{3}{11}\right)$ oe or $1-\left(\frac{5}{12}\times\frac{4}{11}+\frac{4}{12}\times\frac{3}{11}+\frac{3}{12}\times\frac{2}{11}\right)$ oe or **M2** for sum of 3 or more correct product pairs and no incorrect pairs or for $\frac{5}{12}\times\frac{4}{11}+\frac{4}{12}\times\frac{3}{11}+\frac{3}{12}\times\frac{2}{11}$ and no other pairs or **M1** for $\frac{k}{12}\times\frac{j}{11}$ seen If 0 scored **SC1** for answer $\frac{94}{144}$ oe
6(c)	52	**2**	**M1** for $x\times\frac{100-16}{100}=43.68$ oe or better
6(d)(i)	70 or 70.16[5…] or 70.17 or 70.2	**3**	**M2** for $\frac{29750 \text{ to } 29800}{400+25}$ or $\frac{29750 \text{ to } 29800}{400+24}$ or $\frac{29800-50}{400 \text{ to } 425}$ or **B1** for 29 750 or 29 850 or 29 849 or 375 or 425 or 424 seen
6(d)(ii)	2399 or 2400 nfww	**2**	**B1** for 27 450 or 27 550 or 27 549 or 29 850 or 29 849 seen
7(a)	25.2 or 25.23…	**4**	**M1** for midpoints **soi** **M1** for use of $\sum fx$ with x in correct interval including both boundaries **M1** (**dep** on 2nd M1) for $\sum fx \div 150$
7(b)	5 correct blocks	**4**	**B3** for 4 correct blocks or **B2** for 3 correct blocks or **B1** for 2 correct blocks or block widths 10, 10, 5, 15, 10 If 0 scored **SC1** for 4 correct frequency densities from 1.2, 3.8, 6.4, 3.33[3…] and 1.8 oe soi
7(c)(i)	12, 50, 82, 132, 150	**2**	**B1** for 3 or 4 correct

Question	Answer	Marks	Partial Marks
7(c)(ii)	92	**2**	**M1** for 150 −12 oe seen If 0 scored, **SC1** for answer 8[%]
8(a)	$\frac{1}{2}$ or 0.5 oe	**2**	**M1** for $10-3=11p+3p$ oe or better
8(b)	$[m=]\frac{2k}{c^2-g}$ oe final answer	**3**	**M1** for correctly isolating *m* terms **M1** for correctly factorising **M1** for dividing by a bracket with two terms to the final answer Maximum mark **M2** if final answer incorrect
8(c)	0 4.5 oe	**5**	**B4** for $2x^2-9x$ [= 0] or $9x-2x^2$ [= 0] or better OR **M2** for $(2x+3)+4(x-3)=(x-3)(2x+3)$ or better or **M1** for $(2x+3)+4(x-3)$ seen oe or common denominator $(x-3)(2x+3)$ oe **B1** for $2x^2-6x+3x-9$ or better seen
8(d)	$y^2-10y+21[=0]$ or $x^2-4x-12[=0]$	**M2**	**M1** for $y^2+5(12-2y)=39$ oe or $5x+\frac{(12-x)^2}{2^2}=39$ seen oe
	$(y-3)(y-7)$ [= 0] or $(x+2)(x-6)$ [= 0]	**M1**	or for correct factors for *their* 3– term quadratic equation or for correct substitution into quadratic formula or correctly completing the square for *their* 3–term quadratic equation
	$x=-2$ $y=7$ $x=6$ $y=3$	**B2**	**B1** for $x=-2$, $x=6$ or for $y=7$, $y=3$ or for one correct pair of *x* and *y* values
8(e)	$2x^3+x^2-54x+72$ final answer	**3**	**B2** correct expansion of three brackets unsimplified or for final answer of correct form with 3 out of 4 terms correct or **B1** correct expansion of two brackets with at least three terms out of four correct
9(a)	*PMR* = *MSR* = right angle[s] or 90°	**B1**	
	PRM = *MRS* same angle	**B1**	
	AAA oe OR *MPR* = *SMR* 3rd angle of triangle	**B1**	**Dep** on B1B1 and no errors seen

Question	Answer	Marks	Partial Marks
9(b)(i)	5.5	**2**	**M1** for $\frac{x}{4.5}=\frac{9.9}{8.1}$ oe
9(b)(ii)	16.7 or 16.73 to 16.74	**2**	**M1** for $25\times\left(\frac{8.1}{9.9}\right)^2$ oe or $25\times\left(\frac{4.5}{their\ 5.5}\right)^2$ oe
10(a)	1, 2, 3	**2**	**M1** for $15-8>5n-3n$ oe If 0 scored, **B1** for 2 correct answers and no others or 3 correct answers with one extra value
10(b)(i)	$10y + 8x \leqslant 80$ oe final answer $x > 4$ oe final answer $2y > x - 4$ oe final answer	**3**	**B1** for each If 0 scored, **SC1** for $10y + 8x < 80$ oe final answer and $x \geqslant 4$ oe final answer and $2y \geqslant x - 4$ oe final answer
10(b)(ii)	23 final answer	**2**	**M1** for 7 and 2 selected soi
11(a)(i)	4.455 to 4.456… [= 4.46]	**2**	**M1** for $[r =]\ \frac{28}{2\pi}$ oe
11(a)(ii)	1250 or 1247 to 1249.9…	**2**	**M1** for $20\times\pi\times4.46^2$ oe
11(a)(iii)	66[.0] or 65.95 to 66.02	**3**	**M2** for [tan] = $\frac{20}{2\times4.46}$ oe or **B1** for identifying angle *ANB* on cylinder **not on rectangle**
11(b)	11.8 or 11.82 to 11.83	**5**	**M2** for $[r =]\ \sqrt[3]{\frac{310\times3}{2\pi}}$ oe or $[h =]\ \sqrt[3]{\frac{310\times3\times4}{\pi}}$ oe or **M1** for $310=\frac{1}{3}\pi\times r^2\times2r$ or $310=\frac{1}{3}\pi\left(\frac{h}{2}\right)^2 h$ **M2** for $\sqrt{(their\ r)^2+\left(2\times their\ r\right)^2}$ oe or **M1** for $[l^2 =]\left(their\ r\right)^2+\left(2\times their\ r\right)^2$ oe

Question	Answer	Marks	Partial Marks
12(a)	$3x^2 - 2kx$	**M2**	**M1** for $3x^2$ or $-2kx$
	their $\frac{dy}{dx} = 6$	**M1**	Dep on at least M1 for derivative
	$x = 2$ substituted in *their* $\frac{dy}{dx}$	**M1**	Dep on at least M1 for derivative
	Correct working leading to 1.5 oe	**A1**	A0 if any errors in working leading to 1.5
12(b)	(0, 1) (1, 0.5)	**4**	**B3** for $x = 0$ and $x = 1$ or for (1, 0.5) OR **M1** for *their* $\frac{dy}{dx} = 0$ **B1** for $3x^2 - 3x$ oe or better
12(c)	correct sketch 	**2**	with max on positive y-axis and min in 1st quadrant **B1** for positive cubic or for graph with one max which is on pos y-axis and one min which is in 1st quadrant

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MATHEMATICS **0580/43**

Paper 4 (Extended) **May/June 2022**

MARK SCHEME

Maximum Mark: 130

Published

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Maths-Specific Marking Principles	
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oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

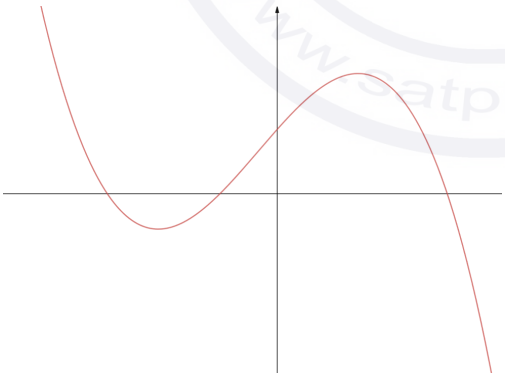
Question	Answer	Marks	Partial Marks
1(a)	10 07	**1**	
1(b)	123	**2**	**M1** for 10 30 – 8 27 soi or 10 30 – 8 52 + 25 soi or 25 + 50 + 48
1(c)	25.2, $25\frac{1}{5}$	**2**	**M1** for figs 29.4 ÷ 70 [× 60] oe
1(d)	\$142.1[0] cao	**4**	**M2** for [adults =] 56 ÷ 8 × 5 and [child =] 56 ÷ 8 × 3 or better or **M1** for 56 ÷ (5 + 3) × k where k = 1, 3 or 5 **M1** for *their* 35 × 2.80 + *their* 21 × 2.80 × $\frac{3}{4}$ oe
2(a)(i)	Triangle drawn at (2, – 1), (2, – 4), (3, – 4)	**2**	**B1** for two correct points If 0 scored, **SC1** for reflection of triangle T in $y = -x$
2(a)(ii)	Triangle drawn at (– 5, 6), (– 2, 5), (– 5, 5)	**2**	**B1** for translation by $\begin{pmatrix}-1\\k\end{pmatrix}$ or by $\begin{pmatrix}k\\3\end{pmatrix}$ If 0 scored **SC1** for triangle drawn at (–4.5, 3.5), (–4.5, 4.5) and (–1.5, 3.5)
2(a)(iii)	Enlargement [SF] – 1.5 oe [centre] (0, 3)	**3**	**B1** for each
2(b)	28.8, $28\frac{8}{10}$, $28\frac{4}{5}$	**2**	**M1** for 1.2^2 oe
3(a)(i)(a)	187 or 186.7 to 186.8 or $186\frac{42}{53}$	**1**	
3(a)(i)(b)	2 : 7 : 42 cao	**2**	**B1** for 106 : 371 : 2226 or any equivalent ratio If 0 scored, **SC1** for 2 : 7 : 42 in the wrong order
3(a)(ii)	33.3 or 33.28 to 33.29	**2**	**M1** for $\frac{2967-2226}{2226}$ [× 100] oe or $\frac{2967}{2226} \times 100$ [– 100] oe

Question	Answer	Marks	Partial Marks
3(a)(iii)	1706 cao nfww	**3**	**B2** for 1705 to 1706.0… or 1710 or **M1** for $\left(1+\frac{30.48}{100}\right)x = 2226$ oe or better If 0 or M1 scored, **SC1** for rounding *their* decimal answer seen to nearest integer
3(b)	3897	**5**	**B1** for $a = 2000$ **M2** for $[b =] \sqrt[3]{\frac{2662}{2000}}$ or **M1** for $2662 = 2000b^3$ **M1** for *their* $2000 \times \left(\sqrt[3]{\frac{2662}{their 2000}}\right)^7$ or for *their* $a \times$ (*their* b)^7 provided *their a* and *their b* are clearly identified in the working If 0 or M1 scored, **SC1** for rounding *their* decimal answer seen to nearest integer.
4(a)	$\frac{(12-2)\times 180}{12}$ [= 150] oe or $180 - \frac{360}{12}$ [= 150]	**1**	Accept $\frac{(2\times 12-4)\times 90}{12}$ [= 150]
4(b)(i)	$\frac{3}{\cos 75}$ oe or $\frac{6\sin 75}{\sin 30}$	**M2**	**M1** for $\frac{3}{AO} = \cos 75$ oe or $\frac{r}{\sin 75} = \frac{6}{\sin 30}$
	11.59…	**A1**	
4(b)(ii)(a)	72.8 or 72.9 or 72.82 to 72.89…	**2**	**M1** for $2 \times \pi \times 11.6$
4(b)(ii)(b)	12.1 or 12.06 to 12.08	**2**	**M1** for [6 +] *their* **(b)(ii)(a)** ÷ 12 oe
4(c)	806 or 807 or 805.9 to 807.4	**3**	**B2** for 402.9… to 403.7 OR **M2** for $\frac{1}{2}\times 6\times 11.6\times \sin 75\times 12\times 2$ oe or **M1** for $\frac{1}{2}\times 6\times 11.6\times \sin 75\ [\times k]$ oe
5(a)(i)	$20 < t \leqslant 35$	**1**	

Question	Answer	Marks	Partial Marks
5(a)(ii)	28 nfww	**4**	**M1** for midpoints **soi** **M1** for use of $\sum fm$ with m in correct interval including both boundaries **M1** (dep on 2nd M1) for $\sum fm \div 80$
5(b)(i)	$\frac{7}{8}$ cao	**2**	**M1** for $\frac{18+28+24}{80}$ oe
5(b)(ii)	$\frac{25}{126}$ oe	**3**	**M2** for $[2\times]\left(\frac{3}{28}\times\frac{25}{27}\right)$ or $[2\times]\left(\frac{25}{28}\times\frac{3}{27}\right)$ oe or **M1** for either $\frac{3}{28}$ or $\frac{25}{27}$ or $\frac{25}{28}$ or $\frac{3}{27}$ If 0 scored, **SC1** for answer $\frac{75}{392}$ oe
5(c)(i)	28 and 56	**1**	
5(c)(ii)	Correct diagram	**3**	**B1FT** *their* **(c)(i)** for plots at 5 correct heights **B1** for 5 plots at upper ends of intervals on correct vertical line **B1FT** (dep on at least B1) for increasing curve or polygon through 5 points After 0 scored, **SC1FT** for 4 correct points plotted
5(c)(iii)	Strict FT *their* reading at 80th percentile for an increasing curve/polygon	**2**	**B1** for 64 written or a mark at cf = 64 on graph or a mark on curve at (t, 64)
5(c)(iv)	Correct integer reading at $t = 45$	**M1**	**FT** *their* cf graph for all three marks
	$\frac{80-(\textit{their}\ \text{reading at}\ t=45)}{80}$ [× 100] or $\frac{(\textit{their}\ \text{reading at}\ t=45)}{80}\times 100$	**M1**	
	Percentage consistent with *their* reading	**A1**	If no working shown then SC1 for a correct percentage that follows from a correct reading from *their* graph.
6(a)	$5b - 2a$ final answer	**2**	**B1** for $5b$ or $-2a$ in final answer or for $5b - 2a$ seen
6(b)	$6x - 23$ final answer nfww	**2**	**M1** for $4x - 20$ or $-3 + 2x$

Question	Answer	Marks	Partial Marks
6(c)	$\frac{35-x}{2x(x-5)}$ or $\frac{35-x}{2x^2-10x}$ oe final answer nfww	**3**	**B1** for $3(2x) - 7(x - 5)$ or better isw **B1** for $2x(x - 5)$ as common denominator isw, allow expanded
6(d)	–5	**3**	**M1** for $13 - 4x = 18 - 3x$ oe or $\frac{-4x}{3} + x = 6 - \frac{13}{3}$ oe **M1FT** for $-4x + 3x = 18 - 13$ oe or for $\frac{-x}{3} = \frac{5}{3}$
6(e)	$[x =] \frac{5p}{y+10}$ oe final answer	**4**	**M1** for correctly clearing the x from the denominator **M1** for correctly expanding the brackets or (dealing with the 5 correctly throughout) **M1** for correctly isolating terms in x **M1** for correctly factorising and dividing by the bracket Max 3 marks if answer is incorrect
7(a)	87.[0] or 86.98 to 86.99	**3**	**M2** for $\sqrt{82^2 + 55^2 - 2 \times 82 \times 55 \times \cos 76}$ oe OR **M1** for $82^2 + 55^2 - 2 \times 82 \times 55 \times \cos 76$ oe **A1** for 7570 or 7566 to 7567
7(b)	66.1 or 66.2 or 66.13 to 66.17	**3**	**M2** for $\frac{82 \times \sin 76}{\textit{their}\ \textbf{(a)}}$ oe or **M1** for $\frac{82}{\sin C} = \frac{\textit{their}\ \textbf{(a)}}{\sin 76}$ oe
7(c)	13.3 or 13.30 to 13.31	**3**	**M2** for $AG = 55 \cos 76$ oe or **M1** for recognition that CG is perpendicular to AB

Question	Answer	Marks	Partial Marks
7(d)	54.1 or 54.13… **and** 125.9 or 125.86 to 125.87	**5**	**B4** for 54.1 or 54.13… or 125.9 or 125.86 to 125.87 **M3** for [sin Q =] $\frac{0.5\times82\times55\times\sin 76}{0.5\times90\times60}$ oe or **M2** for $0.5 \times 82 \times 55 \times \sin 76 = 0.5 \times 60 \times 90 \times \sin Q$ oe or **M1** for $0.5 \times 82 \times 55 \times \sin 76$ oe or for $0.5 \times 60 \times 90 \sin Q$ = *their* area of *ABC* If **B4** not scored then **SC1** for two angles seen that sum to 180 (from use of sine ratio) but not 0 and 180.
8(a)(i)	(–0.5, 1)	**2**	**B1** for each
8(a)(ii)	$\begin{pmatrix} 7 \\ -3 \end{pmatrix}$	**2**	**B1** for each
8(a)(iii)	7.62 or 7.615 to 7.616	**2**	**FT** *their* **(a)(ii)** **M1** for (*their* 7)^2 + (*their* –3)^2 oe
8(a)(iv)	[y =] $–4x –1$ final answer	**3**	**B2** for answer $–4x + c$ [oe] or for correct equation in different form or for $–4x +–1$ or for $–4m – 1$ OR **M1** for $\frac{–5 – 7}{1 – –2}$ oe **M1** for correct substitution shown of (–2, 7) or (1, –5) or *their* (–0.5, 1) into y = (*their m*)$x + c$ oe OR **M1** for $7 = –2m + c$ and $–5 = m + c$ **A1** for $m = –4$ and $c = –1$
8(a)(v)	[y =] $\frac{1}{4}x + \frac{11}{4}$ final answer	**3**	**M1** for grad = $\frac{1}{4}$ oe nfww soi, FT negative reciprocal of *their* gradient from **(iv)** **M1** for correct substitution shown of (5, 4) into y = (*their m*)$x + c$ oe or, if no substitution shown, (5, 4) satisfies *their* final linear equation.

Question	Answer	Marks	Partial Marks
8(b)	$2x^2 + 11x - 21$ [= 0]	**M2**	or **M1** for $8 - 5x = 2x^2 + 6x - 13$ oe or better
	$(2x - 3)(x + 7)$ [= 0] oe or $\frac{-11 \pm \sqrt{11^2 - 4 \times 2 \times (-21)}}{2 \times 2}$ or $-\frac{11}{4} \pm \sqrt{\frac{21}{2} + \left(\frac{11}{4}\right)^2}$ oe	**M2**	Allow correct method to solve *their* quadratic equation e.g. formula, complete the square but not for $2x^2 + 6x - 13$ **M1** FT *their* equation for $2x(x + 7) - 3(x + 7)$ [= 0] or $x(2x - 3) + 7(2x - 3)$ [= 0] or $(2x + a)(x + b)$ [= 0] where $ab = -21$ or $2b + a = 11$ OR **M1** for $\sqrt{11^2 - 4 \times 2 \times -21}$ or for $\frac{-11 + \sqrt{k}}{2 \times 2}$ or $\frac{-11 - \sqrt{k}}{2 \times 2}$ OR **M1** for $\left(x + \frac{11}{4}\right)^2$
	$\left(\frac{3}{2}, \frac{1}{2}\right)$ and $(-7, 43)$	**B2**	**B1** for one correct pair or for 2 correct x-values or 2 correct y-values
9(a)	Correct sketch of negative cubic crossing the x-axis at –3, –1 and 3 and crossing the y-axis at 9 	**4**	**B1** for any negative cubic shape with two turning points **B2** for three intercepts only with x-axis labelled at – 3, –1 and 3 or **B1** for one or two correctly labelled x-intercepts **B1** for intercept with y-axis labelled at 9 If no graph drawn, **SC1** for all four intercepts labelled on axes.
9(b)(i)	$3 - x + 3x - x^2$ or better or $3 + x + 3x + x^2$ or better or $9\ [-3x + 3x] - x^2$	**M1**	At least 3 of the four terms correct or for the correct expansion of all three brackets with all 8 terms correct
	Correct completion to $[y =]\ 9 + 9x - x^2 - x^3$	**A1**	with no errors or omissions seen

Question	Answer	Marks	Partial Marks
9(b)(ii)	$9 - 2x - 3x^2 = 0$ oe	**B3**	**B2** for $9 - 2x - 3x^2$ or **B1** for two correct terms **M1** for *their* derivative = 0 or stating $\frac{dy}{dx} = 0$
	$\frac{--2 \pm \sqrt{(-2)^2 - 4 \times -3 \times 9}}{2 \times -3}$ oe OR $-\frac{1}{3} \pm \sqrt{\frac{9}{3} + \left(\frac{1}{3}\right)^2}$ oe	**B2**	FT *their* derivative **B1FT** for $\sqrt{(-2)^2 - 4(-3)(9)}$ or better or for $\frac{-(-2) + \sqrt{q}}{2 \times -3}$ or $\frac{-(-2) - \sqrt{q}}{2 \times -3}$ OR **B1** for $\left(x + \frac{1}{3}\right)^2$
	–2.10 and 1.43 final answer	**B2**	**B1** for each or for answers –2.1 or –2.097 … and 1.4 or 1.430 to 1.431 or **SC1** for –2.097... **and** 1.43[0] to 1.431 seen in working or for –1.43 **and** 2.10 as final answer
9(b)(iii)	[a =] – 6 [b =] 17	**3**	**B2** for either a correct or b correct or for [a =] –5.04 or –5.049 to –5.05 **and** [b =] 16.9… seen or **M1** for substitution of one of *their* solutions into $9 + 9x - x^2 - x^3$ oe or **SC1** for reversed answers, $a = 17$, $b = -6$
10(a)	20.8 or 20.76 to 20.79	**4**	**B3** for [BC =] 10.4 or 10.38 to 10.39… or $6\sqrt{3}$ oe or **M2** for $(2x)^2 + x^2 + 6^2 = 24^2$ oe or **M1** for $24^2 - 6^2$ oe or $x^2 + 6^2$ oe or $(2x)^2 + 6^2$ oe, or $x^2 + (2x)^2$ oe or **SC2** for final answer of $12\sqrt{5}$ or 26.8 or 26.83… OR **M3** for $x^2 + \left(\frac{x}{2}\right)^2 + 6^2 = 24^2$ oe or **M2** for $x^2 + \left(\frac{x}{2}\right)^2$ or **M1** for $x^2 + 6^2$ oe or $\left(\frac{x}{2}\right)^2 + 6^2$ oe or $24^2 - 6^2$ oe

Question	Answer	Marks	Partial Marks
10(b)	14.5 or 14.47 to 14.48	**3**	**M2** for $\sin[\ldots] = \frac{6}{24}$ oe or **M1** for recognising the correct angle *GAC*

Cambridge Assessment International Education

Cambridge IGCSE™

MATHEMATICS **0580/42**

Paper 4 (Extended) **February/March 2022**

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the February/March 2022 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

[Turn over

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

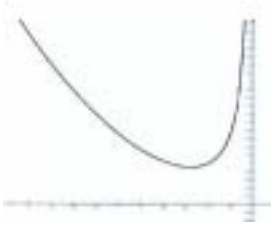
GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)	184	**2**	**M1** for $\frac{852-300}{300}[\times 100]$ oe or for $\frac{852}{300}\times 100[-100]$ oe
1(b)	497	**2**	**M1** for $\frac{852}{5+7}\times k$ oe where k = 1, 5 or 7
1(c)(i)	Forty thousand six hundred	**1**	
1(c)(ii)	4.06×10^4	**1**	
1(d)	435	**3**	**M2** for $3000\times\left(1-\frac{48}{100}-\frac{3}{8}\right)$ oe or **B2** for 2565, or 1440 **and** 1125 or 1875 **and** 1440 or 1560 **and** 1125 or **M1** for $1-\frac{48}{100}-\frac{3}{8}$ or $3000\times\left(\frac{48}{100}+\frac{3}{8}\right)$ oe or **B1** for 1440 or 1125 or 1560 or 1875 If 0 scored **SC1** for answer 975
1(e)	35.7	**3**	**M2** for $\frac{100+15}{100}\times\frac{100+18}{100}$ [–1] oe or better or **M1** for $k\times\frac{100+15}{100}\times\frac{100+18}{100}$ oe
2(a)	1[.0] 0.9	**2**	**B1** for each
2(b)	correct curve 	**4**	**B3 FT** for 6 or 7 points **B2 FT** for 4 or 5 points **B1 FT** for 2 or 3 points

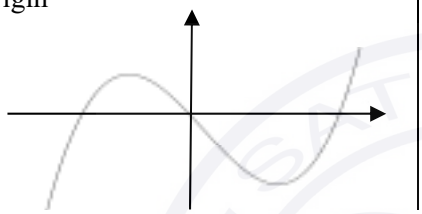
Question	Answer	Marks	Partial Marks
2(c)	ruled line at $y = -1$	**B1**	
	0.3 to 0.32	**B1**	
3(a)(i)	169	**2**	**M1** for g(13) or $(1+4x)^2$ or better
3(a)(ii)	$1+4x^2$ final answer	**1**	
3(a)(iii)	x	**1**	
3(b)	3.5 or $\frac{7}{2}$	**2**	**M1** for $1+4x=15$
4(a)(i)	40.9 or 40.91…	**3**	**M2** for [sin ABC=] $\frac{29.5\sin 51.6}{35.3}$ oe or for [cos ABC =] $\frac{35.3^2+45^2-29.5^2}{2\times35.3\times45}$ or **M1** for $\frac{29.5}{\sin ABC}=\frac{35.3}{\sin 51.6}$ oe or for correct implicit cosine rule
4(a)(ii)	520 or 520.0 to 520.2…	**2**	**FT** *their* (a)(i) if used provided working shown **M1** for $0.5\times29.5\times45\times\sin 51.6$ oe or for $0.5\times35.3\times45\times\sin(\textit{their}(a)(i))$ or for 0.5 × 35.3 × 29.5sin (180–51.6–*their*(a)(i))
4(b)(i)	41.2 or 41.21 to 41.23	**4**	**M1** for $SQ = 2\times32\times\sin\left(\frac{1}{2}\times56\right)$ oe or $\sqrt{32^2+32^2-2\times32\times32\times\cos 56}$ oe or $\frac{32\sin 56}{\sin((180-56)\div2)}$ oe **M2** for $SR^2=47^2+\left(\textit{their}\ SQ^2\right)-2\times47\times\textit{their}\ SQ\times\cos 60$ or **M1** for implicit form
4(b)(ii)	28.3 or 28.25 to 28.29…	**3**	**M2** for 32 × sin62 oe or **M1** for recognition that line from P is perpendicular to SQ
5(a)	121 or 120.8… or 120 $\frac{5}{6}$	**4**	**M1** for midpoints soi **M1** for use of $\sum fx$ with x in correct interval including both boundaries but **not** if x is 50, 50, 100 and 300 **M1** (dep on 2nd M1) for $\sum fx \div 120$

Question	Answer	Marks	Partial Marks
5(b)	12.4 5 1.4	**3**	**B1** for each If 0 scored **SC1** for fd's [0.86,] 0.62, 0.25 and 0.07 oe
5(c)	43 74 99 120	**2**	**B1** for 2 or 3 correct
5(d)	Correct diagram	**3**	**B1** for correct horizontal placement for 4 plots **B1FT** for correct vertical placement for 4 plots **B1FT dep on at least B1** for reasonable increasing curve or polygon through *their* 4 points If 0 scored **SC1 FT** for 3 out of 4 points correctly plotted
5(e)(i)	Strict FT *their* **median** reading	**1**	
5(e)(ii)	Strict FT *their* **UQ** reading	**1**	
5(e)(iii)	Strict FT *their* reading at **40th percentile**	**2**	**B1** for 48 written or mark at cf = 48 on graph
5(e)(iv)	Strict FT *their* reading at 400 – *their* reading at 250	**2**	**B1** for either correct reading at 250 or 400
6(a)	15	**2**	**M1** for $\frac{360}{180-156}$ or for $\frac{180(n-2)}{n}=156$ oe
6(b)	38	**2**	**B1** for $AOB = 76$
6(c)	68	**2**	**B1** for $RSP = 68$ or $RQP = 112$

Question	Answer	Marks	Partial Marks
6(d)	Two pairs of equal angles identified with fully correct reasons	**M3**	**M2** for one pair of equal angles identified with fully correct reasons *KMG* = 90 angle in semicircle and *OGH* = 90 angle between tangent and radius OR *KMG* = *OGH* alternate segment OR *GOH* = *MGK* alternate angles OR Angle *FGM* = angle *GHO* corresponding **and** angle *FGM* = *GKM* alternate segment **and** angle *H* = angle *K* **or M1** for *KMG* = 90, angle in semicircle **or** *OGH* = 90, angle between tangent and radius
	Two or three pairs of angles equal [so similar] oe	**A1**	Dep on M3 with no incorrect work seen
7(a)	31.5	**3**	**M2** for $17.5\times\sqrt{\frac{1134}{350}}$ oe or **M1** for $\sqrt{\frac{1134}{350}}$ oe isw or $\sqrt{\frac{350}{1134}}$ oe isw or for $\frac{1134}{350}=\left(\frac{x}{17.5}\right)^2$ oe
7(b)	163.9375 or $163\frac{15}{16}$ final answer	**2**	**B1** for 15 + 0.25 or 10.5 + 0.25 or better seen
7(c)	40.5[0]	**2**	**M1** for $x\times\left(1-\frac{18}{100}\right)=\frac{166.05}{[5]}$ oe
7(d)	\$2.23 final answer	**3**	**B2** for 2.227… or 2.23 seen OR **M2** for $57-\frac{48.2}{0.88}$ oe or **M1** for $\frac{48.2}{0.88}$ oe If 0 scored **SC1** for 57 × 0.88 oe seen

Question	Answer	Marks	Partial Marks
8(a)	$\frac{12}{x}+\frac{26}{x+10}=2.8$ oe isw	**3**	**B2** for $\frac{12}{x}+\frac{26}{x+10}$ oe isw OR **B1** for $\frac{26}{x+10}$ seen **B1** for time = 2.8 or $\frac{168}{60}$ or $2\frac{48}{60}$ oe
8(b)	$12(x+10)+26x=2.8x(x+10)$ or better	**M2**	**FT** *their* time, provided 2 algebraic fractions one in x and other in $\pm x \pm 10$ **M1** for $12(x+10)+26x$ seen or better
	$12x+120+26x=2.8x^2+28x$	**M1**	**FT** *their* equation dep on M2
	$2.8x^2-10x-120=0$ oe or $30x + 300 + 65x = 7x^2 + 70x$ or better leading to $7x^2-25x-300=0$	**A1**	with no errors or omissions
8(c)	$\frac{[--]25\pm\sqrt{([-]25)^2-4\times7\times-300}}{2\times7}$ oe	**B2**	**B1** for $\sqrt{([-]25)^2-4(7)(-300)}$ or better or for $\frac{[--]25+\sqrt{q}}{2\times7}$ or $\frac{[--]25-\sqrt{q}}{2\times7}$
	− 5 and 8.57 or 8.571…	**B2**	**B1** for each or **SC1** for final answers 5 and –8.57
8(d)	84 to 84.01…	**2**	**FT** $\frac{720}{\textit{their}\text{ positive answer}}$ to 3 sf or better **M1** for $\frac{12}{\textit{their}\text{ positive answer}}$ [× 60] oe
9(a)	54[.0] or 53.99 to 54.03…	**6**	**M2** for [h =] 95.4 × 3 ÷ (π × 2.4^2) oe or **M1** for $95.4=\frac{1}{3}\times\pi\times2.4^2\times h$ **M2** for [slant ht , l =] $\sqrt{(\textit{their}\ h)^2+2.4^2}$ or **M1** for (*their* h)^2 + 2.4^2 **M1** for $\frac{x}{360}\times2\times\pi\times\textit{their}\ l=2\times\pi\times2.4$ oe or $\frac{x}{360}\times\pi\times(\textit{their}\ l)^2=\pi\times2.4\times\textit{their}\ l$

Question	Answer	Marks	Partial Marks
9(b)	14500 or 14470 to 14480	**4**	**M3** for $200 \times 60 \times 24 \times \pi \times 4^2$ [÷1000] or $2 \times 60 \times 24 \times \pi \times 0.04^2$ [×1000] or **M2** for $200 \times \pi \times 4^2$ or for $2 \times \pi \times 0.04^2$ or **M1** for $\pi \times 4^2$ oe or $\pi \times 0.04^2$ seen oe isw or 1000 cm^3 = 1 litre soi or 1 m^3 = 1000 litres soi or for 24×60 seen oe
10(a)	$x^3 + 2x^2 - 5x - 6$ final answer	**3**	**B2** for correct expansion of three brackets unsimplified or for simplified expression of correct form with 3 out of 4 terms correct or **B1** for correct expansion of 2 of the 3 given brackets with at least 3 terms out of four correct
10(b)	$\frac{Mc}{M-2f}$ or $\frac{-Mc}{2f-M}$ final answer	**4**	**M1** for clearing $g - c$ from denominator e.g. $M(g - c) = 2fg$ **M1** for correctly isolating terms in g in numerator on one side **M1** for correctly factorising or simplifying, to single term in g in an equation **M1** for correctly dividing by bracket to final answer
10(c)	$\frac{4x}{x+4}$ final answer	**3**	**B1** for $4x(x - 4)$ **B1** for $(x + 4)(x - 4)$
11(a)(i)	$\frac{1}{6}$ oe on all late branches $\frac{5}{6}$ oe on all not late branches	**2**	**B1** for one correct vertical pair $\frac{1}{6}$ oe and $\frac{5}{6}$ oe
11(a)(ii)	$\frac{5}{36}$ oe	**2**	FT *their* tree **M1** for $their\frac{1}{6} \times their\frac{5}{6}$
11(b)(i)	$(G \cup T \cup M)'$ oe	**1**	
11(b)(ii)	28	**1**	
11(b)(iii)	$\frac{17}{50}$ oe	**1**	

Question	Answer	Marks	Partial Marks
11(b)(iv)	$\frac{4}{7}$ oe	**3**	**M2** for $\frac{16}{21}\times\frac{15}{20}$ or **M1** for $\frac{n}{21}\times\frac{n-1}{20}$ or for $\frac{16}{21}$ and $\frac{15}{20}$ seen If 0 scored **SC1** for answer $\frac{256}{441}$ oe
12(a)	85[.0], 265[.0] and no others	**2**	**B1** for each If 0 scored **SC1** for two values in the range with a difference of 180 but not multiples of 90
12(b)	correct shape and passes through origin 	**3**	**B1** for any positive cubic shape **B1** for sketch with one max and one min and with 3 roots including zero If 0 scored, **SC1** for $x(x + 2)(x – 2)$ soi
12(c)	$a = –12$ $b = 5$ $k = –11$	**6**	**B5** for 2 correct OR **B2** for $3x^2 + a$ or **B1** for $3x^2$ isw **M1dep** on at least B1 for *their* $\frac{dy}{dx} = 0$ **M1dep** on at least B1M1 for $x = 2$ or $x = – 2$ substituted in *their* $\frac{dy}{dx} = 0$ equation **M1** for $k = 2^3 + 2\times \textit{their}\, a + b$ **and** $10 – k = (–2)^3 + (–2)\times \textit{their}\, a + b$

Cambridge Assessment International Education

Cambridge IGCSE™

MATHEMATICS **0580/41**

Paper 4 (Extended) **October/November 2021**

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2021 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

[Turn over

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)(i)	683	**3**	**M2** for [2]((19.4 × 9.2) + (5.7 × 9.2) + (19.4 × 5.7)) oe or **M1** for one of 19.4 × 9.2 or 5.7 × 9.2 or 19.4 × 5.7
1(a)(ii)	1.93[0] or 1.932 to 1.933	**3**	**M2** for 19.4 × 9.2 × 5.7 × 1.9 or **M1** for 19.4 × 9.2 × 5.7
1(b)	39 375	**3**	**M2** for 9000 ÷ 200 × 175 × 5 or **M1** for 9000 ÷ 200 soi or for $\frac{175}{200}$ soi
1(c)	10th July	**3**	**B2** for 4.1 to 4.2 or $4\frac{1}{6}$ or 4 days 1.5 hours Or **M2** for answer 9th July or 11th July or **M1** for 1500 ÷ (9 × 40)
1(d)	167 or 166.9 to 167.0…	**3**	**B2** for answer with figs 167 or figs 1669 to 1670.. or **M1** for $\pi \times 22.5^2 \times 105$ oe If 0 scored **SC1** for answer 668 or 667.9 to 668.1
2(a)(i)	71.4 or 71.42 to 71.43	**1**	
2(a)(ii)	97 [min] 25 [s]	**3**	**B2** for 13 min 55 sec seen or 97.4 or 97.41 to 97.42 seen or 5845 seen OR **M2** for 55.66… ÷ 4 × 7 oe or 3340 ÷ 4 × 7 oe or for 7/4 × 55 + 7/4 × 40 oe or **M1** for 55 min 40 sec ÷ 4 oe or **M1** for **total time** ÷ 16 soi
2(b)(i)	60.8[0]	**2**	**M1** for $47.5 \times \left(1+\frac{28}{100}\right)$ oe or **B1** for 13.3[0]
2(b)(ii)	71.25	**3**	**B2** for 118.75 Or **M2** for $47.50 \div \left(1-\frac{60}{100}\right) - 47.50$ or **M1** for $x \times \left(1-\frac{60}{100}\right) = 47.50$ oe or better

Question	Answer	Marks	Partial Marks
2(c)	15 380	**4**	**M3** for (1 120 000 – 5000) ÷ (70 + 2.5) oe or **B2** for answer figs 15 379 to figs 15 380 or **M2** for (1 120 000 ± 5000) ÷ (70 ± 2.5) oe or **M1** for one of figs 675, 725, 1115, 1125 seen
2(d)	1.8[0] or 1.801 to 1.802 [million] nfww	**2**	**M1** for figs $16 \times \left(1+\frac{2.4}{100}\right)^5$ oe
3(a)	Correct box-and-whisker plot	**4**	**B1** for lowest value and highest value at 30 and 90 **B1** for LQ and UQ at 50 and 72 **B1** for median at 63
3(b)(i)	56	**2**	**M1** for 24 soi
3(b)(ii)	16	**2**	**B1** for 64 written
3(c)(i)	14, 22	**1**	
3(c)(ii)	61.5	**4**	**M1** for 35, 45, 55, 65, 75, 85 soi **M1** for Σfx **M1 dep** for *their* Σfx ÷ (8 + 12 + *their* 14 + *their* 22 + 14 + 10) or Σfx ÷ 80
3(c)(iii)	$\frac{35}{69}$ oe	**3**	**M2** for [2]$\left(\frac{10}{24}\times\frac{14}{23}\right)$ oe or **M1** for $\frac{10}{24}$ or $\frac{14}{24}$ oe seen If 0 scored, **SC1** for answer $\frac{35}{72}$ oe
4(a)(i)	$\frac{10}{3}$ or $3\frac{1}{3}$ or 3.33[3…]	**3**	**M1** for $42 - 12x = 3x - 8$ oe or for $7 - 2x = \frac{3x}{6} - \frac{8}{6}$ oe **M1** for reaching $ax = b$ correctly FT *their* first step
4(a)(ii)	–2.5 or $-2\frac{1}{2}$ or $-\frac{5}{2}$	**3**	**M1** for $3 \times 2x = 2(x - 5)$ oe **M1** for reaching $ax = b$ correctly FT *their* first step

Question	Answer	Marks	Partial Marks
4(b)(i)	$2(x + 12y)(x – 12y)$ final answer	**3**	**B2** for $(2x + 24y)(x – 12y)$ or $(2x – 24y)(x + 12y)$ or for $2(x + 12y)(x – 12y)$ seen OR **M2** for $k(x + 12y)(x – 12y)$ or **M1** for $2(x^2 – 144y^2)$
4(b)(ii)	$(5x – 8)(x + 5)$ final answer	**2**	**M1** for $5x(x + 5) – 8(x + 5)$ or $x(5x – 8) + 5(5x – 8)$ or for $(5x + a)(x + b)$ where $ab = – 40$ or $a + 5b = 17$
4(c)	$4x^2 – 17x + 9$ [= 0] oe	**B1**	
	$\frac{[- -]17 \pm \sqrt{([-]17)^2 - 4(4)(9)}}{2 \times 4}$	**B2**	**FT** *their* 3 term quadratic **B1FT** for $\sqrt{([-]17)^2 - 4(4)(9))}$ or better or $\left(x - \frac{17}{8}\right)^2$ oe or $\sqrt{\frac{([-]17)^2 - 4(4)(9)}{4}}$ or better and **B1FT** for $\frac{[- -]17 + \sqrt{q}}{2(4)}$ or $\frac{[- -]17 - \sqrt{q}}{2(4)}$ or better or $\frac{17}{8} + \sqrt{\frac{145}{64}}$ oe or $\frac{17}{8} - \sqrt{\frac{145}{64}}$ oe or $\frac{\frac{[- -]17}{2} + \sqrt{q}}{4}$ or $\frac{\frac{[- -]17}{2} - \sqrt{q}}{4}$
	0.62 and 3.63 cao	**B2**	**B1** for each **SC1** for 0.6[0] or 0.619 to 0.620 **and** 3.6[0] or 3.6301 to 3.6302 or 0.62 and 3.63 seen in working or –0.62 and–3.63 as final answers
5(a)(i)	62 and Angle at centre is twice angle at circumference oe	**2**	**B1** for either
5(a)(ii)	117 and Isosceles [triangle] and Opposite angles in a cyclic quadrilateral are supplementary	**4**	**B2** for 117 or **B1** for [angle *OCD* =] 28 **B1dep** for isosceles [triangle] and **B1** for opposite angles in a cyclic quadrilateral are supplementary

Question	Answer	Marks	Partial Marks
5(b)	24.9 or 24.94 to 24.95	**5**	**B1** for angle $PQS = 42$ **M2** for $QS = 5.9 \div \cos 42$ oe or **M1** for $\cos 42 = \frac{5.9}{QS}$ oe **M1**dep for *their* $SQ \times \pi$ oe
6(a)(i)	9.5, 4.8 and 8.5	**3**	**B1** for each
6(a)(ii)	correct curve	**5**	**B4** for correct curve, but branches joined or touching y axis or **B3FT** for 9 or 10 correct plots or **B2FT** for 7 or 8 correct plots or **B1FT** for 5 or 6 correct plots AND **B1 indep** two separate branches not touching or cutting *y*-axis
6(b)	$y = \frac{24}{5} - 2x$ ruled and – 0.4 to – 0.2 and 1.45 to 1.7	**4**	**B2** for correct ruled line crossing curve twice or **B1** for correct freehand or for short ruled line or for line with negative gradient through (0, 4.8) or for line with gradient – 2 **B1** for each value
6(c)	[a =] 10 [b =] 20 [c =] – 48	**4**	**B3** for $10x^3 - 15 = 48x - 20x^2$ oe or better or **B2** for 2 correct values or **B1** for 1 correct value or for $5x^2 - \frac{15}{2x} = 24 - 10x$ or better or for $2x^3 - 3 = \frac{48}{5}x - 4x^2$ or better or for $x^3 - \frac{3}{2} = \frac{24}{5}x - 2x^2$ After 0 scored SC1 for correct elimination of a denominator of 5, x or $2x$ from a four term expression.
7(a)(i)(a)	Shape at (–2, 1) (–4, 1) (–4, 7) (0, 7)	**2**	**B1** for 3 correct points or for enlargement SF2 from any centre
7(a)(i)(b)	Shape at (2, –2) (2, –3) (5, –1) (5, –3)	**3**	**B2** for correct orientation but wrong position or for 3 correct points or **B1** for $y = x - 1$ drawn

Question	Answer	Marks	Partial Marks
7(a)(ii)	Rotation 90 [anticlockwise] oe (0, 0) oe	**3**	**B1** for each
7(b)	$\frac{3}{4}\mathbf{p}+\frac{1}{2}\mathbf{q}$ or $\frac{1}{4}(3\mathbf{p}+2\mathbf{q})$ or $\frac{3\boldsymbol{p}+2\boldsymbol{q}}{4}$ final answer	**3**	**M2** for $AM = \overrightarrow{AM} = \frac{1}{2}\left(\mathbf{-p}+\mathbf{q}+\frac{1}{2}\mathbf{p}\right)$ oe or **M1** for correct route for $\overrightarrow{AB}$ oe soi by $-\frac{1}{2}\,\mathbf{p}+\mathbf{q}$ or for $\overrightarrow{OM}$ soi
8(a)(i)	1.6 oe	**2**	**M1** for $3-5x=-5$
8(a)(ii)	$\frac{3-x}{5}$ oe final answer	**2**	**M1** for $x = 3 - 5y$ or $\frac{y}{5}=\frac{3}{5}-x$ or better, or $y-3=-5x$ oe
8(b)(i)	$20.25-(1.5+x)^2$	**3**	Method 1 **B1** for $(\pm 1.5 \pm x)^2$ seen **B1** for [b =] 18 + *their* 1.5^2 OR Method 2 **B1** for $b-a^2-2ax-x^2$ or for b = 20.25 **B1** for a = 1.5
8(b)(ii)	Correct sketch with max in correct quadrant at $(-1.5, 20.25)$	**3**	**FT** *their* $20.25-(\textit{their}1.5+x)^2$ provided in that form **B1** for $\cap$ shape or for $\cup$ shape if in form $c+(d+x)^2$ in part **(b)(i)** **B1** for TP at $(-1.5, k)$ or $(k, 20.25)$ FT *their* $20.25 \pm (\textit{their}1.5+x)^2$ or for (–1.5, 20.25) seen
8(b)(iii)	[y =] $34 - 11x$	**6**	**B2** for $-3-2x$ or **B1** for either kx –3, $k \neq 0$ or $-2x$ + n or for $18-3-2x$ **M1dep** for gradient = *their* (–3 – 2(4)) **B1** for y-value at $x = 4$, is –10 **M1dep** for *their* –10 = (*their* –11)4 + c oe

Question	Answer	Marks	Partial Marks
9(a)	3.5 oe	**3**	**M1** for $2(x + x + 3) = 20$ oe **M1** for correct $ax = b$ for *their* linear equation
9(b)	116.8 or 116.83 to 116.85 nfww	**5**	**M2** for $\sin p = \frac{5\sin 20}{2.5}$ or **M1** for $\frac{2.5}{\sin 20} = \frac{5}{\sin p}$ **A1** for 43.2 or 43.15 to 43.17 **M1**dep for 180 – (20 + *their* 43.2) After 0 scored, **SC1** for length of side = 5
9(c)	5.07 or 5.068 to 5.071	**6**	**B3** for 7.41 or 7.412 to 7.413 or **M2** for $r + r + \frac{40}{360} \times 2 \times \pi \times r = 20$ oe or **M1** for $\frac{40}{360} \times 2 \times \pi \times r$ oe seen **M2** for $2 \times 7.41 \times \sin 20$ oe or $7.41^2 + 7.41^2 - 2(7.41^2) \cos 40$ oe or $\frac{7.41\sin 40}{\sin 70}$ oe or **M1** for implicit version

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MATHEMATICS **0580/42**

Paper 4 (Extended) **October/November 2021**

MARK SCHEME

Maximum Mark: 130

Published

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- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

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Maths-Specific Marking Principles	
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3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)(i)	$\frac{450}{8+7+3}\times 8$ oe	**2**	**M1** for $\frac{450}{8+7+3}$
1(a)(ii)	75	**1**	
1(a)(iii)	56	**2**	**M1** for $\frac{32}{100}\times(450-200-$ *their* 75) oe or $\frac{32}{100}\times\frac{450}{8+7+3}\times 7$ oe If 0 scored, **SC1** for answer 231
1(a)(iv)	59 000 nfww	**3**	**B2** for 58 600 to 58 800 or **B1** for 293 to 294 or **M1** for $\frac{\text{figs}485\times 200}{165}$ oe If 0 scored, **SC1** for *their* more accurate answer seen and rounded to the nearest 1000
1(b)(i)	3 075 000	**1**	
1(b)(ii)	3.075×10^6	**1**	**FT** *their* (b)(i)
1(c)	32.5	**2**	**M1** for $x\times\left(1+\frac{16}{100}\right)=37.7$ or better
1(d)	2460 or 2458. …	**2**	**M1** for $1800\left(1+\frac{2.1}{100}\right)^{15}$ oe
2(a)(i)	90	**1**	
2(a)(ii)	68	**1**	
2(a)(iii)	52	**1**	**FT** 120 – *their* (a)(ii)
2(a)(iv)	20	**2**	**B1** for 60 in working or as answer
2(b)(i)	97.5	**4**	**M1** for mid-points soi (50, 70, 90, 115, 145, 180) **M1** for use of Σfm with m in correct interval including both boundaries **M1** for (dep on 2nd M1) for $\Sigma fm \div 80$
2(b)(ii)	Bars with heights 0.9, 0.5, 0.3, 0.175 and with correct widths	**4**	**B1** for each correct bar If 0 scored, **SC1** for 3 or 4 correct frequency densities

Question	Answer	Marks	Partial Marks
2(b)(iii)	$\frac{28}{395}$ oe	**3**	**M2** for [2 ×] $\frac{16}{80}\times\frac{14}{79}$ oe or **M1** for $\frac{16}{80}$ or $\frac{16}{79}$oe or $\frac{14}{80}$oe or $\frac{14}{79}$ oe seen If 0 scored, **SC1** for answer $\frac{7}{100}$ oe
3(a)(i)	$\frac{AD}{46.1}$ = tan 64 oe or better	**M1**	
	94.51 to 94.52	**A1**	
3(a)(ii)	46[.0] or 45.96… nfww	**3**	**M2** for $56.5\times\frac{\sin 94}{78.4}$oe or **M1** for $\frac{56.5}{\sin BAC}=\frac{78.4}{\sin 94}$oe
3(a)(iii)	102.3 or 102.4 or 102.34 to 102.38	**4**	**M2** for [cos$C$ =] $\frac{38.6^2+78.4^2-94.5^2}{2\times 38.6\times 78.4}$ or **M1** for $94.5^2=38.6^2+78.4^2-2\times 38.6\times 78.4\times\cos C$ and **A1** for –0.214 or –0.2144 to –0.2137 If 0 scored, **SC2** for [CAD =] 23.5 or 23.51 to 23.52 or for [CDA =] 54.1 or 54.14…
3(b)	16.2 or 16.15…	**3**	**M2** for $\frac{1}{2}\times 21.5\times 27.6\sin 111=\frac{1}{2}\times 34.3\times d$ oe or **M1** for $\frac{1}{2}\times 21.5\times 27.6\sin 111$ seen or $\frac{1}{2}\times 34.3\times d$ oe soi
4(a)(i)	Image at (–5, 6) (–5, 8) (–6, 7)	**2**	**B1** for translation by $\begin{pmatrix}-4\\k\end{pmatrix}$ or $\begin{pmatrix}k\\5\end{pmatrix}$
4(a)(ii)	Image at (3, 1) (3, 3) (4, 2)	**2**	**B1** for reflection in $y = 1$ or $x = k$
4(a)(iii)	Image at (3, 4) (3, 8) (1, 6)	**2**	**B1** for enlargement, sf 2, in wrong position
4(b)	Rotation 90º [anticlockwise] oe (–3, 0)	**3**	**B1** for each

Question	Answer	Marks	Partial Marks
5(a)	–1, –0.375, 3	**3**	**B1** for each
5(b)	Correct graph	**4**	**B3FT** for 8 or 9 correct points or **B2FT** for 6 or 7 correct points or **B1FT** for 4 or 5 correct points
5(c)	$y = 2 - x$ ruled correctly AND –0.45 to –0.35 1 2.35 to 2.45	**4**	**B2** for $y = 2 - x$ ruled or **B1** for [$y =$] $2 - x$ soi or $y = k - x$ ruled or $y = kx + 2$ ruled, but not $y = 2$ **B2** for all three values or **B1** for any two values
6(a)(i)	4.5, $4\frac{1}{2}$ or $\frac{9}{2}$	**3**	**M1** for $8x - 12 = 24$ or $2x - 3 = 6$ **M1** for reaching $ax = b$ correctly FT *their* first step
6(a)(ii)	$x > -\frac{4}{3}$ or $x > -1\frac{1}{3}$ final answer	**2**	**M1** for $6x > 6 - 14$ or $x + \frac{14}{6} > 1$
6(b)	[$y =$] $\sqrt[3]{\frac{2x^3 - V}{3}}$ oe final answer	**3**	**M1** for isolating term in y **M1** for division by 3 or FT *their* first step **M1** for cube root or FT *their* previous step to the final answer
6(c)	$4n^2 - 20n + 12$	**M2**	**B1** for $4n^2 - 10n - 10n + 25$
	$4(n^2 - 5n + 3)$ or correct explanation linked to expression	**A1**	with no errors seen e.g. 4, [–]20 and 12 are all multiples of 4 or divides each term or each coefficient by 4
6(d)(i)	$p = -3$ and $q = 23$	**3**	**B2** for $23 - 2(x - 3)^2$ OR **M1** for [q] $- 2x^2 - 4px - 2p^2$ or $-2(x - 3)^2$ seen **B1** for either $p = -3$ or $q = 23$ or **FT** $q = 5 + 2(\textit{their } p)^2$
6(d)(ii)	(3, 23)	**1**	**FT** *their* (d)(i)
6(e)	69	**2**	**M1** for figs 13^2 oe
7(a)(i)	$\frac{16\pi}{3}$ or $5\frac{1}{3}\pi$ final answer	**2**	**M1** for $\frac{1}{2} \times \frac{4}{3}\pi \times 2^3$ oe

Question	Answer	Marks	Partial Marks
7(a)(ii)	2.4[0]	**4**	**B3** for answer in range 2.396… to 2.40… OR **M3** for *their* $\frac{16\pi}{3} + \pi \times 2^2 \times 5.2 +$ $\frac{1}{3}\pi \times 2^2 \times h = \frac{88\pi}{3}$ oe or **M2** for $\frac{88\pi}{3}$ – *their* $\frac{16\pi}{3} - \pi \times 2^2 \times 5.2$ oe or **M1** for $\pi \times 2^2 \times 5.2$ oe or $\frac{1}{3}\pi \times 2^2 \times h$ oe soi
7(a)(iii)	1 hour 38 min or 1 hour 37.8 min to 1 hour 37.9… min	**3**	**B2** for 1.63[2…] or 98 [mins] or 97.8 to 97.9…] or **M1** for $\frac{\frac{88\pi}{3} \times 620}{35000}$ [× 60] oe
7(b)	8.5[0] or 8.496 to 8.497	**4**	**M3** for [r=] $\sqrt{\frac{65}{\frac{140}{360}\pi - \frac{1}{2}\sin 140}}$ oe or **M2** for $\frac{140}{360}\pi \times r^2 - \frac{1}{2} r^2 \times \sin 140$ [=65] oe or **M1** for either area expression seen
8(a)(i)	$\frac{12}{x}$ or 12 ÷ x final answer	**1**	
8(a)(ii)	$\frac{12}{x-4}$ – *their* $\frac{12}{x} = 1.5$ oe	**M1**	Accept 3 or more term equivalents
	$12x - 12(x-4) = 1.5x(x-4)$ or $\frac{12x - 12(x-4)}{x(x-4)}$ [= 1.5]	**M1**	Correctly clearing fractions, or correctly collecting into a 'single fraction' FT *their* expression dep on two fractions both with algebraic denominators
	$12x - 12x + 48 = 1.5x^2 - 6x$	**M1**	Correctly multiplying *their* two sets of brackets FT *their* expression dep on two fractions both with algebraic denominators or first M1 given
	[$1.5x^2 - 6x - 48 = 0$] $x^2 - 4x - 32 = 0$	**A1**	One further step either 3 term equation or division throughout by 1.5 leading to solution With no errors or omissions seen, dep on **M3**

Question	Answer	Marks	Partial Marks
8(a)(iii)	$(x + 4)(x – 8)$	**M2**	**M1** for $(x + a)(x + b)$ where $ab = –32$ or $a + b = –4$ or for $x(x + 4) – 8(x + 4)$ or $x(x – 8) + 4(x – 8)$
	–4 and 8	**B1**	
8(a)(iv)	3	**2**	**FT** $\frac{12}{their\ 8 - 4}$ **M1** for $\frac{12}{their\ 8 - 4}$ or $\frac{12}{their\ 8} + 1.5$ oe or for answer $\frac{12}{their\ 8}$
8(b)	69.6	**3**	**M2** for $\frac{430 \text{ to } 440}{6 + 0.25}$ or $\frac{440 - 5}{6 \text{ to } 6.5}$ oe or **M1** for 440 + 5 oe or 440 – 5 oe or 6 + 0.25 oe or 6 – 0.25 oe seen
9(a)(i)	(3, 1)	**1**	
9(a)(ii)	$\begin{pmatrix} -10 \\ 15 \end{pmatrix}$	**1**	
9(a)(iii)	3.61 or 3.605 to 3.606	**2**	**M1** for $(–2)^2 + 3^2$ oe
9(b)(i)(a)	$\frac{1}{2}$ **c**	**1**	
9(b)(i)(b)	**a** + $\frac{1}{2}$ **c** oe	**1**	FT **a** + *their* (b)(i)(a)

Question	Answer	Marks	Partial Marks
9(b)(ii)(a)	$\overrightarrow{OP} = \frac{1}{3}(2\mathbf{a} + \mathbf{c})$ oe and $\overrightarrow{OQ} = \frac{1}{2}(2\mathbf{a} + \mathbf{c})$ oe OR $\overrightarrow{OP} = \frac{2}{3}(\mathbf{a} + \frac{1}{2}\mathbf{c})$ OR $\overrightarrow{PQ} = \frac{1}{3}(\mathbf{a} + \frac{1}{2}\mathbf{c})$ **and** correct comment e.g. have the same base vector or that they are multiples of one another **and** they share a common point OR e.g. $\overrightarrow{OQ} = 1.5\overrightarrow{OP}$, $2\overrightarrow{PQ} = \overrightarrow{OP}$	**2**	**B1** for $\overrightarrow{OP}$ or $\overrightarrow{PQ}$ factorised or for correct multiplicative statement on relationship without factorised vectors e.g. $\overrightarrow{OQ} = 1.5\overrightarrow{OP}$, $\frac{2}{3}\overrightarrow{OQ} = \overrightarrow{OP}$, $2\overrightarrow{PQ} = \overrightarrow{OP}$, $1.5\left(\frac{2}{3}\mathbf{a} + \frac{1}{3}\mathbf{c}\right) = \mathbf{a} + \frac{1}{2}\mathbf{c}$
9(b)(ii)(b)	1.5 oe	**1**	
10(a)	(2, –10) and (–2, 22)	**5**	**B2** for $3x^2 - 12$ isw or **B1** for $3x^2 + k$ or $px^2 - 12$ ($p \neq 0$) or for $3x^2 - 12 + 6$ isw **M1** for setting *their* derivative = 0 or $\frac{dy}{dx} = 0$ **B1** for $x = \pm 2$ or for one correct coordinate pair
10(b)	(2, –10) minimum with correct reason or sketch (–2, 22) maximum with correct reason or sketch	**3**	**B2** for 1 correct with correct reasoning or **B2FT** for correct evaluation with correct 2nd derivative for both of *their* different x values or **M1** for showing [2nd derivative =] $6x$ or gradients for one value on either side of one correct stationary point or for reasonable sketch of cubic
11(a)(i)	10.2	**2**	**M1** for $\frac{YZ}{13.6} = \frac{15.3}{20.4}$ oe or better

Question	Answer	Marks	Partial Marks
11(a)(ii)	143.1	**3**	**M2** for $\left(\frac{20.4}{13.6}\right)^2 \times 63.6$ oe or **M1** for $\left(\frac{20.4}{13.6}\right)^2$ or $\left(\frac{13.6}{20.4}\right)^2$ oe **Alt method** **M2** for ½ × 20.4 × 15.3 × sin *R* where *R* is $\sin^{-1}\left(\frac{63.6}{0.5\times 13.6\times their(a)(i)}\right)$ or **M1** for $R = \sin^{-1}\left(\frac{63.6}{0.5\times 13.6\times their(a)(i)}\right)$
11(b)	0.55	**3**	**M2** for [ratio of areas] = $\left(\sqrt[3]{\frac{37.5}{64.8}}\right)^2$ or $\left(\sqrt[3]{\frac{64.8}{37.5}}\right)^2$ oe or **M1** for [ratio of lengths] = $\sqrt[3]{\frac{37.5}{64.8}}$ or $\sqrt[3]{\frac{64.8}{37.5}}$ oe or for $\left(\frac{0.792}{x}\right)^3 = \left(\frac{64.8}{37.5}\right)^2$ oe

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MATHEMATICS **0580/43**

Paper 4 (Extended) **October/November 2021**

MARK SCHEME

Maximum Mark: 130

Published

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Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

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[Turn over

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

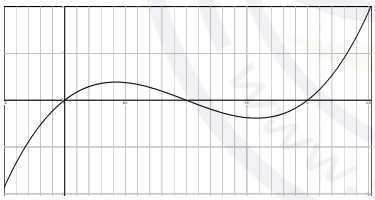
cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)	Rotation 90° clockwise oe [centre] (5, 2)	**3**	**B1** for each
1(b)(i)	Translation $\begin{pmatrix}-1\\4\end{pmatrix}$	**2**	**B1** for each
1(b)(ii)	4.12 or 4.123...	**2**	**M1** for (*their* (–1))^2 + (*their* 4)^2
2(a)	52°	**3**	**M1** for $180 - 2 \times 38$, implied by 104 **M1** for *their AOB* ÷ 2
2(b)(i)	80°	**2**	**B1** for *FEC* =50 or *FCE* = 50
2(b)(ii)	100°	**1**	**FT** 180 – *their* **(i)**
3(a)(i)	4.095	**2**	**B1** for figs 4095 or **M1** for $\frac{525\times7.8}{1000}$
3(a)(ii)	15	**3**	**B2** for 35 OR **M2** for $\frac{1}{2}(10+4)\times5 \times L = 525$ oe **M1** for $\frac{1}{2}(10+4)\times5$ oe
3(a)(iii)	455 or 454.9...	**6**	**M3** for *their* [*BD* =] $\sqrt{3^2+5^2} \times$ (*their* 15) [× 2] or **B2** for $\sqrt{34}$ or 5.83 or 5.830 to 5.831 or **M1** for $5^2 + \left(\frac{1}{2}(10-4)\right)^2$ and **M1** for *their* 35×2 **M1** for (*their* 15) × 10 and (*their* 15) × 4
3(a)(iv)	4200	**3**	**M2** for $525 \times \left(\frac{10}{5}\right)^3$ oe or **M1** for $\left(\frac{10}{5}\right)^3$ or $\left(\frac{5}{10}\right)^3$ oe

Question	Answer	Marks	Partial Marks
3(b)	182.875 ... 307.125 final answer	**3**	**B2** for either seen or **M1** for 10 ± 0.5 or 6 ± 0.5 or 4 ± 0.5 oe
4(a)	Correctly eliminate one variable	**M1**	
	$p = 3$ $q = -1$	**A2**	**A1** for each If M0, **SC1** for 2 values satisfying one of original equations If 0 scored **SC1** for correct answers with no working
4(b)	$1\frac{1}{11}$ or $\frac{12}{11}$ 1.09 or 1.090 to 1.091	**2**	**M1** for $\frac{3x}{12}+\frac{8x}{12}=1$ or better
4(c)(i)	$-2 < x \leqslant 3$	**3**	**B2** for $-2 < x$ or $x \leqslant 3$ or **M1** for $-8 + 2 < 3x$ or $3x \leqslant 7 + 2$
4(c)(ii)	–1, 0, 1, 2, 3	**1**	**FT** dep on –ve and +ve values in *their* **(c)(i)**
4(d)	$4a(4-a)$ final answer	**2**	**B1** for any correct partial factorisation
4(e)(i)	$\frac{2b}{3a}$ final answer	**2**	**M1** for $\frac{1}{2a}\times\frac{4b}{3}$ or better
4(e)(ii)	$\frac{x-2}{x-1}$ final answer nfww	**2**	**B1** for $2(x-1)-x$ oe seen.
5(a)(i)	105	**2**	**M1** for $\frac{3}{100}\times 500[\times 7]$
5(a)(ii)	115 or 114.9...	**3**	**M2** for $500\times\left(1+\frac{3}{100}\right)^{7}[-500]$ or **M1** for $500\times\left(1+\frac{3}{100}\right)^{k}$, k integer $\geqslant 2$
5(b)	8600	**3**	**M2** for $\frac{6269.4}{\left(1-\frac{10}{100}\right)^{3}}$ oe or **M1** for $C\times\left(1-\frac{10}{100}\right)^{3}=6269.4$ oe
6(a)	9.33 or 9.334...	**3**	**M2** for $\frac{12\sin 50}{\sin 100}$ or **M1** for $\frac{\sin 100}{12}=\frac{\sin 50}{AD}$ oe

Question	Answer	Marks	Partial Marks
6(b)	[cos =] $\frac{11^2+12^2-8^2}{2\times11\times12}$	**M2**	**M1** for $8^2 = 11^2+12^2-2\times11\times12\cos(BAC)$
	40.415...	**A2**	**A1** for 0.761... or $\frac{201}{264}$ or $\frac{67}{88}$
6(c)	70.8 or 70.77 to 70.79...	**3**	**M1** for $\frac{1}{2}\times12\times$ *their* **(a)** $\times\sin(180-100-50)$ **M1** for $\frac{1}{2}\times12\times11\times\sin(40.42)$
6(d)	7.13 or 7.131 to 7.132...	**3**	**M2** for $\frac{\text{dist}}{11}=\sin(40.42)$ or **M1** for recognition that shortest distance is perpendicular to AC
7(a)	87	**3**	**M2** for $3c + 4c = 587 + 22$ or better or **M1** for $3c + 2(2c - 11)$ [= 587 or 5.87]
7(b)	1.1[0]	**3**	**M2** for $22w + 22 = 42w$ or better or **M1** for $\frac{22}{w} = \frac{42}{w+1}$ oe OR **B2** for number of bottles = 20 or **M1** for $Nw = 22$ and $N(w+1) = 42$
7(c)(i)	$\frac{9}{x}+\frac{5}{2x+1}=2.5$ oe	**M2**	**M1** for $\frac{9}{x}$ or $\frac{5}{2x+1}$
	$9(2x+1)+5x=2.5x(2x+1)$ oe or $\frac{9(2x+1)+5x}{x(2x+1)}$ [= 2.5 oe]	**M1**	Correctly clearing fractions, or correctly collecting into a single fraction FT *their* expression dep on two fractions both with algebraic denominators
	All brackets expanded leading to $10x^2-41x-18=0$ with no errors or omissions	**A1**	

Question	Answer	Marks	Partial Marks
7(c)(ii)	$(2x-9)(5x+2)$ or $\frac{-(-41)\pm\sqrt{(-41)^2-4(10)(-18)}}{2(10)}$	**M2**	**B1** for $(ax+b)(cx+d)$ with $ac = 10$ and $bd = -18$ or $ad + bc = -41$ or $\sqrt{(-41)^2-4(10)(-18)}$ or $\frac{-(-41)+\sqrt{q}}{2(10)}$ oe or $\frac{-(-41)-\sqrt{q}}{2(10)}$ oe or both or **M1** for $\left(x-\frac{41}{20}\right)^2-\frac{18}{10}-\left(\frac{41}{20}\right)^2=0$ or better
	10	**A2**	**A1** for $[x =]\ \frac{9}{2}$ oe or **M1** for $2 \times$ *their* positive root + 1
8(a)(i)	$\frac{60}{360}\times 600$ oe	**1**	
8(a)(ii)	45	**2**	**M1** for $\frac{27}{360}\times 600$ oe
8(a)(iii)	Correct straight line on the pie chart	**2**	**B1** for 75
8(b)	Correct diagram  0.6 3.4 5.2 7.5 8.7	**3**	**B1** for any three of 0.6, 3.4, 5.2, 7.5, 8.7 correctly placed **B1** for 7.5 and 8.7 seen
8(c)(i)	5	**1**	
8(c)(ii)	2	**1**	
8(c)(iii)	3	**1**	
8(d)	39.2	**4**	**M1** for mid-values soi **M1** for Σfx with x in correct interval including boundaries **M1 dep** for $\frac{\Sigma fx}{50}$ dep on second M1
9(a)	(0, 0), (1, 0), (2, 0)	**2**	**B1** for any two correct If 0 scored, SC1 for all three x values clearly identified

Question	Answer	Marks	Partial Marks
9(b)	$x\left(x^2-x-2x+2\right)$ or $\left(x^2-x\right)(x-2)$ or $(x-1)\left(x^2-2x\right)$ leading to x^3-3x^2+2x with no errors or omissions	**2**	**B1** for $x\left(x^2-x-2x+2\right)$ or $\left(x^2-x\right)(x-2)$ or $(x-1)\left(x^2-2x\right)$
9(c)	$3x^2-6x+2$	**B2**	**B1** for 2 correct terms
	their $\frac{dy}{dx}=0$	**M1**	
	their $\frac{-(-6)\pm\sqrt{(-6)^2-4(3)(2)}}{2(3)}$	**M2**	**M1** for $\sqrt{(-6)^2-4(3)(2)}$ or for $p = -(-6)$ and $r = 2(3)$ if in form $\frac{p\pm\sqrt{q}}{r}$
	(0.4, 0.4) (1.6, –0.4)	**B3**	**B2** for 0.4 or 0.42... **and** 1.6 or 1.57 to 1.58 or for one correct pair of coordinates or **B1** for 0.4 or 0.42... **or** 1.6 or 1.57 to 1.58 If 0 scored **SC1** for $1+\sqrt{\frac{1}{3}}$ and $1-\sqrt{\frac{1}{3}}$ or better or for one correct pair of coordinates in any form
9(d)	Correct sketch 	**2**	**FT** *their* **(c)** but must be cubic i.e. correct shape cubic through origin and max and min in correct quadrants **B1** for cubic shape sketch
10(a)(i)	1	**1**	
10(a)(ii)	$\frac{1}{4}$ oe **nfww**	**2**	**M1** for $\frac{2}{4}\times\frac{2}{4}$ oe
10(a)(iii)	7	**2**	**M1** for trials with $\left(\frac{3}{4}\right)^k\times\frac{1}{4}$ soi
10(b)(i)	0.72 oe	**2**	**M1** for 0.9×0.8
10(b)(ii)	0.26 oe	**3**	**M2** for $0.9\times0.2+0.1\times0.8$ or 1 – *their* **(b)(i)** – 0.1×0.2 or **M1** for 0.9×0.2 or 0.1×0.8 or 1 – *their* **(b)(i)** or $1-0.1\times0.2$
11(a)(i)	64	**1**	

Question	Answer	Marks	Partial Marks
11(a)(ii)	127	**1**	**FT** 2 × *their* **(a)(i)** – 1
11(b)	$\pm\frac{1}{2}$ oe nfww	**4**	**M1** for $(2x-1)^2+2(2x-1)$ **B1** for $4x^2-2x-2x+1$ or $(2x-1)(2x-1+2)$ **B1** for $4x^2-1$ [= 0] or $(2x-1)(2x+1)$ [= 0] OR **M1** for $x(x+2)=0$ (solving g(x) = 0) **A1** for $x = 0$ or –2 **B1** for $2x-1=0$ or $2x-1=-2$
11(c)	$\frac{x+1}{2}$ oe final answer	**2**	**M1** for $y+1=2x$ or $\frac{y}{2}=x-\frac{1}{2}$ or $x=2y-1$
11(d)	$-\frac{1}{6}$ oe nfww	**3**	**B2** for $3x=-\frac{1}{2}$ oe OR **M1** for $2^{2x}\times 2^x$ oe or $4^{\frac{1}{2}x}\times 4^x$ oe or 8^x oe **M1** for $2^{-\frac{1}{2}}$ or $4^{-\frac{1}{4}}$ or $8^{-\frac{1}{6}}$ soi

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MATHEMATICS **0580/41**

Paper 4 (Extended) **May/June 2021**

MARK SCHEME

Maximum Mark: 130

Published

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Maths-Specific Marking Principles	
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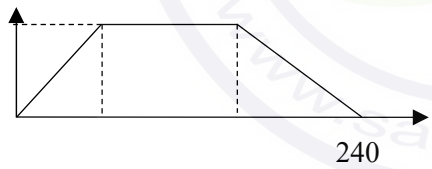
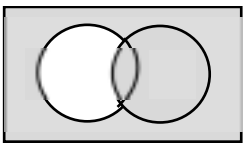
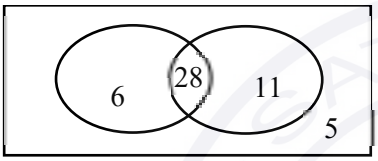
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)(i)	28	**2**	**M1** for $32 \times 0.50 + 30 \times 0.40$
1(a)(ii)	$98 - 100 \times 0.5$ $48 \div 0.4 = 120$ [minutes] = 2 [hrs]	**M3**	**M1** for $100 \times 0.50 + x \times 0.40 = 98$ **M1** for $50 + 0.4x = 98$ or $0.4x = 48$ **M1** for $x = \frac{48}{0.4}$ $x = 120$ [min] = 2 [hr] OR **M1** for $100 \times 0.5 [= 50]$ **M1** for $98 - 50 [= 48]$ **M1** for $48 \div 0.4 = 120$ [min] $= 2$ [hr]
1(b)	2925 1170 4095	**3**	**B2** for one correct answer or **M1** for $8190 \div (5 + 2 + 7)$
1(c)	58	**2**	**M1** for $\left(1 + \frac{45}{100}\right)k = 84.1$ oe
2(a)	0.18 or $\frac{9}{50}$	**1**	
2(b)	$1944 \times \frac{1000}{3600 \times 3600}$	**M1**	
	$9 \div 0.15 = 60$	**M1**	
2(c)		**1**	ruled line to axis with point of contact at 240
2(d)	6.9375	**4**	**M2** for area = $\frac{1}{2} \times (130 + 240) \times 9$ oe or **M1** for one correct partial area **M1dep** for *their* total area ÷ 240
3(a)	2.64 or 2.638…	**4**	**M3** for $[R^2 =] \frac{\pi \times 2.4^2 + \pi \times 2.4 \times 6.3}{\pi + 2\pi}$ oe or **M2** for $\pi \times 2.4^2 + \pi \times 2.4 \times 6.3 = \pi R^2 + \frac{1}{2} \times 4\pi R^2$ or **M1** for $[\pi \times 2.4^2] + \pi \times 2.4 \times 6.3$ oe or $[\pi R^2] + \frac{1}{2} \times 4\pi R^2$ oe

Question	Answer	Marks	Partial Marks
3(b)	953 or 952.6 to 952.8	**4**	**M3** for $\frac{1}{3}\times\pi\times7.6^2\times16\times\left(1-\left(\frac{16-12}{16}\right)^3\right)$ or $\frac{1}{3}\times\pi\times7.6^2\times16-\frac{1}{3}\times\pi\times1.9^2\times(16-12)$ OR **B1** for top radius = 1.9 or $\left(\frac{16-12}{16}\right)^3$ oe **M2** for $\frac{1}{3}\times\pi\times7.6^2\times16-\frac{1}{3}\times\pi\times(their1.9)^2\times(16-12)$ or $\frac{1}{3}\times\pi\times7.6^2\times16\times\left(1-their\left(\frac{16-12}{16}\right)^3\right)$ or **M1** for $\frac{1}{3}\times\pi\times7.6^2\times16$ or for $\frac{1}{3}\times\pi\times(their1.9)^2\times(16-12)$
4(a)(i)	438 cao	**2**	**M1** for $\frac{500}{1.142}$
4(a)(ii)	14.95	**2**	**M1** for [329 –] 275×1.142 oe
4(b)	14	**2**	**M1** for $5.25\times\frac{8}{3}$ oe
4(c)	1.7[0] or 1.699…	**3**	**M2** for $\sqrt[5]{\frac{6669}{6130}}$ or **M1** for $6669 = 6130\ (k)^5$
5(a)	13.5 or 13.47…	**4**	**B1** for angle 102 seen **M2** for $\sqrt{10.6^2+6.4^2-2\times10.6\times6.4\times\cos(180-78)}$ OR **M1** for $10.6^2+6.4^2-2\times10.6\times6.4\times\cos(180-78)$ **A1** for 181.5…
5(b)	8.68 or 8.682 to 8.683 nfww	**4**	**B1** for angle = 44 **M2** for $\sin(180-58-78)\times\frac{10.6}{\sin58}$ oe or **M1** for $\frac{\sin(180-58-78)}{x}=\frac{\sin58}{10.6}$ oe

Question	Answer	Marks	Partial Marks
5(c)	78.2 or 78.17 to 78.19…	**3**	**M2** for $\frac{1}{2}\times 10.6\times(6.4+\textit{their}\ 8.68)\times\sin(78)$ oe OR **M1** for $\frac{1}{2}\times 10.6\times 6.4\times\sin(180-78)$ oe **M1** for $\frac{1}{2}\times 10.6\times\textit{their}\ 8.68\times\sin 78$ oe
6(a)		**1**	
6(b)		**2**	**B1** for 2 or 3 correct elements or **M1** for $34-x$, x and $39-x$ correctly placed on diagram and $x = 28$
6(c)(i)	8	**1**	
6(c)(ii)	11	**1**	
6(c)(iii)	2	**1**	
6(c)(iv)	$C\cap S\cap B'$ oe	**1**	
6(c)(v)	$\frac{19}{30}$ oe	**1**	
6(c)(vi)	$\frac{2}{57}$ oe	**3**	**M2** for $\frac{4}{19}\times\frac{3}{18}$ or **M1** for $\frac{4}{19}$ seen
6(c)(vii)	Equal numbers 15 or equal probability $\frac{15}{30}$ oe	**1**	
7(a)	$\frac{x+5}{x+4}$ final answer	**3**	**B1** for $(x-5)(x+5)$ **B1** for $(x-5)(x+4)$
7(b)	$\frac{2x^2+12x-5}{x(x-1)}$ or $\frac{2x^2+12x-5}{x^2-x}$ final answer	**3**	**B1** for common denominator $x(x-1)$ oe **B1** for $(x-1)(x+5)+x(x+8)$ or better
7(c)(i)	$6x^2-8x$ final answer	**2**	**B1** for each term in final answer or **M1** for correct answer seen and spoilt

Question	Answer	Marks	Partial Marks
7(c)(ii)	64	**2**	**FT** *their* **(c)(i)** correctly evaluated provided at least 2 terms but not the original equation **M1** for substituting $x = 4$ into *their* **(c)(i)**
7(c)(iii)	(0, 6) $\left(\frac{4}{3}, \frac{98}{27}\right)$ oe	**4**	**M1** for *their* derivative = 0 or $\frac{dy}{dx} = 0$ soi **B1** for $x = 0$ and $x = \frac{4}{3}$ **M1dep** for substituting one of *their x* values into $y = 2x^3 - 4x^2 + 6$ soi
8(a)(i)	3 22 43 48 50	**2**	**B1** for 4 correct or **M1** for one error in adding.
8(a)(ii)	correct diagram	**3**	**B1FT** *their* **(a)(i)** for 5 correct heights **B1** for 5 points at upper ends of intervals on correct vertical line **B1FT dep on at least B1** for increasing curve through *their 5* points After 0 scored, **SC1** for 4 of *their* points correctly plotted
8(a)(iii)	35 to 38	**1**	
8(b)	Correct box-and-whisker diagram  1.45 1.57 1.64 1.71 1.83	**4**	**B1** for median 1.64 drawn **B1** for LQ 1.57 drawn **B1** for UQ 1.71 drawn If 0 scored **SC1** for 1.64, 1,57 or 1.71 seen
9(a)	1350 or 1354….	**6**	**M2** for $20^2 - 13^2$ or **M1** for $BC^2 + 13^2 = 20^2$ **A1** for $\sqrt{231}$ or 15.2 or 15.19 to 15.20 **M1** for 20×24 and 13×24 and *their* 15.2×24 **M1** for [½ ×] *their* 15.2×13
9(b)	2370 or 2369 to 2371… cao	**1**	
9(c)	24.6 or 24.58 to 24.59	**4**	**M3** for $\sin[...] = \frac{13}{\sqrt{20^2 + 24^2}}$ oe or **M2** for $\sqrt{20^2 + 24^2}$ or $\sqrt{24^2 + 20^2 - 13^2}$ or **M1** for $AF^2 = 20^2 + 24^2$ or $24^2 + 20^2 - 13^2$ or **M1** for correct angle identified
10(a)	0.75 3 7 3 0.75	**3**	**B2** for 4 or 3 correct or **B1** for 2 correct

Question	Answer	Marks	Partial Marks
10(b)	correct curve 	**4**	**B3FT** for 8 or 9 correct plots **B2FT** for 6 or 7 correct plots **B1FT** for 4or 5 correct plots
10(c)	Accept any integer ≥ 8	**1**	
10(d)	line $y = 4 - \frac{1}{2}x$ ruled	**B3**	**B2** for $[y =]4 - \frac{1}{2}x$ identified or **B1** for ruled line with gradient $-\frac{1}{2}$ or **B1** for ruled line through (0, 4) but not $y = 4$
	0.2 to 0.3 4.2 to 4.3	**B1**	
11(a)	20	**2**	**M1** for $\frac{360}{18}$ or $180 - \frac{16\times180}{18}$
11(b)	4.5	**2**	**M1** for $\frac{BE}{6.75} = \frac{5.2}{5.2+2.6}$ oe
11(c)	5.8[0] or 5.798 to 5.799	**3**	**M2** for $2\times\sqrt[3]{\frac{780}{32}}$ oe or **M1** for $\sqrt[3]{\frac{780}{32}}$ or $\sqrt[3]{\frac{32}{780}}$ or $\frac{2^3}{l^3} = \frac{32}{780}$
11(d)	$QN = NR$ [given]	**B1**	
	Two correct pairs of angles with reasons from angle PQN = angle SRN alternate angle QPN = angle RSN alternate angle PNQ = angle SNR [vertically] opposite	**B2**	**B1** for any correct pair of angles with reason or two correct pairs of angles with no/wrong reasons
	ASA [implies congruent]	**B1**	dep on B1 B2

Question	Answer	Marks	Partial Marks
12(a)	13	**1**	
12(b)	$4x - 3$ final answer	**2**	**M1** for $3 - 2(3 - 2x)$
12(c)	-7 5	**4**	**M1** for $x^2 + 2x - 35\ [= 0]$ or $x^2 + 2x = 35$ **M2** for $(x + 7)(x - 5)$ or $x(x - 5) + 7(x - 5)$ or $x(x + 7) - 5(x + 7)$ or **M1** for $(x + a)(x + b)$ where a, b are integers with $ab = -35$ or $a + b = 2$
12(d)	$\frac{3 - x}{2}$ oe final answer	**2**	**M1** for a correct first step: $x = 3 - 2y$ or $y - 3 = -2x$, $2x = 3 - y$ or $\frac{y}{2} = \frac{3}{2} - x$
12(e)	$32 - 54x + 37x^2 - 8x^3$ final answer	**5**	**B4** for $27 - 36x - 18x + 24x^2 + 12x^2 - 8x^3 + x^2 + 5$ oe OR **B1** for $(3 - 2x)^3 + x^2 + 5$ and **B2** for expansion of the 3 brackets, allow one error or **B1** for correct expansion of 2 of the brackets with at least 3 terms correct

Cambridge Assessment International Education

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MATHEMATICS **0580/42**

Paper 4 (Extended) **May/June 2021**

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the May/June 2021 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

[Turn over

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

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oe	or equivalent
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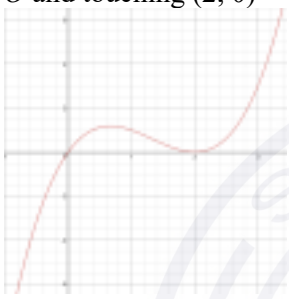
nfww	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)(i)	11.61 final answer	**2**	**M1** for $13.5[0] \times \left(1 - \frac{14}{100}\right)$ oe or **B1** for 1.89
1(a)(ii)	197.37 final answer	**2**	**FT** 17 × *their* (a)(i) exact or correct to nearest cent **M1** for 42.5 ÷ 2.5
1(b)(i)	53.3 or 53.33…	**1**	
1(b)(ii)	7.5	**2**	**M1** for 22.5 ÷ (2 + 8 + 5) oe soi
1(c)	20.55×2.45 oe	**M2**	**M1** for 20.5 + 0.05 oe seen or 2.4 + 0.05 oe seen If 0 scored, **SC1** here for 20.45×2.35 oe
	3 nfww	**A2**	**M1** for *their* area ÷ 10 ÷ 2.5 oe
2(a)(i)	1, –0.5 oe	**2**	**B1** for each
2(a)(ii)	Correct curve	**4**	**B3FT** for 6 or 7 correct plots or **B2FT** for 4 or 5 correct plots or **B1FT** for 2 or 3 correct plots
2(b)	$y = 2.5 - 2x$ ruled	**B2**	**B1** for $y = k - 2x$ or $y = px + 2.5$ ruled $(p \neq 0)$ or for $[y =] \ 2.5 - 2x$ oe identified
	1.3 to 1.4	**B1**	
2(c)	–1	**B1**	
	$y = -1$	**B1**	**FT** *their k* (must be negative)
3(a)(i)	7^{11} cao	**1**	
3(a)(ii)	7^{10} cao	**1**	
3(a)(iii)	7^2 cao	**1**	If answers 11, 10 and 2 in **(a)** then allow **SC1** in this part
3(b)	$1000x^9y^{12}$ final answer	**3**	**B2** for correct answer seen or answer of the form $1000x^9y^k$ or $1000x^ky^{12}$ or kx^9y^{12} or **B1** for answer with one correct element in product or $(10x^3y^4)^{[3]}$ seen
3(c)(i)	108	**2**	**M1** for $[540 =] \ 2^2 [\times] \ 3^3 [\times] \ 5$ or **B1** for 108 oe not in prime factor form e.g. $2^2 \times 3 \times 9$

Question	Answer	Marks	Partial Marks
3(c)(ii)	30 240	**2**	**M1** for $(540 \times 2^5 \times 3^3 \times 7) \div$ *their* **(c)(i)** oe or **B1** for answer 30 240 oe not in prime factor form e.g. $2^5 \times 3^3 \times 35$
3(c)(iii)	98	**2**	**B1** for 592 704 seen or $2^6 \times 3^3 \times 7^3$ seen or 2×7^2 oe seen
3(d)(i)	$(x - 7)(x + 4)$ final answer	**2**	**M1** for $x(x - 7) + 4(x - 7)$ or $x(x + 4) - 7(x + 4)$ or better or for $(x + a)(x + b)$ where $ab = -28$ or $a + b = -3$
3(d)(ii)	$(a + 2b)(11a + 14b)$ final answer	**2**	**M1** for $(a + 2b)(7(a + 2b) + 4a)$ or $(a + pb)(11a + qb)$ where $pq = 28$ or $11p + q = 36$ If 0 scored, **SC1** for $a + 2b$ $(11a + 14b)$
3(e)	$[y =]\frac{5x-1}{2}$ oe final answer	**4**	**B2** for $2x - 1 = -2x + 2y - x$ oe or **B1** for $9^x = 3^{2x}$ or better **M1dep** for correct rearrangement of *their* 5 term 'linear' equation in y and x to make y the subject
4(a)(i)	Correct histogram	**3**	**B1** for each correct block If 0 scored**, SC1** for any two of fds 7.5, 3.33…, 0.8 oe soi
4(a)(ii)	3.7875 or 3.79 or 3.787 or 3.788	**4**	**M1** for 0.75, 1.5, 3, 5.5, 9.5 soi **M1** for Σfx **M1 dep** for *their* $\Sigma fx \div 40$
4(a)(iii)	$\frac{11}{40}$ oe	**1**	
4(a)(iv)	$\frac{30}{203}$ oe	**3**	**M2** for $[2 \times]\frac{4}{29} \times \frac{15}{28}$ oe or **M1** for $\frac{4}{29}$ or $\frac{15}{29}$ oe seen After 0 scored, **SC1** for $[2\times]\left(\frac{4}{40} \times \frac{26}{39}\right)$ oe or for answer $\frac{120}{841}$ oe
4(b)(i)	4.6	**1**	
4(b)(ii)	3.2	**1**	

Question	Answer	Marks	Partial Marks
4(b)(iii)	[median] remains the same oe and one is below [the median/middle] and one is above oe	**2**	**B1** for each statement
5(a)(i)(a)	$\begin{pmatrix}5\\-13\end{pmatrix}$ final answer	**1**	
5(a)(i)(b)	$\begin{pmatrix}-4\\11\end{pmatrix}$ final answer	**2**	**B1** for answer $\begin{pmatrix}-4\\k\end{pmatrix}$ or $\begin{pmatrix}k\\11\end{pmatrix}$ or $\begin{pmatrix}-6\\16\end{pmatrix}$ seen
5(a)(i)(c)	5.39 or 5.385…	**2**	**M1** for $2^2 + ([-]5)^2$
5(a)(ii)	$[k =]$ 8 $[m =] -32$	**3**	**B2** for $k = 8$ or $m = -32$ or **M1** for $-3 + 2k = 13$ oe or for $m = -5 \times$ *their* $k + 8$ correctly evaluated
5(b)(i)(a)	$\mathbf{p} + \mathbf{q}$ final answer	**1**	
5(b)(i)(b)	$\frac{1}{2}\mathbf{p} - \frac{1}{2}\mathbf{q}$ **or** $\frac{1}{2}(\mathbf{p} - \mathbf{q})$ or $\frac{\mathbf{p}-\mathbf{q}}{2}$ final answer	**2**	**M1** for unsimplified answer or any correct vector route for $\overrightarrow{CM}$, e.g. $-\mathbf{q} + \frac{1}{2}$ *their* **(b)(i)(a)**
5(b)(i)(c)	$\frac{1}{2}\mathbf{p} + \frac{1}{10}\mathbf{q}$ or $\frac{5\mathbf{p}+\mathbf{q}}{10}$ final answer	**2**	**M1** for unsimplified answer or any correct vector route for $\overrightarrow{MN}$
5(b)(ii)	$\frac{5}{3}\mathbf{p} + \mathbf{q}$ or $\frac{5\mathbf{p}+3\mathbf{q}}{3}$ final answer	**3**	**B2** for unsimplified correct answer OR **M1** for $\mathbf{p} + \frac{3}{5}\mathbf{q}$ seen **B1** for final answer of form $k\mathbf{p} + \mathbf{q}$ $(k > 1)$ or final answer $\frac{5}{3}\mathbf{p} + j\mathbf{q}$ oe (any j)
6(a)	$\sqrt{16^2 + 19^2 - 2\times16\times19\cos 57}$ oe	**M2**	or **M1** for $16^2 + 19^2 - 2\times16\times19\cos 57$ **A1** for 285.8 to 285.9
	16.90 to 16.91	**A1**	

Question	Answer	Marks	Partial Marks
6(b)	74.3 or 74.30 to 74.33	**4**	**M2** for [sin ... =] $\frac{16.9\times\sin 75}{32}$ oe or **M1** for $\frac{16.9}{\sin C}=\frac{32}{\sin 75}$ oe **B1** for [angle *BCD* =] 30.7 or 30.67 to 30.69… or **M1dep** for 105 – *their* angle *BCD*
6(c)	388 or 387.7 to 387.9… nfww	**3**	**M1** for $\frac{1}{2}\times 16\times 19\times\sin 57$ oe **M1** for $\frac{1}{2}\times 16.9\times 32\times\sin$ *their* **(b)** oe
6(d)	13.4 or 13.41 to 13.42 nfww	**3**	**M2** for $\frac{x}{16}=\sin 57$ oe or **M1** for distance required is perpendicular to *AD* soi
7(a)(i)	Triangle at (4, 0) (4, 3) (6, 3)	**2**	**B1** for translation by $\begin{pmatrix}2\\k\end{pmatrix}$ or $\begin{pmatrix}k\\-1\end{pmatrix}$ If 0 scored **SC1** for triangle at (3, 0.5) (3, 3.5) (5, 3.5)
7(a)(ii)	Triangle at (1, –2) (4, –4) (4, –2)	**2**	**B1** for rotation 90 clockwise wrong centre or for rotation 90 anticlockwise about the origin
7(a)(iii)	Triangle at (–4, 4) (–4, 2.5) (–5, 2.5)	**2**	**B1** for enlargement SF $-\frac{1}{2}$ with wrong centre or for enlargement SF $\frac{1}{2}$ with centre (–2, 3)
7(b)	Reflection $y = -x$ oe	**2**	**B1** for each
8(a)	[*L* =] 11.8 [*W* =] 5.9 [*H* =] 7.1	**5**	**M1** for $L = 2W$ oe soi **M1** for $W + 2H = 20.1$ oe **M1** for $2L + 2H = 37.8$ oe **B1** for at least one correct answer
8(b)(i)	0.559 to 0.56[0…]	**B4**	**M2** for $\frac{1}{3}\times 18\times 15\times\sqrt{24^2-18^2}$ isw conversion or **M1** for $h^2 + 18^2 = 24^2$ oe or better **M1** for figs 800 ÷ figs *their* volume isw
	g/cm^3 or g cm^{-3} final answer	**B1**	

Question	Answer	Marks	Partial Marks
8(b)(ii)	34.1 or 34.11 to 34.12	**4**	**M3** for tan [ ] = $\frac{\sqrt{24^2 - 18^2}}{\sqrt{18^2 + 15^2}}$ oe or **M2** for $\sqrt{18^2 + 15^2}$ isw or $\sqrt{24^2 + 15^2}$ isw or **M1** for $18^2 + 15^2$ isw or $24^2 + 15^2$ isw or **M1** for indicating required angle is *EBD*
9(a)(i)	2	**2**	**M1** for $x(x^2 - 4x + 4)$ or $x(x - 2)^2$ or $(x^2 - 2x)(x - 2)$ or $x^3 - 2ax^2 + a^2x$
9(a)(ii)	Correct sketch with curve passing through *O* and touching (2, 0) 	**4**	**B1** for any positive cubic **B1** for sketch through or touching *O* **B1** for sketch with min or max touching *x*-axis once only but not at (0, 0) **B1FT** *their* **(a)(i)** for sketch with min or max touching *x*-axis at (*their* 2, 0) and *their* 2 is labelled or clearly indicated
9(b)	$y = 20x - 64$ final answer nfww	**7**	**B6** for equivalent correct equation OR **B2** for $3x^2 - 8x + 4$ isw or **B1** for $3x^2$ or $-8x$ seen **M2dep** for [grad =] 20 soi nfww or **M1dep** for substituting 4 into *their* derivative isw **B1** for (4, 16) soi **M1dep** for 16 = *their* $20 \times 4 + c$ oe
10	125 n^3 oe final ans	**B2**	**B1** for 125 **B1** for n^3
	29 $6n - 1$ oe final ans	**B3**	**B1** for 29 **B2** for $6n - 1$ oe or **B1** for $6n + k$ or $an - 1$ ($a \neq 0$)
	2^{n-3} oe final ans	**B2**	**B1** for $2^{n\,[+\,k]}$ oe
	25 $6n - 1 - 2^{n-3}$ oe final ans OR 25.25 $-\frac{1}{24}n^3 + \frac{1}{8}n^2 + \frac{17}{3}n - 1$ oe final ans	**B2**	**FT** *their* 29 – 4 and *their* $6n - 1$ – *their* 2^{n-3} **B1FT** for each OR **B1** for each

Cambridge Assessment International Education

Cambridge IGCSE™

MATHEMATICS **0580/43**

Paper 4 (Extended) **May/June 2021**

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the May/June 2021 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

[Turn over

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

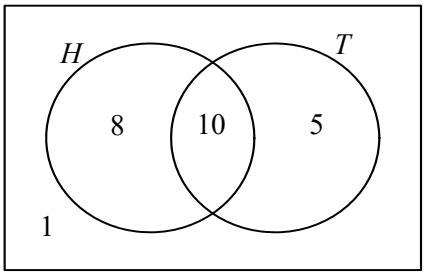
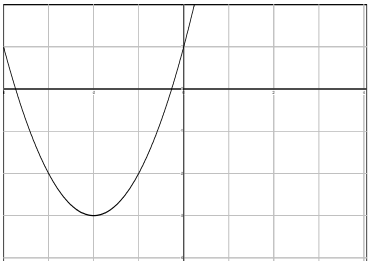
Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)(i)	120	**2**	**M1** for $6 \div (21 - 19)$ oe soi or for $\frac{2x}{40} = 6$
1(a)(ii)(a)	34	**2**	**M1** for $40 - \frac{15}{100} \times 40$ oe or better or **B1** for 6
1(a)(ii)(b)	35	**2**	**M1** for $\left(1 - \frac{15}{100}\right) \times p = 29.75$ or better
1(b)(i)	44 274 cao	**3**	**B2** for 44273 to 44274 or 44270 or **M1** for $40100 \times \left(1 + \frac{2}{100}\right)^5$ oe
1(b)(ii)	2019 nfww	**3**	**M2** for one correct trial of $n = 8$ or $n = 9$ either to find a salary or, if working with 1.02^n and 47 500÷ 40 100 [= 1.1845], to find a value of 1.02^n or **B2** for final answer 9 or 4 nfww or **M1** for *their* $44\,274 \times \left(1 + \frac{2}{100}\right)^n = 47\,500$ oe or $40\,100 \times \left(1 + \frac{2}{100}\right)^n = 47\,500$ oe or for at least one trial giving a value greater than *their* 44 274
1(c)	2.9 [increase]	**2**	**M1** for $\left(1 + \frac{5}{100}\right) \times \left(1 - \frac{2}{100}\right)$ oe implied by 1.029 or 102.9[%]
2(a)(i)	–1	**2**	**M1** for $3 \times 2^2 - 13$ oe
2(a)(ii)	$[\pm]\sqrt{\frac{y-t}{p}}$ oe final answer	**3**	**M1** for correct rearrangement to isolate x^2 term **M1** for correct division by p **M1** for correct square root Incorrect answer scores a maximum of M2 If 0 scored, SC1 for a correctly rearranged formula with $p = 3$ and $t = -13$ substituted

Question	Answer	Marks	Partial Marks
2(b)(i)	$(5x-4)(3x+2)$ oe final answer	**2**	**B1** for $(ax+b)(cx+d)$ where either $ac = 15$ and $bd = -8$ or $ad + bc = -2$ or $5x(3x + 2) – 4(3x + 2)$ or $3x(5x – 4) + 2(5x – 4)$ or correct factors seen and spoiled
2(b)(ii)	$\frac{4}{5}$ oe and $-\frac{2}{3}$ oe	**1**	**FT** a factorised quadratic
2(c)	$x(x+4y)(x-4y)$ final answer	**3**	**B2** for $(x^2+4xy)(x-4y)$ or $(x+4y)(x^2-4xy)$ or answer in the form $x(a + b)(a – b)$ or correct answer seen and spoiled or **B1** for $x(x^2-16y^2)$ oe or $(x+4y)(x-4y)$
2(d)	$\frac{1-2a}{x}$ oe final answer	**4**	**B2** for $(2x – 1)(1 – 2a)$ oe or **B1** for $2x – 1 – 2a(2x – 1)$ or $2x(1 – 2a) – (1 – 2a)$ **B1** for $x(2x – 1)$
3(a)(i)	4	**1**	
3(a)(ii)	7	**1**	
3(a)(iii)	8	**1**	
3(b)(i)	14	**1**	
3(b)(ii)	4	**2**	**B1** for [l.q. =] 11 or [u.q =] 15
3(c)	8.09	**3**	**M1** for $5 \times 3 + 10 \times 6 + 43 \times 7 + 75 \times 8 + 48 \times 9 + 21 \times 10$ **M1 dep** ÷ 200
3(d)	30, 70, 40, 36, 24 seen	**B2**	**B1** for 3 or 4 correct or **M1** for $1 \times (80 – 50)$, $3.5 \times (100 – 80)$, $4 \times (110 – 100)$, $3.6 \times (120 – 110)$ and $0.6 \times (160 – 120)$ oe
	(their 30×65 + *their* 70×90 + *their* 40×105 + *their* 36×115 + *their* $24 \times 140) \div 200$	**M3**	**M1** for midpoints soi **M1** for Σfx, x in interval or boundary of interval **M1 dep on second M1** for ÷ 200
	99.75	**A1**	
4(a)(i)	(2, 7)	**2**	**B1** for each coordinate

Question	Answer	Marks	Partial Marks
4(a)(ii)	$-\frac{1}{2}x+8$ oe	**4**	Correct equivalent in different form scores 3 marks. **M1** for gradient of $AB = \frac{9-5}{3-1}$ or $\frac{4}{2}$ or 2 **M1 dep** for gradient $p = -\frac{1}{\textit{their grad of AB}}$ **M1 (dep** on previous M1) for substitution of *their* midpoint into $y = (\textit{their } p)x + c$ oe where *their* $p \neq 0$
4(b)(i)	$\begin{pmatrix}0\\2\end{pmatrix}$	**2**	**B1** for $\begin{pmatrix}0\\k\end{pmatrix}$ or $\begin{pmatrix}k\\2\end{pmatrix}$
4(b)(ii)	$\begin{pmatrix}-2\\9\end{pmatrix}$	**2**	**FT** *their* $\overrightarrow{PQ}$ **B1FT** for $\begin{pmatrix}0\\6\end{pmatrix}$
4(c)(i)	$\frac{2}{3}\mathbf{t}+\frac{1}{3}\mathbf{u}$ or $\frac{1}{3}(2\mathbf{t}+\mathbf{u})$ final answer	**2**	**M1** for $\overrightarrow{UY} = \frac{2}{3}(\mathbf{t}-\mathbf{u})$ oe or $\overrightarrow{TY} = \frac{1}{3}(\mathbf{u}-\mathbf{t})$ oe or correct route soi
4(c)(ii)	$\frac{2}{3}\mathbf{t}$ cao	**1**	
5(a)	$[x =]$ 7 $[y =]$ 3	**2**	**B1** for each
5(b)	$[x =]$ 0, $[y =]$ 2 $[x =]$ –3, $[y =]$ 5	**4**	**B3** for $x = 0$ and $x = -3$ or **B2** for $x^2 + 3x = 0$ or **M1** for $2 - x = x^2 + 2x + 2$ If 0 scored award **B1** for $x = 0$, $y = 2$ or $x = -3$, $y = 5$ from no/incorrect working ALTERNATIVE **B3** for $y = 2$ and $y = 5$ or **B2** for $y^2 - 7y + 10 = 0$ or **M1** for $y = (2 - y)^2 + 2(2 - y) + 2$ If 0 scored award **B1** for $x = 0$, $y = 2$ or $x = -3$, $y = 5$ from no/incorrect working

Question	Answer	Marks	Partial Marks
6(a)		**2**	i.e. 8, 10 and 5 correctly placed **B1** for 10 correctly placed or **M1** for $18 - x$, x and $15 - x$ correctly placed on diagram and $x = 10$ seen
6(b)	10	**1**	**FT** *their* Venn diagram
6(c)	5	**1**	**FT** *their* Venn diagram
6(d)	$\frac{5}{24}$ oe	**1**	**FT** *their* 5 on the Venn diagram
6(e)	0	**1**	
6(f)	$\frac{5}{17}$ oe	**3**	**M2** for $\frac{their10}{18} \times \frac{their9}{17}$ or **B1FT** for $\frac{their10}{18}$ or $\frac{their9}{17}$ seen After 0 scored, **SC1** for answer $\frac{25}{81}$ oe
7(a)	$-2 < x \leqslant 1$	**2**	**B1** for $-2 < x$ or $x \leqslant 1$
7(b)(i)	$(x+2)^2 - 3$	**2**	**M1** for $(x+2)^2 + k$
7(b)(ii)	$(x+2)^2 = 3$	**M1**	**FTdep** *their* **(b)(i)** for $k < 0$
	–3.73 or –3.732... and –0.268 or –0.2679...	**B1**	
7(b)(iii)	(–2, –3)	**2**	**FT** *their* $(x+2)^2 - 3$ **B1** for each coordinate
7(b)(iv)	Correct sketch 	**2**	Parabola with minimum point in correct quadrant and both x-intercepts negative and positive y-intercept **B1** for parabola with minimum point.

Question	Answer	Marks	Partial Marks
8(a)(i)	1200	**1**	
8(a)(ii)(a)	800	**3**	**M2** for [2 ×] (20 × 12 + 20 × 5 + 12 × 5) or **M1** for 20 × 12 or 20 × 5 or 12 × 5
8(a)(ii)(b)	0.19	**1**	**FT** 152 ÷ *their* 800
8(b)	$\frac{3x}{2}$ or $1.5x$	**3**	**B2** for $r^3 = \frac{27x^3[\pi]}{8[\pi]}$ or better or **M1** for $\frac{4}{3}\pi r^3 = \pi x^2 \times \frac{9x}{2}$
8(c)	13.6 or 13.59 to 13.61	**7**	If chord is *AB* and *O* is centre of the cross section **M2** for $2 \times \quad \cos^{-1}\left(\frac{20-5}{20}\right)$ oe or **M1** for cos = $\frac{20-5}{20}$ oe **M1** for $\frac{theirAOB}{360} \times \pi \times 20^2$ or $\frac{1}{2}(20)^2\left(\frac{82.8\pi}{180}\right)$ **M1** for $\frac{1}{2} \times 20^2 \times \sin(their\ AOB)$ oe **M1** for *their* area × 150 **M1** for *their* volume ÷ 1000
9(a)	42.3 or 42.28 to 42.30...	**7**	**M1** for $\frac{AB}{14} = \cos 35$ oe **M1** for $\frac{AD}{14} = \sin 35$ oe **B1** for [*C* =] 75 **M3** for [BC =] $\frac{14\sin 60}{\sin their 75}$ oe **and** [DC] $\frac{14\sin 45}{\sin their 75}$ oe or **M2** for $\frac{14\sin 60}{\sin their 75}$ **or** $\frac{14\sin 45}{\sin their 75}$ oe or **M1** for $\frac{\sin their 75}{14} = \frac{\sin 60}{BC}$ oe or $\frac{\sin their 75}{14} = \frac{\sin 45}{CD}$ oe

Question	Answer	Marks	Partial Marks
9(b)(i)	4.91 or 4.907...	**3**	**B2** for [l^2 =] 24.1 or 24.08... or M2 for $\sqrt{3}\,l = 8.5$ or [l =] $\sqrt{\frac{8.5^2}{3}}$ oe or **M1** for $l^2 + l^2 + l^2 = 8.5^2$ oe
9(b)(ii)	35.3 or 35.26 to 35.3 nfww	**3**	**M2dep** for sin (angle) = $\frac{\textit{their}\ \textbf{(b)(i)}}{8.5}$ oe or **M1** for clear recognition of correct angle
10(a)(i)	4	**1**	
10(a)(ii)	3	**1**	
10(a)(iii)	13	**1**	**FT** 5 × *their* **(a)(i)** – 7
10(b)	$\frac{x+2}{3}$ final answer	**2**	**M1** for $y + 2 = 3x$ or for $\frac{y}{3} = x - \frac{2}{3}$ or for $x = 3y - 2$
10(c)	$9x^2 - 9x + 2$ final answer	**3**	**M1** for $(3x-2)^2 + 3x - 2$ **B1** for $(3x-2)^2 = 9x^2 - 6x - 6x + 4$
10(d)	$2x + 1$	**1**	
10(e)(i)	81	**1**	
10(e)(ii)	x	**1**	Not $y = x$
11(a)(i)	–5	**1**	
11(a)(ii)	Subtract 4 oe	**1**	
11(a)(iii)	$15 - 4n$ oe final answer	**2**	**B1** for $k - 4n$ or $15 - jn$ $j \neq 0$
11(b)(i)	$\frac{1}{21}$ or equivalent fraction	**2**	**B1** for $\frac{12}{7}$ and $\frac{10}{6}$
11(b)(ii)	$n = \frac{3}{5}$ oe or $2n \geqslant n + 1$ but $3 < 4$.	**M2**	**M1** for $\frac{3}{4} = \frac{2n}{n+1}$ oe or **M1** for $2n > n + 1$ but $3 < 4$
	No, n is not an integer oe or No, $\frac{3}{4}$ is less than 1, oe	**A1**	

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MATHEMATICS **0580/42**

Paper 4 (Extended) **March 2021**

MARK SCHEME

Maximum Mark: 130

Published

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cao	correct answer only
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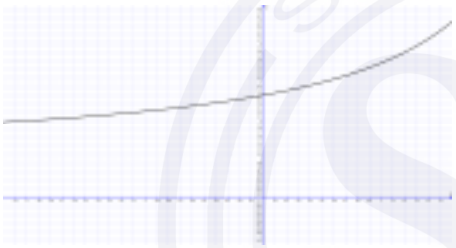
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)	245	**1**	
1(b)	8	**2**	**M1** for $40 + 26.5x = 252$ oe or **B1** for 212 seen
1(c)	6	**2**	**M1** for $(224 - 2 \times 48) \div 32$ oe or $2 \times 48 + 32(x - 2) = 224$ soi
1(d)	35 : 36 : 32 final answer	**2**	**B1** for *their* (a) : 252 : 224 or equivalent ratio
2(a)(i)	rotation 90 anticlockwise oe (–3, 2)	**3**	**B1** for each
2(a)(ii)	enlargement $-\frac{1}{2}$ $(-2,-1)$	**3**	**B1** for each
2(b)	Image at (– 3, – 5) (1, – 5) (1, 3)	**2**	**B1** for translation by $\begin{pmatrix}-5\\k\end{pmatrix}$ or $\begin{pmatrix}k\\-10\end{pmatrix}$
2(c)	Image at (2, 3) (6, 3) (6, – 5)	**2**	**B1** for reflection in $y = k$ or $x = 4$
3(a)	126 54 117	**3**	**B1** for each
3(b)	angle [in a] semicircle is 90	**B1**	Do not accept triangle for angle
	Allied, co-interior [add to 180] or Angles in triangle [= 180] **and** alternate oe	**B1**	
	32	**B1**	
3(c)	109	**2**	**B1** for 218 or 71 in correct places or correctly labelled

Question	Answer	Marks	Partial Marks
4(a)	462	**1**	
4(b)(i)	$\frac{7}{15}$ oe	**1**	
4(b)(ii)	$\frac{7}{15}\times\frac{6}{14}+\frac{6}{15}\times\frac{5}{14}+\frac{2}{15}\times\frac{1}{14}$ $=\frac{37}{105}$	**3**	**M2** for addition of two of $\frac{7}{15}\times\frac{6}{14}+\frac{6}{15}\times\frac{5}{14}+\frac{2}{15}\times\frac{1}{14}$ or **M1** for one of the products seen
4(b)(iii)	$\frac{29}{65}$ oe	**4**	**M3** for $\frac{7}{15}\times\frac{6}{14}\times\frac{5}{13}+3\times\frac{7}{15}\times\frac{6}{14}\times\frac{6}{13}+3\times\frac{7}{15}\times\frac{6}{14}\times\frac{2}{13}$ oe or $1-3\left(\frac{8}{15}\times\frac{7}{14}\times\frac{7}{13}\right)-\left(\frac{8}{15}\times\frac{7}{14}\times\frac{6}{13}\right)$ oe or **M2** for the sum of at least two of $\frac{7}{15}\times\frac{6}{14}\times\frac{5}{13}$, $N\times\frac{7}{15}\times\frac{6}{14}\times\frac{6}{13}$, $N\times\frac{7}{15}\times\frac{6}{14}\times\frac{2}{13}$ seen or for $\frac{7}{15}\times\frac{6}{14}\times\frac{13}{13}$ or $\frac{7}{15}\times\frac{6}{14}+N\times\frac{7}{15}\times\frac{6}{14}\times\frac{k}{13}$ seen or **M1** for $\frac{7}{15}\times\frac{6}{14}\times\frac{5}{13}$ or $N\times\frac{7}{15}\times\frac{6}{14}\times\frac{6}{13}$ or $N\times\frac{7}{15}\times\frac{6}{14}\times\frac{2}{13}$ seen If 0 scored **SC1** for $\frac{1519}{3375}$ oe
5(a)	27[.0] or 26.97… nfww	**3**	**M2** for [cos =] $\frac{8.6^2+9.7^2-4.4^2}{2\times8.6\times9.7}$ or **M1** for implicit form
5(b)	9.19 or 9.192 to 9.193	**4**	**B1** for [angle BCD =] 73 seen **M2** for $\frac{9.7\times\sin 65}{\sin(180-65-42)}$ oe or **M1** for $\frac{\sin(180-65-42)}{9.7}=\frac{\sin 65}{DC}$ oe

Question	Answer	Marks	Partial Marks
5(c)	6.15 or 6.149 to 6.151…	**3**	**M2** for $\frac{d}{their\,9.19} = \sin 42$ oe or **M1** for right angle between line from C to BD and BD soi
6(a)(i)	$[a =]\ 4$ $[b =] -3$ nfww	**2**	**B1** for $[a =]\ 4$ **B1** for $[b =] -3$ nfww
6(a)(ii)	$y = 4$ oe	**1**	
6(a)(iii)	$y = -6x + 7$ oe final answer	**2**	**B1** for answer $-6x + 7$ or answers $y = -6x + c$ or $y = kx + 7$ $(k < 0)$
6(b)(i)	2.25 2.67 3.5	**3**	**B1** for each
6(b)(ii)	correct curve 	**4**	**B3 FT** for 7 or 8 points or **B2 FT** for 5 or 6 points or **B1 FT** for 3 or 4 points
6(c)(i)	–0.78 to –0.72 and 0.55 to 0.59	**2**	**B1** for each
6(c)(ii)	$3x^3 - 9x^2 - 3x + 4$ $[= 0]$ final answer	**4**	**B3FT** for 3 out of 4 correct terms or for $bx^3 - 3bx^2 + (a - 1)x + 8 - 3a$ $[= 0]$ oe or **B2FT** for 2 out of 4 correct terms or for 3 out of 4 terms from $bx^3 - 3bx^2 + (a - 1)x + 8 - 3a$ $[= 0]$ or **M1** for $1 + \frac{5}{3 - x} = their\ 4 + (their(-3))x^2$ oe
7(a)(i)	70	**1**	
7(a)(ii)	78	**1**	
7(a)(iii)	Value in range $86 < V \leq 90$	**1**	

Question	Answer	Marks	Partial Marks
7(a)(iv)	One general comment interpreting the median comparison nfww e.g. Students did better on second test oe OR One general comment interpreting IQR/range comparison nfww e.g. Students marks were more consistent on the 2nd test oe	**1**	
7(b)	31.2	**4**	**M1** for mid-values soi **M1** for Σfm where m is any value in interval including boundaries **M1** (dep on second **M1**) for *their* $\Sigma fm \div 50$
7(c)(i)	38	**1**	
7(c)(ii)	Blocks of heights 4.4 and 3.4 with correct widths	**2**	**B1** for each correct block If **B0** scored, **SC1** for both correct frequency densities soi

Question	Answer	Marks	Partial Marks
8(a)(i)	$\frac{53}{360}\times\pi\times9.5^2$	**M1**	
	41.74 to 41.75	**A1**	
8(a)(ii)	5.9[0] or 5.899 to 5.903..	**4**	**M3** for $\left[OA^2=\right]\ \frac{\frac{1}{3}\times41.7}{\frac{1}{2}\sin53}$ oe **M2** for $\frac{1}{2}\times OA^2\times\sin53=\frac{1}{3}\times41.7$ oe **M1** for $\frac{1}{2}\times OA\times OB\times\sin53=\frac{1}{3}\times41.7$ seen or better
8(b)	396 or 397 or 396.4 to 396.6	**6**	**M2** for $\left[r=\right]\left(\frac{60}{360}\times2\times\pi\times24\right)\div2\pi$ oe or better or **M1** for $2\pi r=\frac{60}{360}\times2\times\pi\times24$ oe **M2** for $\sqrt{24^2-a^2}$ or **M1** for $h^2+a^2=24^2$ **M1** for $\frac{1}{3}\pi\times their\ r^2\times their\ h$
9(a)(i)	$(5a-b)(m+2p)$ final answer	**2**	**M1** for $5a(m+2p)-b(m+2p)$ or $m(5a-b)+2p(5a-b)$ or **B1** for correct answer seen
9(a)(ii)	$5(k+g)(3k+3g-4)$ final answer	**2**	**M1** for correct partial factorisation by 5 or $(k+g)$ isw eg $5\left(3k^2+6kg+3g^2-4k-4g\right)$ or $5(3(k+g)^2-4(k+g))$ or $(k+g)\left(15(k+g)-20\right)$ or $(5k+5g)(3k+3g-4)$ or **B1** for correct answer seen
9(a)(iii)	$\left(2x-y^2\right)\left(2x+y^2\right)$ final answer	**2**	**M1** for answer in form $(a+b)(a-b)$ or **B1** for correct answer seen
9(b)	$3x^3-10x^2-x+12$ final answer	**3**	**B2** for correct unsimplified expansion or simplified expression with 3 terms correct in a 4-term expression of required form or **B1** for correct expansion of two of the brackets with at least 3 terms correct
9(c)	$[a=]$ 11 $[b=]$ 121	**2**	**B1** for each

Question	Answer	Marks	Partial Marks
10(a)	1600	**3**	**B2** for answer figs 16 or **M2** for 90.72 ÷ (figs45 × figs3 × figs42) or **M1** for volume = figs 45 × figs 3 × figs 42 isw
10(b)	62.8 or 62.83 to 62.84	**3**	**M2** for $\frac{\pi\times10^2\times30}{15000}\times100$ or **M1** for $\pi\times10^2\times30$
10(c)	12.9[0]	**3**	**B2** for 86 OR **M2** for $\frac{98.9}{1+\frac{15}{100}}\times0.15$ oe or $98.9-\frac{98.9}{1+\frac{15}{100}}$ oe or **M1** for $\left(1+\frac{15}{100}\right)a=98.9$ oe isw
10(d)	50	**2**	**M1** for 3540 ÷ 70.8
11(a)	$\frac{48}{x}$ final answer	**1**	Accept 48 ÷ x
11(b)	$their(a)-\frac{60}{x+2}=4$ oe	**M1**	FT *their* (a) provided expression in x
	$48(x+2)-60x=4x(x+2)$ oe	**M2**	**FT** *their* 3 term eqn with algebraic denominators, x and $x + 2$, for M2 or M1 **M1** for common denominator $x(x+2)$ oe seen or any two terms in a 3 term equation from ± 48 (x + 2) , ± 60x , ± 4x(x + 2) oe seen
	$48x + 96 – 60x = 4x^2 + 8x$ oe leading to $x^2+5x-24=0$	**A1**	With brackets expanded and no errors or omissions seen
11(c)	$(x-3)(x+8)$	**B2**	**B1** for $x(x + 8) – 3(x + 8)$ or $x(x – 3) + 8(x – 3)$ or $(x + a)(x + b)$ [= 0] where $ab = – 24$ or $a + b = 5$ [a, b integers]
	3 and − 8	**B1**	
11(d)	12	**1**	
12(a)	17	**3**	**M2** for $3\times2x^2-7$ or better isw or **M1** for $3\times2x^2$ oe or $kx^2 – 7$ seen

Question	Answer	Marks	Partial Marks
12(b)(i)	13.4 or 13.41 to 13.42	**3**	**M2** for $\sqrt{(-5-7)^2+(8-2)^2}$ oe or **M1** for $(-5-7)^2+(8-2)^2$ oe
12(b)(ii)	$[y=]\ 2x+5$ final answer	**4**	**M1** for [gradient of AB =] $\frac{8-2}{-5-7}$ oe **M1dep** for gradient $p = -1 \div$ *their* $-\frac{1}{2}$ oe **M1dep** on previous M1 for substituting (−1, 3) into y = *their* $px + c$ oe where *their* $p \neq 0$
12(b)(iii)	(5, 0)	**4**	**B3** for $\overrightarrow{AD}=\begin{pmatrix}-2\\-2\end{pmatrix}$ or $\overrightarrow{DA}=\begin{pmatrix}2\\2\end{pmatrix}$ or coordinates of C (−7, 6) and $\left[\overrightarrow{CD}=\right]\ \begin{pmatrix}12\\-6\end{pmatrix}$ oe seen or **B2** for $a = b = 2$ soi or coordinates of C (−7, 6) or **M1** for $a = b$ oe soi or for $a^2+b^2=\left(\sqrt{8}\right)^2$ oe or cos 45 = $\frac{a}{\sqrt{8}}$ oe or for $\left[\overrightarrow{DC}=\right]\begin{pmatrix}-12\\6\end{pmatrix}$ or $\left[\overrightarrow{CD}=\right]\ \begin{pmatrix}12\\-6\end{pmatrix}$ seen or $\frac{y-8}{x--5}=1$ oe or $\frac{y-2}{x-7}=1$

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MATHEMATICS **0580/41**

Paper 4 (Extended) **October/November 2020**

MARK SCHEME

Maximum Mark: 130

Published

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[Turn over

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

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- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)	Image at (4, –1) (4, –4) (5, –4)	**2**	**B1** for translation by $\begin{pmatrix}8\\k\end{pmatrix}$ or $\begin{pmatrix}k\\-6\end{pmatrix}$ or for correct vertices not joined
1(b)	Image at (–4, –4) (–4, –7) (–3, –4)	**2**	**B1** for reflection in $x = -1$ or $y = k$ or for correct vertices not joined
1(c)	Enlargement 3 (–5, 5)	**3**	**B1** for each
1(d)	Rotation 90º clockwise oe (1, 1)	**3**	**B1** for each
2(a)	1 : 5 : 12	**2**	**M1** for 2 : 10 : 24 or 7 : 35 : 84 or $\frac{1}{18}:\frac{5}{18}:\frac{12}{18}$
2(b)(i)	266 and 95	**3**	**B2** for 266 or 95 or 266 and 95 reversed or **M1** for $\frac{114}{6}$
2(b)(ii)	15	**2**	**M1** for $\frac{114-96.9}{114}$ [× 100] oe or $\frac{96.9}{114}\times 100$
2(c)(i)	2h 50min	**1**	
2(c)(ii)	636	**2**	**M1** for 1802 ÷ *their* 2h 50min
3(a)	Disagree: the median for the women is greater (than the median for the men) oe Disagree: the men have a smaller [interquartile] range of times oe	**2**	**B1** for each correct statement oe
3(b)(i)	87.4 nfww	**4**	**M1** for mid-points **soi** (30, 80, 130, 190, 270) **M1** for use of Σ*fm* with *m* in correct interval including both boundaries **M1** (dep on 2nd M1) for Σ*fm* ÷ (41 + 24 + 23 + 8 + 4)
3(b)(ii)(a)	90	**1**	
3(b)(ii)(b)	8	**2**	**B1** for 92 seen

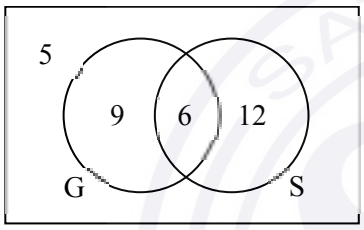
Question	Answer	Marks	Partial Marks
3(b)(iii)	2.4	**2**	**M1** for $\frac{24}{40}$ or $\frac{8}{60}$ Or **B1** for [multiplier] 18 or $\frac{1}{18}$
4(a)	38.6	**3**	**M2** for [2 ×] (8.5 + 0.05 + 10.7 + 0.05) or **M1** for 8.5 + 0.05 or 10.7 + 0.05
4(b)(i)	8.86 or 8.863…	**2**	**M1** for $\frac{h}{9}$ = sin 80 or better oe
4(b)(ii)	∠CDF = 100 leading to $\angle DCF = 40$ Or ∠EDF = 80 leading to $\angle DCF = 40$	**M1**	Implied by 180-(100 + 40) = 40 or 80 – 40
	'two equal angles'	**A1**	With no incorrect work seen
4(b)(iii)	66.5 or 66.45 to 66.47…	**3**	**M2** for $0.5(3 + 12) \times$ *their* **(b)(i)** or $12 \times$ *their* **(b)(i)** $- 0.5 \times 9 \times 9 \times \sin 100$ oe or **B1** for $DC = 9$ or $BC = 3$

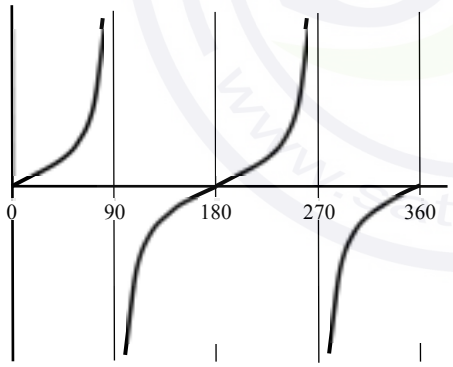
Question	Answer	Marks	Partial Marks
4(c)	130 nfww or 129.6 to 129.8	**5**	**B1** for $\angle ACD = 21°$ or $\angle CAD = 69°$ **Method 1** **M2** for $\cos 21 = \frac{12}{AC}$ oe or **M1** for $\angle ADC = 90$ soi **M1** for $\pi(\textit{their } AC/2)^2$ OR **Method 2** **M2** for $\frac{12}{\sin 138} = \frac{r}{\sin 21}$ oe or **M1** for $\angle COD = 138$ soi **M1** for $\pi(\textit{their } r)^2$ OR **Method 3** **M2** for $\cos 21 = \frac{6}{OC}$ oe or **M1** for $\angle CXO = 90$ soi where X is the point where the perpendicular from O meets the chord CD **M1** for $\pi(\textit{their } OC)^2$
4(d)	78.4 or 78.37 to 78.41	**3**	**M2** for $\frac{x}{360} \times 2 \times \pi \times 9.5 + 2 \times 9.5 = 4 \times 8$ oe or **M1** for $\frac{x}{360} \times 2 \times \pi \times 9.5$ After **M0, SC1** for $9.5x + 19 = 32$ oe
5(a)(i)	2.7 to 2.8	**1**	

Question	Answer	Marks	Partial Marks
5(a)(ii)	tangent ruled at $x = -2$	**B1**	
	6 to 10	**2**	**dep on B1** or a close attempt at tangent at $x = -2$ or **M1** for rise/run for *their* tangent, or close attempt, at any point Must see correct or implied calculation from a drawn tangent After **M0, SC1** for gradient of tangent (or close attempt) in range embedded in $y = mx + c$
5(a)(iii)	$y = 2x - 2$ ruled and $x = -2.9$ to -2.8 cao	**3**	**B2** for correct ruled line or **B1** for short line or for freehand line or broken line or ruled line with gradient 2 or with y-intercept at –2 (but not $y = -2$)
5(b)	A (4, 17) B (–1.5, 0.5)	**5**	**B4** for (–1.5, 0.5) and (4, 17), or for $x = 4$ and $x = -1.5$ OR **B3** for A(4, 17) or B(–1.5, 0.5) OR **M1** for $2x^2 - 2x - 7 = 3x + 5$ oe AND either **M2** for $(2x + 3)(x - 4)$ or **M1** for $2x(x - 4) + 3(x - 4)$ or $x(2x + 3) - 4(2x + 3)$ or $(2x + c)(x + d)$ where $cd = -12$ or $c + 2d = -5$ [c and d are integers] OR **M2** for $\frac{-\text{their } b \pm \sqrt{(\text{their } b)^2 - 4(\text{their } a)(\text{their } c)}}{2(\text{their } a)}$ or **M1** for $\sqrt{(\text{their } b)^2 - 4(\text{their } a)(\text{their } c)}$ or for $p = -\text{their } b$, $r = 2(\text{their } a)$ if in the form $\frac{p + \sqrt{q}}{r}$ or $\frac{p - \sqrt{q}}{r}$

Question	Answer	Marks	Partial Marks
6(a)(i)	106.01 to 106.02	**4**	**M2** for $[\cos[\angle CBD] =] \frac{192^2 + 168^2 - 287.9^2}{2 \times 192 \times 168}$ oe or **M1** for the implicit form **A1** for –0.276 to – 0.275
6(a)(ii)	292.0 or 291.98 to 291.99	**1**	
6(a)(iii)	310.0 or 310.03 to 310.04	**5**	**M2** for $[\sin A =] \frac{168 \times \sin(90-38)}{205.8}$ or **M1** for $\frac{\sin A}{168} = \frac{\sin(90-38)}{205.8}$ **A1** for [A =] 40.0 or 40.03 to 40.04 **M1 dep** for 270 + *their* angle DAB oe
6(b)(i)	15 500 or 15 501 to 15 503. …	**2**	**M1** for $0.5 \times 192 \times 168 \times \sin(106)$ oe
6(b)(ii)	55 400	**2**	**FT** $3.575 \times$ *their* **(b)(i)** oe rounded to nearest 100 **M1** for figs 35 75 × figs *their* **(b)(i)** or figs 554 or figs 5541 to figs 5543
7(a)	25 36 10 15 35 51	**2**	**B1** for 3, 4 or 5 correct
7(b)	n^2	**1**	
7(c)(i)	92	**1**	
7(c)(ii)	$\frac{1}{2}(n^2 - n)$ oe	**2**	**M1** for $\frac{1}{2}(3n^2 - n) - n^2$ oe or for final quadratic answer with $\frac{1}{2}n^2$ oe or $-\frac{1}{2}n^2$ oe but not both

Question	Answer	Marks	Partial Marks
7(d)	$a = \frac{1}{2}$, $b = \frac{1}{2}$	**5**	**B2** for 2 correct equations eg $a + b = 1$, $8a + 4b = 6$ or **B1** for 1 correct equation **B2** for one correct value or **M1** (dep on at least B1) for correctly eliminating one variable from two linear equations in a and b OR **B2** for $a = \frac{1}{2}$ or **B1** for $6a = 3$ or for 3rd difference = 3 **B2** for $b = \frac{1}{2}$ or **M1** for substituting *their* a into a correct equation of first differences
8(a)	$ab(3a - b)$ final answer	**2**	**B1** for $a(3ab - b^2)$ or $b(3a^2 - ab)$ or $ab(3a - b)$ seen
8(b)	$x > 7.5$ final answer	**2**	**B1** for $12+3 < 5x - 3x$ oe
8(c)	$27x^6y^{12}$	**2**	**B1** for two of 27, x^6 and y^{12} correct
8(d)	0.5 or $\frac{1}{2}$	**3**	**M2** for $4 = 6x + 2x$ or better or **M1** for $2(2 - x) = 6x$ oe
8(e)	$2x^3 + 5x^2 - 23x + 10$ final answer	**3**	**B2** for correct expansion of three brackets unsimplified **B1** for correct expansion of two brackets with at least 3 terms correct
8(f)(i)	$200\left(1+\frac{r}{100}\right)^2 = 206.46$ oe	**M1**	
	$1 + \frac{2r}{100} + \frac{r^2}{100^2}$ oe	**M1**	
	$r^2 + 200r - 323 = 0$	**A1**	Correct solution reached with no errors or omissions seen If 0 scored, **SC1** for $200(n)^2 = 206.46$

Question	Answer	Marks	Partial Marks
8(f)(ii)	$\frac{-200+\sqrt{200^2-4(1)(-323)}}{2\times1}$	**B2**	**B1** for $\sqrt{200^2-4(1)(-323)}$ or $(r+100)^2$ **B1** for $\frac{-200+\sqrt{q}}{2\times1}$ or $r=\sqrt{323+100^2}-100$ OR **B2** for $100\left(\sqrt{\frac{206.46}{200}}-1\right)$ or **B1** for $\sqrt{\frac{206.46}{200}}$
	1.60 cao final answer	**B1**	
9(a)(i)		**2**	**B1** for two correct values Or **B1** 5 outside and total in G = 15 and total in S = 18
9(a)(ii)	$\frac{3}{8}$ oe	**1**	**FT** $\frac{\textit{their}\ 12}{32}$
9(a)(iii)	$\frac{2}{5}$ oe	**1**	**FT** $\frac{\textit{their}\ 6}{15}$
9(b)	96	**2**	**M1** for $\frac{36}{64}=\frac{54}{x}$ oe or $36=\frac{54}{(54+b)}\times100$ oe If 0 scored **SC**1 for answer 150
9(c)(i)	$\frac{9}{25}$ oe	**2**	**M1** for $\frac{15}{25}\times\frac{15}{25}$ oe
9(c)(ii)	$\frac{16}{25}$ oe	**1**	**FT** 1 – *their* **(c)(i)**
9(d)	$\frac{17}{20}$ oe	**3**	**M2** for $1-\frac{10}{25}\times\frac{9}{24}$ oe or for $\frac{15}{25}\times\frac{14}{24}+\frac{15}{25}\times\frac{8}{24}+\frac{15}{25}\times\frac{2}{24}+\frac{8}{25}\times\frac{15}{24}+\frac{2}{25}\times\frac{15}{24}$ oe or **M1** for one correct relevant product

Question	Answer	Marks	Partial Marks
10(a)(i)	$A(-4, 0)$ $B(1, 0)$ $C(0, -4)$	**4**	**B3** for A and B correct Or **B2** for B (–4, 0) and A (1, 0) Or **B1** for $(x + 4)(x - 1)$ or for $\frac{-3 \pm \sqrt{3^2 - 4\times1\times-4}}{2}$ oe and **B1** for A or B correct **B1** for C(0, –4) OR **SC2** for –4, 1 and –4 in correct positions on the graph
10(a)(ii)	$2x + 3$ [± 0] final answer	**2**	**B1** for answer $2x + c$ or for $ax + 3$, $a \neq 0$ or for correct answer seen
10(a)(iii)	$y = 7x - 8$ oe	**3**	**B2** for answer $7x - 8$ OR **M1** for [gradient =] 2(2) + 3 FT *their* part **(a)(ii)** of the form $ax + b$ **M1dep** for substitution of (2, 6) into $y = \textit{their } mx + c$ oe
10(b)(i)	Correct sketch  	**2**	**B1** for one correct section out of 4 OR **B1** for two properties correct from • Crosses x-axis at (0, 0) (180, 0) and (360, 0) only • Correct curvature in each section of 90° • Asymptotes at $x = 90$ and $x = 270$
10(b)(ii)	125.5 or 125.53 to 125.54 and 305.5 or 305.53 to 305.54	**3**	**B2** for one correct angle or **B1** for –54.5 or –54.46… or for 2 angles with a difference of 180.

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MATHEMATICS **0580/42**

Paper 4 (Extended) **October/November 2020**

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Published

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GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

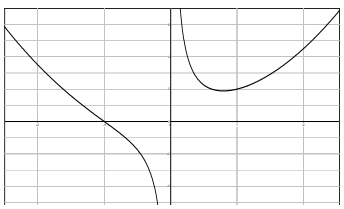
Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)	9080 cao	**3**	**B2** for 9078 to 9081… or **M1** for 813 × *their* 11h 10min
1(b)(i)	654 or 653.5…	**2**	**M1** for 10260 ÷ 15 h 42 min oe
1(b)(ii)(a)	21.8 or 21.82 to 21.83	**1**	
1(b)(ii)(b)	4.58 or 4.59 cao	**2**	**M1** for 470 ÷ (10260 ÷ 100) oe or 100 ÷ *their* **(b)(ii)(a)**
1(c)	12.97	**1**	
2(a)	Translation $\begin{pmatrix}1\\-6\end{pmatrix}$	**2**	**B1** for each
2(b)(i)	Image at (0, 1), (–3, 1), (–3, 2)	**2**	**B1** for reflection in $x = k$ or $y = 1$
2(b)(ii)	Image at (5, –4), (5, –1), (4, –1)	**2**	**B1** for rotation 90° anticlockwise with other centre or for rotation 90° clockwise about (6, 0)
2(b)(iii)	Image at (–1, –2), (–7, –2), (–7, –4)	**2**	**B1** for enlargement, factor –2 with other centre
3(a)(i)	2210 or 2208 or 2208.2, or 2208.16…	**2**	**M1** for $2000 \times \left(1+\frac{2}{100}\right)^5$ oe
3(a)(ii)	10.4 or 10.5 or 10.40 to 10.41	**2**	**M1** for $\frac{\textit{their}\,\textbf{(a)(i)} - 2000}{2000}$ [×100] or $\frac{\textit{their}\,\textbf{(a)(i)}}{2000} \times 100$ or $\left(1+\frac{2}{100}\right)^5 - 1$ or $\left(1+\frac{2}{100}\right)^5 \times 100$ oe
3(a)(iii)	12	**3**	**B2** for 11.3 or 11.26 to 11.27 **OR** **M2** for [2000 ×] $\left(1+\frac{2}{100}\right)^{11}$ oe or [2000 ×] $\left(1+\frac{2}{100}\right)^{12}$ oe seen or **M1** for [2000 ×] $\left(1+\frac{2}{100}\right)^{n}$ oe, $n > 5$ oe or for $2000 \times \left(1+\frac{2}{100}\right)^{n} =$ or > or ⩾ 2500 oe

Question	Answer	Marks	Partial Marks
3(b)	490 cao	**3**	**M2** for $p\times\left(1-\frac{4}{100}\right)^{16}=255$ oe soi by 490.0... or **M1** for $p\times\left(1-\frac{4}{100}\right)^{n}=255$ oe, $n>1$ oe
4(a)(i)	25	**1**	
4(a)(ii)	10 nfww	**2**	**B1** for [lq =] 22 or [uq =] 32
4(a)(iii)	27	**1**	
4(a)(iv)	6	**2**	**B1** for 114 written
4(b)(i)	27.9 or 27.91 to 27.92 nfww	**4**	**M1** for mid-values **M1** for $\sum fx$ where x lies within or on boundary of correct interval **M1 dep** $\sum fx \div 120$ dep on second M1
4(b)(ii)	7.6	**2**	**M1** for $\frac{18}{10}$ oe or $\frac{38}{20}$ oe or **B1** for [multiplier] 4 or ¼
5(a)	1.48	**3**	**B2** for $7x + 2 = 12.36$ or better or **M1** for $3x + 2(2x + 1)$ [= 12.36] or better
5(b)	1.75 or $1\frac{3}{4}$	**3**	**B2** for $18x - 14x = 7$ or better or **M1** for $18x = 7(2x + 1)$
5(c)	[0].8 oe	**3**	**B2** for $4(2x + 1) = 13x$ or **M1** for $\frac{4}{x}=\frac{13}{2x+1}$ oe or correct equation to find number of cakes

Question	Answer	Marks	Partial Marks
5(d)	$\frac{20}{x}+\frac{10}{2x+1}=45$ oe	**M2**	**B1** for $\frac{20}{x}$ seen or $\frac{10}{2x+1}$ seen
	$90x^2 - 5x - 20$ [= 0] oe	**B2**	**B1** for $\frac{20(2x+1)+10x}{x(2x+1)} = 45$ or better
	$(9x + 4)(2x – 1)$ [= 0] or for $\frac{--1\pm\sqrt{(-1)^2-4(18)(-4)}}{2(18)}$ oe	**M2**	**FT** *their* 3-term quadratic **M1** for factors that give two correct terms when expanded or for correct discriminant or correct $\frac{-b}{2a}$ provided quadratic formula is in correct form
	[0].5 or $\frac{1}{2}$ final answer	**B1**	
6(a)(i)	$\frac{1}{3}$ oe	**1**	
6(a)(ii)	0	**1**	
6(a)(iii)	$\frac{1}{6}$ oe	**1**	
6(b)(i)	$\frac{1}{15}$ oe	**2**	**M1** for $\frac{2}{6}\times\frac{1}{5}$ or equivalent method
6(b)(ii)	$\frac{4}{15}$ oe	**3**	**M2** for $\frac{2}{6}\times\frac{1}{5} + \frac{3}{6}\times\frac{2}{5}$ or equivalent method or **M1** for $\frac{2}{6}\times\frac{1}{5}$ oe seen or $\frac{3}{6}\times\frac{2}{5}$ oe seen
6(c)	$\frac{7}{18}$ oe	**3**	**M2** for $\left(\frac{1}{6}\right)^2+\left(\frac{2}{6}\right)^2+\left(\frac{3}{6}\right)^2$ oe or **M1** for one correct product seen or sample space with 14 correct pairs identified
7(a)	2, 4.5	**2**	**B1** for each
7(b)	Correct graph 	**4**	**B3 FT** for 6 or 7 correct points FT *their* table or **B2 FT** for 4 or 5 correct points FT *their* table or **B1 FT** for 2 or 3 correct points FT *their* table

Question	Answer	Marks	Partial Marks
7(c)(i)	–0.5 to –0.4	**1**	
7(c)(ii)	$y = 1 - x$ ruled **and** –1.9 to –1.75	**2**	**M1** for [y =] $1 - x$ or $\left[x^2 + \frac{1}{x} =\right] 1 - x$ soi or **B1** for –1.9 to –1.75
7(d)	Any integer ≥ 2	**1**	
8(a)	[v =] 40 [w =] 80 [x =] 40 [y =] 100 [z =] 60	**5**	**B1** for each **FT** angle z as 140 – *their w*
8(b)	24	**3**	**M2** for $360 - 11x = 2 \times 2x$ oe or **M1** for $360 - 11x$ seen or obtuse angle $KOL = 2 \times 2x$ oe
8(c)(i)	angle ADX = angle BCX oe same segment oe angle DAX = angle CBX oe same segment oe angle AXD = BXC oe [vertically] opposite oe	**M2**	Accept in any order **M1** for one correct pair with reason If 0 scored, **SC1** for two correct pairs of equal angles identified with incorrect/no reasons
	corresponding angles are equal oe	**A1**	
8(c)(ii)(a)	8.75 or 8¾	**2**	**M1** for $\frac{8}{10} = \frac{7}{DX}$ oe
8(c)(ii)(b)	81.8 or 81.78 to 81.79	**4**	**M2** for [cos[BXC] =] $\frac{5^2 + 7^2 - 8^2}{2 \times 5 \times 7}$ oe or **M1** for $8^2 = 5^2 + 7^2 - 2 \times 5 \times 7 \times \cos(...)$ oe **A1** for $\frac{10}{70}$ oe

Question	Answer	Marks	Partial Marks
9(a)	315 or 314.5 to 315.0	**6**	**M1** for $\tan 70 = \frac{\text{height}}{\frac{1}{2}(8-5)}$ oe or better seen **M1dep** for $\frac{1}{2}(8+5)\times$ *their* height or better seen **dep** on trig attempt for height **M2** for $12 \times \frac{\frac{1}{2}(8-5)}{\cos 70}$ oe or better seen or **M1** for $\frac{\frac{1}{2}(8-5)}{\cos 70}$ oe or better seen **M1** for 8×12 oe isw and 5×12 oe isw
9(b)(i)	$8 - ½ (8 - 5)$ or $5 + ½ (8 - 5)$	**M1**	
9(b)(ii)	13.6 or 13.64 to 13.65	**2**	**M1** for $12^2 + (6.5)^2$ oe
9(b)(iii)	16.8 or 16.9 or 16.79 to 16.91… nfww	**2**	**M1** for identifying angle *GAX* from a diagram or from working or better
10(a)(i)	10	**1**	
10(a)(ii)	–19	**1**	FT 1 – 2 *their* **(a)(i)**
10(b)	$\frac{1-x}{2}$ oe final answer	**2**	**M1** for $x = 1 – 2y$ or $y + 2x = 1$ or $\frac{y}{2} = \frac{1}{2} - x$ or $y – 1 = –2x$ or better
10(c)	$\frac{1}{2}$ oe	**1**	
10(d)	$4x^2 – 8x + 2$ final answer	**4**	**M1** for $(1 – 2x)(1 – 2x) – (1– 2(1 – 2x))$ or better **B1** for $1 – 2x – 2x + 4x^2$ **B1** for $– (1 – 2 + 4x)$ or better or [+] $1 – 4x$ or for correct answer seen then spoiled
10(e)	x final answer	**1**	
10(f)	3125	**1**	
10(g)	25	**1**	
10(h)	–2	**2**	**B1** for $\frac{1}{25}$ or 0.04
11(a)	A : –3 $17 – 4n$ oe	**3**	**B1** for –3 **B2** for $17 – 4n$ oe or **B1** for $k – 4n$ oe or $17 – pn$ oe, $p \neq 0$

Question	Answer	Marks	Partial Marks
	B : 124 $n^3 - 1$ oe	**3**	**B1** for 124 **B2** for $n^3 - 1$ oe or **B1** for any cubic
	C : $\frac{11}{128}$ $\frac{n+6}{2^{n+2}}$ oe	**4**	**B1** for $\frac{11}{128}$ **B3** for $\frac{n+6}{2^{n+2}}$ oe or **B2** for 2^{n+2} oe seen or **B1** for 2^k oe or $n + 6$ seen
11(b)	$\frac{p+1}{2q}$ oe	**2**	**B1** for $p + 1$ or $2q$ oe

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MATHEMATICS **0580/43**

Paper 4 (Extended) **October/November 2020**

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2020 series for most Cambridge IGCSE™, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

[Turn over

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

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- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

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Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
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3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
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5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)(i)	$5.101[00\ldots] \times 10^8$ final answer	**1**	
1(a)(ii)	361 150 800 oe	**2**	**FT** *their* **(a)(i)** **M1** for $\frac{70.8}{100} \times 510\,100\,000$ or for $\frac{70.8}{100} \times$ *their* **a(i)**
1(b)(i)	6070 oe	**1**	
1(b)(ii)	32 000 oe	**2**	**B1** for figs 32
1(b)(iii)	6.68 or 6.677 …	**2**	**M1** for $\frac{6.41\times10^5}{9.6[0]\times10^6}$ $[\times 100]$ oe
1(b)(iv)	1250 or 1248 to 1249 oe	**2**	**B1** for figs 125 or figs1248 to figs 1249
1(c)(i)	25.1 or 25.08…	**2**	**M1** for $\frac{7.53[\times10^9] - 6.02[\times10^9]}{6.02[\times10^9]}$ oe or $\frac{7.53[\times10^9]}{6.02[\times10^9]}\times100$
1(c)(ii)	1.33 or 1.325…	**3**	**M2** for $\sqrt[17]{\frac{7.53[\times10^9]}{6.02[\times10^9]}}$ or $\sqrt[17]{1+\frac{\textit{their}\ \textbf{(c)(i)}}{100}}$ or **M1** for $6.02[\times10^9] \times p^{17} = 7.53[\times10^9]$ or $p^{17} = 1+\frac{\textit{their}\ \textbf{(c)(i)}}{100}$
2(a)(i)	Triangle at (–3, 2) (–3, 3) (–5, 2)	**2**	**B1** for correct rotation about incorrect point or for rotation 90 clockwise around (0, 0)
2(a)(ii)	Triangle at (5, –2) (6, –2) (5, 0)	**2**	**B1** for translation by $\begin{pmatrix}3\\k\end{pmatrix}$ or $\begin{pmatrix}k\\-5\end{pmatrix}$
2(b)	Enlargement [SF] 3 [Centre] (1, 4)	**3**	**B1** for each
3(a)(i)	43	**1**	
3(a)(ii)	65	**1**	
3(a)(iii)	13	**1**	

Question	Answer	Marks	Partial Marks
3(b)	80	**3**	**M2** for $\frac{400}{18}\times\frac{60\times60}{1000}$ oe Or **M1** for $\frac{400}{18}$ or for *their* speed in m/s $\times\frac{60\times60}{1000}$ or for $\frac{400}{1000}$ and $\frac{18}{60\times60}$ soi
4(a)(i)	$\frac{1}{11}$ oe	**1**	
4(a)(ii)	$\frac{1}{110}$ oe	**2**	**M1** for $\frac{1}{11}\times\frac{1}{10}$ oe
4(a)(iii)	$\frac{4}{55}$ oe	**3**	**M2** for $\left(\frac{2}{11}\times\frac{1}{10}\right)+\left(\frac{3}{11}\times\frac{2}{10}\right)$ oe **or M1** for $\left(\frac{2}{11}\times\frac{1}{10}\right)$ or $\left(\frac{3}{11}\times\frac{2}{10}\right)$ seen oe
4(b)(i)	$\frac{1}{165}$ oe	**2**	**M1** for $\frac{3}{11}\times\frac{2}{10}\times\frac{1}{9}$ oe
4(b)(ii)	$\frac{1}{5}$ oe	**5**	**M4** for $3\left(\frac{2}{11}\times\frac{1}{10}\times\left[\frac{9}{9}\right]\right)+3\left(\frac{3}{11}\times\frac{2}{10}\times\frac{8}{9}\right)$ oe or **M3** for $3\left(\frac{3}{11}\times\frac{2}{10}\times\frac{8}{9}\right)$ or **M2** for $3\left(\frac{2}{11}\times\frac{1}{10}\times\left[\frac{9}{9}\right]\right)$ or $\frac{3}{11}\times\frac{2}{10}\times\frac{8}{9}$ oe or **M1** for $\frac{2}{11}\times\frac{1}{10}\times\left[\frac{k}{9}\right]$ where k is 3, 6 or 9
4(b)(iii)	$\frac{131}{165}$ oe	**2**	**M1** for 1 – (*their* **(b)(i)** + *their* **(b)(ii)**) oe
5(a)(i)	81° Angle at centre is twice angle at circumference oe	**2**	**B1** for 81°
5(a)(ii)	81° Alternate segment [theorem] oe	**2**	**FT** *their* **(a)(i)** **B1FT** for 81°

Question	Answer	Marks	Partial Marks
5(a)(iii)	123° Angles on a straight line [= 180] Opposite angles in a cyclic quadrilateral are supplementary oe	**3**	**FT** *their* acute **(a)(ii)** + 42 **B1** for each element
5(b)(i)	Angle *PTU* = angle *PRQ* corresponding Angle *PUT* = angle *PQR* corresponding Angle *RPQ* is common oe	**M2**	Accept in any order **M1** for one correct pair with reason If 0 scored, **SC1** for two correct pairs of equal angles identified with incorrect/no reasons
	Corresponding angles are equal oe	**A1**	
5(b)(ii)(a)	4 : 7 oe	**1**	
5(b)(ii)(b)	41.25 oe	**3**	**M2** for $20\times\left(\frac{7}{4}\right)^2$ oe or $20\times\frac{7^2-4^2}{4^2}$ oe or **M1** for $\left(\frac{7}{4}\right)^2$ or $\left(\frac{4}{7}\right)^2$ or $\frac{7^2-4^2}{4^2}$ or $\frac{4^2}{7^2-4^2}$
6(a)	440	**2**	**M1** for $8\times5\times11$
6(b)	$\sqrt{8^2+5^2+11^2}$ oe or $8^2 + 5^2 + 11^2$ and 13^2 ALTERNATIVE $\sqrt{8^2+11^2}$ or $8^2 + 11^2$ and 13^2	**M3**	**M2** for $8^2 + 5^2 + 11^2$ or $8^2 + 11^2$ oe or **M1** for $8^2 + 5^2$ or $5^2 + 11^2$ oe
	Yes and 14.5 or 14.4 or 14.49… or Yes and 13.6[0…]	**A1**	Accept equivalent conclusion
6(c)(i)	32.0[…]	**2**	**M1** for tan[..] = $\frac{5}{8}$ oe
6(c)(ii)	49.4 or 49.38 to 49.39	**2**	**M1** for sin[..] = $\frac{11}{\textit{their AG}}$ oe
7(a)(i)	$(8 - x)(3 + x)$	**2**	**M1** for $8(3 + x) - x(3 + x)$ or $3(8 - x) + x(8 - x)$ or $(a - x)(b + x)$ where $ab = 24$ or $a - b = 5$

Question	Answer	Marks	Partial Marks
7(a)(ii)	[a =] –3 [b =] 8 [c =] 24	**3**	**FT** *their* **(a)(i)** for a and b **B1FT** for each of a and b or both correct but reversed **B1** for [c =] 24
7(a)(iii)	8	**3**	**M2** for $5 - 2x$ or **M1** for $-2x$ or $5 - kx$, $k \neq 0$
7(b)(i)	Correct sketch: positive cubic shape and max on the y-axis or to the right of y-axis with one root at (–1, 0) and turning point at (3, 0) and y-intercept at (0, 9) all labelled	**4**	**B1** for positive cubic shape with max on the y-axis or to the right of y-axis **B1** for root at (–1, 0) **B1** for turning point at (3, 0) **B1** for y-intercept (0, 9) If 0 score **SC1** for all three intercepts on axes identified
7(b)(ii)	$x^3 - 5x^2 + 3x + 9$ final answer	**3**	**B2** for correct expansion of three brackets unsimplified **B1** for correct expansion of two brackets with at least 3 terms correct
8(a)(i)	$\begin{pmatrix} 4 \\ 4 \end{pmatrix}$	**2**	**B1** for $\begin{pmatrix} 4 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ 4 \end{pmatrix}$
8(a)(ii)	$\begin{pmatrix} -4 \\ 8 \end{pmatrix}$	**2**	**B1** for $\begin{pmatrix} -4 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ 8 \end{pmatrix}$
8(a)(iii)	5.39 or 5.385..	**2**	**M1** for $(-2)^2 + 5^2$ oe
8(b)(i)	$\mathbf{a} + \mathbf{b}$	**1**	
8(b)(ii)	$\frac{3}{2}\mathbf{a} + \mathbf{b}$	**2**	**M1** for a correct route, e.g. $\overrightarrow{OA} + \overrightarrow{AE}$
8(b)(iii)	$2\mathbf{a} + \frac{4}{3}\mathbf{b}$	**3**	**M2** for unsimplified $\overrightarrow{OD}$ or for $\frac{4}{3}\mathbf{b}$ or **M1** for $\overrightarrow{OD}$ attempted in terms of **a** and **b** or for $\overrightarrow{CD} = \frac{1}{3}\mathbf{b}$ or $\overrightarrow{DB} = \frac{2}{3}\mathbf{b}$ seen
9(a)	2, 3, 4, 5	**2**	**B1** for 3 correct and no extra or 4 correct and one extra or **M1** for $1 < x \leqslant 5$
9(b)(i)	$3y\,(2y - 5x)$	**2**	**B1** for $3(2y^2 - 5xy)$ or $y\,(6y - 15x)$ or for the correct answer seen and then spoiled

Question	Answer	Marks	Partial Marks
9(b)(ii)	$(y - 3x)(y + 3x)$	**2**	**B1** for $(y + 3)(y - 3)$
9(c)	$\frac{4x+5}{(x-1)(2x+1)}$ or $\frac{4x+5}{2x^2-x-1}$ final answer	**3**	**M1** for $3(2x + 1) - 2(x - 1)$ oe isw **M1** for $(x - 1)(2x + 1)$ oe isw
9(d)	(1.74 , 7.21 to 7.24) and (–3.74 , –9.20 to –9.22) cao	**6**	For the y values accept any value rounded to 2 decimal places in the given range **B5** for (1.74 , 7.21 to 7.24) or (–3.74 , –9.20 to –9.22) or $x = 1.74$ and $x = -3.74$ OR **M2** for $2x^2 + 4x - 13 = 0$ or $2y^2 + 4y - 133 = 0$ or **M1** for $2x^2 + 7x - 11 = 3x + 2$ or $y = 2\left(\frac{y-2}{3}\right)^2 + 7\left(\frac{y-2}{3}\right) - 11$ AND **FT** *their* quadratic expression (not $2x^2 + 7x - 11$) **M2FT** for $\frac{-4 \pm \sqrt{4^2 - 4\times2\times-13}}{2\times2}$ or $-1 \pm \sqrt{\frac{15}{2}}$ oe or **M1FT** for $\sqrt{4^2 - 4\times2\times-13}$ oe or for $\frac{-4+\sqrt{k}}{2\times2}$ or $\frac{-4-\sqrt{k}}{2\times2}$ or $(x + 1)^2$ [– 13/2 – 1 = 0]
10(a)	–23	**2**	**M1** for $4 - 3(3^x)$ oe soi
10(b)	$\frac{4-x}{3}$ oe final answer	**2**	**M1** for $x = 4 - 3y$ or $y + 3x = 4$ or $x + 3y = 4$ or $\frac{y}{-3} = \frac{4}{-3} + x$ oe or $\frac{x}{-3} = \frac{4}{-3} + y$ oe
10(c)(i)	$1 + 6x$ final answer	**2**	**M1** for $4 - 3(1 - 2x)$

Question	Answer	Marks	Partial Marks
10(c)(ii)	$20 - 36x$ or $4(5 - 9x)$ final answer	**4**	**B3** for $20 - 36x$ seen in working then spoiled OR **M1** for $(4 - 3x)^2 + 4 - 3x - 9(x^2 + x)$ or better **B1** for $[(4 - 3x)^2 =] 16 - 12x - 12x + 9x^2$ or better **B1** for answer $20 - kx$ or $k - 36x$ oe or answer $20 - 36x + kx^2$ $k \neq 0$
10(d)	$-\frac{1}{2}$ oe	**2**	**M1** for $(3^2)^{kx}$ or $9^{kx} = 9^{-\frac{1}{2}x}$ oe
11A	24	**B1**	
	$5n - 1$ oe	**B2**	**B1** for $5n - k$ or $jn - 1$ oe $j \neq 0$
11B	127	**B1**	
	$n^3 + 2$ oe	**B2**	**B1** for n^3 oe
11C	256	**B1**	
	$4^{(n-1)}$ oe	**B2**	**B1** for 4^k oe

Cambridge Assessment International Education

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MATHEMATICS **0580/41**

Paper 4 (Extended) **May/June 2020**

MARK SCHEME

Maximum Mark: 130

Published

Students did not sit exam papers in the June 2020 series due to the Covid-19 global pandemic.

This mark scheme is published to support teachers and students and should be read together with the question paper. It shows the requirements of the exam. The answer column of the mark scheme shows the proposed basis on which Examiners would award marks for this exam. Where appropriate, this column also provides the most likely acceptable alternative responses expected from students. Examiners usually review the mark scheme after they have seen student responses and update the mark scheme if appropriate. In the June series, Examiners were unable to consider the acceptability of alternative responses, as there were no student responses to consider.

Mark schemes should usually be read together with the Principal Examiner Report for Teachers. However, because students did not sit exam papers, there is no Principal Examiner Report for Teachers for the June 2020 series.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the June 2020 series for most Cambridge IGCSE™ and Cambridge International A & AS Level components, and some Cambridge O Level components.

[Turn over

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

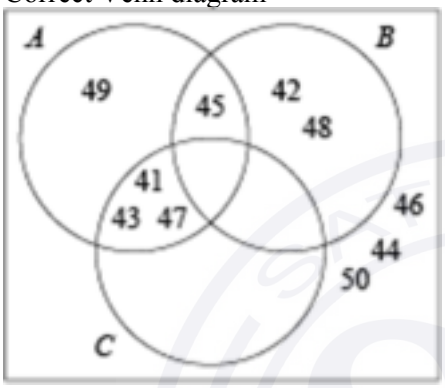
Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao correct answer only
dep dependent
FT follow through after error
isw ignore subsequent working
oe or equivalent
SC Special Case
nfww not from wrong working
soi seen or implied

Question	Answer	Marks	Partial Marks
1(a)(i)	7680	**2**	**M1** for $0.24 \times 32\,000$ oe
1(a)(ii)	34 240	**2**	**M1** for $32\,000 \times \frac{100+7}{100}$ oe
1(b)	5306.04	**2**	**M1** for $5000 \times \left(1+\frac{2}{100}\right)^3$ oe
1(c)	26.7 or 26.66... to 26.67	**4**	**B3** for 96 or $\frac{96}{360}$ oe OR **M3** for $(1-\frac{1}{5}) \times (1-\frac{2}{3}) \times 100$ oe or **M2** for $(1-\frac{1}{5})$ and $(1-\frac{2}{3})$ oe OR **M1** for $360 \div 5$ [$\times 4$] oe **M1** for *their* $288 \div 3$ [$\times 2$]
1(d)	33 500	**2**	**M1** for $36\,515 \div \frac{100+9}{100}$ oe
1(e)	6525	**4**	**M3** for $\left(\frac{65}{45}-\frac{63}{45}\right)[A]=290$ oe or **M2** for $\left(\frac{13}{9}-\frac{7}{5}\right)[A]=290$ oe or **M1** for correct attempt to convert to a common ratio value for Arjun or for $\frac{13}{9}-\frac{7}{5}$ oe
2(a)(i)	$1.5 < h \leqslant 1.6$	**1**	
2(a)(ii)	1.62 or 1.623… nfww	**4**	**M1** for 1.35, 1.45, 1.55, 1.65, 1.75 1.85 soi **M1** for Σfx **M1 dep** for *their* $\Sigma fx \div 120$

Question	Answer	Marks	Partial Marks
2(b)(i)	$\frac{14}{120}$ oe	**1**	
2(b)(ii)	$\frac{21}{20060}$ oe	**4**	**M3** for $3\left(\frac{14}{120}\times\frac{7}{119}\times\frac{6}{118}\right)$ or **M2** for $\frac{14}{120}\times\frac{7}{119}\times\frac{6}{118}$ isw or **M1** for $\frac{14}{120}, \frac{7}{119}, \frac{6}{118}$ After 0 scored, **SC1** for answer $\frac{343}{864000}$ or $\frac{343}{288000}$ oe
2(c)(i)	55, 79, 106, 120	**2**	**B1** for 2 or 3 correct
2(c)(ii)	Correct diagram	**3**	**B1** for correct horizontal plots **B1FT** for correct vertical plots **B1FT dep on at least B1** for reasonable increasing curve or polygon through *their* 6 points If 0 scored **SC1** for 5 out of 6 points correctly plotted
2(d)(i)	1.62 to 1.63	**1**	
2(d)(ii)	1.57 to 1.58	**2**	**B1** for 48 soi
3(a)	75.6	**2**	**M1** for $5.2\times 7+\frac{1}{2}\times 1.6\times 7^2$
3(b)(i)	$2a - 3b$ final answer	**2**	**B1** for answer $2a + kb$ or $ka - 3b$ or for $2a - 3b$ seen in working
3(b)(ii)	$\frac{3}{4}$	**2**	**B1** for $\frac{45x}{60x}$ oe single fraction
3(c)(i)	−5	**1**	
3(c)(ii)	−0.25 or $-\frac{1}{4}$	**3**	**M1** for $20 - 12x = 23$ or for $5 - 3x = \frac{23}{4}$ **M1** for correct completion to $ax = b$ FT *their* first step
3(d)	$9x^6$	**2**	**B1** for $9x^k$ or kx^6
3(e)	$6x^2 - 7xy - 5y^2$	**2**	**M1** for 3 terms out of 4 from $6x^2 - 10xy + 3xy - 5y^2$

Question	Answer	Marks	Partial Marks
4(a)	Triangle at (–4, –4) (–1, –3) (–4, –3)	**2**	**B1** for correct points not joined or for reflection in any $y = k$ or for reflection in $x = –1$
4(b)	Triangle at (1, 1) (1, 4) (2, 4)	**2**	**B1** for correct points not joined or rotation 90 clockwise around any point or rotation 90 anticlockwise around (0, 0)
4(c)	Translation $\begin{pmatrix} 5 \\ -6 \end{pmatrix}$	**2**	**B1** for translation or correct vector oe
5(a)	Correct Venn diagram 	**3**	**B2** for 8 or 9 numbers correct or **B1** for 6 or 7 numbers correct
5(b)(i)	41, 43, 47	**1**	**FT** *their* Venn diagram
5(b)(ii)	44, 46, 49, 50	**1**	**FT** *their* Venn diagram
5(c)	0	**1**	**FT** *their* Venn diagram
6(a)	$y \geqslant x$ oe	**1**	
6(b)	$2.25x + 1.5y \leqslant 22.5$ oe	**M1**	
	One step shown to $3x + 2y \leqslant 30$	**A1**	
6(c)	$y = 10$ ruled	**1**	Broken line
	$3x + 2y = 30$ ruled	**B2**	Solid line **B1** for line passing through (0, 15) or (10, 0)
	$y = x$ ruled	**B1**	Solid line
	Correct region indicated	**B1**	
6(d)	412	**2**	**M1** for (4, 9) identified or for evaluation $40x + 28y$ for an integer point in the region ($x > 0$ and $y > 0$)
7(a)	$[BC^2 =] 80^2 + 115^2 – 2 \times 80 \times 115 \cos 72$ oe	**M1**	
	118.06…	**A2**	**A1** for 13939…

Question	Answer	Marks	Partial Marks
7(b)	67.8 or 67.9 or 67.83 to 67.88	**3**	**M2** for [sin B =] $\frac{115\times\sin 72}{118.1}$ oe or **M1** for $\frac{115}{\sin B}=\frac{118.1}{\sin 72}$ oe
7(c)(i)	255	**3**	**B1** for bearing of B from A is 75 soi **M1** for 180 + 75 oe
7(c)(ii)	[00]7.2	**2**	**M1** for *their* **(c)(i)** – *their* **(b)** –180
7(d)	11.8 or 11.82 to 11.83	**3**	**M1** for 115 ÷ 35 oe **M1** for *their* speed in m/s × 60 × 60 ÷ 1000
7(e)	76.1 or 76.08 to 76.09	**3**	**M2** for $\frac{\text{distance}}{80}=\sin 72$ oe or **M1** for distance required is perpendicular to AC soi
8(a)(i)	Correct sketch	**2**	**B1** for correct shape but inaccurate
8(a)(ii)	Rotational [symmetry] order 2 [centre] (180, 0)	**2**	**B1** for rotational [symmetry]
8(b)	48.6 or 48.59 to 48.60 and 131.4 or 131.40 to 131.41	**3**	**B2** for 48.6 or 48.59 to 48.60 or 131.4 or 131.40 to 131.41 or **M1** for sin x = 0.75 or better If 0 scored, **SC1** for two answers adding to 180
8(c)(i)	$(x + 5)^2 – 11$	**2**	**M1** for $(x + 5)^2 + k$ or (x + *their* 5)^2 + 14 – (*their* 5)^2 or a = 5
8(c)(ii)	Sketch of U-shaped parabola with a minimum indicated at (–5, –11) with no part of graph in 4th quadrant	**3**	**FT** *their* $(x + 5)^2 – 11$ provided in that form **B1** for U shape curve **B1FT** for turning point at (–5, k) or (k, –11)
9(a)	39[.0] or 39.03 to 39.04…	**3**	**M2** for $\frac{165}{360}\times 2\times\pi\times 8 + 16$ or **M1** for $\frac{165}{360}\times 2\times\pi\times 8$
9(b)	2.71 or 2.708…	**4**	**M3** for $\sqrt{\frac{\frac{165}{360}[\times\pi]\times 8^2}{4[\times\pi]}}$ oe or **M2** for $r^2=\frac{\frac{165}{360}[\times\pi]\times 8^2}{4[\times\pi]}$ oe or **M1** for $\frac{165}{360}\times\pi\times 8^2$ oe seen

Question	Answer	Marks	Partial Marks
9(c)(i)	3.67 or 3.666 to 3.667	**2**	**M1** for $\frac{165}{360} \times 2[\times\pi] \times 8 = 2[\times\pi] \times r$ or better or for $\frac{165}{360}[\times\pi] \times 8^2 = [\pi\times]r \times 8$ or better
9(c)(ii)	100 or 100.0 to 100.1… final answer	**4**	**M3** for $\frac{1}{3}\pi \times their(c)(i)^2 \times \sqrt{8^2 - their\ \text{radius}^2}$ or **M2** for $\sqrt{8^2 - their\ \text{radius}^2}$ or **M1** for $(their\ (c)(i))^2 + h^2 = 8^2$
10(a)(i)	15.7 or 15.65...	**3**	**M2** for $\sqrt{(4-10)^2 + (4--3)^2}$ oe or **M1** for $(-4-10)^2 + (4--3)^2$ oe
10(a)(ii)	$\frac{-10-4}{4--3}[=-2]$ oe	**M1**	
	$10 = -2(-3) + c$ Or $-4 = -2(4) + c$ and correct completion to $y = -2x + 4$	**A1**	
10(a)(iii)	$y = \frac{1}{2}x + \frac{11}{4}$ oe	**4**	**M1** for grad = ½ soi **M1** for [midpoint =] (½, 3) **M1** for substitution of (1/2, 3) into *their* $y = mx + c$ oe
10(b)(i)	$\left(-\frac{1}{3}, -\frac{22}{27}\right)$ oe and (–5, 50)	**6**	**B2** for $3x^2 + 16x + 5$ Or **B1** for one correct **M1** for derivative = 0 or *their* derivative = 0 **M1** for $[x =] -\frac{1}{3}$ and $[x =] -5$ **B1** for $-\frac{22}{27}$ and 50
10(b)(ii)	$\left(-\frac{1}{3}, -\frac{22}{27}\right)$ minimum (–5, 50) maximum with correct reasons	**3**	**B2** for one correct with reason or **M1** for correct attempt e.g. 2nd derivatives, gradients or sketching

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MATHEMATICS **0580/42**

Paper 4 (Extended) **May/June 2020**

MARK SCHEME

Maximum Mark: 130

Published

Students did not sit exam papers in the June 2020 series due to the Covid-19 global pandemic.

This mark scheme is published to support teachers and students and should be read together with the question paper. It shows the requirements of the exam. The answer column of the mark scheme shows the proposed basis on which Examiners would award marks for this exam. Where appropriate, this column also provides the most likely acceptable alternative responses expected from students. Examiners usually review the mark scheme after they have seen student responses and update the mark scheme if appropriate. In the June series, Examiners were unable to consider the acceptability of alternative responses, as there were no student responses to consider.

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[Turn over

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- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

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GENERIC MARKING PRINCIPLE 3:

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- marks are not deducted for omissions
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Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

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Maths-Specific Marking Principles	
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3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

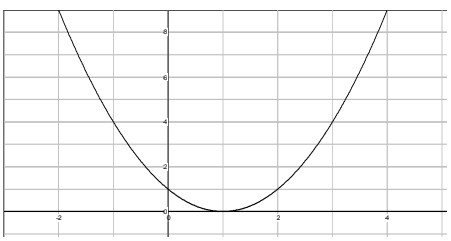
Abbreviations

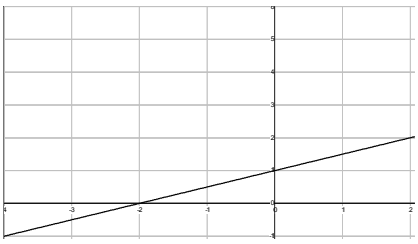
cao correct answer only
dep dependent
FT follow through after error
isw ignore subsequent working
oe or equivalent
SC Special Case
nfww not from wrong working
soi seen or implied

Question	Answer	Marks	Partial Marks
1(a)(i)	14, 10	**2**	**M1** for 24 ÷ (7 + 5)
1(a)(ii)	$\frac{3}{350}$	**2**	**B1** for correct fraction not in lowest terms
1(a)(iii)	120	**1**	
1(b)(i)	10.2[0]	**2**	**M1** for $\frac{15}{100}\times 12$ oe or better
1(b)(ii)	45	**2**	**M1** for $\frac{38.25}{1-\frac{15}{100}}$ oe
1(c)(i)	85	**2**	**M1** for $\frac{500\times 1.7\times 10}{100}$ oe
1(c)(ii)	203 or 202.5 to 202.6	**2**	**M1** for $200\times\left(1+\frac{0.0035}{100}\right)^{365}$
1(c)(iii)	1.9	**3**	**M2** for $\sqrt[6]{\frac{559.78}{500}}$ or **M1** for $500\left(1+\frac{r}{100}\right)^{6}=559.78$
2(a)(i)	$\binom{6}{17}$	**2**	**B1** for each
2(a)(ii)	6.4[0] or 6.403...	**2**	**M1** for $4^2 + 5^2$
2(b)	(1, 2)	**1**	
2(c)	(0, –2)	**1**	

Question	Answer	Marks	Partial Marks
2(d)	$\frac{1}{2}\mathbf{c} + \frac{1}{3}\mathbf{d}$	**3**	**B2** for correct unsimplified answer or **M1** for $\overrightarrow{CT} = -\mathbf{c} + \frac{2}{3}\mathbf{d}$ oe or $\overrightarrow{TC} = \mathbf{c} - \frac{2}{3}\mathbf{d}$ oe or for correct route
3(a)	41.4	**4**	**M1** for 10, 30, 42.5, 47.5, 55, 70 **M1** for Σfx where x lies in or on the boundary of each interval. **M1 dep** for $\frac{\Sigma fx}{200}$ dep on second M1
3(b)(i)	112, 170	**1**	
3(b)(ii)	Correct diagram	**3**	**B1** for correct horizontal plot **B1FT** for correct vertical plots **B1 FT** dep on at least B1 earned for reasonable increasing curve or polygon through their 6 points If 0 scored **SC1FT** for 5 out of 6 points plotted correctly
3(b)(iii)(a)	48	**1**	
3(b)(iii)(b)	160	**2**	**M1** for 40 seen
3(c)	$\frac{87}{3980}$ oe	**2**	**M1** for $\frac{30}{200}\times\frac{29}{199}$ oe
3(d)	Correct histogram	**3**	**B1** for each column If 0 scored **SC1** for correct frequency densities soi 1.25, 12, 1
4(a)	65.4 or 65.36 to 65.37	**3**	**M1** for $150^2 + 120^2 - 2 \times 150 \times 120 \cos 25$ **A1** for 4270 or 4272 to 4273
4(b)	125 or 124.7 to 124.8	**4**	**B1** for [angle S =] 80 **M2** for $\frac{150\sin 55}{\sin \textit{their}80}$ or **M1** for $\frac{\sin \textit{their}80}{150} = \frac{\sin 55}{RS}$ oe
4(c)	10 400 or 10 410 to 10 440 nfww	**3**	**M1** for $\frac{1}{2}\times 120\times 150\sin 25$ oe **M1** for $\frac{1}{2}\times 150\times \textit{their}$ **(b)**$\sin 45$ oe

Question	Answer	Marks	Partial Marks
5(a)	[0]38 or [0]37.9 or [0]37.87...	**2**	**M1** for tan = $\frac{350}{450}$ oe If 0 scored, **SC1** for answer [0]52 or [0]52.1 or [0]52.12 to [0]52.13
5(b)	624 or 623.8 to 623.9	**6**	**M2** for 450 – 400 sin 50 or **M1** for sin 50 = $\frac{...}{400}$ **M2** for 350 + 400 cos 50 or **M1** for cos 50 = $\frac{...}{400}$ **M1** for (*their* (450 – 400 sin 50))^2 + (*their* (350 + 400 cos 50))^2
5(c)	10 min 8 s	**4**	**B3** for 10.1 or 10.13… or **M2** for (400 + 350 + 450 + *their DA*) ÷ 3 [÷ 60] oe or **M1** for any distance ÷ 3 **M1** for rounding *their* minutes into minutes and seconds to nearest second if clearly seen
6(a)	256	**1**	
6(b)	8	**2**	**M1** for 3(x^2 + 1) + 2 or for 3(2) + 2
6(c)	$9x^2 + 12x + 5$	**3**	**M1** for (3x + 2)^2 + 1 **B1** for [(3x + 2)^2 =] $9x^2 + 6x + 6x + 4$ oe
6(d)	16	**2**	**M1** for 3x + 2 = 7^2 + 1 or better
6(e)	$\frac{x-2}{3}$ oe final answer	**2**	**M1** for x = 3y + 2 or for y – 2 = 3x or for $\frac{y}{3} = x + \frac{2}{3}$
6(f)	$\frac{4x^2 + 2x + 1}{3x + 2}$ final answer	**3**	**B1** for x^2 + 1 + x (3x + 2) or better seen **M1** for common denominator 3x + 2
6(g)	16	**1**	
7(a)	0.1	1	
7(b)(i)	0.2 oe 0.6, 0.3, 0.1 oe	**2**	**B1** for 0.2 **B1** for 0.6, 0.3, 0.1
7(b)(ii)	0.48 oe	**2**	**FT** *their* 0.6 from tree diagram **M1** for 0.8 × *their* 0.6

Question	Answer	Marks	Partial Marks
7(b)(iii)	0.28 oe	**3**	**M2** for $0.2 + 0.8 \times 0.1$ oe or **M1** for 0.2 or 0.8×0.1 or $0.8 \times (0.6 + 0.3)$
7(c)	0.32 oe	**3**	**M2** for $0.8 \times 0.2 + 0.2 \times 0.8$ oe **M1** for one of these products
8(a)(i)	36	**2**	**M1** for $\left(\frac{8}{12}\right)^2$ or $\left(\frac{12}{8}\right)^2$ oe
8(a)(ii)	30	**3**	**M2** for $320 \div 16 \times \frac{12}{8}$ oe or **M1** for $320 \div 16$
8(b)	3.375 cao	**3**	**M2** for $\frac{\frac{4}{3}\pi \times 4.5^3}{\pi \times 6^2}$ or better or **M1** for $\pi \times 6^2 \times h = \frac{4}{3} \times \pi \times 4.5^3$
8(c)	3.63 or 3.627 to 3.628	**3**	**M2** for $\frac{20^3}{40 \times \frac{4}{3}\pi}$ or **M1** for $40 \times \frac{4}{3} \times \pi \times r^3 = 20^3$
8(d)	$\frac{3x}{2}$ or $1.5x$ or $1\frac{1}{2}x$	**3**	**B2** for $4R^2 = 9x^2$ oe or better or **M1** for $4\pi R^2 = 2\pi x^2 + \pi \times 2x \times \frac{7x}{2}$
9(a)(i)	$(x+4)^2 - 25$	**2**	**B1** for $(x+k)^2 - 9 - (their\,k)^2$ or $(x+4)^2 - h$ or $k = 4$
9(a)(ii)	$x + 4 = [\pm]\ 5$	**M1**	**FT** *their* **(a)(i)**
	–9 and 1	**A1**	
9(b)	$[b =]\ 7$ $[c =]\ -3$	**3**	**B1** for $[b =]\ 7$ **M1** for $b^2 - 4c = 61$
9(c)(i)(a)	Correct sketch 	**2**	**B2** for correct quadratic curve with min touching x-axis or **B1** for parabola vertex downwards

Question	Answer	Marks	Partial Marks
9(c)(i)(b)	Correct sketch 	**2**	**B2** for correct straight line intersecting curve on y-axis or **B1** for straight line with positive gradient and positive y-intercept
9(c)(ii)	2.8[0] or 2.795...	**7**	**B3** for $x^2 - \frac{5}{2}x = 0$ oe or **M1** for $(x-1)^2 = \frac{1}{2}x + 1$ **B1** for $[(x-1)^2 =] \; x^2 - x - x + 1$ AND **B2** for (0, 1) and $\left(\frac{5}{2}, \frac{9}{4}\right)$ oe or **B1** $[x =] \; 0$ and $\frac{5}{2}$ oe AND **M1** for (difference in x)^2 + (difference in y)^2
10(a)(i)	5	**2**	**M1** for $(-1)^4 - 4(-1)^3$
10(a)(ii)	(0, 0) and (3, –27)	**6**	**B2** for $4x^3 - 12x^2$ [= 0] or **B1** for $4x^3$ or $12x^2$ AND **M1** for derivative = 0 or *their* derivative = 0 **M1** for $4x^2(x - 3)$[= 0] **B1** for [x =] 0 and [x =] 3 or [y =] 0 and [y =] –27 or for one correct coordinate pair
10(b)	[p =] 11 [q =] 5	**2**	**B1** for each or **M1** for $\frac{dy}{dx} = px^{p-1} + 2qx^{q-1}$

Cambridge Assessment International Education

Cambridge IGCSE™

MATHEMATICS **0580/43**

Paper 4 (Extended) **May/June 2020**

MARK SCHEME

Maximum Mark: 130

Published

Students did not sit exam papers in the June 2020 series due to the Covid-19 global pandemic.

This mark scheme is published to support teachers and students and should be read together with the question paper. It shows the requirements of the exam. The answer column of the mark scheme shows the proposed basis on which Examiners would award marks for this exam. Where appropriate, this column also provides the most likely acceptable alternative responses expected from students. Examiners usually review the mark scheme after they have seen student responses and update the mark scheme if appropriate. In the June series, Examiners were unable to consider the acceptability of alternative responses, as there were no student responses to consider.

Mark schemes should usually be read together with the Principal Examiner Report for Teachers. However, because students did not sit exam papers, there is no Principal Examiner Report for Teachers for the June 2020 series.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the June 2020 series for most Cambridge IGCSE™ and Cambridge International A & AS Level components, and some Cambridge O Level components.

[Turn over

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao correct answer only
dep dependent
FT follow through after error
isw ignore subsequent working
oe or equivalent
SC Special Case
nfww not from wrong working
soi seen or implied

Question	Answer	Marks	Partial Marks
1(a)	1260	**2**	**M1** for $15 \times 54 + 25 \times 18$
1(b)	38 800	**2**	**M1** for $37054 \div \left(1 - \frac{4.5}{100}\right)$ oe
1(c)(i)	15 : 12 : 28	**2**	**M1** for correct attempt to find a common multiple for the women oe
1(c)(ii)	216	**3**	**M2** for 224 ÷ *their* 28 × *their* (15 + 12) or **M1** for 224 ÷ *their* 28
1(d)	55.25	**2**	**M1** for 8 + 0.5 or 6 + 0.5 seen
1(e)	156 or 156.3…	**2**	**M1** for $\left(1 + \frac{1.5}{100}\right)^{30}$
2(a)(i)	triangle with vertices at (–2, –1) (–8, –1) (–2, –5)	**2**	**B1** for correct reflection in $y = x$
2(a)(ii)	triangle with vertices at (–1, –1) (–1, –7) (3, –7)	**2**	**B1** for translation by $\begin{pmatrix} k \\ -9 \end{pmatrix}$ or $\begin{pmatrix} -2 \\ k \end{pmatrix}$
2(b)(i)	Enlargement [centre] (–7, 8) [sf] ½	**3**	**B1** for each
2(b)(ii)	Rotation [centre] (0, 0) 90° clockwise oe	**3**	**B1** for each
3(a)	correct diagram	**4**	**B1** for median line correctly drawn at 148 **B1** for 105 soi **B1** for whisker at 159 soi
3(b)	6.48	**3**	**M1** for (5 × 8) + (6 × 2) + (12 × 7) + … **M1dep** for *their* ∑f*x* ÷ *their* (8 + 2 + 12 + 2 + 0 + 1)
4(a)	$m \geq 3.4$ oe final answer	**2**	**M1** for $12 + 5 \leq 8m - 3m$ or better or $3m - 8m \leq -5 - 12$ or better

Question	Answer	Marks	Partial Marks
4(b)	$x = -0.75$ oe	**3**	**M1** for $15(2x+5) = 14(3-x)$ **B1** for $30x + 75 = 42 - 14x$ or better
4(c)	$3x^2 - 16x - 35[= 0]$ or $3y^2 - 8y - 51[= 0]$	**M3**	**M1** for $x^2 + 2(4-x)^2 = 67$ or $(4-y)^2 + 2y^2 = 67$ seen **B1** for $16 - 8x + x^2$ or $16 - 8y + y^2$
	$(3x + 5)(x - 7)$ [= 0] or $(3y - 17)(y + 3)$[= 0]	**M1**	or for correct factors for *their* equation or for correct use of quadratic formula or completing the square for *their* equation
	$x = 7,\ y = -3$ $x = -\frac{5}{3},\ y = 5\frac{2}{3}$	**B2**	**B1** for $x = 7,\ x = -\frac{5}{3}$ or for $y = -3,\ y = 5\frac{2}{3}$ or for a correct pair of x and y values
5(a)	$(4x-5)(x+3) + (x+1)(x-3) = 342$ or $2x(4x-5) - (3x-6)(x-3) = 342$	**M2**	**M1** for $(4x-5)(x+3)$ or $(x+1)(x-3)$ or for $2x(4x-5)$ or $(3x-6)(x-3)$
	$4x^2 + 12x - 5x - 15$ oe and $x^2 + x - 3x - 3$ oe seen OR $8x^2 - 10x$ and $3x^2 - 15x + 18$ seen	**M2**	**M1** for each
	$5x^2 + 5x - 18 = 342$ leading to $x^2 + x - 72 = 0$	**A1**	no errors or omission
5(b)	$(x+9)(x-8)$	**M2**	**B1** for $(x + a)(x + b)$ where $ab = -72$ or $a + b = 1$ and a, b are integers
	8, –9	**B1**	
5(c)	86	**2**	**FT** for $12 \times$ *their* $x - 10$ (x positive) **B1** for any one of 27, 11, 16 seen or for $2x + 2x + 4x - 5 + 4x - 5$ oe or better soi
5(d)	22.2 or 22.16 to 22.17	**2**	**M1** for tan = $\frac{11}{27}$ or $\frac{\textit{their } x + 3}{4 \times \textit{their } x - 5}$
6(a)(i)	29.5 or 29.50…	**4**	**M2** for $\frac{11^2 + 5.3^2 - 6.9^2}{2 \times 11 \times 5.3}$ or **M1** for $6.9^2 = 11^2 + 5.3^2 - 2 \times 11 \times 5.3 \cos x$ **A1** for 0.87[0…] oe

Question	Answer	Marks	Partial Marks
6(a)(ii)	13.4 or 13.38…	**4**	**B1FT** 84 – *their* **(*a*)(i)** **M2** for $\frac{11}{\sin 42}\times \sin \textit{their}\, 54.5$ or **M1** for implicit form
6(b)	2700	**4**	**M2** for $15 \times 2.5 \times 20 \times 60 \times 60$ or **M1** for $15 \times 2.5 \times 20$ **M1** for *their* volume ÷ 1000 If 0 scored, **SC1** for figs 27 with no working
7(a)(i)	$\frac{3}{4}, \frac{1}{4}$ $\frac{2}{5}, \frac{3}{5}$ $\frac{2}{5}, \frac{3}{5}$	**2**	**B1** for one correct pair
7(a)(ii)	$\frac{3}{10}$ oe	**2**	**FT** *their* tree diagram **M1** for $\frac{3}{4}\times\frac{2}{5}$
7(a)(iii)	$\frac{11}{20}$ oe	**3**	**M2** for $\frac{3}{4}\times\frac{3}{5} + \frac{1}{4}\times\frac{2}{5}$ or **M1** for $\frac{3}{4}\times\frac{3}{5}$ or $\frac{1}{4}\times\frac{2}{5}$
7(b)	$\frac{36}{125}$ oe	**3**	**M2** for $\left(\frac{2}{5}\right)^2 \times \frac{3}{5} \times 3$ oe or **M1** for $\left(\frac{2}{5}\right)^2 \times \frac{3}{5}$
7(c)	$\frac{3}{28}$ oe	**2**	**M1** for $\frac{3}{4}\times\frac{1}{7}$
8(a)	12	**2**	**M1** for $150 = \frac{(n-2)\times 180}{n}$ or $\frac{360}{180-150}$ oe
8(b)(i)	45	**2**	**B1** for angles at *M* or *K* = 45 or angle at *L* = 90
8(b)(ii)	85	**2**	**B1** for either angle in alt segment = 58
8(b)(iii)	72	**2**	**B1** for either angle at *J* or *H*=108 or angle at *F*=72
8(c)	*OA* = *OB* = *OC* = *OD* Radii	**B1**	
	AB = *CD* chords equidistant from centre are equal	**B1**	
	SSS implies congruent	**B1**	

Question	Answer	Marks	Partial Marks
9(a)(i)	$\frac{3}{8}$	**2**	**M1** for $8y = 3x + 20$ or better
9(a)(ii)	(0, 2.5) oe	**1**	
(b)(i)	15.6 or 15.62…	**3**	**M2** for $\sqrt{(9--3)^2 + (-2-8)^2}$ oe seen or **M1** for $(9--3)^2$ or $(-2-8)^2$ oe seen
9(b)(ii)	$y = -\frac{5}{6}x + 4$ oe	**3**	**M1** for gradient $\frac{-2-8}{9--3}$ oe **M1** for substituting (6, −1) into a linear equation oe
9(b)(iii)	$y = \frac{6}{5}x - \frac{3}{5}$ oe	**4**	**M1** for gradient -1 / *their* $\left(-\frac{5}{6}\right)$ **B1** for midpoint at (3, 3) **M1** for *their* midpoint substituted into $y = \textit{their } m \times x + c$ oe
10(a)(i)	$x + 5$	**2**	**B1** for linear equation with positive gradient or intercept 5
10(a)(ii)	2 sin x oe	**2**	**B1** for recognition of sin or cos(x – 90)
10(b)	tangent ruled at P	**B1**	
	1.3 to 1.4	**B2**	**dep** on tangent drawn **M1** for rise/run
11(a)	4	**1**	
11(b)	52	**2**	**M1** for f(8) seen or $7 \times \frac{2x}{x-3} - 4$
11(c)	$7x^2 - 4$	**1**	
11(d)	$\frac{7x^2 - 21x + 12}{2(x-3)}$ or $\frac{7x^2 - 21x + 12}{2x - 6}$ final answer	**3**	**M1** for $(7x-4)(x-3) + 2 \times 2x$ **B1** for denominator $2(x-3)$ or $2x - 6$
11(e)	–3	**2**	**M1** for $7x + 14 - 4 = -11$
11(f)	[p =] 0 and [p =] 1	**2**	**B1** for each
12(a)(i)	$\left(-\frac{1}{2}, 4\right)$ and $\left(\frac{1}{2}, 2\right)$	**5**	**B2** for $12x^2 - 3$[= 0] or **B1** for $12x^2$ or – 3 **M1** for their derivative = 0 or dy/dx = 0 **B1** for [x =] – ½ and ½ or one coordinate pair correct

Question	Answer	Marks	Partial Marks
12(a)(ii)	$\left(-\frac{1}{2}, 4\right)$ Max with reason $\left(\frac{1}{2}, 2\right)$ Min with reason	**3**	**B2** for one correct with reason or **M1** for correct attempt to find e.g. 2nd derivative/gradients/sketch
12(b)	line $y = x + 3$ ruled	**M2**	**B1** for $[y =]x + 3$ identified or rules $y = x + k$ or $y = px + 3$
	–0.7 to –0.8 2.7 to 2.8	**A1**	

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MATHEMATICS **0580/42**

Paper 4 (Extended) **March 2020**

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the March 2020 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

[Turn over

Generic Marking Principles

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GENERIC MARKING PRINCIPLE 1:

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- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

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Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

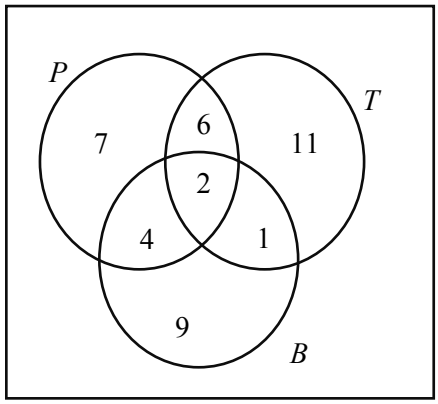
cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)(i)	295	**2**	**M1** for [87 +] 4×52 oe
1(a)(ii)	29.5 or 29.49…	**1**	**FT** $\frac{87}{\textit{their}\textbf{(a)(i)}} \times 100$
1(b)	11	**2**	**M1** for 18×4 [± 61] oe
1(c)	4160 cao nfww	**2**	**M1** for $64 \div 0.0154$ or **B1** for rounding *their* answer to nearest 10
1(d)	2.4[0] nfww	**2**	**M1** for $\left(1+\frac{12.5}{100}\right)x = 2.7[0]$ oe
1(e)	53 : 36	**3**	**M2** for 265 : 180 oe or for answer 36 : 53 or 53 min: 36 min or **M1** for 4h 25 [mins] or 265 [mins] seen
1(f)	6[.00] or 5.999…	**3**	**M2** for $\sqrt[5]{\frac{736}{550}}$ or **M1** for $736 = 550 \times (x)^5$
2(a)(i)	3 2.25 1	**3**	**B1** for each
2(a)(ii)	Fully correct smooth curve	**4**	**B3FT** for 7 or 6 correct plots **B2FT** for 5 or 4 correct plots **B1FT** for 3 correct plots
2(a)(iii)	–0.6 to –0.51, 0.75 to 0.85, 1.7 to 1.85	**3**	**B1** for each If 0 scored, **SC1** for $y = 1.5$ drawn
2(a)(iv)	–3 or –2 or –1 or 0	**1**	
2(b)(i)	Tangent ruled at $x = 1$	**1**	
2(b)(ii)	4.4 to 5.6	**2**	Dep on tangent at $x = 1$ or close attempt **M1** for rise/run for *their* line

Question	Answer	Marks	Partial Marks
2(b)(iii)	y = (4.4 to 5.6)x – (1.8 to 2.2) or [y =] *their* **(b)(ii)**x + *their*(y-intercept)	**2**	**FT** for any line but not horizontal or vertical line for 2 marks or **B1** **B1FT** for [m =] *their* 5 or for *their* y-intercept
3(a)	187	**2**	**M1** for $220 \times \left(1 - \frac{15}{100}\right)$ oe or **B1** for 33 seen
3(b)	19.8	**3**	**M2** for $29.7 \times \sqrt[3]{\frac{0.4}{1.35}}$ oe or **M1** for $\sqrt[3]{\frac{0.4}{1.35}}$ or $\sqrt[3]{\frac{1.35}{0.4}}$ oe seen or for $\frac{29.7^3}{x^3} = \frac{1.35}{0.4}$ oe
3(c)	12.4 or 12.44…	**3**	**M1** for $90 \times 75 \times h = 7 \times$ figs 12 **B1** for 1000 cm^3 = 1 litre soi
4(a)	32.9 or 32.91 to 32.92…	**2**	**M1** for $\pi \times 1.65 \times 4.7 + \pi \times 1.65^2$
4(b)	69.4 or 69.44 to 69.45	**2**	**M1** for cos = 1.65 ÷ 4.7 oe
4(c)(i)	12.5 or 12.54 to 12.55	**4**	**M3** for $\frac{1}{3} \times \pi \times 1.65^2 \times \sqrt{4.7^2 - 1.65^2}$ oe or **M2** for $\sqrt{4.7^2 - 1.65^2}$ oe or for $4.7 \times \sin($*their* **(b)**$)$ oe or **M1** for $1.65^2 + h^2 = 4.7^2$ oe or for $\frac{h}{4.7} = \sin($*their* **(b)**$)$ oe
4(c)(ii)	41 nfww	**4**	**B3** for 41.7… to 41.9 or **M2** for $\frac{4}{3} \times \pi \times 5^3 \div$ *their* 12.5 or **M1** for $\frac{4}{3} \times \pi \times 5^3$ After **M2** scored, **M1** for truncating *their* decimal number of cones seen to an integer answer
5(a)	$\frac{10x}{(x-3)(x+2)}$ or $\frac{10x}{x^2 - x - 6}$ final answer	**4**	**M1** for common denominator $(x-3)(x+2)$ isw **M1** for $(x+3)(x+2) - (x-2)(x-3)$ isw **B1** for correct numerator in terms of x only

Question	Answer	Marks	Partial Marks
5(b)	14	**2**	**M1** for $12-\frac{k}{2}=5$ or $2^{\frac{k}{2}}=\frac{2^{12}}{2^5}$ oe or $\frac{4096}{32}$ or $12-5$ or $2^{12}\div 2^{\frac{14}{2}}$ [= 32] seen
5(c)	$2y^3-3y^2-23y+12$ final answer	**3**	**B2** for correct unsimplified expanded expression or for simplified four-term expression of correct form with 3 terms correct or **B1** for correct expansion of 2 of the brackets with at least 3 terms correct
5(d)	$[x=]\frac{3}{y-1}$ final answer	**3**	**M1** for $xy = 3 + x$ **M1** for $xy - x = 3$ or $x - \frac{x}{y}=\frac{3}{y}$ **M1** for factorising and dividing
6(a)(i)	$\frac{1}{3}$ oe	**1**	
6(a)(ii)	100	**1**	**FT** *their* **(a)(i)** × 300 to at least 3 sf or rounded to the nearest integer
6(b)(i)	$\frac{2}{15}$ oe	**3**	**M2** for $4\times\frac{1}{6}\times\frac{1}{5}$ oe or **M1** for $k\left(\frac{1}{6}\times\frac{1}{5}\right)$ oe or list or indication of 4 correct pairs
6(b)(ii)	$\frac{3}{5}$ oe	**3**	**M2** for $1-\frac{4}{6}\times\frac{3}{5}$ or $2\left(\frac{2}{6}\times\frac{4}{5}\right)+\frac{2}{6}\times\frac{1}{5}$ oe or $\frac{2}{6}+\left(\frac{4}{6}\times\frac{2}{5}\right)$ oe or **M1** for $\frac{4}{6}\times\frac{3}{5}$ oe seen or $\frac{2}{6}\times\frac{4}{5}[\times 2]$ oe seen or $\frac{2}{6}\times\frac{1}{5}$ oe seen or correct identification of 18 pairs or space diagram oe
7(a)	$n - 5 + 3n + 10 > 105$ or better	**B1**	
	$n > 25$ final answer	**B2**	**M1** for $4n > 100$

Question	Answer	Marks	Partial Marks
7(b)	4.8	**3**	**M1** for $y = \frac{k}{x^2}$ or better **M1** for $[y =]\frac{their\ k}{5^2}$ OR **M2** for $y \times 5^2 = 7.5 \times 4^2$
7(c)(i)	$6 - 2n$ oe final answer	**2**	**B1** for answer $6 - kn$ $(k \neq 0)$ oe or answer $j - 2n$ oe or for correct expression shown in working and then spoilt
7(c)(ii)	$2n^2 - 1$ oe final answer	**2**	**B1** for 2nd diff = 4 or a quadratic expression or for correct expression shown in working and then spoilt
8(a)(i)	2.67 or 2.666…	**3**	**M2** for $\frac{6 \times \sin 25}{\sin 72}$ or **M1** for implicit version
8(a)(ii)	4.14 or 4.140…	**3**	**M1** for $6^2 + 7.4^2 - 2 \times 6 \times 7.4 \times \cos 34$ **A1** for 17.1 to 17.2
8(a)(iii)	20.4 or 20.35 to 20.36…	**4**	**B1** for angle $SQR = 83$ **M1** for $\frac{1}{2} \times 6 \times$ *their* **(a)(i)** $\times \sin$ *their* (180–72–25) oe **M1** for $\frac{1}{2} \times 6 \times 7.4 \times \sin 34$ oe
8(b)(i)	8.7[0] or 8.695…	**4**	**B3** for $\sqrt{980}$ oe or 31.3 or 31.30… or **M3** for $40 - \sqrt{20^2 + 18^2 + 16^2}$ oe or **M2** for $20^2 + 18^2 + 16^2$ oe or **M1** for any correct attempt at 2-dimensional Pythagoras' e.g. $18^2 + 16^2$
8(b)(ii)	30.7 or 30.73 to 30.74…	**3**	**M2** for $[\sin =]\frac{16}{\sqrt{20^2 + 18^2 + 16^2}}$ oe or **B1** for identifying angle *GAC*

Question	Answer	Marks	Partial Marks
9(a)		**3**	**B2** for 5 correct entries including '2' correctly placed at the intersection of the 3 sets or **M1** for $k+8-k+3-k+6-k=40-(7+9+11)$ oe or for k, $8-k$, $3-k$, $6-k$, seen correctly placed on diagram with 7, 11 and 9 correctly placed
9(b)	11	**1**	
9(c)	Ø or { }	**1**	
9(d)	$\frac{7}{260}$ oe	**2**	**M1** for $\frac{7}{40}\times\frac{6}{39}$ oe
9(e)	$\frac{14}{95}$ oe	**2**	**FT** *their* Venn diagram **M1** for $\frac{8}{20}\times\frac{7}{19}$
10(a)(i)	$4x-13$ final answer	**1**	
10(a)(ii)	$25x^2$ final answer	**1**	
10(b)	$\frac{x+1}{4}$ or $\frac{x}{4}+\frac{1}{4}$	**2**	**M1** for correct first step $x=4y-1$ or $y+1=4x$ or $\frac{y}{4}=x-\frac{1}{4}$
10(c)	0.6934 final answer	**3**	**B2** for 0.69336… or $3^{-\frac{1}{3}}$ oe or 0.693 or **M1** for $3^{-3^{-x}}$ oe
10(d)(i)	$(3x-2)^2-3^{-(-3)}$	**M1**	
	$9x^2-6x-6x+4-27$ or $9x^2-12x+4-27$ leading to $9x^2-12x-23$	**A1**	with no errors seen

Question	Answer	Marks	Partial Marks
10(d)(ii)	$\frac{-(-12)\pm\sqrt{(-12)^2-4(9)(-23)}}{2\times9}$ or better	**B2**	**B1** for $\sqrt{(-12)^2-4(9)(-23)}$ oe or $\frac{-(-12)+\sqrt{q}}{2\times9}$ oe or $\frac{-(-12)-\sqrt{q}}{2\times9}$ oe or both
	– 1.07, 2.40 final answers	**B2**	**B1** for each If **B0, SC1** for answers – 1.1 or –1.06 or –1.065… to – 1.065 **and** 2.4 or 2.39 or 2.398 to 2.398… or – 1.07 **and** 2.40 seen in working or for –2.40 and 1.07 as final answer
10(e)	-5 final answer	**2**	**M1** for $243 = 3^{-x}$
11(a)	(1, 2) $(-1, 6)$	**5**	**B2** for **[**derivative oe = **]** $3x^2-3$ or **B1** for [derivative oe =] $3x^2$ or $f(x)-3$ **M1** for *their* derivative = 0 or recognition of $\frac{dy}{dx}=0$ oe **B1** for [x =] -1, 1 or for one coordinate pair
11(b)	(1, 2) minimum with reason $(-1, 6)$ maximum with reason	**3**	Reasons could be e.g. a reasonable sketch correct use of 2nd derivative = $6x = 6$, $6 > 0$, so (1, 2) minimum oe 2nd derivative = $6x = –6$, $–6 < 0$ so (–1, 6) maximum oe, or finds gradient on each side of both correct stationary points with correct conclusion **B2** for 1 correct with reason or **M1** for showing [2nd derivative =] $6x$ or gradients for one value on either side of one correct stationary point or for reasonable sketch of cubic

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

MATHEMATICS **0580/41**

Paper 4 (Extended) **October/November 2019**

MARK SCHEME

Maximum Mark: 130

Published

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- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

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GENERIC MARKING PRINCIPLE 3:

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- marks are awarded when candidates clearly demonstrate what they know and can do
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- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)	[p =] 132 [q =] 77	**3**	**B1** for 132 [=p] **B2** for 77 [=q] or **M1** for 180 – (55 + 48) oe or for *their* p – 55
1(b)	74	**3**	**B2** for $5x - 10 = 360$ or **M1** for $x + (x + 5) + (2x - 25) + (x + 10) = 360$ or for $5x - 10 = k$
1(c)	175	**3**	**M2** for $180 - \frac{360}{72}$ or for $\frac{180(72-2)}{72}$ or **M1** for $\frac{360}{72}$ or for 180 (72 – 2)
1(d)	[u =] 30 [v =] 60 [w =] 60 [x =] 120 [y =] 40	**6**	**B1** for 30 **B1** for 60 **B1** for 60 FT *their v* **B1** for 120 FT 2 × *their w* **B2** for 40 or **B1** for angle $BDC = 20$ or angle $ADO = 30$ or angle $ADB = 70$
1(e)	26	**4**	**B3** for $360 - 22 = 10x + 3x$ oe or better or for $5x + 1.5x = 180 - 11$ oe or better or **M2** for $360 - (3x + 22) = 2 \times 5x$ oe or for $5x + \frac{1}{2}(3x + 22) = 180$ oe or **SC2** for $360 + 22 = 10x + 3x$ oe or better or **M1** for $180 - 5x$, $10x$ or $360 - (3x + 22)$ correctly placed on the diagram or identified or for angle A + angle $C = 5x$
2(a)	[Ali] 2700 [Mo] 2100	**3**	**B2** for one correct or for correct values reversed or **M1** for 600 ÷ (9 – 7) or for any equation that would lead to an answer of 300, 2700 or 2100, or 4800 (for the total)

Question	Answer	Marks	Partial Marks
2(b)	11	**3**	**M2** for $\frac{220-195.8}{220}[\times 100]$ or for $[100-]\frac{195.8}{220}\times 100$ or **M1** for 220 – 195.8 or for $\frac{195.8}{220}$ or a correct implicit equation for percentage reduction or for $\frac{195.8-220}{220}$
2(c)	84	**3**	**M2** for $\frac{63}{1-\frac{25}{100}}$ oe or **M1** for associating 63 with (100 – 25)% or a correct implicit equation for the original price.
3(a)	662.45	**2**	**M1** for $600\times\left(1+\frac{2}{100}\right)^5$ oe
3(b)(i)	800	**2**	**M1** for $x\left(1+\frac{5}{100}\right)^2=882$ oe or **SC1** for answer 82
3(b)(ii)	5 nfww	**2**	**M1** for trial with $882\times\left(1+\frac{5}{100}\right)^n$ with $n>1$
4(a)(i)	955 or 955.0 to 955.2	**2**	**M1** for $2\times\pi\times 8\times 19$ oe
4(a)(ii)	812 or 811.7 to 811.9...	**2**	**FT** *their* (i) × 0.85 **M1** for *their* (i) × 0.85 or *their* (i) × 85
4(b)(i)	$\frac{\frac{4}{3}\times\pi\times 6^3}{\frac{1}{3}\times\pi\times 8^2}$ or cancelling clearly seen to reach 13.5	**M2**	**M1** for $\frac{4}{3}\times\pi\times 6^3=\frac{1}{3}\times\pi\times 8^2\times h$
4(b)(ii)	15.7 or 15.69...	**2**	**M1** for $8^2 + 13.5^2$ or better
4(b)(iii)	394 or 395 or 394.3 to 394.6...	**1**	**FT** $\pi \times 8 \times$ *their* (b)(ii)

Question	Answer	Marks	Partial Marks
4(c)	567	**3**	**M2** for $\frac{168}{V} = \left(\frac{80}{180}\right)^{\frac{3}{2}}$ oe or better or **M1** for $\left(\frac{180}{80}\right)^{\frac{1}{2}}$ or $\left(\frac{80}{180}\right)^{\frac{1}{2}}$ oe seen or better
4(d)	51.3 or 51.34...	**3**	**M2** for $\tan = \frac{5}{4}$ oe or **M1** for recognition of angle *PBX*
5(a)	4.29 or 4.285 to 4.286	**3**	**M2** for $\frac{150}{\frac{450}{3.6} - \frac{120}{4} - \frac{180}{3}}$ or **M1** for [time =] $120 \div 4$ or $180 \div 3$ or $450 \div 3.6$ or $3.6 = \frac{150+180+120}{\text{total time}}$
5(b)	82.8 or 82.81 to 82.82 using cosine rule	**4**	**M2** for $\frac{150^2 + 120^2 - 180^2}{2 \times 150 \times 120}$ or **M1** for $180^2 = 120^2 + 150^2 - 2 \times 120 \times 150 \cos(...)$ **A1** for $\frac{4500}{36000}$ oe
5(c)(i)	127.2 or 127.1 to 127.2 or 127	**1**	**FT** 210 – *their* (b)
5(c)(ii)	307.2 or 307.1 to 307.2 or 307	**2**	**FT** 180 + *their*(c)(i) **M1** for 180 + *their* (c)(i)
5(d)	15 or 14.99 to 15.04	**2**	**M1** for $\cos(\textit{their (b)}) = \frac{\text{dist}}{120}$ oe
6(a)(i)	34	**1**	
6(a)(ii)	18	**2**	**B1** for [l.q. =] 25 or [u.q. =] 43 seen
6(a)(iii)	60	**2**	**M1** for 140 written
6(b)(i)	49	**1**	
6(b)(ii)	20	**1**	
6(b)(iii)	10	**1**	
6(b)(iv)	220	**2**	**M1** for $3 \times 1 + 1 \times 2 + 3 \times 5 + 2 \times 10 + 4 \times 20 + 2 \times 50$
6(b)(v)	14.7 or 14.66 to 14.67	**1**	**FT** *their* (iv) ÷ 15

Question	Answer	Marks	Partial Marks
6(c)	13.25 nfww	**6**	**B2** for frequencies 30, 40, 30 soi or **B1** for 2 of these **M1** for 5, 12.5, 22.5 **M1** Σfx with *their* frequencies (if seen) and each x in correct interval including boundaries **M1 dependent** for $\frac{\Sigma fx}{100}$ (dependent on second M1) **OR** **Alternative Method** **B2** for frequencies 15, 15, 40, 10, 10, 10 soi or **B1** for 2 of 15, 40, 10 **M1** for 2.5, 7.5, 12.5, 17.5, 22.5, 27.5 **M1** Σfx with *their* frequencies (if seen) and each x in correct interval including boundaries **M1 dependent** for $\frac{\Sigma fx}{100}$ (dependent on second M1)
7(a)	9	**3**	**M2** for $0.42x + 0.42 = 4.2$ oe or better or **M1** for $0.21x + 0.21(x + 2)$ oe [= 420 or 4.20] or for $21x + 21(x + 2)$ oe [= 420 or 4.20] or for $420 \div 21$ oe [=20]
7(b)	$5r + p = 245$	**B1**	
	$2r + 3p = 215$	**B1**	
	45	**3**	Finds p **M1** for correctly equating coefficients of r **M1** for correct method to eliminate r OR **M1** for correctly making r the subject of one of *their* equations **M1** for correctly substituting *their* correct r to form an equation in p OR Finds r first **M1** for correctly eliminating p from *their* equations **M1** for correctly substituting *their* value of r to find p

Question	Answer	Marks	Partial Marks
7(c)(i)	$\frac{12}{x}+\frac{6}{x-1}[=5]$	**M1**	
	$12(x-1)+6x=5x(x-1)$	**M1**	**Dependent** on previous M1 earned May be over common denominator
	$5x^2-23x+12=0$ reached, with at least one more line of working and with no errors or omissions	**A1**	
7(c)(ii)	$(5x-3)(x-4)$ final answer	**2**	**B1** for $(5x+a)(x+b)$ with $ab=12$ or $a+5b=-23$ or for $5x(x-4)-3(x-4)$ or $x(5x-3)-4(5x-3)$
7(c)(iii)	$\frac{3}{5}$ oe and 4	**1**	**FT** from their two brackets in (c)(ii)
7(c)(iv)	3 cao	**1**	
8(a)(i)	$\frac{4}{5}$ oe	**1**	
8(a)(ii)	$\frac{4}{5}$ oe	**1**	
8(b)(i)	$\frac{6}{20}$ oe nfww	**3**	**M2** for $\frac{1}{5}\times\frac{3}{4}+\frac{3}{5}\times\frac{1}{4}$ oe or $2\times\frac{1}{5}\times\frac{3}{4}$ oe or **M1** for $\frac{1}{5}\times\frac{3}{4}$ alone or $\frac{3}{5}\times\frac{1}{4}$ alone or for answer $\frac{3}{20}$ nfww After 0 scored, **SC1** for answer $\frac{6}{25}$
8(b)(ii)	$\frac{8}{20}$ oe nfww	**3**	**M2** for $1-\frac{4}{5}\times\frac{3}{4}$ or $\frac{1}{5}\times1+\frac{4}{5}\times\frac{1}{4}$ oe or $2\times\frac{1}{5}\times1$ or $2\times\frac{1}{5}\times\frac{3}{4}+2\times\frac{1}{5}\times\frac{1}{4}$ or *their* (b)(i) + $2\times\frac{1}{5}\times\frac{1}{4}$ or **M1** for answer $\frac{2\text{ or }4\text{ or }5\text{ or }6\text{ or }7}{20}$ oe nfww After 0 scored, **SC1** for answer $\frac{8}{25}$

9(a)	$x + y \geqslant 6$ oe $y \leqslant x$ oe $x \leqslant 8$	**3**	**B1** for each
9(b)	$4x + 6y \leqslant 60$	**1**	
9(c)	Correct region indicated cao	**6**	**B1** for $x + y = 6$ ruled and long enough **B1** for $x = y$ ruled and long enough **B1** for $x = 8$ ruled and long enough **B2** for $2x + 3y = 30$ ruled and long enough or **B1** for ruled line through (0, 10) or (15, 0) but not $y = 10$ or $x = 15$
9(d)(i)	6, 6	**1**	
9(d)(ii)	34	**2**	**M1** for trying $4x + 6y$ with (4, 3) or (5, 2) or (6, 1) or (7, 0)
10(a)	-7 $13 - 4n$ oe 36 $(n + 1)^2$ oe 125 n^3 oe 128 2^{n+2} oe	**11**	**B1** **B2** or **B1** for $13 - kn$ ($k \neq 0$) or for $k - 4n$ **B1** **B2** or **B1** for any quadratic **B1** **B1** **B1** **B2** or **B1** for 2^k oe
10(b)	...., ..., 6, 10, 16 .... , 3, 4, 7, ... 2, ..., 1, 0, ...	**3**	**B1** for each correct row
10(c)(i)	$\frac{q}{p+q}$	**1**	
10(c)(ii)	$\frac{18}{29}$	**1**	

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MATHEMATICS **0580/42**

Paper 4 (Extended) **October/November 2019**

MARK SCHEME

Maximum Mark: 130

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cao correct answer only
dep dependent
FT follow through after error
isw ignore subsequent working
oe or equivalent
SC Special Case
nfww not from wrong working
soi seen or implied

Question	Answer	Marks	Partial Marks
1(a)(i)	5 : 6	**1**	
1(a)(ii)	2.0736[0] × 10^5 final answer	**3**	**B2** for 207360 oe or **M1** for 16 × 18 × 720
1(b)(i)	26780	**2**	**M1** for 18540 ÷ 9 soi
1(b)(ii)	1.36	**2**	**M1** for 0.85 × 1.6 oe or **B1** for 0.51 or 51
1(c)	66.7 or 66.66 to 66.67	**5**	**M4** for $\frac{(2.3-1.5\times0.92)}{1.5\times0.92}$[×100] oe or $\frac{2.3\times100}{1.5\times0.92}$ oe **OR** **Working in euros** **B2** for [€]1.38 or **M1** for 1.5[0] × 0.92 **M2dep on B2 or M1** for $\frac{2.3-\textit{their}\ 1.38}{\textit{their}\ 1.38}$[×100] oe or $\frac{2.3-\textit{their}\ 1.38}{\textit{their}\ 1.38}\times100$ oe or **M1** for 2.3 – *their* 1.38 or $\frac{2.3}{\textit{their}\ 1.38}$ **OR** **Working in dollars** **B2** for [$]2.50 or **M1** for or 2.3[0] ÷ 0.92 **M2dep on B2 or M1** for $\frac{\textit{their}\ 2.5-1.5}{1.5}$[×100] oe or $\frac{\textit{their}2.5}{1.5}\times100$ or **M1** for *their* 2.5 – 1.5 or $\frac{\textit{their}2.5}{1.5}$

Question	Answer	Marks	Partial Marks
1(d)	219 000 or 218814[.3….] rounded to 4 sf or more	**3**	**B2** for 414000 or 414414[.3….] rounded to 4 sf or more or **M2** for $195600 \times \left(1+\frac{8.7}{100}\right)^{9}$ [– 195600] or **M1** for $195600 \times \left(1+\frac{8.7}{100}\right)^{k}$ or better (k >1 and an integer)
2(a)(i)	54	**1**	
2(a)(ii)	29	**2**	**M1** for [UQ =] 65 or [LQ =] 36
2(a)(iii)	32	**1**	
2(a)(iv)	17, 18 or 19	**2**	**M1** for 61 to 63 written or for decimal answer in range 17 to 19
2(b)(i)	18, 26, 26	**2**	**B1** for 1 or 2 correct
2(b)(ii)	51 nfww	**4**	**M1** for 10 , 30 , 50 , 70 , 90 soi **M1** for Σfx **M1 dep** for *their* $\Sigma fx \div \Sigma f$
2(c)(i)	75	**1**	
2(c)(ii)	IQR is bigger for the girls with [boys =] 20 seen oe	**2**	**FT** *their* IQR from (a)(ii) **M1** for IQR for boys = 20 isw or for girls IQR is bigger than boys IQR oe isw **FT** *their* IQR from (a)(iii)
3(a)(i)	(3, 5.5)	**2**	**B1** for either value correct
3(a)(ii)	$\frac{5}{4}x+\frac{7}{4}$ final answer	**3**	**B2** for answer $\frac{5}{4}x + c$ oe or for correct equation in different form or **M1** for $\frac{8-3}{5-1}$ oe **and M1** for correct substitution shown of (1, 3) or (5, 8) or *their* (a)(i) into $y =$ (*their m*)$x + c$ oe
3(b)(i)	(6, 1) (10, 6)	**2**	**B1** for 2 or 3 values correct
3(b)(ii)	(–3, 1) (–8, 5)	**2**	**B1** for 2 or 3 values correct If 0 scored, **SC1** for (3, –1) and (8, –5)
3(b)(iii)	(3, 3) (–1, 8)	**2**	**B1** for 2 or 3 values correct but not for (1, 3) and (5, 8)

Question	Answer	Marks	Partial Marks
3(b)(iv)	(5, –3) (11, –8)	**2**	**B1** for either or **M1** for $\begin{pmatrix}-1 & 2\\ 0 & -1\end{pmatrix}\begin{pmatrix}1\\3\end{pmatrix}$ or $\begin{pmatrix}-1 & 2\\ 0 & -1\end{pmatrix}\begin{pmatrix}5\\8\end{pmatrix}$
3(c)	Enlargement –2 Origin oe	**3**	**B1** for each
4(a)	452 or 452.2 to 452.4…	**2**	**M1** for $\left[\frac{1}{2}\times\right]\frac{4}{3}\times\pi\times 6^3$
	cm^3	**1**	
4(b)(i)(a)	400 or 399.6 to 399.9	**6**	**B3** for [*CD* =] $\sqrt{72.96}$ or [angle *CBD* =] 58.7 or 58.66 to 58.67 or **M2** for $\sqrt{10^2-5.2^2}$ oe or [*CBD* =] $\cos^{-1}\left(\frac{5.2}{10}\right)$ oe or **M1** for $(CD)^2 + 5.2^2 = 10^2$ oe or $\cos[CBD] = \frac{5.2}{10}$ oe or $\sin[CDB] = \frac{5.2}{10}$ oe **M1dep** for $\frac{5.2\times \textit{their } CD}{2}$ oe or $\frac{1}{2}\times 5.2\times 10\times\sin(\textit{their } CBD)$ oe **M1** for *their* area × 18 oe
4(b)(i)(b)	14.6 or 14.62 to 14.63…	**4**	**M3** for $\sin BEC = \frac{5.2}{\sqrt{10^2+18^2}}$ oe or **M2** for [*BE*=] $\sqrt{10^2+18^2}$ oe seen or [*EC* =] $\sqrt{18^2+10^2-5.2^2}$ oe seen or **M1** for [BE^2 =] $10^2 + 18^2$ oe seen or [EC^2=] $18^2 + 10^2 - 5.2^2$ seen
4(b)(ii)	125 or 124.9 to 125.0…	**3**	**B2** for 55[.0…] seen or **M2** for $180 - \tan^{-1}\left(\frac{10}{7}\right)$ oe or $\cos EGB = \frac{11^2+(10^2+7^2)-(10^2+18)^2}{2\times 11\times\sqrt{10^2+7^2}}$ oe or **M1** for $\tan[\ \ ] = \left(\frac{10}{7}\right)$ oe or for $(10^2 + 18^2) = 11^2 + (10^2 + 7^2) - 2\times 11\times$ $\sqrt{10^2+7^2}\ \cos EGB$ oe

Question	Answer	Marks	Partial Marks
5(a)	3.5, 15, 3.9	**3**	**B1** for each
5(b)	Correct graph	**5**	**B4** for correct curves but branches joined or touching y-axis or **B3FT** 10 or 11 points or **B2FT** for 8 or 9 points or **B1FT** for 6 or 7 points **B1indep** two separate branches not touching or crossing y-axis
5(c)	0.5 to 0.6 and 1.3 to 1.6	**2**	**B1** for each or both correct but in reverse order
5(d)	1	**1**	
5(e)(i)	$y = 3x + 1$ ruled and 0.3 to 0.49	**3**	**B2** for correct ruled line that crosses *their* curve or **B1** for $y = 3x + 1$ soi or freehand line or ruled line with gradient 3 or with y – intercept at 1 (but not $y = 1$)
5(e)(ii)	$[a =] -6$ $[b =] -2$ $[c =] -4$	**3**	**M2** for $x^4 + 2 - 4x = 6x^3 + 2x^2$ or better seen or **B1** for each correct value to a maximum of 2 marks If 0 scored, **SC1** for answer $[a =] 6$, $[b =] 2$ and $[c =] 4$ or for $x^5 + 2x - 4x^2 = 6x^4 + 2x^3$ or better
6(a)(i)	13.9[0…] from cosine rule	**4**	**M2** for $8^2 + 13^2 - 2 \times 8 \times 13\cos 79$ or **M1** for $\cos 79 = \dfrac{13^2 + 8^2 - BC^2}{2 \times 8 \times 13}$ **A1** for 193 ....
6(a)(ii)	66.6 or 66.60… to 66.65 from sine rule	**3**	**M2** for $[\sin ACB =] \dfrac{13 \times \sin 79}{their(a)(i)}$ or **M1** for $\dfrac{\sin ACB}{13} = \dfrac{\sin 79}{their(a)(i)}$ oe
6(b)(i)	$\frac{1}{2}(x + 4)(4x - 5)\sin 30 = 70$	**M1**	
	$4x^2 + 16x - 5x - 20 = 280$	**M2**	**Dep on M1** **B1** for $4x^2 + 16x - 5x - 20$ or better
	Leading to $4x^2 + 11x - 300 = 0$	**A1**	with no errors or omissions seen

Question	Answer	Marks	Partial Marks
6(b)(ii)	$\frac{-11 \pm \sqrt{11^2 - 4 \times 4 \times -300}}{2 \times 4}$	**B2**	**B1** for $\sqrt{11^2 - 4(4)(-300)}$ or better or for $\frac{-11 + \sqrt{q}}{2 \times 4}$ or $\frac{-11 - \sqrt{q}}{2 \times 4}$
	–10.14 and 7.39	**B2**	**B1** for each or **SC1** for final answers –10.1 or –10.144 to –10.143 **and** 7.4 or 7.393 to 7.394 or –10.14 **and** 7.39 seen in working or for –7.39 **and** 10.14 as final answer
6(b)(iii)	11.4 or 11.39…	**1**	**FT** *their* positive root + 4
7(a)(i)	13	**1**	
7(a)(ii)	3	**2**	**M1** for $\text{h}\left(\frac{10}{30}\right)$ oe soi or $27^{\frac{10}{x}}$
7(a)(iii)	$\frac{7-x}{2}$ oe final answer	**2**	**M1** for $x = 7 - 2y$ or $y - 7 = -2x$ or $7 - y = 2x$ or $-\frac{y}{2} = -\frac{7}{2} + x$ oe
7(b)	0.75 oe final answer	**3**	**M1** for $\frac{10}{2x+1} = 4$ **M1** for $10 = 8x + 4$ or better
7(c)	$\frac{70-19x}{x(7-2x)}$ or $\frac{70-19x}{7x-2x^2}$ final answer	**3**	**M1** for $x + 10(7 - 2x)$ or better isw **B1** for common denominator $x(7 - 2x)$ oe isw
7(d)	3 final answer	**1**	
8(a)(i)	$\frac{m-7}{5}$ oe final answer	**2**	**M1** for $5p = m - 7$ or $p + \frac{7}{5} = \frac{m}{5}$
8(a)(ii)	$[\pm]\sqrt{\frac{y^2-h}{2}}$ or $[\pm]\sqrt{\frac{h-y^2}{-2}}$ oe final answer	**3**	**M1** for first correct step isolate term in p or divide by ±2 **M1** for second correct step FT *their* first step
8(b)(i)	$\begin{pmatrix}0\\5\end{pmatrix}$	**1**	
8(b)(ii)	$\begin{pmatrix}-3\\-1\end{pmatrix}$	**1**	

Question	Answer	Marks	Partial Marks
8(b)(iii)	3.22 or 3.216... to 3.220...	**6**	**B3** for [angle AOB =] 36.8 or 36.9 or 36.84 to 36.87 or **M2** for $\tan[AOB] = \frac{3}{4}$ oe or for [AOB =]$2 \times \sin^{-1}\left(\frac{\sqrt{(5-4)^2+(0--3)^2}}{10}\right)$ oe or for $\cos[AOB =] \frac{5^2+5^2-\left(\sqrt{(5-4)^2+(0--3)^2}\right)^2}{2\times5\times5}$ oe or **M1** for recognition of right-angle with perpendicular from B to OA or x-axis or for $[AB^2 =](5-4)^2+(0--3)^2$ or better oe or (*their* AB)$^2 = 5^2 + 5^2 - 2 \times 5 \times 5 \times \cos OAB$ oe **M2** for $\frac{\textit{their}\ \text{angle}\ AOB}{360} \times 2 \times \pi \times 5$ oe or **M1** for radius = 5 soi
9(a)	171 or 171.0…	**3**	**M2** for $\frac{7.6}{160} \times 60 \times 60$ oe or **M1** for $\frac{7.6}{160}$ or $\frac{7.6}{2\frac{2}{3}}$ or $\frac{7.6}{2\,\text{min}\,40\,\text{sec}}$ If 0 scored, **SC1** for answer 189 or 188.6 to 188.7
9(b)(i)	77 [min] 20 [s]	**4**	**M3** for $\frac{32}{12} \times 29$ oe or **B2** for 4640 or 1.29 or 1.288 to 1.289, $\frac{58}{45}$ oe or 32 laps or 29 laps or **M2** for $2^5 \times 5 \times 29$ oe or **M1** for 2 m 40 sec ÷ (2 m 40 sec – 2 m 25 sec) soi for 2 m 25 sec ÷ (2 m 40 sec – 2 m 25 sec) soi or for an attempt to find LCM or 23 200 seen or correctly find prime factors of 145 or 160 or for $\frac{7.6}{145}$ or $\frac{7.6}{2\frac{5}{12}}$ or $\frac{7.6}{2\,\text{min}\,25\,\text{sec}}$ oe, provided SC1 not earned in part (a)
9(b)(ii)	220.4	**2**	**M1** for *their* (b)(i) ÷ 2min 40 sec [× 7.6] oe or *their* (a) × *their* (b)(i) ÷ 60 oe

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

MATHEMATICS **0580/43**

Paper 4 (Extended) **October/November 2019**

MARK SCHEME

Maximum Mark: 130

Published

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Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

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- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Abbreviations

cao correct answer only
dep dependent
FT follow through after error
isw ignore subsequent working
oe or equivalent
SC Special Case
nfww not from wrong working
soi seen or implied

Question	Answer	Marks	Partial Marks
1(a)(i)	1254	**2**	**M1** for 342 ÷ 3
1(a)(ii)	27.3 or 27.27…	**1**	
1(b)	867	**2**	**M1** for $1020\times\frac{15}{100}$ oe or $1020\times\left(1-\frac{15}{100}\right)$ oe
1(c)	4.5[0]	**3**	**M2** for $\frac{79.5[0]}{100+6}[\times 6]$ oe or $\frac{79.5[0]}{100+6}\times 100$ oe or **M1** for 79.5[0] associated with 106[%]
1(d)	22.6 or 22.58… nfww	**4**	**M1** for $\frac{45}{20}$ or better and **M2** for $\frac{60+45}{\textit{their}\ 2\text{h}\ 24\text{min}+\textit{their}\ \frac{45}{20}}$ or **M1** for *their* $\frac{45}{20}$ + *their* 2h 24min
1(e)	91.6[0] to 91.61	**3**	**M2** for $480\times\left(1+\frac{2.1}{100}\right)^4-430$ oe OR **M1** for $480\times\left(1+\frac{2.1}{100}\right)^4$ oe **A1** for 522, 521.6[0] to 521.61
1(f)	112.8125	**2**	**B1** for 2.5 or 9.5 seen

Question	Answer	Marks	Partial Marks
2(a)(i)	$2a + a + 2b + 3b + 10 = 180$ leading to $3a + 5b = 170$ without error or omission	**1**	
2(a)(ii)	$8a + 3a + 2b + b + 50 + 4b - 2a = 360$ leading to $9a + 7b = 310$ without error or omission	**1**	
2(a)(iii)	Correct method to eliminate one variable	**M1**	
	[a =]15 [b=]25	**A2**	**A1** for each correct value If 0 scored, **SC1** for two values that satisfy one of the equations or for two correct answers with no/incorrect working
2(a)(iv)	30	**1**	
2(b)	–1.5 or $-1\frac{1}{2}$ or $-\frac{3}{2}$	**2**	**M1** for $6x = -12 + 3$ or better
2(c)	$\frac{3x+3}{2}$ oe final answer	**3**	**M1** for $8x - 2y = 5x - 3$ or $4x - y = \frac{1}{2}(5x - 3)$ **M1FT** for isolating the y term correctly
2(d)	$9x^6$	**2**	**M1** for $(3x^3)^2$ or $\left(729x^{18}\right)^{\frac{1}{3}}$ seen or for $9x^k$ or kx^6 as final answer
2(e)	$\frac{x}{x-5}$ final answer nfww	**3**	**M1** for $x(x + 5)$ **M1** for $(x - 5)(x + 5)$
3(a)	5, –3, 21	**3**	**B1** for each
3(b)	Fully correct curve	**4**	**B3 FT** for 9 or 10 points or **B2 FT** for 7 or 8 points or **B1 FT** for 5 or 6 points
3(c)	–2.9 to –2.7 0 1.7 to 1.9	**2**	**B1** for 2 correct values

Question	Answer	Marks	Partial Marks
3(d)	Tangent ruled at $x = 2$	**B1**	
	10 to 14	**B2**	Dep on correct tangent or close attempt at tangent at $x = 2$ **M1** for rise/run **also dep on** correct tangent drawn or close attempt at tangent Must see correct or implied calculation from a drawn tangent
3(e)	6	**1**	
4(a)	36.8 or 36.84…	**2**	**M1** for $\frac{h}{107} = \tan 19$ or $\frac{h}{\sin 19} = \frac{107}{\sin 71}$ oe or better
4(b)	42.1 or 42.12… from cosine rule	**4**	**M2** for $[\cos BAC =]\frac{158^2 + 132^2 - 107^2}{2 \times 158 \times 132}$ or **M1** for implicit version **A1** for $[\cos BAC =]\frac{30939}{41712}$ or 0.7417…
4(c)	35.8 or 35.84… from sine rule	**3**	**M2** for $\frac{86 \times \sin 116}{132}[= 0.58557...]$ or **M1** for $\frac{\sin CAD}{86} = \frac{\sin 116}{132}$ oe
4(d)	9670 or 9669 to 9676	**3**	**M2** for $\frac{1}{2} \times 158 \times 132 \times \sin(their\ (b))$ oe and $\frac{1}{2} \times 86 \times 132 \times \sin(64 - their\ (c))$ oe or **M1** for either area
4(e)	214.2 or 214.1… or 214	**2**	**M1** for [180 +]70–*their* (c) oe
5(a)(i)	52	**1**	
5(a)(ii)	36	**1**	
5(a)(iii)	26	**1**	**FT** 62 – *their* (a)(ii) evaluated correctly
5(b)	Valid comment	**1**	Strict **FT** *their* (a)(iii), e.g. distances for females are more varied
5(c)	$\frac{11}{20}$ oe	**2**	**M1** for 27 written or answer of $\frac{27}{60}$ oe
5(d)(i)	[18 9] 14 12 5 [2]	**2**	**B1** for 1 correct value

Question	Answer	Marks	Partial Marks
5(d)(ii)	48.75 nfww	**4**	**M1** for midpoints soi **M1** for use of $\sum fx$ with *their* frequencies **M1** (dep on 2nd M1) for $\sum fx \div$ (60 or by *their* $\sum f$)
6(a)(i)	Angle ABC=52 nfww	**B1**	ALTERNATIVE [Reflex] angle AOC = 256
	Opposite angles in cyclic quad oe Angles in opposite segments	**B1**	Angle at centre=2 × angle at circumference/arc
	[Angle AOC=104] Angle at centre=2 × angle at circumference/arc nfww	**B1**	Angles around a point
6(a)(ii)	22 nfww	**2**	**B1** for angle OAC = 38 or angle CAD = 24
6(a)(iii)	28	**1**	
6(a)(iv)	36.6 or 36.62 to 36.63 nfww	**3**	**B2** for 7.4 or 17.42 to 17.43 or **M2** for $9.6\times 2+\frac{104}{360}\times 2\times\pi\times 9.6$ or **M1** for $\frac{104}{360}\times 2\times\pi\times 9.6$
6(b)(i)	81	**3**	**M2** for $\frac{A}{36}=\left(\sqrt[3]{\frac{2187}{648}}\right)$ oe or better or for $A\times\frac{648}{36}\times\sqrt[3]{\frac{2187}{648}}=2187$ oe or better or **M1** for $\frac{A^3}{36^3}=\frac{2187^2}{648^2}$ oe or $\sqrt[3]{\frac{2187}{648}}$ or $\sqrt[3]{\frac{648}{2187}}$
6(b)(ii)	8.05 or 8.051 to 8.052…	**3**	**M2** for $\left[r^3=\right]\frac{2187\times 3}{4\times\pi}$ oe or **M1** for $\frac{4\pi r^3}{3}=2187$ **SC2** for $\frac{648\times 3}{4\times\pi}$ or **SC1** for $\frac{4\pi r^3}{3}=648$
7(a)	Reflection $y=-1$	**2**	**B1** for each
7(b)(i)	Image at (–6, 5) (–6, 7) (–5, 7) (–4, 5)	**2**	**B1** for translation by $\begin{pmatrix}-3\\k\end{pmatrix}$ or $\begin{pmatrix}k\\4\end{pmatrix}$

Question	Answer	Marks	Partial Marks
7(b)(ii)	Image at (1, –1) (3, –1) (3, –3) (2, –3)	**2**	**B1** for shape correct size and orientation but wrong position
7(b)(iii)	Image at (1, 2) (1, 6) (3, 6) (5, 2)	**2**	**B1** for shape correct size and orientation, wrong position
8(a)(i)	$\frac{2}{5}$ oe	**2**	**M1** for $\frac{4}{6}\times\frac{3}{5}$
8(a)(ii)	$\frac{3}{5}$ oe	**1**	**FT** 1 – *their* $\frac{12}{30}$ oe
8(b)	$\frac{5}{7}$ oe nfww	**4**	**M3** for $\frac{2}{7}+\frac{5}{7}\times\frac{2}{6}+\frac{5}{7}\times\frac{4}{6}\times\frac{2}{5}$ oe or for $1-\frac{5}{7}\times\frac{4}{6}\times\frac{3}{5}$ oe or **M1** for each of $\frac{5}{7}\times\frac{2}{6}$ and $\frac{5}{7}\times\frac{4}{6}\times\frac{2}{5}$ oe or completed tree diagram with appropriate probabilities shown
9(a)(i)	5	**1**	
9(a)(ii)	1	**2**	**M1** for h(0) or 3^{9-x^2} or better
9(a)(iii)	$9 – 4x^2$ final answer	**1**	
9(a)(iv)	$15 – 2x^2$ final answer	**2**	**M1** for $2(9 – x^2) –3$ or better
9(b)	$\frac{x+3}{2}$ final answer	**2**	**M1** for $x = 2y – 3$ or $y + 3 = 2x$ or better or $\frac{y}{2}=x-\frac{3}{2}$
9(c)	1.8 or $1\frac{4}{5}$ or $\frac{9}{5}$	**2**	**M1** for $10x-15=3$ or $2x-3=\frac{3}{5}$
9(d)	–1 and 4 nfww	**4**	**M1** for $9 – (2x – 3)^2= –16$ **A1** for $4x^2 – 12x – 16[= 0]$ oe **M1** (dep on first M1) for correct factors or use of formula or completing the square for their 3-term quadratic OR **M1** for $9 – y^2= –16$ **A1** for $y^2 = 25$ **M1** (dep on first M1) for $2x – 3= \pm5$
9(e)	$\frac{1}{9}$	**1**	

Question	Answer	Marks	Partial Marks
10	$x + 1 - 2x = 3x(x + 1)$	**M2**	**M1** for a common denominator of $x(x + 1)$ seen or attempt to multiply through by denominators or for $\frac{x+1-2x}{x(x+1)} = 3$
	$3x^2 + 4x - 1[= 0]$ oe nfww	**A1**	
	$[x =]\frac{-4 \pm \sqrt{4^2 - 4 \times 3 \times (-1)}}{2 \times 3}$	**B2**	**B1FT** for $\sqrt{4^2 - 4 \times 3 \times (-1)}$ or better or for $\left(x + \frac{2}{3}\right)^2$ **B1FT** for $\frac{-4 + \sqrt{q}}{2 \times 3}$ or $\frac{-4 - \sqrt{q}}{2 \times 3}$ or for $-\frac{2}{3} \pm \sqrt{\frac{1}{3} + \left(\frac{2}{3}\right)^2}$
	–1.55 and 0.22 final answers	**B2**	**B1** for each or **B1** for –1.548 to –1.549 **and** 0.215… or for –1.55 **and** 0.22 seen in working or for –0.22 **and** 1.55 as final answer or for –1.5 or –1.54 **and** 0.2 or 0.21 as final answer
11(a)(i)	8**b** – 4**a** oe	**1**	
11(a)(ii)	6**b**	**1**	
11(a)(iii)	6**b** – 2**a** or 2(3**b** – **a**)	**1**	**FT** –2**a** + *their* (a)(ii)
11(b)	2 : 1 oe final answer	**3**	Dep on correct $\overrightarrow{BC}$ or correct $\overrightarrow{AC}$ seen **B2** for $\overrightarrow{BC}$ = 4**b**–2**a** or **M1** for a correct route for $\overrightarrow{BC}$ in terms of **a** and **b** or for a correct route for $\overrightarrow{AC}$ in terms of **a** and **b** If no/incorrect working seen then **SC1** for final answer of 2 : 1 (oe)

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MATHEMATICS **0580/41**

Paper 4 (Extended) **May/June 2019**

MARK SCHEME

Maximum Mark: 130

Published

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- marks are awarded when candidates clearly demonstrate what they know and can do
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- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

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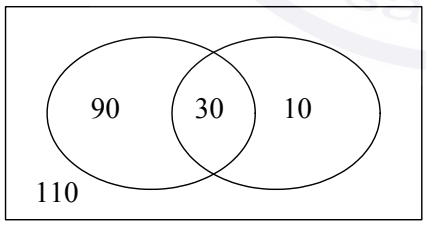
Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)(i)	Image at (1, 7), (4, 7), (4, 9), (3, 9)	**2**	**B1** for translation by $\begin{pmatrix}-1\\k\end{pmatrix}$ or $\begin{pmatrix}k\\6\end{pmatrix}$
1(a)(ii)	Image at (5, 3), (6, 3), (8, 5), (5, 5)	**2**	**B1** for 180° rotation with wrong centre
1(a)(iii)	Rotation 180° (4.5, 6) OR Enlargement, [factor] – 1 (4.5, 6)	**3**	**B1** for rotation **B1** for 180° **B1FT** for centre from *their* (a)(i) **B1** for enlargement **B1** for – 1 **B1FT** for centre from *their* **(a)(i)**
1(b)(i)	Image at (1, 2), (1, 5), (3, 5), (3, 4)	**2**	**B1** for $y = x$ drawn or for 3 correct points
1(b)(ii)	$\begin{pmatrix}0 & 1\\1 & 0\end{pmatrix}$	**2**	**B1** for one correct row or one column within a 2 by 2 matrix
2(a)	2, 2, 6	**3**	**B1** for each
2(b)	Correct graph	**4**	**B3FT** for 10 or 11 correct plots or **B2FT** for 8 or 9 correct plots or **B1FT** for 6 or 7 correct plots
2(c)	–3.3 to –3.1	**1**	**FT** *their* graph
2(d)	$y = -2x$ ruled	**M1**	or **B1** for $y = -2x$ stated
	–2.6 to –2.45	**A1**	
2(e)	3 or 4 or 5	**1**	**FT** *their* graph Allow more than one correct value

Question	Answer	Marks	Partial Marks
3(a)	530	**4**	**B3** for $[DE] = 130$ m and $[DC] = 80$ m or **B2** for $[DE] = 130$ m or $[DC] = 80$ m or **M1** for $50^2 + 120^2$ or $170^2 - 150^2$
3(b)	52.9 or 52.89…	**4**	**M2** for $\frac{100^2 + 150^2 - 120^2}{2 \times 100 \times 150}$ or **M1** for $120^2 = 100^2 + 150^2 - 2 \times 100 \times 150\cos(\ldots)$ **A1** for 0.603 or 0.6033…or $\frac{181}{300}$
3(c)(i)	28.1 or 28.07…	**2**	**M1** for $\cos = \frac{15}{17}$ oe
3(c)(ii)	331.9 or 331.9…	**2**	**FT** 360 – *their* **(c)(i)** **M1** for 360 – *their* **(c)(i)** oe
3(d)	1.5[0] or 1.498… nfww	**4**	**M1** for $\frac{1}{2} \times 50 \times 120$ oe **M1** for $\frac{1}{2} \times 100 \times 150 \sin(\textit{their}\textbf{(b)})$ oe **M1** for $\frac{1}{2} \times 150 \times \textit{their}CD$ oe or $\frac{1}{2} \times 150 \times 170 \times \sin \textit{their}\textbf{(c)(i)}$ If 0 scored, **SC1** for dividing *their* area by 10 000
4(a)(i)	range = 7	**1**	
	mode = 21	**1**	
	median = 22.5	**2**	**M1** for evidence of middle value
	mean = 22.7 or 22.71…	**2**	**M1** for use of $\Sigma x \div 14$
4(a)(ii)	$\frac{3}{14}$ oe	**1**	
4(b)	$x - n + 1$ final answer	**3**	**M2** for $nx - (n-1)(x+1)$ or **M1** for $(n-1)(x+1)$
4(c)(i)	16.6 or 16.60 to 16.61 nfww	**4**	**M1** for 5, 12.5, 17.5, 22.5, 30 soi **M1** for Σfx where x is in correct interval, including boundaries **M1 dep** on second M1 for $\frac{\Sigma fx}{50 + 85 + 100 + 120 + 10}$

Question	Answer	Marks	Partial Marks
4(c)(ii)	Correct histogram	**4**	**B1** for each correct block If 0 scored, **SC1** for 5, 20, 24, 1 seen
5(a)	4.73 or 4.730 to 4.731...	**3**	**M2** for $3 \times 1.2 + \pi \times 0.6^2$ oe or **M1** for $\pi \times 0.6^2$ or $\frac{1}{2} \times \pi \times 0.6^2$ or 3×1.2
5(b)	946 or 946.0 to 946.2...	**3**	**M2** for *their* **(a)** $\times 0.2 \times 1000$ oe or **M1** for *their* **(a)** $\times 0.2$ or 20 implied by figs 946[0] to 9462
5(c)	1.28 or 1.29 or 1.284 to 1.290	**3**	**M2** for $\frac{(1007 - \textit{their}(\mathbf{b})) \div 1000}{\textit{their}(\mathbf{a})} \times 100$ oe or for $\frac{1007 - \textit{their}(\mathbf{b})}{\textit{their}(\mathbf{b})} \times 20$ oe or **M1** for figs$\frac{1007 - \textit{their}(\mathbf{b})}{\textit{their}(\mathbf{a})}$ or figs$\frac{1007}{\textit{their}(\mathbf{a})}$ or for $\frac{1007 - \textit{their}(\mathbf{b})}{\textit{their}(\mathbf{b})}$ or $\frac{1007}{\textit{their}(\mathbf{b})} \times 20$ oe
6(a)		**2**	**B1** for any one correct
6(b)	110	**1**	**FT** *their* 110 in Venn diagram
6(c)	$\frac{10}{240}$ oe	**1**	**FT** $\frac{\textit{their}10}{240}$

Question	Answer	Marks	Partial Marks
6(d)	$\frac{870}{1560}$ oe	**3**	**M2** for $\frac{their30}{40}\times\frac{their30-1}{39}$ or **M1** for $\frac{p}{q}\times\frac{p-1}{q-1}$ $p<q$ or for $\frac{their30}{40}$ soi
7(a)(i)	1.991×10^3	**4**	**B3** for 1991 or 1.99×10^3 or $1.991\ldots\times10^3$ or **B2** for 1990 or 1991. … OR **M1** for $104.3\times26.5+\frac{1}{2}\times(-2.2)\times26.5^2$ oe **B1** for *their* seen value correctly rounded to 4 sf **B1** for *their* seen value correctly converted into standard form
7(a)(ii)	$\frac{2(s-ut)}{t^2}$ oe final answer	**3**	**M1** for correct multiplication by 2 oe **M1** for correct rearrangement to isolate term with a **M1** for correct division by t^2 for 3 marks e.g. cannot have a fraction in denominator nor $\div t^2$ in numerator
7(b)(i)	$(2x+3)(x-1)-(x+1)(x-2)=62$	**M1**	
	$2x^2+3x-2x-3$ oe or $x^2+x-2x-2$ oe	**B1**	
	$x^2+2x-63=0$	**A1**	Established with no errors or omissions
7(b)(ii)	$(x+9)(x-7)$	**2**	**B1** for $(x+a)(x+b)$ where $ab=-63$ or $a+b=2$ or for $x(x-7)+9(x-7)$ or for $x(x+9)-7(x+9)$
7(b)(iii)	20	**2**	**FT** $2\times$ *their* positive root $+6$ **M1** for substituting *their* positive root into four lengths or for stating $2x+6$

Question	Answer	Marks	Partial Marks
8(a)	6 nfww	**3**	**M2** for $\frac{2.65-2.50}{2.50}[\times 100]$ or for $\frac{2.65}{2.50}\times 100$ or **M1** for $\frac{2.65}{2.50}$
8(b)	552.5[0]	**3**	**B2** for 52.5[0] or **M2** for $500\times\frac{1.5}{100}\times 7+500$ oe or **M1** for $500\times\frac{1.5}{100}$ [× 7] oe
8(c)	37.4 or 37.36…	**2**	**M1** for $\left(1+\frac{1.6}{100}\right)^{20}$ oe soi 1.37…
8(d)	4[.00...]	**3**	**M2** for $\sqrt[22]{\frac{2607}{6400}}$ or **M1** for $6400\times x^{22}=2607$ oe or better
9(a)	82	**2**	**M1** for $(3^x)^2+1$ soi by $(3^2)^2+1$ or g(9) isw
9(b)	$\frac{x+2}{7}$ final answer	**2**	**M1** for $y+2=7x$ or $\frac{y}{7}=x-\frac{2}{7}$ or $x=7y-2$
9(c)	[a =] 1, [b =] 2, [c =] 2	**3**	**B2** for $x^4+x^2+x^2+1+1$ or **M1** for $(x^2+1)^2+1$
9(d)	$\frac{6}{7}$ oe	**3**	**M2** for $7x-2=4$ or **M1** for $3^x=81$ soi f(x) = 4 or for $3^{7x-2}=81$ or better
10(a)	10	**1**	
10(b)	6.2[0] or 6.203 to 6.204	**3**	**M2** for [x^3 =] $1000\div\frac{4}{3}\pi$ oe or better or **M1** for $\frac{4}{3}\pi x^3=1000$
10(c)	7.82 or 7.815 to 7.816	**4**	**B3** for $[x^3=]1000\div\frac{1}{3}\pi\div 2$ oe or better or **M1** for $\left(x\sqrt{5}\right)^2-x^2$ soi by $4x^2$ or $2x$ **M1dep** for $\frac{1}{3}\pi\times x^2\times$ *theirh*[=1000]

Question	Answer	Marks	Partial Marks
10(d)	$6\frac{2}{3}$ or 6.67 or 6.666 to 6.667	**4**	**B3** for $[x^3 =]1000 \div \frac{27}{8}$ oe or $\frac{3x}{2} = 10$ or better or **M2** for $\frac{1}{2} \times x \times \frac{x}{2} \times \frac{27x}{2} = 1000$ oe or **M1** for $\frac{1}{2} \times x \times \frac{x}{2}$ If 0 scored, **SC2** for answer 5.29 or 5.291..
11	[Total time =]16 h 6 min or 16.1 h	**2**	**B1** for 22 h 6 min or 22.1h or 966 mins If 0 scored, **SC1** for 9 h 41 min
	[Distance to airport in New York =] 16.5	**2**	**M1** for 18×55
	[Arc length =] 6200 or 6199 to 6200. …	**3**	**M2** for $\frac{55.5}{360} \times 2 \times \pi \times 6400$ or **M1** for $\frac{55.5}{360}$ or $2 \times \pi \times 2400$
	[Distance Geneva to Chamonix =] 104	**2**	**M1** for 65×1.6 or 65×96 oe
	392 to 393	**2**	**M1** for $\frac{6316 \text{ to } 6322.4}{\textit{their}\,16.1}$ Must be correct value in numerator

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

MATHEMATICS **0580/42**

Paper 4 (Extended) **May/June 2019**

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

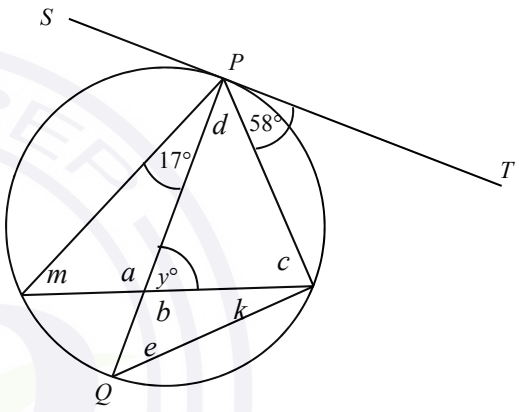
GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)	16.5 or 16.49...	**3**	**M2** for $\frac{1.13-0.97}{0.97}[\times 100]$ oe or $\frac{1.13}{0.97}\times 100$ oe or **M1** for $\frac{1.13}{0.97}$ oe
1(b)(i)	35	**2**	**M1** for $60 \div (5+7)$
1(b)(ii)	140	**1**	
1(c)	\$1.26 final answer	**3**	**B2** for 1.259... or 1.26 but not as final answer or **M1** for $2.25 \div 0.9416$ If 0 scored, **SC1** for 1.13 × 0.9416
1(d)	15[.0…]	**3**	**M2** for $\sqrt[21]{\frac{58000}{1763000}}$ oe or **M1** for $58000 = 1763000\ (k)^{21}$
1(e)	1239.75	**2**	**B1** for 43 + 0.5 or 28 + 0.5 oe seen
2(a)	103	**3**	**M1** for angle *ABC* or angle *ACB* = $\frac{1}{2}(180-26)$ oe **M1** for angle *ABF* = 26 or angle *CBD* or angle *FBE* = 77 or exterior angle *ACB* = 103 correctly identified or in correct position

Question	Answer	Marks	Partial Marks
2(b)	75	**5**	**B4** for 105 at *a* or *b* **or** 73 at *c* **and** 32 at *d* or **B3** for 58 at *m* **or** 58 at *e* **and** 17 at *k* or **B2** for 32 at *d* **and** 90 soi at (*c*+*k)* **or** 32 at *d* **and** 17 at *k* **or** 73 at *c* or **B1** for 90 soi at (*c* + *k*) or between tangent and radius **or** 32 at *d* **or** 17 at *k* 
3(a)	$1 - r$	**1**	
3(b)(i)	$(1 - r)\ (1.3 - r)$ [= 0.4]	**1**	**FT** *their***(a)** dep on **(a)** being an expression in *r*
3(b)(ii)	$1.3 - 1.3r - r + r^2$ or better nfww	**M1**	**FT** *their* **(b)(i)**
	$0.9 - 2.3r + r^2 [= 0]$ OR $13 - 13r - 10r + 10r^2 = 4$ oe	**M1**	**Strict FT** *their* expansion to a quadratic then equating to 0.4 and then collecting to 3 terms on 'one side' OR **Strict FT** *their* expansion to a quadratic = 0.4 all multiplied by 10
	$10r^2 - 23r + 9 = 0$	**A1**	no errors or omissions seen

Question	Answer	Marks	Partial Marks
3(b)(iii)	$(5r-9)(2r-1)$ [= 0]	**B2**	or **B2** for e.g. $5r(2r-1)-9(2r-1)$ **and then** $5r-9=0$ **and** $2r-1=0$ or **B1** for $5r(2r-1)-9(2r-1)$ [= 0] or $2r(5r-9)-1(5r-9)$ [= 0] or $(5r+a)(2r+b)$ [= 0] where a, b are integers and $ab = +9$ or $2a+5b=-23$ If 0 scored, **SC1** for $5r-9$ **and** $2r-1$ seen but not in factorised form
	[r =] $\frac{9}{5}$ oe [r =] $\frac{1}{2}$ oe	**B1**	
3(b)(iv)	0.8 or $\frac{4}{5}$ oe	**1**	
4(a)(i)	1.5 oe	**1**	
4(a)(ii)	(0, 2)	**1**	
4(b)(i)	$y=-2x+6$ oe final answer	**3**	**B2** for $y=-2x+c$ oe or $y=mx+6$ oe $m\neq 0$ or for answer $-2x+6$ or **B1** for [gradient =] $-\frac{6}{3}$ oe or c = + 6 soi
4(b)(ii)	$y=0.5x-1.5$ oe final answer	**3**	**B1** for [gradient =] – 1 divided by *their* gradient from **(b)(i)** evaluated soi **M1** for substitution of (9, 3) into y = (*their m*)x+ c seen in working
4(c)(i)	12.6 or 12.64 to 12.65	**3**	**M2** for $\sqrt{(8--4)^2+(5-1)^2}$ oe or **M1** for $(8--4)^2+(5-1)^2$ oe
4(c)(ii)	(2, 3)	**2**	**B1** for each
5(a)	2.45, 0.25, – 0.25	**3**	**B1** for each
5(b)	Fully correct smooth curve	**4**	**B3FT** for 6 or 7 points or **B2 FT** for 4 or 5 points or **B1 FT** for 2 or 3 points
5(c)	0.7 to 0.8	**1**	**FT** *their* curve
5(d)(i)	Correct ruled line	**2**	**M1** for good freehand, or ruled line with gradient –1.05 to –0.95 or ruled line through (0, 2) but not line y = 2

Question	Answer	Marks	Partial Marks
5(d)(ii)	Both intersections of *their* **(b)** and *their* **(d)(i)**	**2**	**Strict FT** intersection of *their* **(b)** and *their* **(d)(i)** **B1FT** for one correct OR **B2** for 0.27 to 0.28 **and** 2.38 to 2.39
5(e)	Substitutes $x = \sqrt{2}$ into $\frac{1}{2x} - \frac{x}{4}$ OR Identifies $y = 0$ oe OR Correctly manipulates to a single fraction e.g. $\frac{2-x^2}{4x}$ oe seen	**M1**	
	Concludes 'read the graph at $y = 0$' oe OR Manipulates $0 = \frac{1}{2x} - \frac{x}{4}$ oe leading to $x^2 = 2$ OR States $\frac{2-x^2}{4x}$ oe $= 0$ leading to $x^2 = 2$	**A1**	
6(a)	$x^2 + 4x - 21$ final answer	**2**	**B1** for three of $x^2, +7x, -3x, -21$
6(b)(i)	$5q^2(3p^2 - 5q)$ final answer	**2**	**B1** for $5(3p^2q^2 - 5q^3)$ or $q^2(15p^2 - 25q)$ or $q(15p^2q - 25q^2)$ or $5q(3p^2q - 5q^2)$ or for correct answer seen
6(b)(ii)	$(2g + 5k)(2f + 3h)$ final answer	**2**	**B1** for $2g(2f + 3h) + 5k(2f + 3h)$ or $2f(2g + 5k) + 3h(2g + 5k)$ or for correct answer seen
6(b)(iii)	$(9k + m)(9k - m)$ final answer	**2**	**M1** for $(9 + m)(9 - m)$ or for correct answer seen

Question	Answer	Marks	Partial Marks
6(c)	5.5	**4**	**M1** for $5\times3(x-4)+x+2=5\times6$ **M1** for $15x-60+x+2=30$ **FT** *their* first step or $3x-12+\frac{x+2}{5}=6$ If M0M0, **SC1** for $3x-12+x+2=30$ oe **M1dep** for $16x=88$ **FT** *their* previous steps
7(a)	$180-\frac{360}{5}$ or $\frac{(5-2)\times180}{5}$ or $\frac{(2\times5-4)\times90}{5}$ or $\frac{5\times180-360}{5}$	**M2**	or **M1** for $\frac{360}{5}$ or $(5-2)\times180$ or $90(2\times5-4)$ or $3\times180\div5$ or $6\times90\div5$ or $5\times180-360$ If 0 scored, **SC1** for $\frac{5-2\times180}{5}$
7(b)(i)	7.05 or 7.053…	**3**	**M2** for $12\times\cos54$ oe or **M1** for implicit form or **B1** for length of edge of pentagon = 14.1 to 14.11 If 0 scored, **SC1** for right angle at *M*
7(b)(ii)(a)	22.8 or 22.81 to 22.83… nfww	**3**	**M2** for $\frac{\textit{their}\,\textbf{(b)(i)}}{\cos72}$ oe or **M1** for implicit form oe or **B1** for *AX* = 36.9 or 36.93 to 36.94
7(b)(ii)(b)	179 or 179.1 to 179.3…	**3**	**M2** for $\frac{1}{2}\times12\times\textit{their}\,AX\times\sin54$ oe or $\frac{1}{2}\times12\times\textit{their}\,OX\times\sin108$ oe or $\frac{1}{2}\times\textit{their}\,AX\times\textit{their}\,OX\times\sin18$ or $\frac{1}{2}\times12^2\times\sin72+\text{area}\,OBX$ oe or $\frac{1}{2}\times12^2\times\sin72+\text{area}\,OMB+\text{area}\,MBX$ oe or **M1** for a correct method to find area of one relevant triangle *AOB*, *OMB*, *MBX*, *OBX* or *ONX* **seen**
8(a)(i)	15.7 or 15.70...	**4**	**M2** for $16.5^2+12.4^2-2\times16.5\times12.4\times\cos64$ or **M1** for implicit form **A1** for 246 to 247

Question	Answer	Marks	Partial Marks
8(a)(ii)	18.7 or 18.68 to 18.69	**4**	**B1** for 32 or angle $DBM = 37$ or angle $CBM = 58$ **M2** for $\frac{12.4 \times \sin 53}{\sin 32}$ oe or **M1** for implicit form oe
8(b)(i)	116.1 or 116.08 to 116.09...	**2**	**M1** for $\frac{y}{360} \times 2 \times \pi \times 3.8 = 7.7$ oe
8(b)(ii)	14.6 or 14.61 to 14.63…	**2**	**M1** for $\frac{\textit{their}\textbf{(b)(i)}}{360} \times \pi \times 3.8^2$ oe
9(a)	12.8[0]	**4**	**M1** for midpoints **soi** **M1** for use of $\sum fm$ with m in correct interval including both boundaries **M1** (dep on 2nd **M1**) for $\sum fm \div 100$
9(b)	54 84 93	**2**	**B1** for 2 correct or 1 error and 2 correct or **FT**
9(c)	correct diagram with all points correctly plotted	**3**	**B1FT** *their* **(b)** for plots at 5 correct heights **B1** for 5 points at upper ends of intervals on correct vertical line **B1FT** (dep on at least **B1**) for increasing curve or polygon through 5 points After 0 scored, **SC1FT** for 4 correct points plotted
9(d)(i)	9 to 9.8 final answer	**1**	
9(d)(ii)	8.5 to 11.5	**2**	**B1** for [UQ =] 15.5 to 17.5 or [LQ =] 6 to 7 seen
9(d)(iii)	10, 11 or 12	**2**	**B1** for 88 to 90 seen or for answer between 10 and 12
10(a)(i)	18[.0] or 17.99 to 18.00…	**3**	**M2** for $\sqrt[3]{\frac{24430 \times 3}{4\pi}}$ oe or **M1** for $\frac{4}{3}\pi r^3 = 24430$
10(a)(ii)	447 or 446.8 to 446.9...	**3**	**M2** for $\pi \times 50^2 \times 60 - 24430$ oe or **M1** for $\pi \times 50^2 \times 60$ oe

Question	Answer	Marks	Partial Marks
10(b)	4 [hours] 30 [mins] nfww	**4**	**B3** for 16200 or 4.5 or 270 or **M2** for $\frac{\text{figs } 18 \times \text{figs } 15 \times \text{figs } 12}{\text{figs } 2}$ oe or **M1** for figs 18 × figs 15 × figs 12 oe
10(c)	12.5 or 12.50…	**3**	**M2** for $17 \times \sqrt{\frac{159.5}{295}}$ oe or **M1** for $\sqrt{\frac{159.5}{295}}$ or $\sqrt{\frac{295}{159.5}}$ seen or for $\frac{159.5}{295} = \frac{x^2}{17^2}$ oe
11(a)	40 54 26 34	**4**	**B1** for each
11(b)	$n^2 + 3n$ or $n(n+3)$ oe	**2**	**B1** for a quadratic expression or for 2nd common difference 2 (at least 2 shown) or for 2 correct equations seen or for subtracting n^2
11(c)	100	**2**	**M1** for *their* **(b)** = 10300 seen
11(d)	$[a =] \frac{1}{2}$ oe and $[b =] \frac{5}{2}$ oe	**2**	**B1** for each or **M1** for one correct equation or for 2nd difference = 1 soi (at least 2 shown)

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

MATHEMATICS **0580/43**

Paper 4 (Extended) **May/June 2019**

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

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- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
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GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Abbreviations
cao correct answer only
dep dependent
FT follow through after error
isw ignore subsequent working
oe or equivalent
SC Special Case
nfww not from wrong working
soi seen or implied

Question	Answer	Marks	Partial Marks
1(a)(i)	6h 27 mins	**2**	**B1** for answer .....h 27 mins
1(a)(ii)	150 km/h	**3**	**M2** for $\frac{90}{36} \times 60$ or **M1** for $\frac{90}{\textit{their}\ \text{time}}$ or **B1** for 36 [mins] seen
1(a)(iii)	780	**4**	**M3** for $\left(90 \times \frac{35}{3600}\right) \times 1000 - 95$ oe or **M2** for $\left(90 \times \frac{35}{3600}\right) \times 1000$ oe or **B1** for figs 875 or **M1** for $90 \times \frac{35}{3600}$ seen or for $90 \times \frac{1000}{3600}$ oe If 0 scored, **SC1** for *their* distance (> 95) – 95
1(b)(i)	7 : 5	**1**	
1(b)(ii)	66.7 or 66.66 to 66.67	**3**	**M2** for $\frac{140-84}{84}$ [× 100] oe or for $\frac{140}{84} \times 100$ oe or **M1** for $\frac{140}{84}$ oe
1(b)(iii)	24 576	**5**	**M4** for complete method, $40 \times 60 + 0.7 \times 220 \times 84 + 0.3 \times 220 \times 140$ oe OR **B1** for 40 [children] **M1** for $0.7 \times 220 \times 84$ oe **M1** for $0.3 \times 220 \times 140$ oe **B1** for 2400 or 12936 or 9240 nfww

Question	Answer	Marks	Partial Marks
1(c)	3.5×10^5 nfww	**3**	**M2** for $3.08 \times 10^5 \div \left(\frac{100-12}{100}\right)$ oe or **M1** for 3.08 [$\times 10^5$] associated with (100–12)%
2(a)	–10	**2**	**M1** for $-17 - 3 = 7x - 5x$ oe or better
2(b)	−1, 0, 1, 2 final answer	**3**	**B2** for 3 correct values and no incorrect values or 4 correct values and one incorrect value or **M2** for $-\frac{7}{4} < n \leqslant 2$ oe or **M1** for $-\frac{7}{4} < n \leqslant k$ or $k < n \leqslant 2$ oe
2(c)(i)	a^9	**1**	
2(c)(ii)	$125x^3y^6$ final answer	**2**	**B1** for 2 correct elements if in form kx^ny^m
2(c)(iii)	$\frac{4y^{[1]}}{3x^4}$ final answer	**3**	**B2** for $\left(\frac{3x^4}{4y^{[1]}}\right)^{[-1]}$ oe seen OR **B1** for $3x^4$ or $4y^{[1]}$ **and** **M1** for $\left(\frac{64y^3}{27x^{12}}\right)^{\left[\frac{1}{3}\right]}$ oe If 0 scored, **SC1** for $\frac{64y^{[1]}}{27x^4}$ or $\frac{0.333x^{-4}}{0.25y^{-1}}$ seen
3(a)(i)	Image at (–5, 4), (–2, 4), (–4, 6)	**2**	**B1** for translation by $\begin{pmatrix}-3\\k\end{pmatrix}$ or $\begin{pmatrix}k\\2\end{pmatrix}$
3(a)(ii)	Image at (2, 1), (4, –1), (2, –2)	**2**	**B1** for reflection in $y = -x$ or $y = x$ drawn
3(b)	Rotation 90°[anticlockwise] oe (1, –1)	**3**	**B1** for each
3(c)(i)	$\begin{pmatrix}-2 & 0\\0 & -2\end{pmatrix}$	**2**	**B1** for 2 by 2 matrix with one correct row or column
3(c)(ii)	Strict **FT** *their* **(c)(i)**	**1**	Answer not equal to zero **FT** *their* **(c)(i)** only if 2 by 2

Question	Answer	Marks	Partial Marks
4(a)(i)	$\frac{1}{2}\times\frac{4}{3}\times\pi\times5.6^3$	**M1**	
	367.8... to 367.9	**A1**	
4(a)(ii)	3.06 or 3.060 to 3.061...	**4**	**M1** for 0.8×368 [= 294.4] **M2** for [r^2 =] $\frac{their\ 294.4}{10\pi}$ oe or **M1** for $\pi r^2 \times 10 = their$ 294.4 oe
4(b)(i)	44[.0] or 43.98 to 43.99 nfww	**5**	**B2** for [slant height =] $\frac{25}{4}$ oe or **M1** for [l^2 =] $6^2 + 1.75^2$ oe **M2** for $\pi\times1.75\times their\ l+\pi\times1.75^2$ or **M1** for $\pi\times1.75\times their\ l$ or $\pi\times1.75^2$
4(b)(ii)(a)	SF = $\frac{1}{4}$ oe soi	**B1**	
	$\frac{1}{3}\pi\times1.75^2\times6-\frac{1}{3}\pi\times their\ 0.4375^2\times1.5$ **OR** $\frac{1}{3}\pi\times1.75^2\times6\times\left(1-\left(\frac{1}{4}\right)^3\right)$ oe	**M2**	**M1** for $\frac{1}{3}\pi\times1.75^2\times6$ or $\frac{1}{3}\pi\times their\ 0.4375^2\times1.5$ **OR** **M1** for $1-\left(\frac{1}{4}\right)^3$ oe
	18.94 or 18.939 to18.944…	**A1**	
4(b)(ii)(b)	95 final answer	**3**	**B2** for 94.5 or 94.69 to 94.722 OR **M2** for $18.9\times10^3\div200$ oe or **M1** for 18.9×10^3 or $200\div10^3$ or figs 189..÷ 200 or 18.9.. ÷ figs 2
5(a)(i)	–3	**1**	
5(a)(ii)	6.2 to 6.4 oe	**2**	**M1** for 3 seen or used
5(b)	$y = 5 – 3x$ ruled	**2**	**B1** for $y = 5 – 3x$ soi or ruled line with gradient – 3 or with y – intercept at 5 (but not $y = 5$) or **B1FT** for incorrect line equation/expression shown in working and *their* line correctly drawn
	– 0.3 to – 0.2 1.65 to 1.8	**2**	**B1** for each, dep on $y = 5 – 3x$ drawn or **FT** *their* line provided equation/expression shown in working, dep on B1FT for line

Question	Answer	Marks	Partial Marks
5(c)	Tangent ruled at $x = –2$	**1**	**B1** for correct tangent
	–4.5 to –2.5	**2**	**Dep** on B1 for tangent or close attempt at tangent at $x = –2$ **M1** for rise/run **also dep on** tangent drawn or close attempt at correct tangent Must see correct or implied calculation from a drawn tangent
5(d)(i)	8, 4, 0.25 oe	**3**	**B1** for each
5(d)(ii)	Correct graph	**3**	**B2FT** for 6 or 7 correct plots or **B1FT** for 4 or 5 correct plots
5(d)(iii)	1.8 to 1.9	**1**	
6(a)	40.5 or 40.45[8..] or 40.46 nfww	**4**	**M1** for 25, 32.5, 37.5, 50, 80 soi **M1** for Σft **M1 dep** for their $\Sigma ft \div 120$
6(b)	Fully correct histogram	**4**	**B1** for each correct bar If 0 scored, **SC1** for frequency densities of 5.4, 4.2, 0.8 and 0.45 seen
7(a)	$[y =] 4x + 5$	**3**	**B2** for answer $[y =] 4x + c$ oe (c can be numeric or algebraic) OR **M2** for $\frac{y-9}{x-1} = \frac{9-(-3)}{1-(-2)}$ oe OR **M1** for $\frac{9--3}{1--2}$ oe or for **M1** for correct substitution of (–2, –3) or (1, 9) into $y = (\textit{their } m)x + c$ oe
7(b)	76[.0] or 75.96...	**2**	**M1** for tan[ ] = 4 oe

Question	Answer	Marks	Partial Marks
7(c)(i)	$[y =] -\frac{1}{4}x + \frac{23}{8}$ oe	**3**	**B2FT** for $[y =] -\frac{1}{\textit{their}\text{ gradient from }\textbf{(a)}}x + c$ oe (c can be numeric or algebraic) OR **M2** for $\frac{y-2}{x-3.5} = -\frac{1}{\textit{their}\text{ gradient from }\textbf{(a)}}$ oe OR **M1** for $-\frac{1}{\textit{their}\text{ gradient from }\textbf{(a)}}$ soi **M1** for correct substitution of (3.5, 2) into $y = (\textit{their } m)x + c$ oe
7(c)(ii)	(–4.5, 4)	**2**	**B1** for each value or for $\begin{pmatrix}-8\\2\end{pmatrix}$ seen
8(a)(i)	$\frac{x-1}{x+2}$	**2**	**B1** for either numerator or denominator correct
8(a)(ii)(a)	$\frac{x}{x+3} \times \frac{x-1}{x+2} = \frac{7}{15}$	**B1**	**FT** *their* **(a)(i)** = $\frac{7}{15}$
	$15x(x – 1) = 7(x + 3)(x + 2)$	**M1**	Removes all algebraic fractions **FT** *their* equation if in comparable form
	$15x^2 – 15x = 7x^2 + 21x + 14x + 42$	**M1**	Correctly expands all brackets **FT** *their* equation if in comparable form
	$[8x^2 – 50x – 42 = 0]$ $4x^2 – 25x – 21 = 0$	**A1**	With no errors or omissions seen and one further stage seen after final M1
8(a)(ii)(b)	$(4x + 3)(x – 7)$ [= 0]	**M2**	**M1** for $4x(x – 7) + 3(x – 7)$ or $x(4x + 3) – 7(4x + 3)$ or for $(4x + a)(x + b)$ where either $ab = –21$ or $4b + a = –25$ If 0 scored, **SC1** for $4x + 3$ **and** $x – 7$ seen but not in factorised form
	7 and $-\frac{3}{4}$	**B1**	
8(a)(ii)(c)	7	**1**	**FT** *their* positive solution

Question	Answer	Marks	Partial Marks
8(b)	$\frac{1}{6}$ oe	**4**	**M3** for $\frac{5}{9}\times\frac{4}{8}\times\frac{3}{7}+\frac{4}{9}\times\frac{3}{8}\times\frac{2}{7}$ or **M2** for $\frac{5}{9}\times\frac{4}{8}\times\frac{3}{7}$ or $\frac{4}{9}\times\frac{3}{8}\times\frac{2}{7}$ or **M1** for $\frac{5}{9},\frac{4}{8},\frac{3}{7}$ seen or $\frac{4}{9},\frac{3}{8},\frac{2}{7}$ seen If 0 scored, **SC1** for $\frac{5^3+4^3}{729}$ oe
9(a)(i)	$\angle ACD = 46$ soi or $\angle CDE = 44$ soi	**B2**	**B1** for angle $ADC = 108$ or angle $DCB = 18$
	$\frac{58\sin 108}{\sin \textit{their} 46}$	**M2**	**M1** for $\frac{\sin 108}{x}=\frac{\sin \textit{their} 46}{58}$ oe
	76.68… nfww	**A1**	
9(a)(ii)	10.9 or 10.91 to 10.94	**3**	**B2** for [AB =] 68.9 or 68.91 to 68.94 or **M2** for a correct explicit statement for AB or BD or **M1** for $\frac{AB}{76.7}$ = cos26 oe
9(b)(i)	10.4 or 10.43 to 10.44	**4**	**M3** for $\sqrt{\frac{70}{\sin 40}}$ oe or **M2** for $x^2 \times \sin 40 = 70$ oe or **M1** for $\frac{1}{2}x \times 2x \times \sin 40 = 70$
9(b)(ii)	140	**1**	
10(a)(i)	3, –1	**2**	**B1** for each
10(a)(ii)	23 – 4n oe final answer	**2**	**M1** for $k - 4n$ or $23 - jn$ ($j \neq 0$)
10(a)(iii)	22	**2**	**M1** for *their* **(a)(ii)** = –65
10(b)	23	**2**	**B1** for 37 or 60

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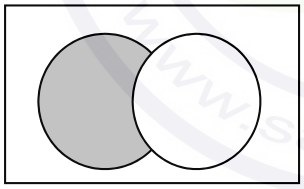
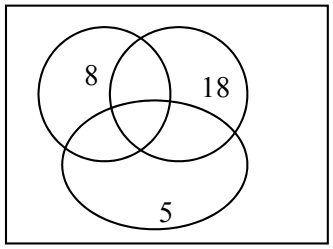
dep dependent
FT follow through after error
isw ignore subsequent working
oe or equivalent
SC Special Case
nfww not from wrong working
soi seen or implied

Question	Answer	Marks	Partial Marks
1(a)	473	**2**	**M1** for 645 ÷ (11 + 4)
1(b)	212.5	**2**	**M1** for 50×4.25
1(c)	31.5 or 31.45 to 31.46	**3**	**M2** for $54 \div 1\frac{43}{60}$ oe or **M1** for time =1h 43min or 103 [mins] or 54 ÷ *their* time
1(d)	875	**1**	
1(e)	10.4 or 10.38 to 10.39	**1**	
1(f)(i)	30 [×] 70 and 2100	**1**	
1(f)(ii)	both numbers rounded up oe	**1**	
2(a)(i)	Reflection $x = 1.5$	**2**	**B1** for each
2(a)(ii)	Rotation (0, –1) 90° [anticlockwise] oe	**3**	**B1** for each
2(b)(i)	Image at (5, –1) (6, –1) (6, –3)	**2**	**B1** for correct size and orientation but wrong position If 0 scored, **SC1** for enlargement SF $\frac{1}{2}$ with centre (3, 0)
2(b)(ii)	Image at (–6, 3) (–4, 3) (–6, 7)	**2**	**B1** for translation $\begin{pmatrix} -3 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ 1 \end{pmatrix}$
2(b)(iii)	Image at (2, –1) (2, –3) (6, –3)	**3**	**M2** for 3 correct coordinates soi or **M1** for $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}\begin{pmatrix} -1 & -3 & -3 \\ 2 & 2 & 6 \end{pmatrix}$ or **B1** for stating reflection in $y = x$

Question	Answer	Marks	Partial Marks
3(a)	$\frac{5}{9}$ oe	**1**	
3(b)	$\frac{80}{153}$ oe	**3**	**M2** for $2\times\frac{10}{18}\times\frac{8}{17}$ oe or **M1** for $\frac{10}{18}\times\frac{8}{17}$ oe If 0 scored, **SC1** for $\frac{160}{324}$ oe
3(c)	$\frac{11}{51}$ oe	**4**	**M3** for $\frac{10}{18}\times\frac{9}{17}\times\frac{8}{16}+\frac{8}{18}\times\frac{7}{17}\times\frac{6}{16}$ oe or **M2** for $\frac{10}{18}\times\frac{9}{17}\times\frac{8}{16}$ oe or $\frac{8}{18}\times\frac{7}{17}\times\frac{6}{16}$ oe or **M1** for $\frac{10}{18},\frac{9}{17},\frac{8}{16}$ or $\frac{8}{18},\frac{7}{17},\frac{6}{16}$ If 0 scored, **SC1** for $\frac{1512}{5832}$ oe
4(a)	Correct ruled line with *D* marked	**2**	**B1** for correct ruled line or short line
4(b)	47.5	**2**	**B1** for 9.5 or 95 mm seen or for answer figs 465 to figs 485
4(c)	Correct arc radius 7 cm	**2**	**B1** for complete arc other radius, centre *A* or correct but short arc
	Correct ruled perpendicular bisector of *BC* with correct pairs of arcs	**2**	**B1** for correct perpendicular bisector without correct arcs or for correct arcs, no/incorrect line
	Correct ruled bisector of angle *BCD* with correct pairs of arcs	**2**	**B1** for correct angle bisector without correct arcs or for correct arcs, no/incorrect line
	correct region shaded	**1**	Dep on at least **B1B1B1** and five boundaries one of which is an arc
4(d)	[1 :] 500	**1**	

Question	Answer	Marks	Partial Marks
5(a)	–2.1, 1.6, –1.7, 2.1	**3**	**B2** for 3 correct or **B1** for 2 correct
5(b)	Fully correct curve	**4**	**B3FT** for 8 or 9 correct plots or **B2FT** for 6 or 7 correct plots or **B1FT** for 4 or 5 correct plots
5(c)	line $y = \frac{1}{2}(1-x)$ ruled	**M2**	**M1** for line with gradient $-\frac{1}{2}$ **M1** for line through $(0, \frac{1}{2})$ but not $y = \frac{1}{2}$
	–2.15 to –2.01 –0.45 to –0.2 2.25 to 2.45	**B2**	**B1** for two correct
5(d)	number of intersections of *their* curve and the line $y = 1$	**1**	strict **FT** for *their* curve
6(a)	5.83 or 5.832 to 5.833	**5**	**B2** for sector angle = 210 soi or **M1** for $[\cos DOE =] \frac{0.25}{0.5}$ oe **M2** for $\frac{their 210}{360} \times 2 \times \pi \times 0.5 + 2 \times 1.5 + 2 \times 0.5$ oe or **M1** for $\frac{their 210}{360} \times 2 \times \pi \times 0.5$ oe isw
6(b)	1.21 or 1.208…	**3**	**M2** for $\frac{their 210}{360} \times \pi \times 0.5 \times 0.5 + 1.5 \times 0.5$ oe or **M1** for $\frac{their 210}{360} \times \pi \times 0.5 \times 0.5$ oe isw
6(c)(i)	4[.00...]	**3**	**M2** for $0.5 \times \sqrt{\frac{77.44}{their\textbf{(b)}}}$ oe or **M1** for $\sqrt{\frac{77.44}{their\textbf{(b)}}}$ or $\sqrt{\frac{their\textbf{(b)}}{77.44}}$ or for $\frac{their\textbf{(b)}}{77.44} = \frac{0.5^2}{r^2}$ oe
6(c)(ii)	2.20704	**3**	**M2** for 77.44 × 1.5 × 19 ÷ 1000 oe or **M1** for figs 2207[04] or figs 221 seen or [vol =] 77.44 × 1.5

Question	Answer	Marks	Partial Marks
7(a)(i)	111.25	**4**	**M1** for midpoints **soi** (25, 75, 112.5, 137.5, 175) **M1** for $\sum fx$ with x in correct interval including both boundaries **M1** (dep on 2nd **M1**) for $\sum fx \div 20$
7(a)(ii)	2 7 11 17	**2**	**B1** for three correct
7(a)(iii)	$\frac{3}{20}$ oe	**1**	
7(b)	20 6	**2**	**B1** for one correct value or [SF =] 5 or $\frac{1}{5}$ oe
7(c)(i)	5 nfww	**3**	**M2** for $\sum fx \div \sum f = 4.28$ oe or **M1** for $179 + 7x$ oe or $4.28 \times (45 + x)$ oe seen
7(c)(ii)	3	**1**	
7(c)(iii)	4	**1**	
8(a)	–3	**1**	
8(b)	$\frac{12}{11}$ oe	**2**	**M1** for $\frac{3}{\frac{3}{x+2}+2}$ soi
8(c)	$64x-45$ final answer	**2**	**M1** for $8(8x-5)-5$ isw
8(d)	$\frac{x+5}{8}$ oe final answer	**2**	**M1** for a correct first step $y+5=8x$, $\frac{y}{8}=x-\frac{5}{8}$ or $x=8y-5$
8(e)	$\frac{8x^2+11x-13}{x+2}$ final answer	**3**	**M1** for $(8x-5)(x+2)-3$ oe isw **B1** for common denominator $(x+2)$

Question	Answer	Marks	Partial Marks
8(f)(i)	$(8x-5)^2+6 = 19$	**M1**	
	$64x^2-40x-40x+25$	**B1**	
	$64x^2-40x-40x+25+6=19$ oe leading to $16x^2-20x+3=0$	**A1**	with no errors and must show $(8x-5)^2+6 = 19$ with no omissions after this
8(f)(ii)	$\frac{[--]20\pm\sqrt{([-]20)^2-4(16)(3)}}{2\times16}$ oe	**2**	**B1** for $\sqrt{([-]20)^2-4(16)(3)}$ or better or **B1** for $\frac{[--]20+\sqrt{q}}{2(16)}$ oe or $\frac{[--]20-\sqrt{q}}{2(16)}$
	0.17 and 1.08 final ans	**2**	**B1** for each If 0 scored, **SC1** for answer 0.2 and 1.1 or answer – 0.17 and –1.08 or 0.174... and 1.075 to 1.076 seen or 0.17 and 1.08 seen in working
9(a)(i)(a)	$\in$	**1**	
9(a)(i)(b)	$A \cap B$	**1**	
9(a)(ii)	B or A'	**1**	
9(b)		**1**	
9(c)(i)	$3x+7=19$ oe	**M1**	must see 19 and 7
	$3x=19-7$ or better leading to $x = 4$	**A1**	with no errors seen
9(c)(ii)		**2**	**B1** for 2 correct
9(c)(iii)	$\varnothing$ or { }	**1**	
9(c)(iv)	15	**1**	

Question	Answer	Marks	Partial Marks
10(a)	correctly equating one set of coefficients	**M1**	or making x or y the subject of one equation correctly
	correct method to eliminate one variable	**M1**	or substitution for x or y for *their* rearranged formula
	$x = 7$ $y = -3$	**A2**	**A1** for one correct value If A0 scored, **SC1** for 2 values satisfying one of the original equations or if no working shown, but 2 correct answers given
10(b)	2	**3**	**M1** for $y = \frac{k}{(x+3)^2}$ oe **M1** for $y = \frac{\textit{their } k}{(7+3)^2}$ oe OR **M2** for $8(2+3)^2 = y(7+3)^2$ oe
10(c)	$x > -5$ final answer	**3**	**M1** for $3x - 6 < 7x + 14$ **M1** for $\textit{their}(-6) - \textit{their}14 < 7x - 3x$ oe
11(a)(i)	77 243	**2**	**B1** for each
11(a)(ii)(a)	$2n^2 + 5$ oe	**2**	**M1** for a quadratic expression as the answer or **B1** for common 2nd difference of 4
11(a)(ii)(b)	3^{n-1} oe	**2**	**B1** for 3^k oe where k is a linear function of n
11(b)(i)	21	**1**	
11(b)(ii)	11	**3**	**B2** for $(4n + 45)(n - 11)$ seen or **B1** for $4n^2 + n + 3 = 498$ oe

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

MATHEMATICS **0580/41**

Paper 4 (Extended) **October/November 2018**

MARK SCHEME

Maximum Mark: 130

Published

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Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

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Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

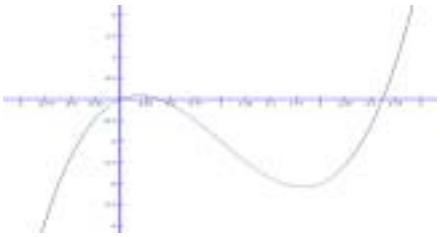
GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

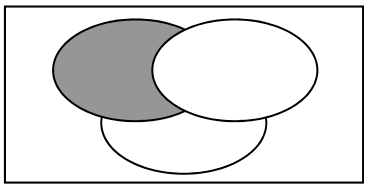
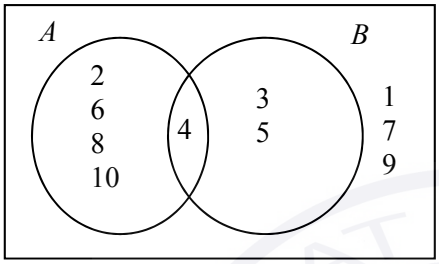
Abbreviations

cao correct answer only
dep dependent
FT follow through after error
isw ignore subsequent working
oe or equivalent
SC Special Case
nfww not from wrong working
soi seen or implied

Question	Answer	Marks	Partial Marks
1(a)(i)	2.25 final answer	**2**	**M1** for $\frac{3}{5+3}$ or $\frac{6}{5+3}$ oe
1(a)(ii)	37.5	**1**	**FT** *their* $\frac{\textbf{(a)(i)}}{6}\times 100$
1(a)(iii)	5.5[0] or 5.499 to 5.500	**2**	**M1** for $6 \div 1.091$
1(b)	21	**3**	**M2** for $15\times\sqrt{\frac{352.8}{15\times 12}}$ oe or **SC2** for answer 16.8 or **M1** for $\sqrt{\frac{352.8}{15\times 12}}$ or $\sqrt{\frac{15\times 12}{352.8}}$ seen or **M1** for a correct implicit statement for the length
1(c)	525	**3**	**M2** for $\frac{483}{100-8}[\times 100]$ oe or **M1** for 483 associated with 92 [%]
2(a)(i)	Translation $\begin{pmatrix}5\\8\end{pmatrix}$	**2**	**B1** for each Accept 5 right and 8 up
2(a)(ii)	Enlargement [sf] 0.5 oe [centre] (0, −7)	**3**	**B1** for each
2(a)(iii)	Rotation 90 [anticlockwise] oe Origin oe	**3**	**B1** for each
2(b)	Image at (−8, 1) (−8, 5) (−8, 7) (−4, 1)	**2**	**B1** for reflection of flag *A* in the line $x = -1$ or $y = k$ or for vertices of triangle in correct place but not joined

Question	Answer	Marks	Partial Marks
3(a)	0 –2 0.9	**3**	**B1** for each
3(b)	Correct curve 	**4**	**B3 FT** for 9 or 10 points or **B2 FT** for 7 or 8 points or **B1 FT** for 5 or 6 points
3(c)	−0.45 to –0.35 1 2.35 to 2.45	**3**	**FT** *their* graph **B1** for each in the correct position If zero scored, **SC1FT** for 3 correct values
3(d)(i)	$y = 1 - x$ oe	**2**	**B1** for $y = 1 - kx$ oe, $k \neq 0$ or $y = k - x$ oe or $1 - x$
3(d)(ii)	Correct ruled line and 2.25 to 2.4	**3**	**B2FTdep** for correct ruled line or **B1 dep** for line through (0, 1) when extended but not $y = 1$ or with gradient –1.1 to –0.9 or correct line but freehand or **SC2** for $y = x - 1$ ruled after answer $[y =] x - 1$ in **(d)(i)** **and** **B1** for 2.25 to 2.4
3(e)	Correct tangent and 1.7 to 3.7	**3**	No daylight between tangent and curve at $x = –0.25$. Point of contact is the midpoint between two vertices of daylight and this point of contact must be between –0.35 and –0.15 **B2** for close attempt at tangent at $x = –0.25$ and answer in range OR **B1** for ruled tangent at $x = –0.25$, no daylight Consider point of contact as midpoint between two vertices of daylight, the midpoint must be between $x = –0.35$ and –0.15 and **M1** dep on **B1** or close attempt at tangent at $x = –0.25$ for $\frac{rise}{run}$
4(a)	100.2 nfww	**4**	**M1** for midpoints soi 65, 80, 95, 105, 112.5, 120 **M1** for use of $\sum fx$ with x in correct interval including both boundaries **M1**dep for $\sum fx \div 180$ dep on previous **M1**
4(b)	0.8 2.8 0.65	**3**	**B1** for each If zero scored, **SC1** for 1.6, 5.6 and 1.3 seen

Question	Answer	Marks	Partial Marks
4(c)	8 34 69 136 164	**2**	**B1** for one error **FT** other values or for 3 or 4 correct
4(d)	Correct diagram	**3**	**B1FT** for correct vertical placement for 6 plots **B1** for correct horizontal placement for 6 plots **B1FT dep on at least B1** for reasonable increasing curve or polygon through *their* 6 points If zero scored, **SC1FT** for 5 out of 6 correct plots
4(e)(i)	15 to 17	**2**	**B1** for [LQ =] 93 to 94 or [UQ =] 109 to 110
4(e)(ii)	107 to 109	**2**	**B1** for 126 seen
4(e)(iii)	66 to 72	**2**	**FT** their graph for 2 marks **B1** for answer 106 to 114 or **B1FT** *their* graph reading at 106 cm seen
5(a)(i)	[h =] $253.8 \div 18 \div \left(\frac{6}{2}\right)$ or [h =] $\frac{253.8 \times 2}{6 \times 18}$ or [h =] $\frac{253.8}{18 \times \frac{6}{2}}$	**3**	For **M3** no errors at any stage **M2** for $253.8 = \frac{1}{2} \times 6 \times h \times 18$ oe (no previous errors) or **M1** for triangle area = $\frac{1}{2} \times 6 \times h$ soi
5(a)(ii)	38.1 or 38.06 to 38.08	**2**	**M1** for tan = $\frac{4.7}{6}$ oe
5(b)	358 or 357.9 to 358	**6**	**M1** for $6^2 + 4.7^2$ **M1** for $\sqrt{6^2 + 4.7^2} \times 18$ [× 2] **M1** for 6 × 18 [× 2] **M1** for 4.7 × 18 **M1** for $2 \times \frac{1}{2} \times 6 \times 4.7$ oe
6(a)(i)	14	**1**	
6(a)(ii)	16	**1**	
6(a)(iii)	$\frac{20}{462}$ oe	**3**	**M2** for $\frac{5}{22} \times \frac{4}{21}$ or **M1** for $\frac{5}{22}$ seen

Question	Answer	Marks	Partial Marks
6(a)(iv)	Correct shading 	**1**	
6(b)(i)	Fully correct Venn diagram 	**4**	**B1** for each correct region
6(b)(ii)	3 4 5	**1**	**FT** *their* **(b)(i)**
7(a)	42.2 or 42.23....	**2**	**M1** for $\frac{1}{2}\times 8.9\times 12.5\times \sin 130.6$ oe
7(b)(i)	27[.0] or 27.00 to 27.01	**3**	**M2** for $\frac{11.6\times \sin 123.5}{21.3}$ or **M1** for $\frac{11.6}{\sin BCD}=\frac{21.3}{\sin 123.5}$ oe
7(b)(ii)	15.9 or 15.90 to 15.91	**5**	**M1** for angle ABD = *their* angle BCD + 33.5 **and** **M2** for $11.6^2+18^2-2\times 11.6\times 18\times \cos(their ABD)$ or **M1** for implicit version **A1** for 252.9 to 253
8(a)	(5, 6)	**1**	
8(b)	$[y=]-\frac{4}{5}x+3$ nfww	**3**	**B2** for $[y=]-\frac{4}{5}x+c$ nfww or **M1** for $\frac{rise}{run}$ using any two of (–5, 7) (0, 3) and (5, –1) **and B1** for $[y=]mx+3$ $(m\neq 0)$

Question	Answer	Marks	Partial Marks
8(c)	$y = -\frac{4}{5}x - 2$ oe	**2**	**FT** *their* gradient from **8(b)** **B1** for y = (*their* gradient)x + c (c not 0) or for $y = mx - 2$ $(m \neq 0)$ or for $-\frac{4}{5}x - 2$ alone
8(d)(i)	$y = \frac{5}{4}x + 4$ oe	**3**	**M1** for $-\frac{1}{\textit{their}\ \text{gradient}}$ from **8(b)** **M1** for (8, 14) substituted into *their* $y = mx + c$ or $\frac{y-14}{x-8} = m$ or better
8(d)(ii)	8.54 or 8.544...	**3**	**M2** for $(14 - \textit{their}\,6)^2 + (8 - \textit{their}\,5)^2$ or better or **M1** for $14 - \textit{their}\,6$ and $8 - \textit{their}\,5$ seen
8(d)(iii)	(4, 6)	**2**	**B1** for each
9(a)(i)	$\frac{72}{m}$	**1**	
9(a)(ii)	$\frac{72}{m+0.9}$	**1**	
9 (b)	$\frac{72}{m} - \frac{72}{m+0.9} = 4$ oe	**M1**	**FT** *their* **(a)(i)** and **(a)(ii)** if expressions in m
	$72(m+0.9) - 72m = 4m(m+0.9)$ oe	**M1**	**Dependent** on **M1** and **correct** fractions
	$[72m - 72m] + 64.8 = 4m^2 + 3.6m$ oe nfww	**A1**	
	Correct completion to $10m^2 + 9m - 162 = 0$	**A1**	
9(c)(i)	3.6 and –4.5 final answer	**3**	**B2** for $(2m+9)(5m-18)$ or $\frac{-9 \pm \sqrt{(9)^2 - 4(10)(-162)}}{2 \times 10}$ or better or **B1** for $(am+b)(cm+d)$ where ac = 10 and either $bd = -162$ or $ad + bc = 9$ or for $\sqrt{(9)^2 - 4(10)(-162)}$ or better or $\frac{-9 \pm \sqrt{q}}{2(10)}$ or better
9(c)(ii)	20	**1**	

Question	Answer	Marks	Partial Marks
10(a)	132.26 to 132.28 or 132.3	**5**	**B1** for angle *ABO* or angle *CBO* = 90 soi **M1** for tan [*XOB*] $= \frac{15}{8}$ oe **M1** for tan [*BOY*] $= \frac{22.4}{8}$ oe **A1** for [*BOY* =]70.3… or [*XOB* =] 61.9….
10(b)	18.4 or 18.5 or 18.43 to 18.48	**2**	**M1** for $\frac{\textit{their (a)}}{360} \times 2 \times \pi \times 8$ oe
10(c)	75.7 to 75.9	**4**	**M1** for $\frac{1}{2}(15 + 22.4) \times 8$ oe **M2** for $\frac{\textit{their}(\mathbf{a})}{360} \times \pi \times 8^2$ oe or **M1** for one sector either $\frac{\textit{inv}\tan\left(\frac{15}{8}\right)}{360} \times \pi \times 8^2$ oe or $\frac{\textit{inv}\tan\left(\frac{22.4}{8}\right)}{360} \times \pi \times 8^2$ oe
11(a)	$5\left(m - 2p^2\right)\left(m + 2p^2\right)$ final answer	**3**	**M2** for $(5m + k)(m + j)$ where $kj = -20p^4$ or $5j + k = 0$ or **M1** for $5\left(m^2 - 4p^4\right)$ seen
11(b)	[*P* =] $\frac{100A}{100 + TR}$ final answer	**3**	**M1** for 100*A* = 100*P* + *PRT* or for *A* = *P*(1+ $\frac{RT}{100}$) **M1** for 100*A* = *P*(100 + *RT*) or for $\frac{A}{1 + \frac{RT}{100}} = P$ or for 100*A* = *P*(1 + *RT*) after 100*A* = *P* + *PRT* as first step

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

MATHEMATICS **0580/42**

Paper 4 (Extended) **October/November 2018**

MARK SCHEME

Maximum Mark: 130

Published

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Abbreviations

cao correct answer only
dep dependent
FT follow through after error
isw ignore subsequent working
oe or equivalent
SC Special Case
nfww not from wrong working
soi seen or implied

Question	Answer	Marks	Partial Marks
1(a)(i)	1200	**2**	**M1** for 1962 ÷ 1.635
1(a)(ii)	1667.7[0] final answer	**2**	**M1** for $1962 \times (1 - \frac{15}{100})$ oe or **B1** for 294.3[0] If 0 scored, **SC1** for answer 1020
1(a)(iii)	275	**2**	**M1** for 220 ÷ *their* (5 – 1) soi
1b(i)	165	**3**	**M2** for $\frac{9752-3680}{3680}[\times 100]$ oe or $\frac{9752}{3680}\times 100$ oe or **M1** for $\frac{9752}{3680}$ or 9752 – 3680
1b(ii)	51 200	**3**	**M2** for $\frac{74240}{100+45}[\times 100]$ oe or **M1** for 74 240 associated with 145[%] oe
2(a)	–1.5	**3**	**M1** for $30 + 2x = 9 - 12x$ or $10 + \frac{2}{3}x = 3 - 4x$ **M1** for collecting *their* terms correctly to reach $ax = b$
2(b)	$6ab^2(2b + 3a^2)$ final answer	**2**	**M1** for any correct partial factorisation seen or for correct answer seen
2(c)(i)	$10a^5c^9$ final answer	**2**	**B1** for final answer with $10a^kc^9$ or $10a^5c^k$ or ka^5c^9
2(c)(ii)	$\frac{8a^6}{c^9}$ or $8a^6c^{-9}$ final answer	**2**	**B1** for final answer with $\frac{8a^6}{c^k}$ or $\frac{8a^k}{c^9}$ or $\frac{ka^6}{c^9}$ $[k \neq 0]$ or for correct answer seen

Question	Answer	Marks	Partial Marks
2(d)	0.5 or $\frac{1}{2}$	**3**	**M1** for $y = \frac{k}{(x+2)^2}$ oe **B1** for $k = 50$ or **M2** for $2(3 + 2)^2 = y(8 + 2)^2$ oe
2(e)	$\frac{7x-x^2}{2(x-2)}$ or $\frac{7x-x^2}{2x-4}$ oe final answer	**3**	**M1** for $5 \times 2 - (x - 5)(x - 2)$ oe seen **M1** for common denominator $2(x - 2)$ oe isw
3(a)	Rotation $90^{[\circ]}$ clockwise oe Origin oe	**3**	**B1** for each
3(b)(i)	Image at (–4, –1) (–4, –4) (–2, –4)	**1**	
3(b)(ii)	Image at (3, –1) (5, –1) (3, –4)	**2**	**B1** for translation by $\begin{pmatrix}7\\k\end{pmatrix}$ or $\begin{pmatrix}k\\-5\end{pmatrix}$ or for 3 correct points not joined
3(b)(iii)	Image at (–2, ½) (–2, 2) (–1, 2)	**3**	**B2** for 3 correct co-ordinates soi in working or correct size and orientation in wrong position or **M1** for $\begin{pmatrix}0.5 & 0\\0 & 0.5\end{pmatrix}\begin{pmatrix}-4 & -4 & -2\\1 & 4 & 4\end{pmatrix}$ shown or for statement: enlargement, sf 0.5, (0, 0)
4(a)	$\frac{1}{2} \times 4(x - 1) \times (2x + 5)[\sin 90] = 30$ oe	**M1**	
	$8x^2 – 8x + 20x – 20$ or better	**B1**	correct expansion of brackets
	Completion to $2x^2 + 3x – 20 = 0$	**A1**	with no errors or omissions seen
4(b)	$(2x – 5)(x + 4)$	**M2**	Allow **M2** for e.g. $2x(x + 4) – 5(x + 4)$ then $2x – 5[= 0]$ and $x + 4[= 0]$ **M1** for $2x(x + 4) – 5(x + 4)$ or $x(2x – 5) + 4(2x – 5)$ or $(2x + a)(x + b)$ [= 0] where $ab = – 20$ or $a + 2b = 3$ [a, b integers]
	2.5 and –4 cao	**B1**	

Question	Answer	Marks	Partial Marks
4(c)	11.7 or 11.66 … or 11.67	**3**	**M2dep** for $(4(their 2.5-1))^2+(2\times their 2.5+5)^2$ or **M1dep** for $4(their 2.5-1)$ or $2\times their 2.5+5$ OR **B1** for $\sqrt{20x^2-12x+41}$ and **M1dep** for substituting x = *their* 2.5 into $\sqrt{20x^2-12x+41}$ at any stage
5(a)	–3, 17	**2**	**B1** for each
5(b)	Fully correct curve	**4**	**B3 FT** for 10 or 11 points or **B2 FT** for 8 or 9 points or **B1 FT** for 6 or 7 points
5(c)(i)	Correct ruled tangent for *their* curve through (0, −17)	**1**	
5(c)(ii)	(1.7 to 2.2, –1 to 2.5)	**1**	
5(c)(iii)	[y =] $9x$ – 17 final answer	**3**	**M2dep** for answer [y =] $9x$[+] – c OR **M1dep** for gradient = $\frac{rise}{run}$ for *their* tangent at any point **B1** for answer [y =] kx[+] – 17 ($k \neq 0$)
5(d)	$y = 3x + 2$ ruled correctly and –2.2 … to –2.1 –0.6 to –0.4 2.6 to 2.8	**4**	**B2** for $y = 3x + 2$ ruled or **B1** for [y =] $3x + 2$ soi or $y = 3x + k$ ruled or $y = kx + 2$ but not $y = 2$ **B2** for all 3 values or **B1** for 2 values
6(a)	0.6	**1**	
6(b)	50.7	**3**	**M2** for $1.2 \times 19 + \frac{1}{2}(19 + 12) \times 1.8$ oe or **M1** for method for finding any relevant area
6(c)	17.9	**3**	**M2** for *their* 50.7 – 1.2×19 [– 10] oe or **M1** for 1.2×19 oe seen isw
7(a)	29	**1**	
7(b)	128	**2**	**FT** 180 – 2 (55 – *their* **(a)**) **M1** for angle OCA or angle OAC = 55 – *their* **(a)** soi

Question	Answer	Marks	Partial Marks
7(c)	64	**1**	**FT** *their* **(b)** ÷ 2
7(d)	116	**1**	**FT** 180 – *their* **(c)**
8(a)	370 or 370.2 to 370.3	**2**	**M1** for 864 ÷ *their* time
8(b)	991 or 990.5 …	**4**	**M2** for $864^2 + 928^2 - 2 \times 864 \times 928\cos 67$ or **M1** for correct implicit version **A1** for 981100 to 981110
8(c)(i)	313	**2**	**M1** for 180 + 133 or 360 – 47
8(c)(ii)	[0]79.5 to [0]79.6 …	**4**	**M2** for $\frac{928\times\sin 67}{\textit{their}\ 991}$ or $\frac{864\times\sin 67}{\textit{their}\ 991}$ oe or **M1** for implicit form of either **A1** for [angle *HGB* =] 59.5 to 59.6 … or [angle *HBG* =] 53.4 or 53.37 to 53.42 **M1 dep** for *their* angle *HGB* + 20 leading to answer or for 133 – *their* angle *HBG* leading to answer
9(a)(i)	42.8 or 42.79 … nfww	**4**	**M1** for mid-values soi **M1** for Σ*fm* where *m* is any value in interval including boundaries **M1** (dep on second **M1**) for *their* Σ*fm* ÷ 120
9(a)(ii)	Blocks of height 1.8 4.4 8 2.1 with correct widths	**4**	**B1** for each correct block If **B0**, **SC1** for correct frequency densities seen
9(b)	Valid general comment about distributions	**1**	e.g. [On average], shoppers spend less time shopping on Wednesday oe
10(a)(i)	75 000 × 60 × 20 oe	**M1**	Allow × 1200 for × 60 × 20
10(a)(ii)	16.4 or 16.36 …	**3**	**M2** for $\frac{9\times10^7\times100}{1000\times55\times10^4}$ oe or **B2** for answer 0.164 or 0.1636 … or **B1** for answer figs 164 or 1636 … or **M1** for figs 9 ÷ figs 55
10(a)(iii)	28.3 or 28.27 to 28.28	**3**	**M2** for $\frac{76}{360} \times 2\pi \times 8.5 + 2 \times 8.5$ oe or **M1** for $\frac{76}{360} \times 2\pi \times 8.5$ oe

Question	Answer	Marks	Partial Marks
10(b)(i)	3770 or 3769 to 3770. …	**2**	**M1** for $\frac{1}{3}\times\pi\times10^2\times36$
10(b)(ii)	3.68 or 3.683 to 3.684 …	**4**	**M3** for $[r^3=]\ \frac{1}{2}\times$ *their* **(b)(i)** $\times\ \frac{3}{4\pi\times9}$ oe or **M2** for $\frac{4\pi r^3}{3}+\frac{4\pi(2r)^3}{3}=\frac{1}{2}\times$ *their* **(b)(i)** or for $\frac{4\pi r^3}{3}=\frac{1}{1+8}\times\frac{1}{2}\times$ *their* **(b)(i)** or **M1** for $\frac{4\pi r^3}{3}+\frac{4\pi(2r)^3}{3}$ or $\frac{1}{2}\times\frac{\pi\times10^2\times36}{3}$ or $\frac{1}{2}$ *their* **(b)(i)** seen or ratio of vols = $1:2^3$ oe seen
11(a)(i)	$\begin{pmatrix}-19\\-2\end{pmatrix}$	**2**	**B1** for answer $\begin{pmatrix}-19\\k\end{pmatrix}$ or $\begin{pmatrix}k\\-2\end{pmatrix}$ or for $\begin{pmatrix}-9\\6\end{pmatrix}$ or $\pm\begin{pmatrix}10\\8\end{pmatrix}$ seen
11(a)(ii)	3.61 or 3.605 to 3.606	**2**	**M1** for $\sqrt{([-]3)^2+2^2}$ oe
11(a)(iii)	$-3m+5n=14$ and $2m+4n=9$	**B1**	Accept equivalents
	$[m=]-\frac{1}{2}$ or -0.5 and $[n=]\ 2\frac{1}{2}$ or 2.5 or $\frac{5}{2}$ with evidence of a correct algebraic method	**4**	**M1** for correctly equating one set of coefficients of *their* equations or rearranges one of *their* equations to make *m* or *n* the subject e.g. $[m=]\ \frac{1}{2}(9-4n)$ oe **M1** for correct method to eliminate one variable for *their* equations or correctly substitutes *their m* or *their n* into the other equation e.g. $-\frac{3(9-4n)}{2}+5n=14$ oe **B1** for one correct answer
11(b)(i)(a)	$-\mathbf{a}+2\mathbf{c}$	**1**	
11(b)(i)(b)	$\frac{3}{8}(-\mathbf{a}+2\mathbf{c})$ or $-\frac{3}{8}\mathbf{a}+\frac{3}{4}\mathbf{c}$ oe	**1**	**FT** $\frac{3}{8}$ (*their* **(b)(i)(a)**) in simplest form

Question	Answer	Marks	Partial Marks
11(b)(i)(c)	$\frac{1}{2}(5\mathbf{a}-2\mathbf{c})$ or $\frac{5}{2}\mathbf{a}-\mathbf{c}$ oe	**1**	
11(b)(i)(d)	$\frac{1}{8}(5\mathbf{a}-2\mathbf{c})$ or $\frac{5}{8}\mathbf{a}-\frac{1}{4}\mathbf{c}$ oe	**2**	**M1** for a correct unsimplified route
11(b)(ii)	4	**1**	
12(a)(i)	$\frac{10}{20}\times\frac{9}{19}$ oe	**M2**	**B1** for $\frac{9}{19}$ oe seen
12(a)(ii)	$\frac{62}{95}$ oe	**4**	**M3** for $\frac{6}{20}\times\frac{14}{19}+\frac{10}{20}\times\frac{10}{19}+\frac{4}{20}\times\frac{16}{19}$ oe or $1-\frac{6}{20}\times\frac{5}{19}-\frac{10}{20}\times\frac{9}{19}-\frac{4}{20}\times\frac{3}{19}$ oe or **M2** for the sum of two products of different flavours isw or **M1** for one correct product of different flavours isw
12(b)	$\frac{5}{57}$ oe	**3**	**M2** for $N\times\left(\frac{4}{20}\times\frac{3}{19}\times\frac{16}{18}\right)+\frac{4}{20}\times\frac{3}{19}\times\frac{2}{18}$ oe or for $3\left(\frac{4}{20}\times\frac{3}{19}\times\frac{16}{18}\right)$ oe or $1-\{N\times\left(\frac{4}{20}\times\frac{16}{19}\times\frac{15}{18}\right)+\frac{16}{20}\times\frac{15}{19}\times\frac{14}{18}\}$ oe or **M1** for $\frac{4}{20}\times\frac{3}{19}\times\frac{k}{18}$ oe seen

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

MATHEMATICS **0580/41**

Paper 4 (Extended) **May/June 2018**

MARK SCHEME

Maximum Mark: 130

Published

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- the standard of response required by a candidate as exemplified by the standardisation scripts.

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GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)	$\frac{9}{9+7+4}\times 680$	**1**	
1(b)	238 136	**3**	**B2** for 238 or 136 or **M1** for $\frac{7}{9+7+4}\times 680$ oe or $\frac{4}{9+7+4}\times 680$ oe seen
1(c)	272	**2**	**M1** for $306 \div 1.125$
1(d)	1.37	**3**	**M2** for $(17.56-5\times 2.69)\div 3$ or **M1** for $17.56-5\times 2.69$ or **B1** for 13.45 [cost of apples]
1(e)	40.8[0]	**3**	**3FT** for $0.3\times$ *their* 136 from part **(b)** or **M2** for *their* $136(\frac{1}{2}+\frac{1}{5})$ or better or **M1** for *their* $136\times\frac{1}{2}$ or *their* $136\times\frac{1}{5}$ or **B1** for 68 or 27.2 or $\frac{3}{10}$ or 0.3 seen
2(a)(i)	9	**1**	
2(a)(ii)	*ABCD* completed accurately with arcs	**2**	**M1** for intersecting arcs radius *their* 9 cm or for *ABCD* completed accurately with no arcs
2(b)	Correct ruled perpendicular bisector of *AB* with 2 correct pairs of arcs Correct ruled bisector of angle *ABC* with 2 correct pairs of arcs Lines intersecting	**4**	**B2** for correct ruled perpendicular bisector of *AB* with 2 correct pairs of arcs or **B1** for correct perpendicular bisector without/wrong arcs and **B2** for correct ruled bisector of angle *ABC* with 2 correct pairs of arcs or **B1** for correct bisector of angle *ABC* without/wrong arcs If lines do not intersect, max **B3**

Question	Answer	Marks	Partial Marks
3(a)	6.06 or 6.060 to 6.061	**3**	**M2** for $\frac{82500-77500}{82500}[\times 100]$ oe or **M1** for $\frac{77500}{82500}[\times 100]$ soi
3(b)	13 674 cao	**3**	**M1** for $12000\left(1+\frac{2.2}{100}\right)^6$ **A1** for 13673.7...
4(a)(i)	Translation $\begin{pmatrix}-8\\2\end{pmatrix}$ oe	**2**	**B1** for each
4(a)(ii)	Enlargement [sf =] $\frac{1}{2}$ oe $(-4, 0)$	**3**	**B1** for each
4(a)(iii)	Rotation 90° clockwise oe $(1, -1)$	**3**	**B1** for each
4(b)	Triangle with (1, –1), (5, –1), (1,7)	**2**	**B1** for correct size and orientation in wrong position or for 3 correct points not joined
5(a)(i)	$(2n+m)(m-3)$ final answer	**2**	**M1** for $m(2n+m)-3(2n+m)$ or $2n(m-3)+m(m-3)$
5(a)(ii)	$(2y-9)(2y+9)$ final answer	**1**	
5(a)(iii)	$(t-4)(t-2)$ final answer	**2**	**B1** for $(t-4)(t-2)$ seen and spoiled or **M1** for $t(t-2)-4(t-2)$ or $t(t-4)-2(t-4)$ or $(t+a)(t+b)$ where $a+b=-6$ or $ab=+8$
5(b)	$[x=]\frac{2m}{k+1}$	**4**	**M1** for $xk=2m-x$ or $k=\frac{2m}{x}-1$ **M1** for $xk+x=2m$ or $k+1=\frac{2m}{x}$ **M1** for $x(k+1)=2m$

Question	Answer	Marks	Partial Marks
5(c)	correctly eliminating one variable	**M1**	
	[x =] 6	**A1**	
	[y =] –2	**A1**	If 0 scored **SC1** for 2 values satisfying one of the original equations or **SC1** if no working shown, but 2 correct answers given
5(d)(i)	$3m-4(m+4)=6m(m+4)$	**M1**	or $\frac{3m-4(m+4)}{m(m+4)}[=6]$ oe
	$3m-4m-16=6m^2+24m$	**M1**	removes brackets correctly
	$6m^2+25m+16=0$	**A1**	with no errors or omissions
5(d)(ii)	$\frac{-25\pm\sqrt{(25)^2-4(6)(16)}}{2\times6}$ or $\frac{-25}{12}\pm\sqrt{\left(\frac{25}{12}\right)^2-\frac{16}{6}}$	**2**	**B1** for $\sqrt{(25)^2-4(6)(16)}$ or better or **B1** for $\left(m+\frac{25}{12}\right)^2$ and if in form $\frac{p+\sqrt{q}}{r}$ or $\frac{p-\sqrt{q}}{r}$ **B1** for p = –25 and r = 2(6)
	–0.79 and –3.38 final ans cao	**2**	**B1** for each **SC1** for –0.8 and –3.4 or for –0.78 and –3.37 or –0.789... and –3.377... or 0.79 and 3.38 or –0.79 and –3.38 seen in working
6(a)	4.79 or 4.788 to 4.789	**3**	**M2** for $\sqrt[3]{\frac{230\times3}{2\times\pi}}$ oe or **M1** for $230=\frac{2}{3}\times\pi\times r^3$ oe If 0 scored **SC1** for answer 3.8[0…]
6(b)(i)	8.7[0] or 8.702 to 8.704	**3**	**M2** for $(300-230)\div(1.6^2\pi)$ or **M1** for $\pi\times1.6^2\times h$
6(b)(ii)	6.4	**3**	**M2** for $1.6\times\sqrt[3]{\frac{19200}{300}}$ oe or **M1** for sf $\sqrt[3]{\frac{19200}{300}}$ or $\sqrt[3]{\frac{300}{19200}}$ oe or for $\left(\frac{1.6}{r}\right)^3=\frac{300}{19200}$

Question	Answer	Marks	Partial Marks
7(a)	$x = 0$	**1**	
7(b)	Tangent ruled at $x = 0.5$	**B1**	No daylight between tangent and curve at point of contact
	–9 to –6.5	**2**	**dep** on ruled tangent or close attempt at tangent at $x = 0.5$ **M1** for rise/run also dep on tangent or close attempt at tangent at $x = 0.5$
7(c)(i)	0 2.4 or better 4	**3**	**B1** for each
7(c)(ii)	Correct smooth curve	**4**	**B3FT** for 6 or 7 correct plots or **B2 FT** for 4 or 5 correct plots or **B1 FT** for 2 or 3 correct plots **FT** *their* table
7(d)	$x^3 + 3x + 4 = 10 - 8x^2$ and correctly completed	**1**	
7(e)	line $y = -2x + 2$ drawn and –0.45 to –0.35 nfww	**3**	**B2** for ruled $y = -2x + 2$ or **B1** for $-2x + 2$ seen or for line $y = -2x + c$ drawn or for $y = cx + 2$ ($c \neq 0$) drawn and **B1** for –0.45 to – 0.35 nfww
8(a)	18	**3**	**B2** for 20 nfww or **M1** for $8x + x = 180$ or better
8(b)	32	**3**	**B1** for angle $DBC = 58$ **B1** for angle $BCD = 90$
8(c)(i)	24	**2**	**B1** for angle $PRQ = 24$
8(c)(ii)	29.4 or 29.40 to 29.41	**3**	**M2** for $\frac{360 - 48}{360} \times 2 \times \pi \times 5.4$ or **B2** for answer (minor arc) 4.52 or 4.523 to 4.524… or **M1** for $\frac{48}{360} \times 2 \times \pi \times 5.4$
9(a)	$\frac{5}{8}$ $\frac{3}{8}$ $\frac{1}{6}$ $\frac{5}{6}$ $\frac{7}{10}$ $\frac{3}{10}$	**3**	**B1** for each pair

Question	Answer	Marks	Partial Marks
9(b)	$\frac{5}{48}$ oe	**2**	**M1FT** for *their* $\frac{5}{8} \times$ *their* $\frac{1}{6}$
9(c)	$\frac{304}{480}$ oe	**3**	**M2** for *their* $\frac{5}{8} \times$ *their* $\frac{5}{6}$ + *their* $\frac{3}{8} \times$ *their* $\frac{3}{10}$ oe or **M1** for *their* $\frac{5}{8} \times$ *their* $\frac{5}{6}$ or *their* $\frac{3}{8} \times$ *their* $\frac{3}{10}$
10(a)	75	**3**	**M2** for 79.5 ÷ 1.06 oe or **M1** for 79.5 associated with 106 [%]
10(b)	962.5 cao	**2**	**B1** for 35 or 27.5 seen
10(c)(i)	16	**1**	
10(c)(ii)	50	**1**	
10(c)(iii)	$\frac{4}{50}$ oe	**2**	**FT** *their* **(c)(ii)** for 1 or 2 marks **B1** for $\frac{4}{k}$, $k > 4$ or $\frac{k}{their 50}$, $k < 50$
10(c)(iv)	19	**1**	
11(a)(i)	12.6 or 12.64 to 12.65	**3**	**M2** for $12^2 + (-4)^2$ OR **B1** for $\begin{pmatrix}12\\-4\end{pmatrix}$ **M1** for $(their 12)^2 + (their - 4)^2$
11(a)(ii)	$\begin{pmatrix}-11\\13\end{pmatrix}$	**2**	**B1** for $\begin{pmatrix}-11\\k\end{pmatrix}$ or $\begin{pmatrix}k\\13\end{pmatrix}$ or for $[\overrightarrow{BA} =]\begin{pmatrix}-8\\7\end{pmatrix}$
11(b)	$\frac{1}{2}$**(b − a)** oe	**2**	**M1** for correct route or correct unsimplified answer or **B1** for $\overrightarrow{QS}$ = **b** – **a** oe
11(c)(i)	$\begin{pmatrix}9 & 50\\10 & 69\end{pmatrix}$	**2**	**B1** for 2 correct elements
11(c)(ii)	$\frac{1}{11}\begin{pmatrix}8 & -5\\-1 & 2\end{pmatrix}$ oe isw	**2**	**B1** for $k\begin{pmatrix}8 & -5\\-1 & 2\end{pmatrix}$ or $\frac{1}{11}\begin{pmatrix}a & b\\c & d\end{pmatrix}$ or det = 11 soi

Question	Answer	Marks	Partial Marks
12(a)	18 28	**2**	**B1** for each
12(b)	$3n + 3$ oe	**2**	**B1** for $3n + k$ oe or $cn + 3$ oe $c \neq 0$
12(c)	45	**2**	**M1** for identifying 7th pattern or **M1** for *their* $(3n + 3) = 24$
12(d)	$[a =]\frac{3}{2}$ oe $[b =]\frac{13}{3}$ oe	**6**	**M1** for any correct substitution e.g. $\frac{1}{6}(2)^3 + 2^2a + 2b$ **A1** for one of e.g. $\frac{1}{6} + a + b = 6$ oe $\frac{8}{6} + 4a + 2b = 16$ oe $\frac{27}{6} + 9a + 3b = 31$ oe $\frac{64}{6} + 16a + 4b = 52$ oe **A1** for another of the above **M1** for correctly eliminating one variable from *their* equations **A1** for $a = \frac{3}{2}$ **A1** for $b = \frac{13}{3}$ oe

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MATHEMATICS **0580/42**

Paper 4 (Extended) **May/June 2018**

MARK SCHEME

Maximum Mark: 130

Published

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oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)(i)	85	**1**	
1(a)(ii)	455	**2**	**M1** for 260 ÷ 20 × 35 oe
1(a)(iii)	61	**3**	**B2** for 61.5… seen or **M1** for 2000 ÷ 650 soi or for $\frac{x}{2000}=\frac{20}{650}$ oe or other attempt at scaling up with 650 or for 650 ÷ 20 oe
1(b)(i)	40	**3**	**M2** for $\frac{1.89-1.35}{1.35}$ [× 100] oe or $\frac{1.89}{1.35}\times 100$ oe or **M1** for oe $\frac{1.89}{1.35}$[×100] soi
1(b)(ii)	1.75 nfww	**3**	**M2** for $1.89 \div \left(\frac{100+8}{100}\right)$ or better or **M1** for 1.89 associated with 108 [%]
1(c)	10.1 or 10.06…	**3**	**M2** for $\sqrt[3]{\frac{20.8}{15.6}}$ oe or **M1** for $15.6\times k^3 = 20.8$ oe
1(d)(i)	14:15	**3**	**B2** for correct unsimplified 3 term ratio A: B: C or correct unsimplified two term ratio A : C or **M1** for attempt to find common multiple of 4 and 10 or other common value for B or for 7 × $\frac{4}{10}$ oe or 3 × $\frac{10}{4}$ oe

Question	Answer	Marks	Partial Marks
1(d)(ii)	147	**3**	**M2** for $\frac{45}{15}(14+20\,[+15])$ oe or $45 \div 3 \times 4 + (45 \div 3 \times 4) \div 10 \times 7\,[+45]$ or **M1** for $45 \div 3$ oe or $45 \div$ *their* **(d)(i)** value for C shown
2(a)(i)	$20\,[< t \leqslant]\,25$	**1**	
2(a)(ii)	$25\,[< t \leqslant]\,30$	**1**	
2(a)(iii)	28.3 or 28.33..	**4**	**M1** for 22.5, 27.5, 32.5, 37.5, 42.5 soi **M1** for $\sum fx$ where x is in the correct interval including boundaries **M1**dep for $\sum fx \div 120$ or $\sum fx \div (44 + 32 + 28 + 12 + 4)$
2(a)(iv)	$\frac{4}{120}$ oe isw	**1**	
2(b)(i)	76, 104, 116, 120	**2**	**B1** for one error FT other values or for 3 correct
2(b)(ii)	Correct curve	**3**	**B1** for correct horizontal placement for 6 plots **B1FT** for correct vertical placement for 6 plots **B1FT dep on at least B1** for reasonable increasing curve or polygon through *their* 6 points If 0 scored **SC1FT** for 5 out of 6 points correctly plotted
2(b)(iii)	27 to 27.5	**1**	
2(b)(iv)	8.5 to 9.5	**2**	**B1** for [UQ=] 32 to 32.5 or [LQ=] 23 to 23.5
2(b)(v)	8, 9, 10, 11 or 12	**2**	**B1** for 108 to 112 seen or **B1FT** *their* graph reading at 37 mins seen
3(a)(i)	Image at (3, – 3), (7, – 3), (7, – 5)	**2**	**B1** for reflection in any $x = k$ or if 3 correct points not joined
3(a)(ii)	Image at (– 5, 1), (– 1, 1), (– 5, – 1)	**2**	**B1** for translation by $\begin{pmatrix}-2\\k\end{pmatrix}$ or $\begin{pmatrix}k\\4\end{pmatrix}$ or if 3 correct points not joined

Question	Answer	Marks	Partial Marks
3(a)(iii)	Image at (6, 3), (6, 4), (4, 3)	**3**	**B2** for correct size and orientation but wrong position or if 3 correct points not joined **B1** for enlargement SF ½ with centre (3, 1)
3(b)	Rotation 90° [anticlockwise]oe (– 6, – 2)	**3**	**B1** for each
3(c)	Reflection $y = -x$ oe	**2**	**B1** for each
4(a)(i)	$243p^{10}$ final answer	**2**	**B1** for answer $243p^{k}$ or kp^{10} $(k \neq 0)$
4(a)(ii)	$9xy^{4}$ final answer	**2**	**B1** for answer with two correct elements in correct form of expression
4(a)(iii)	$\frac{m^2}{25}$ final answer	**1**	
4(b)	10	**4**	**B2** for $x = 8$ or for [length of rectangle =] 31 or **M1** for $5x - 9 = 3x + 7$ oe or better **M1** for $\frac{310}{(3 \times their x + 7)}$ or $\frac{310}{(5 \times their x - 9)}$ <u>Alt method using simultaneous eqns</u> **M1** for $5xw - 9w = 310$ **and** $3xw + 7w = 310$ **M1** for equating coefficients of xw **M1** for subtraction to eliminate term in xw
5(a)	$8^2 + 7^2 - 2 \times 7 \times 8 \times \cos 78$ oe	**M2**	**M1** for correct implicit version
	9.471.. to 9.472	**A2**	**A1** for 89.7…
5(b)	46.3 or 46.29 to 46.30…	**3**	**M2** for $[\sin OAC =] \frac{7 \sin 78}{9.47}$ or **M1** for $\frac{\sin OAC}{7} = \frac{\sin 78}{9.47}$

Question	Answer	Marks	Partial Marks
5(c)	29.5 – (7 + 8 + 9.47)	**M1**	
	$\frac{360\times(29.5-(7+8+9.47))}{2\times\pi\times7}$	**M3**	**M2** for $\frac{x}{360}\times2\times\pi\times7$ = *their* arc length oe or **M1** for $\frac{x}{360}\times2\times\pi\times7$ oe
	41.15 to 41.171..	**B1**	
5(d)	45[.0] or 44.98 to 45.01 nfww	**4**	**M3** for ½ × 8 × 7 × sin 78 oe + $\frac{41.2}{360}\times\pi\times7^2$ oe OR **M1** for ½ × 8 × 7 × sin 78 oe or ½ × 8 × 9.47 × sin *their* **(b)** oe **M1** for $\frac{41.2}{360}\times\pi\times7^2$ oe
6(a)	– 2[.0], – 0.2, 2.5	**3**	**B1** for each
6(b)	Fully correct curve	**5**	**B4** for correct curve, but branches joined or **B3FT** for 9 or 10 correct plots or **B2FT** for 7 or 8 correct plots or **B1FT** for 5 or 6 correct plots and **B1 indep** two separate branches not touching or cutting *y*-axis
6(c)(i)	Correct tangent and 3 ⩽ grad ⩽ 5	**3**	**B2** for close attempt at tangent to curve at $x = -2$ **and** answer in range OR **B1** for ruled tangent at $x = -2$, no daylight at $x = -2$ and **M1dep** (dep on **B1** or close attempt at tangent) [at $x = -2$] for $\frac{rise}{run}$
6(c)(ii)	[y =] *their* **(c)(i)** x + *their* y-intercept final answer	**2**	**Strict FT** *their* y-intercept for *their* line **M1** for y = *their* **(c)(i)** x + *any value* or 'c' oe seen or for y = *any value*(non-zero) x or 'mx' + *their* y-intercept seen oe
6(d)(i)	1.05 to 1.25	**1**	
6(d)(ii)	– 2.3 to – 2.2 – 0.4 to – 0.3 0.3 to 0.4	**3**	**B1** for each After 0 scored **B1** for $y = -4$ ruled

Question	Answer	Marks	Partial Marks
6(e)	[a =] 2 [b =] 24 [n =] 5	**3**	**B2** for 2 correct or for $2x^5 + 24x^2$ [–3 = 0] or **B1** for 1 correct or for $\frac{2x^5 - 3 + 4(6x^2)}{6x^2}$ [= 0] oe If 0 scored **SC1** for $2x^5$ seen in final line of algebra
7(a)	$x^2 + (2x – 3)^2 = 6^2$ oe or $x^2 + 4x^2 – 6x – 6x + 9 = 36$	**M1**	
	$4x^2 – 6x – 6x + 9$ or better	**B1**	
	$5x^2 – 12x – 27 = 0$	**A1**	Dep on **M1B1** with no errors or omissions
7(b)	$\frac{-(-12) \pm \sqrt{(-12)^2 - 4(5)(-27)}}{2 \times 5}$ or better or $\frac{12}{10} \pm \sqrt{\left(\frac{12}{10}\right)^2 + \frac{27}{5}}$	**B2**	**B1** for $\sqrt{(-12)^2 - 4(5)(-27)}$ or for $\left(x - \frac{12}{10}\right)^2$ oe or $\frac{-(-12) + \sqrt{q}}{2 \times 5}$ oe or $\frac{-(-12) - \sqrt{q}}{2 \times 5}$ oe or both
	– 1.42, 3.82 final answers	**B2**	**B1** for each If **B0**, **SC1** for answers – 1.4 or –1.415… to – 1.415 **and** 3.8 or 3.815 to 3.815… or answers –1.41 and 3.81 or – 1.42 **and** 3.82 seen in working or for –3.82 and 1.42 as final ans
7(c)	14.4 or 14.5 or 14.44 to 14.46	**2**	**2FT** for 3 × *their* positive root + 3 evaluated to 3sf or better **M1** for 3 × *their* positive root + 3 oe
7(d)	39.5 or 39.46 to 39.54…	**2**	**M1** for trig statement seen to find either angle sin = $\frac{\textit{their } x}{6}$ oe or sin = $\frac{\textit{their}(2x-3)}{6}$ oe
8(a)(i)	1	**2**	**M1** for h(0) or for 2^{8-3x}
8(a)(ii)	8	**2**	**M1** for g(¼) or for $\frac{10}{2^x + 1}$

Question	Answer	Marks	Partial Marks
8(a)(iii)	$\frac{10-x}{x}$ or $\frac{10}{x}-1$ final answer	**3**	**M2** for $x = \frac{10-y}{y}$ or better or $xy = 10 - x$ or better or $y + 1 = \frac{10}{x}$ or **M1** for $x(y + 1) = 10$ or $y(x + 1) = 10$ or $x = \frac{10}{y+1}$ or $x + 1 = \frac{10}{y}$
8(a)(iv)	5	**1**	
8(b)	$\frac{-3x^2+5x+18}{x+1}$ final answer	**3**	**M1** for $\frac{(8-3x)(x+1)+10}{x+1}$ **B1** for $-3x^2 - 3x + 8x + 8$ [+10]
9(a)(i)(a)	62 and Isosceles [triangle] and Angle at centre is twice angle at circumference oe	**3**	**B2** for 62 and one correct reason or **B1** for 62 with no/wrong reason or for angle *EOD* = 124 soi or for no/wrong angle with correct reason
9(a)(i)(b)	62 and [Angles in] same segment oe or angle at centre is twice angle at circumference oe	**2**	**2FT** *their* **(a)(i)(a)** and correct reason **B1FT** for *their* **(a)(i)(a)** with no/wrong reason or for no/wrong angle with correct reason
9(a)(ii)	8	**3**	**M2** for (180 –109) – 28 – 35 oe or **M1** for [angle *AED* =] 180 – 109 oe
9(b)(i)	24	**3**	x = ext angle **B2** for [x =] 15 isw or **M1** for $x + 11x = 180$ oe or for $\frac{180(n-2)}{[n]} = \frac{360}{[n]} \times 11$
9(b)(ii)	3960	**2**	**FT** (*their* 24 – 2) × 180 dep on **(b)(i)** an integer and > 6 **M1** for (*their* 24 – 2) × 180 oe or *their* 24 × 11 × *their* 15 oe or 11 × 360

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

MATHEMATICS **0580/43**

Paper 4 (Extended) **May/June 2018**

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the May/June 2018 series for most Cambridge IGCSE™, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Abbreviations
cao correct answer only
dep dependent
FT follow through after error
isw ignore subsequent working
oe or equivalent
SC Special Case
nfww not from wrong working
soi seen or implied

Question	Answer	Marks	Partial Marks
1(a)(i)	13.5	**3**	**M2** for $\frac{45.4[0]-40}{40}$ [$\times 100$] or $\frac{45.4[0]}{40} \times 100$ or **M1** for $\frac{45.4[0]}{40}$ [$\times 100$]
1(a)(ii)	35.5[0]	**3**	**M2** for $42.6[0] \div \left(1+\frac{20}{100}\right)$ or better or **M1** for recognising 42.6[0] as 120[%]
1(b)	150 cao	**2**	**M1** for $\frac{500\times 2\times 15}{100}$ oe
1(c)(i)	7800 cao	**3**	**B2** for 7790 or 7785 to 7786 or **M1** for $21000\times\left(1-\frac{18}{100}\right)^5$ oe isw If 0 or 1 scored, **SC1** for *their* 7785… seen and rounded correctly to nearest 100
1(c)(ii)	9[.00…]	**3**	**M2** for $\sqrt[12]{\frac{42190}{15000}}$ or better or **M1** for $15000\left(1+\frac{x}{100}\right)^{12}=[42190]$
2(a)(i)	1, ….., ….., …., 16	**2**	**B1** for each
2(a)(ii)	14, ….., ….., …., – 2	**2**	**B1** for each
2(b)	Fully correct smooth curves	**6**	**B3** for correct curve of $y=2^x$ or **B2FT** for 4 or 5 correct points or **B1FT** for 2 or 3 correct points **B3** for correct curve of $y=14-x^2$ or **B2FT** for 4 or 5 correct points or **B1FT** for 2 or 3 correct points
2(c)(i)	3.5 to 3.7	**1**	
2(c)(ii)	2.65 to 2.8	**1**	

Question	Answer	Marks	Partial Marks
2(d)(i)	Correct line	**1**	Ruled, through (4, 2) and gradient −4
2(d)(ii)	Tangent (2, 10)	**2**	**B1** for each
3(a)(i)	Positive	**1**	Ignore strong, weak, etc.
3(a)(ii)	Correct ruled line	**1**	
3(a)(iii)	2	**1**	
3(b)	[mode =] 0 [median =] 1 [mean =] 1.04 or 1.041 to 1.042	**5**	**B1** **B1** **B3** or **M2** for ([10 × 0] + 8 × 1 + 3 × 2 + 2 × 3 + [0 × 4] + 1 × 5) ÷ 24 oe or **M1** for [10 × 0] + 8 × 1 + 3 × 2 + 2 × 3 + [0 × 4] + 1 × 5 oe
3(c)(i)	60.9 or 60.91... nfww	**4**	**M1** for 49, 57, 71 correct **M1** for use of Σfx with x in the correct interval including both boundaries **M1** (dep on 2nd **M1**) for *their* (78 × 49 + 180 × 57 + 162 × 71) ÷ (78 + 180 + 162)
3(c)(ii)	Correct histogram	**4**	**B1** for correct widths in correct position **B1** height 13 **B1** height 18 **B1** height 9 If 0 scored **B1** for 13, 18 and 9 seen
4(a)(i)	$\frac{8}{20}$ oe	**3**	**M2** for $\frac{2}{5}\times\frac{1}{4}+\frac{3}{5}\times\frac{2}{4}$ or **M1** for one of these products OR **M1** for probability tree identifying all 20 outcomes with the correct 8 identified OR **M1** for completed possibility space / 2-way table identifying the 8 possible outcomes out of 20, oe **SC1** for $\frac{13}{25}$ with replacement

Question	Answer	Marks	Partial Marks
4(a)(ii)	$\frac{9}{25}$ oe	**3**	**M2** for $\frac{2}{5}\times\frac{3}{5}+\frac{3}{5}\times\frac{1}{5}$ oe or **M1** for one of these products OR **M1** for probability tree identifying all 25 outcomes with the correct 9 identified OR **M1** for completed possibility space / 2-way table identifying the 9 possible outcomes out of 25, oe
4(a)(iii)	Jojo and e.g. $\frac{40}{100}>\frac{36}{100}$	**1**	**1FT** *their* **(i)** and **(ii)** dep on being in range 0 to 1
4(b)	$\frac{24}{60}$ oe	**3**	**M2** for $\frac{2}{5}\times\frac{3}{4}\times\frac{1}{3}+\frac{3}{5}\times\frac{2}{4}\times\frac{1}{3}+\frac{3}{5}\times\frac{2}{4}\times\frac{2}{3}$ oe or **M1** for any one correct product OR **M1** for 4, 5, 4 and 5, 4, 4 and 5, 5, 4 clearly identified on a tree or in a list
5(a)	15.6[0]	**4**	**B3** for $20\,900x = 326\,040$ or better or **M2** for $18\,500x + 2400(x - 2.5[0]) = 320\,040$ or **M1** for $18\,500x$ or $2400(x - 2.5[0])$
5(b)(i)	$(y+12)(y-7)$ final answer	**2**	**B1** for $(y+a)(y+b)$ where $ab = -84$ or $a+b=5$ or $y(y+12)-7(y+12)$ or $y(y-7)+12(y-7)$
5(b)(ii)	38 cao	**3**	**B2** for $y = 7$ or **M1** for $y(y+5) = 84$ oe
5(c)(i)	$168(m-0.75)+207m = 100m(m-0.75)$ oe OR $207 = 100m - 168 - 75 + \frac{126}{m}$	**M2**	May be all over common denominator **M1** for $\frac{168}{m}$ or $\frac{207}{m-0.75}$ used
	at least one interim line leading to $50m^2 - 225m + 63 = 0$	**A1**	No errors or omissions

Question	Answer	Marks	Partial Marks
5(c)(ii)	$(10m-3)(5m-21)$ OR $m=\frac{-(-225)\pm\sqrt{(-225)^2-4(50)(63)}}{2(50)}$ oe OR $m=\frac{225}{100}\pm\sqrt{\left(\frac{225}{100}\right)^2-\frac{63}{50}}$ oe	**B2**	**M1** for $(10m+a)(5m+b)$ where $ab=63$ or $5a+10b=-225$ or $10m(5m-21)-3(5m-21)$ or $5m(10m-3)-21(10m-3)$ OR **M1** for $\sqrt{(-225)^2-4(50)(63)}$ or for $p=-(-225)$, $r=2(50)$ if in form $\frac{p+\sqrt{q}}{r}$ or $\frac{p-\sqrt{q}}{r}$ OR **M1** for $\left(m-\frac{225}{100}\right)^2$ oe
	4.2[0] cao	**B1**	
6(a)(i)	116.6 or 116.56 to 116.57	**4**	**M1** for $\sin[EAD]=\frac{6}{12}$ oe **M1** for $\tan[BAC]=\frac{6}{12}$ oe **B1** for [angle DAC] = 60
6(a)(ii)	13.4 or 13.41 to 13.42	**2**	**M1** for 12^2+6^2
6(a)(iii)	10.4 or 10.39…	**3**	**M2** for $\sqrt{12^2-6^2}$ or **M1** for $AE^2+6^2=12^2$
6(a)(iv)	130 or 129.5… to 129.6	**4**	**M1** for $0.5\times6\times theirAE$ oe **M1** for $0.5\times12\times12\times\sin60$ oe **M1** for $0.5\times6\times12$ oe
6(b)(i)	3	**1**	
6(b)(ii)	51.3 or 51.30 to 51.34…	**4**	**M3** for tan = $\frac{8}{\sqrt{4^2+5^2}}$ or sin = $\frac{8}{\sqrt{4^2+5^2+8^2}}$ oe or **M2** for $\sqrt{4^2+5^2}$ or $\sqrt{4^2+5^2+8^2}$ or **M1** for angle ARB clearly indicated
7(a)	204 or 203.5 to 203.6… nfww	**4**	**M2** for $\pi\times1.5^2\times8\times60\times60$ or **M1** for $\pi\times1.5^2$ **M1** for dividing *their* volume by 1000 If 0 scored **SC1** for an answer figs 204 or figs 2035 to 2036 without working
7(b)(i)	$\pi\times6\times12+\pi\times6^2=108\pi$	**M2**	**M1** for $\pi\times6\times12$

Question	Answer	Marks	Partial Marks
7(b)(ii)	[x =] 5.2[0] or 5.196… [y =] 6	**4**	**B2** or **M1** for $4\pi x^2 = 108\pi$ seen **B2** or **M1** for $\frac{1}{2}(4\pi y^2) + \pi y^2$ or better seen
8(a)(i)	× ✓ ✓ × × ✓	**4**	**B3** for 5 correct **B2** for 4 correct **B1** for 3 correct
8(a)(ii)	$\begin{pmatrix}5\\3\end{pmatrix}$	**1**	Fraction line and/or missing brackets scores 0
8(a)(iii)	$\begin{pmatrix}4 & 8\\1 & 2\end{pmatrix}$	**2**	**B1** for 2 or 3 correct elements (dep on 2 × 2 matrix)
8(a)(iv)	$\frac{1}{2}\begin{pmatrix}3 & -1\\-4 & 2\end{pmatrix}$ oe isw	**2**	**B1** for $k\begin{pmatrix}3 & -1\\-4 & 2\end{pmatrix}$ or determinant = 2 soi
8(b)	Rotation Origin oe 90 [anticlockwise] oe	**3**	**B1** for each
9(a)	$y = -2x + 5$ oe	**3**	**B2** for $-2x + 5$ or **M1** for gradient = $-1 \div \frac{1}{2}$ or better **M1** for substituting (1, 3) into $y =$ (*their m*)$x + c$ oe If 0 scored **SC1** for (1, 3) satisfying their wrong equation ($c \neq 0$) with gradient $\neq \frac{1}{2}$
9(b)(i)	$x \geqslant 2$ oe $y \leqslant 5$ oe $y \geqslant \frac{1}{2}x$ oe	**4**	**SC3** for $x > 2$ and $y < 5$ and $y > \frac{1}{2}x$ OR **B1** for $x \geqslant 2$ **B1** for $y \leqslant 5$ **B2** for $y \geqslant \frac{1}{2}x$ or **M1** for $y \geqslant kx$ ($k > 0$) OR **SC2** for all three boundary lines identified but with incorrect sign(s) If 0 scored **SC1** for one or two correct boundary lines with incorrect sign(s)

Question	Answer	Marks	Partial Marks
9(b)(ii)	(5, 4)	**2**	**M1** for one trial of an integer point inside region or for $3x + 5y = 35$ drawn
10(a)(i)	26	**2**	**M1** for g(5) or for $\left(x^2 + 1\right)^2 + 1$
10(a)(ii)	$x^2 + 4x + 5$	**2**	**M1** for $\left(x + 2\right)^2 + 1$
10(a)(iii)	5	**2**	**M1** for $2x - 3 = 7$
10(a)(iv)	$\frac{x+3}{2}$ oe	**2**	**M1** for $x = 2y - 3$ or $y + 3 = 2x$ or $\frac{y}{2} = x - \frac{3}{2}$ oe
10(b)(i)	[0].70 cao	**2**	**B1** for [0].696 to [0].697
10(b)(ii)	4 cao	**1**	

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

MATHEMATICS **0580/42**

Paper 42 (Extended) **March 2018**

MARK SCHEME

Maximum Mark: 130

Published

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- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

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- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

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GENERIC MARKING PRINCIPLE 6:

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Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)(i)	23.27 final answer	**2**	**M1** for 9×2.97 soi
1(a)(ii)	2.75 final answer	**3**	**M2** for $2.97 \div \frac{108}{100}$ oe or **M1** for 108[%] associated with 2.97 oe
1(b)	12.4[0] or 12.41 to 12.42	**2**	**M1** for $35 \div 0.0153$ oe If 0 scored, **SC1** for answer 0.19
1(c)	70 nfww	**3**	**M2** for $(600 + 2.5) \div (9 - 0.5)$ or **B1** for one of $600 + 2.5$ or $9 - 0.5$ seen
2(a)	128	**2**	**M1** for $4 \times \frac{1}{2} \times 8 \times 8$ oe
2(b)(i)	18.3 or 18.26 to 18.29…	**3**	**M2** for $\frac{1}{4}(\pi \times 8^2 - \textit{their}\,128)$ oe or **M1** for $\pi \times 8^2 - \textit{their}\,128$ oe or for $\frac{1}{4} \times \pi \times 8^2$ oe OR **SC2dep** for answer 4.56 to 4.57...
2(b)(ii)	23.9 or 23.87 to 23.882	**4**	**M3** for $\frac{90}{360} \times 2 \times \pi \times 8 + \sqrt{8^2 + 8^2}$ oe OR **M1** for $\frac{90}{360} \times 2 \times \pi \times 8$ oe **M1** for $\sqrt{128}$ oe OR **SC3dep** for answer 11.9 or 11.93 to 11.94…
3(a)	0 –0.17 2.4	**3**	**B1** for each
3(b)	Fully correct smooth curve	**4**	**B3FT** for 9 or 10 correct points or **B2FT** for 7 or 8 correct points or **B1FT** for 5 or 6 correct points
3(c)	$x \leqslant 0.17$ to 0.25 and $x \geqslant 2.25$ to 2.3	**3**	**B2** for strict inequalities or one correct or **B1** for 0.17 to 0.25 and 2.25 to 2.3 seen

Question	Answer	Marks	Partial Marks
3(d)(i)	$y = 4 - x$ oe final answer	**2**	**B1** for $4 - x$ or $y = k - x$ or $y = 4 + kx$ oe
3(d)(ii)	correct ruled line	**1**	**FT** if in form $y = mx + c$ oe ($m, c \neq 0$)
	0.125 to 0.2 and 2.15 to 2.2	**2**	**B1** for each
4(a)	$[\pm]\sqrt{k-s}$ final answer	**2**	**M1** for $t^2 = k - s$
4(b)(i)	$(x-5)(x+5)$ final answer	**1**	
4(b)(ii)	$\frac{x-5}{x-7}$ nfww final answer	**3**	**M2** for $(x-7)(x+5)$ or **M1** for $x(x+5) - 7(x+5)$ or $x(x-7) + 5(x-7)$ or $(x + a)(x + b)$ where $a + b = -2$ or $ab = -35$
4(c)	$\frac{4x^2 - 7x - 8}{x(x+1)}$ or $\frac{4x^2 - 7x - 8}{x^2 + x}$ final answer	**3**	**M1** for $(x-8)(x+1) + 3x \times x$ oe isw **B1** for common denominator $x(x+1)$ oe isw
4(d)	3, 4, 5, 6 nfww	**3**	**B2** for 3 correct or 4 correct and 1 extra or **M2** for $n > \frac{18}{8}$ oe and $n \leqslant 6$ or **M1** for $18 < 8n$ [$\leqslant 30 + 3n$] or [$18 - 3n <$] $5n \leqslant 30$ seen
5(a)(i)	1930 or 1940 or 1933.4 to 1935.3	**5**	**B1** for interior angle 120 soi or angle at centre 60 soi or for correct use of Pythagoras' with 7 and 3.5 or with 14 and 7 **M3** for $6 \times \frac{1}{2} \times 7^2 \times \sin 60 \times 15.2$ oe or complete other methods or **M2** for $6 \times \frac{1}{2} \times 7^2 \times \sin 60$ oe OR **M1** for $\frac{1}{2} \times 7^2 \times \sin 60$ oe or other partial area of hexagon **M1dep** for *their* area × 15.2 evaluated

Question	Answer	Marks	Partial Marks
5(a)(ii)	893 or 892.8 to 893.0…	**3**	**M2** for $6 \times 7 \times 15.2 + 2 \times 6 \times \frac{1}{2} \times 7^2 \times \sin 60$ oe or for $6 \times 7 \times 15.2 + 2 \times$ *their* area of hexagon from **(a)** oe or **M1** for [6 ×] 7 × 15.2 oe or 2 × *their* area of hexagon from **(a)** oe
5(b)	2.71 or 2.709 to 2.710	**3**	**M2** for $\sqrt[3]{500 \div \left(6 \times \frac{4}{3}\pi\right)}$ oe or **M1** for $500 = 6 \times \frac{4}{3}\pi r^3$ oe If 0 scored, **SC1** for answer 4.92 or 4.923 to 4.924
6(a)	$y > x$	**1**	
	$x \geqslant 15$	**1**	
	$y < 50$	**1**	
	$x + y \leqslant 70$	**1**	
6(b)	Four correct ruled lines and correct region indicated	**5**	all lines ruled **B1** for $y = x$ broken **B1** for $x = 15$ **B1** for $y = 50$ broken **B1** for $x + y = 70$
6(c)	189	**2**	**M1** for (21, 49) seen or for $2x + 3y$ written for a point (x, y) in *their* region where x and y are integers
7(a)(i)	$\frac{9}{160}$ oe	**1**	
7(a)(ii)	58.125 nfww	**4**	**M1** for mid-points soi **M1** for use of Σfx with x in correct interval including both boundaries **M1** (dep on 2nd M1) for $\Sigma fx \div 160$
7(b)	[3 42] 85 140 151 160	**2**	**B1** for 1 error **FT** other values

Question	Answer	Marks	Partial Marks
7(c)	correct curve	**3**	**B1FT** *their* **(b)** for 6 correct heights **B1** for 6 points at upper ends of intervals on correct vertical line **B1FT dep on at least B1** for increasing curve through *their* 6 points After 0 scored, **SC1** for *their* 5 correct points plotted
7(d)(i)	57 to 59	**1**	
7(d)(ii)	36 to 42	**2**	**B1** for UQ = 76 to 80 or LQ = 38 to 40 soi
7(d)(iii)	92 to 94	**2**	**B1** for 144 seen
7(d)(iv)	130 to 137	**2**	**B1** for 23 to 30 seen
8(a)	356 or 356.2 to 356.3	**4**	**B1** for [Angle *LPM*] = 74 soi **M2** for $\frac{248 \times \sin \textit{their } 74}{\sin 42}$ oe or **M1** for implicit statement
8(b)(i)	320 or 319.9 to 320.2...	**3**	**B1** for angle *PLM* = 64 soi or for angle between *LM* and perpendicular from *M* = 26 soi or [*PM* =] 333.[1…] **M1** for *their* 356 × sin *their* 64 oe or *their* 356 × cos *their* 26 oe
8(b)(ii)	02 57 or 2 57 am	**3**	**B2** for 6 hours 12 mins or 372 mins seen or **M1** for 248 ÷ 40 oe If 0 scored, **SC1** for *their* time in hours converted to hours and minutes
9(a)	7.07 or 7.071...	**2**	**M1** for $(-1)^2 + 7^2$ oe
9(b)	–6	**2**	**M1** for $6 \times m - 5 \times 2m$ [= 24]
9(c)(i)	(10) final answer	**2**	**B1** for answer 10 without brackets
9(c)(ii)	$\begin{pmatrix} 2 \\ 6 \end{pmatrix}$ final answer	**2**	**M1** for $\begin{pmatrix} 2 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ 6 \end{pmatrix}$
9(c)(iii)	$\begin{pmatrix} 19 & 55 \\ 33 & 96 \end{pmatrix}$ final answer	**2**	**M1** for 2 or 3 correct elements
9(c)(iv)	$\frac{1}{3}\begin{pmatrix} 9 & -5 \\ -3 & 2 \end{pmatrix}$ oe isw	**2**	**B1** for $k\begin{pmatrix} 9 & -5 \\ -3 & 2 \end{pmatrix}$ soi or det = 3 soi

Question	Answer	Marks	Partial Marks
10(a)	10.8 or 10.81 to 10.82	**3**	**M2** for $\sqrt{(6--3)^2+(-2-4)^2}$ oe or **M1** for $(6--3)^2+(-2-4)^2$ oe
10(b)(i)	(6, 4)	**2**	**B1** for each
10(b)(ii)	2	**2**	**M1** for $\frac{12-(-4)}{10-2}$ oe
10(b)(iii)	$y=-\frac{1}{2}x+4$ oe final answer	**3**	**M1** for gradient = $-\frac{1}{2}$ or $-\frac{1}{\textit{their}}$ **(b)(ii)** **M1** for (2, 3) substituted into *their* $y=mx+c$ or $y-y_1=m(x-x_1)$ oe
11(a)	25 9 16	**3**	**B1** for each
11(b)(i)	$(n-1)^2$ oe	**2**	**B1** for any quadratic of form [1]n^2[+bn+c]
11(b)(ii)	$n+3$ oe	**1**	
11(c)	25	**2**	**M1** for *their* $(n-1)^2 = 576$
11(d)(i)	n^2-3n-2 final answer	**3**	**M1** for *their*$(n-1)^2$ − *their*$(n+3)$ oe or 2nd diff = 2 soi **B1** for $n^2-n-n+1$ or better or $-n-3$ or for expression of form $n^2 - 2n - n + k$ or correct expression not in simplest form
11(d)(ii)	808 cao	**2**	**M1** for substituting 30 in *their* **(d)(i)**

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

MATHEMATICS **0580/42**

Paper 4 (Extended) **October/November 2017**

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2017 series for most Cambridge IGCSE®, Cambridge International A and AS Level components and some Cambridge O Level components.

Abbreviations

cao correct answer only
dep dependent
FT follow through after error
isw ignore subsequent working
oe or equivalent
SC Special Case
nfww not from wrong working
soi seen or implied

Question	Answer	Marks	Partial marks
1(a)(i)	4 : 5	**1**	
1(a)(ii)	4 : 5	**1**	
1(a)(iii)	3 : 4	**2**	**B1** for 12 : 16 or answer 4 : 3
1(b)(i)	26.8 or 26.79…	**3**	**M2** for $\frac{15600-11420}{15600}[\times 100]$ or $\frac{11420}{15600}\times 100$ or **M1** for $\frac{11420}{15600}$
1(b)(ii)	16 000 nfww	**3**	**M2** for $15600\times\frac{100}{100-2.5}$ oe or **M1** for 15600 associated with 97.5[%] seen
1(c)	1.6 or $\frac{8}{5}$	**2**	**M1** for $\frac{200\times x\times 15}{100}=48$ oe or **M1** for figs 16
1(d)	2.5 or $\frac{5}{2}$ cao nfww	**3**	**B2** for 2.49[9…] or 102.4[99…] or 1.024[99…] or 2.50 or 102.5 or 1.025 or **M2** for $\sqrt[10]{\frac{256}{200}}$ oe or **M1** for $256=200(x)^{10}$ seen

Question	Answer	Marks	Partial marks
2(a)(i)	1070 or 1072. ..	**3**	**M1** for $\pi \times 8^2 \times 2 \times 8$ **M1** for $\frac{4}{3} \times \pi \times 8^3$ or **M2** for $\frac{2}{3}\pi r^3$ or **M1** for $\pi r^2 2r - \frac{4}{3}\pi r^3$
2(a)(ii)	2.58 or 2.580 to 2.581	**3**	**B2** for $r^3 = \frac{36 \times 3}{2\pi}$ or better or **M1** for $\pi \times r^2 \times 2 \times r - \frac{4}{3} \times \pi \times r^3 = 36$ oe
2(b)(i)	4.24 or 4.241 to 4.242	**4**	**M3** for $(\pi \times 5^2 + \pi \times 5 \times \sqrt{5^2 + 12^2})$ or **M2** for $\pi \times 5 \times \sqrt{5^2 + 12^2}$ or **M1** for $5^2 + 12^2$ or $\pi \times 5^2$
2(b)(ii)	64 cao final answer	**3**	**M2** for $\frac{[k\pi] \times 5^2 \times 12}{[k\pi] \times 1.25^2 \times 3}$ or **M1** for $\frac{1}{3} \times \pi \times 5^2 \times 12$ or $\frac{1}{3} \times \pi \times 1.25^2 \times 3$ OR **M2** for 4^3 or $\left(\frac{1}{4}\right)^3$ seen or **M1** for factor 4 or $\frac{1}{4}$ soi
3(a)	7040 or 7035. …	**3**	**M1** for $\frac{1}{2} \times 100 \times 70$ oe **M1** for $\frac{1}{2} \times 100 \times 110 \times \sin 40$ oe
3(b)	374 or 375 or 374.4 to 374.5….	**5**	**M2** for $110^2 + 100^2 - 2 \times 110 \times 100 \times \cos 40$ oe or **M1** for implicit form **A1** for 5250 or 5247. … (or 72.4 or 72.43 to 72.44) **M1** for $70^2 + 100^2$
3(c)	64.3 or 64.27 to 64.28 nfww	**2**	**M1** for $\sin 40 = \frac{\text{distance}}{100}$ oe
3(d)	235	**3**	**B2** for [angle ACB =] 34.99 to 35 or [angle ABC =] 55[.0…] or **M1** for $\tan[ACB] = \frac{70}{100}$ or $\tan[ABC] = \frac{100}{70}$ or equivalent trig ratio

Question	Answer	Marks	Partial marks
4(a)(i)	Correct translation	**2**	**B1** for translation $\begin{pmatrix}6\\k\end{pmatrix}$ or $\begin{pmatrix}k\\-2\end{pmatrix}$
4(a)(ii)	Correct rotation	**2**	**B1** for rotation 180° but other centre
4(a)(iii)	Correct reflection	**2**	**B1** for reflection in $y = -x$
4(b)(i)	Enlargement [factor] $\frac{1}{2}$ or 0.5 [centre] (0, 0) oe	**3**	**B1** for each
4(b)(ii)	$\begin{pmatrix}\frac{1}{2} & 0\\0 & \frac{1}{2}\end{pmatrix}$ oe	**2**	**B1** for matrix of form $\begin{pmatrix}k & 0\\0 & k\end{pmatrix}$ oe, $k \neq 0$ or 1
4(c)	± 2.5	**3**	**B2** for $25u^2 = 156.25$ or $5u = [\pm]12.5$ or **M1** for $(4u)^2 + (3u)^2$
5(a)	3.2 or 3.15 or 3.152 to 3.153 5.2 or 5.19 or 5.20 or 5.196…	**2**	**B1** for each
5(b)	Correct graph for $0.5 \leqslant x \leqslant 3.5$	**4**	**B3FT** for 6 or 7 correct points or **B2FT** for 4 or 5 correct points or **B1FT** for 2 or 3 correct points
5(c)	1.7 to 1.8	**1FT**	**FT** *their* graph if one answer
5(d)(i)	Any integer $k \geqslant -1$	**1**	
5(d)(ii)	Any integer $k < -1$	**1**	
5(e)	Tangent ruled at $x = -3$	**B1**	
	2.5 to 4	**B2**	**dep** on tangent drawn at $x = -3$ or close attempt at tangent at $x = -3$ **M1** for rise/run also dep on tangent at $x = -3$ or close attempt at tangent at $x = -3$

Question	Answer	Marks	Partial marks
5(f)(i)	$y = 6 - x$ ruled accurately	**M2**	**M1** for correct line but freehand or ruled line gradient –1.1 to –0.9, or through (0, 6) but not $y = 6$
	$2.85 \leqslant x \leqslant 3$	**A1**	
5(f)(ii)	[a =] 8 [b =] –48 [c =] –16	**4**	**B3** for 2 correct or $x^5 + 8x^3 - 48x^2 - 16 = 0$ seen or $-x^5 - 8x^3 + 48x^2 + 16 = 0$ seen or **M2** for correct multiplication by $8x^2$ or **B1** for answers ± 8, ± 48, ± 16 or **M1** for $\frac{x^2 \times x^3 - 8 \times 2}{x^2 \times 8} = 6 - x$ or **M1** for correct multiplication by 8 or **M1** for correct multiplication by x^2
6(a)(i)	280	**1**	
6(a)(ii)	320	**1**	
6(a)(iii)	90	**1**	
6(a)(iv)	10	**2**	**M1** for 90 written
6(b)(i)	250.2 nfww cao	**4**	**M1** for at least 4 correct mid-values **M1** for Σfx **M1 dep on second M1** for $\Sigma fx \div 100$
6(b)(ii)	Correct completion of histogram	**4**	**B1** for each correct block If zero scored, then **SC1** for correct frequency densities seen
6(c)	[22 m] further oe	**1**	
7(a)	$\frac{5}{6}$	**1**	
7(b)	$\frac{4}{36}$ oe	**2**	**M1** for $\frac{2}{6} \times \frac{2}{6}$
7(c)	20	**1**	

Question	Answer	Marks	Partial marks
7(d)(i)	Diagram completed correctly x x 3 3 3 9 x x 2 2 2 6 x x 2 2 2 6 x x 2 2 2 6 x x 1 1 1 3	**2**	**B1** for 3 correct columns or for 4 correct rows
7(d)(ii)(a)	$\frac{9}{36}$ oe	**1FT**	**FT** *their* **(d)(i)**
7(d)(ii)(b)	$\frac{4}{36}$ oe	**1FT**	**FT** *their* **(d)(i)**
7(e)	$\frac{512}{7776}$ oe	**2**	**M1** for $\left(\frac{4}{6}\right)^k \times \frac{2}{6}$ oe $k = 3$, 4 or 5 only
8(a)(i)	$7a + 9p = 354$ oe final answer	**1**	
8(a)(ii)	$[a =]$ 21 $[p =]$ 23	**3**	**M1** for correctly eliminating one variable **A1** for $a = 21$ **A1** for $p = 23$
8(b)(i)	$\frac{2}{x}$	**1**	
8(b)(ii)(a)	$\frac{2}{x} + \frac{3}{x-1} = 2$	**M1**	
	$2(x-1) + 3x = 2x(x-1)$ oe	**M1dep**	Both sides of the equation could be over $x(x-1)$ at this stage Dep on **M1** or 3 term equation with fractions but one sign error
	$2x - 2 + 3x = 2x^2 - 2x$ oe $2x^2 - 7x + 2 = 0$	**A1**	Answer reached with one correctly expanded line seen and no errors seen
8(b)(ii)(b)	$\sqrt{(-7)^2 - 4(2)(2)}$	**B1**	or for $\left(x - \frac{7}{4}\right)^2$
	$\frac{--7 + \sqrt{q}}{2 \times 2}$ or $\frac{--7 - \sqrt{q}}{2 \times 2}$	**B1**	or for $\frac{7}{4} + \text{or} - \sqrt{-1 + \left(\frac{7}{4}\right)^2}$
	3.19 only	**B2**	**B1** for 3.19 with other root or for 3.2 or 3.186… isw other root or for 0.31 or 0.314 or 0.3138 to 0.3139

Question	Answer	Marks	Partial marks
9(a)	3	**1**	
9(b)	$-\frac{2}{5}$ oe	**2**	**M1** for $2(1-2x)=x+4$
9(c)	$-2x-7$ final answer	**2**	**M1** for $1-2(x+4)$
9(d)	26	**2**	**B1** for h(5) soi or **M1** for $\left(x^2+1\right)^2+1$
9(e)	$\frac{1-x}{2}$ oe final answer	**2**	**M1** for $x=1-2y$ or $2x=1-y$ or $\frac{y}{2}=\frac{1}{2}-x$ or $y-1=-2x$
9(f)	$[p=]-20$ $[q=]\ 26$	**4**	**B3** for [hgf(x)] = $4x^2-20x+26$ seen and not spoilt by further working or **M1** for $(1-2x)+4$ **M1 dep** for $\left(their\ (5-2x)\right)^2+1$ **B1FT dep** for $25-10x-10x+4x^2$
10(a)	5.68 or 5.684 to 5.685	**5**	**M2** for $2x\sqrt{x^2+x^2}$ oe or $2\times\sqrt{2}\times x^2$ or **M1** for $x\sqrt{2}$ or $\sqrt{x^2+x^2}$ oe soi **M1** for $\frac{270}{360}\times\pi\times x^2$ oe **M1** for $0.5\ x^2$ oe
10(b)	4.4[0] or 4.398 to 4.401	**2**	**dep** on a correct value for k in **(a)** **M1** for $\left[x^2\right]=\frac{110}{their\ k}$

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

MATHEMATICS **0580/43**

Paper 4 (Extended) **October/November 2017**

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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Abbreviations

cao correct answer only
dep dependent
FT follow through after error
isw ignore subsequent working
oe or equivalent
SC Special Case
nfww not from wrong working
soi seen or implied

Question	Answer	Marks	Partial Marks
1(a)(i)	180 ÷ (2 + 3 + 5) × 5 [= 90]	**1**	with no errors seen
1(a)(ii)	7.05 or 7.053….	**3**	**M2** for $\frac{x}{12} = \sin 36$ oe or better or **B1** for 36 or 54 seen
1(b)(i)	13	**2**	**M1** for 7.8 ÷ 3 soi
1(b)(ii)	36.9 or 36.86 to 36.87	**3**	**B1** for smallest angle identified **M1** for sin[ ] = $\frac{3}{5}$ oe or sin[ ] = $\frac{7.8}{\textit{their}\ \textbf{(b)(i)}}$ oe If zero scored, **SC1** for calculation of 53.1
2(a)	343	**1**	
2(b)(i)	1	**1**	
2(b)(ii)	x^{10} final answer	**1**	
2(b)(iii)	$9x^{16}$ final answer	**2**	**B1** for x^{12} or x^{16} or $(3x^8)^2$ seen
2(c)(i)	$2(x – 3)(x + 3)$ final answer	**2**	**M1** for $(2x + 6)(x – 3)$ or $(2x – 6)(x + 3)$ or $(x – 3)(x + 3)$
2(c)(ii)	$\frac{2(x+3)}{x+10}$ or $\frac{2x+6}{x+10}$ final answer nfww	**3**	**M2** for $(x + 10)(x – 3)$ or **M1** for $(x + a)(x + b)$ where $ab = –30$ or $a + b = 7$

Question	Answer	Marks	Partial Marks
3(a)(i)	1890	**2**	**M1** for 126 ÷ 4 [× 60] oe If zero scored, **SC1** for answer 31.5
3(a)(ii)	103.95	**4**	**M3** for $0.5 \times \left(\frac{44}{60} + \frac{55}{60}\right) \times 126$ oe or **SC3** for figs 10395 or figs 104 or **M2** for two correct area methods or for a full method without minutes to hours conversion or **M1** for one correct area with or without minutes to hours conversion
3(b)(i)	126 × 1000 ÷ (60 × 60)	**1**	
3(b)(ii)	46.3 or 46.28 to 46.29	**3**	**M2** for (1400 + 220) ÷ 35 oe or **M1** for distance ÷ speed or 1400 + 220
3(c)	180 nfww	**4**	**B3** for final answer 3 OR **M3** for $\frac{217.5}{72.5} \times 60$ oe or **M2** for 217.5 ÷ 72.5 oe or $\frac{210 \text{ to } 220}{72.5} \times 60$ or $\frac{217.5}{72 \text{ to } 74} \times 60$ or **M1** for 217.5 or 72.5 seen or $\frac{215}{73} \times 60$
4(a)	$80 < t \leqslant 100$	**1**	
4(b)	86 nfww	**4**	**M1** for midpoints soi **M1** for use of Σfx with x in correct interval including both boundaries **M1** (dep on 2nd **M1**) for $\Sigma fx \div 150$
4(c)(i)	Reference to not knowing the individual values so we do not know the highest or the lowest values	**1**	
4(c)(ii)	62.4	**2**	**M1** for 26 ÷ 150 or 360 ÷ 150 soi
4(d)	$\frac{22}{150}$ oe	**1**	

Question	Answer	Marks	Partial Marks
4(e)(i)	$\frac{90}{22350}$ oe	**2**	**M1** for $\frac{10}{150}\times\frac{9}{149}$ After zero scored, **SC1** for answer $\frac{100}{22500}$ oe
4(e)(ii)	$\frac{440}{22350}$ oe	**3**	**M2** for $\frac{10}{150}\times\frac{22}{149}+\frac{22}{150}\times\frac{10}{149}$ oe or **M1** for $\frac{10}{150}\times\frac{22}{149}$ or $\frac{22}{150}\times\frac{10}{149}$ oe After zero scored, **SC1** for answer $\frac{440}{22500}$ oe
4(f)	13, 8.5, 7.25, 1.1	**3**	**B2** for 3 correct or **B1** for 1 correct or for 3 correct FD.s 5.2, 3.4, 2.9, 0.44 oe
5(a)(i)	Image at (0, 1), (0, 2), (–3, 1)	**2**	**B1** for reflection in $y = 0$ or $x = k$
5(a)(ii)	Image at (0, 0), (0, –2), (6, –2)	**2**	**B1** for correct size and correct orientation wrong position or for 2 correct vertices plotted
5(a)(iii)	Image at (–5, 4), (–5, 5), (–2, 4)	**2**	**B1** for translation by $\begin{pmatrix}-5\\k\end{pmatrix}$ or $\begin{pmatrix}k\\3\end{pmatrix}$
5(b)	Rotation 90° clockwise oe (4, –1)	**3**	**B1** for each
5(c)(i)	(4, 1)	**2**	**M1** for $\begin{pmatrix}0&-1\\1&0\end{pmatrix}\begin{pmatrix}1\\-4\end{pmatrix}$
5(c)(ii)	(8, –1)	**2**	**M1** for $\begin{pmatrix}0&-1\\1&0\end{pmatrix}\begin{pmatrix}3&1\\0&2\end{pmatrix}\begin{pmatrix}1\\-4\end{pmatrix}$ or $\begin{pmatrix}0&-2\\3&1\end{pmatrix}\begin{pmatrix}1\\-4\end{pmatrix}$ or $\begin{pmatrix}0&-1\\1&0\end{pmatrix}\begin{pmatrix}-1\\-8\end{pmatrix}$
5(c)(iii)	Rotation 90° anti-clockwise oe Origin oe	**3**	**B1** for each

Question	Answer	Marks	Partial Marks
6(a)(i)	25.5 or 25.46…	**2**	**M1** for $\pi \times 5^2 \times h = 2000$ oe
6(a)(ii)	9.85 or 9.847…	**3**	**M2** for $[r^3=]\ 2000 \div \left(\frac{2}{3}\pi\right)$ oe or **M1** for $\frac{2}{3}\pi r^3 = 2000$ oe
6(a)(iii)	952 or 952.4….	**3**	**M2** for $[6 \times]\ \sqrt[3]{2000}^2$ or **M1** for $\sqrt[3]{2000}$ or 6 times *their* area of one face
6(b)(i)	22.5 or 22.49…	**2**	**M1** for $\frac{1}{2} \times 7 \times 10 \times \sin 40$
6(b)(ii)	$\sqrt{(10^2 + 7^2 - 2 \times 10 \times 7 \cos 40)} + 7 + 10$	**M3**	**M2** for $10^2 + 7^2 - 2 \times 10 \times 7 \cos 40$ or **M1** for correct implicit cosine rule
	23.46…	**A2**	**A1** for 6.46… or 41.7 to 41.8
6(c)	64.9 or 64.92 to 64.94	**3**	**M2** for $28.2 - 2 \times 9 = \frac{c}{360} \times 2 \times \pi \times 9$ oe or **M1** for $\frac{c}{360} \times 2 \times \pi \times 9$ soi
7(a)	9, – 6, 9	**3**	**B1** for each
7(b)	Correct graph	**4**	**B3FT** for 6 or 7 correct points or **B2FT** for 4 or 5 correct points or **B1FT** for 2 or 3 correct points
7(c)	–3.5 to –3.35 and 0.8 to 0.9..	**2FT**	**FT** *their* graph **B1FT** for either
7(d)	$a = \frac{5}{4}$ or $1\frac{1}{4}$ or 1.25 $b = -\frac{49}{8}$ or $-6\frac{1}{8}$ or –6.125	**3**	**B2** for either correct or **M1** for $[2]\left(x + \frac{5}{4}\right)^2$ seen isw or for $2x^2 + 4ax + 2a^2 + b$
8(a)(i)	5	**1**	
8(a)(ii)	$-\frac{3}{2}$ oe	**1**	
8(b)	$\left(\frac{4}{5},\ 0\right)$ oe	**2**	**M1** for $5x - 4 = 0$ soi

Question	Answer	Marks	Partial Marks
8(c)	$y = –0.2x + 11$ final answer	**4**	**M2** for $y = –0.2x + c$ oe (any form) **FT** *their* **(a)** or **B1FT** for grad = $\frac{-1}{\textit{their}\ \textbf{(a)(i)}}$ soi and **M1** for substitution of (10, 9) into *their* equation
8(d)	(2, 6)	**3**	**M1** for elimination of one variable **A1** for $x = 2$ or $y = 6$
8(e)	13	**3**	**M2** for $(4 + 9) \times$ *their* $2 \div 2$ oe or **B1** for 9 oe or 4 or –4 seen
9(a)	$\frac{10}{x-0.5}$ oe final answer	**1**	Accept $\frac{20}{2x-1}$
9(b)(i)	$\frac{10}{x-0.5} - \frac{10}{x} = 0.25$ oe	**M1**	**FT** *their* **(a)**
	$10x – 10(x – 0.5) = 0.25x\ (x – 0.5)$ oe	**M1**	Clears algebraic denominators or collects as a single fraction FT *their* algebraic fractions dep on two fractions with algebraic denominators
	$10x – 10x + 5 = 0.25x^2 – 0.125x$ or better	**B1**	Expands brackets
	$2x^2 – x – 40 = 0$	**A1**	Dep on **M1M1B1** and no errors seen
9(b)(ii)	$\frac{--1 \pm \sqrt{(-1)^2 - 4 \times 2 \times -40}}{2 \times 2}$ oe	**B2**	**B1** for $\sqrt{(-1)^2 - 4(2)(-40)}$ or better or **B1** for $\frac{--1+\sqrt{q}}{2\times 2}$ or $\frac{--1-\sqrt{q}}{2\times 2}$ or both
	–4.23 and 4.73 final answers	**B1 B1**	**SC1** for –4.229… **and** 4.729… or for –4.23 **and** 4.73 seen in working or for –4.73 **and** 4.23 as final answer or for –4.2 or –4.22 **and** 4.7 or 4.72 as final answer
9(b)(iii)	2 [hours] 7 [minutes]	**3**	**B2** for 2.11 or 2.114 to 2.115 or 126.8 to 126.9 or 127 or **M1** for $10 \div$ *their* positive root from **(b)(ii)**
10(a)(i)	$2^2 \times 3^2 \times 5$ oe	**2**	**M1** for 3 correct prime factors in a tree or table seen before the first error or for 2, 3, 5 identified
10(a)(ii)	540	**2**	**M1** for $2^2 \times 3^3 \times 5$ or 2×3^3 shown or answer $540k$

Question	Answer	Marks	Partial Marks
10(b)	$X = 8575$ $Y = 6125$	**4**	**B3** for $X = 8575$ or $Y = 6125$ or **B2** for $a = 5$ or $b = 1$ soi or **B1** for $1225 = 5^2 \times 7^2$ or $42\,875 = 5^3 \times 7^3$ or **M1** for $a^2 \times 7^2$ [= 1225] or $a^3 \times 7^{b+2}$ [= 42 875]

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

MATHEMATICS **0580/41**

Paper 4 (Extended) **May/June 2017**

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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Cambridge is publishing the mark schemes for the May/June 2017 series for most Cambridge IGCSE®, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

Question	Answer	Marks	Part marks
1(a)(i)	275.31	**2**	**M1** for $90 \times 23.15 + 1885 \times 13.5$ oe
1(a)(ii)	3202	**3**	**M2** for $\frac{198.16 - 90 \times 0.245}{0.055}$ oe **M1** for 90×0.245 or 90×24.5 oe
1(b)	17.[0] or 17.00 to 17.01	**2**	**M1** for $13.5 \times \left(1 + \frac{8}{100}\right)^3$
1(c)(i)	40	**3**	**M2** for $\frac{7.7 - 5.5}{5.5}$ [$\times 100$] oe or $\frac{7.7}{5.5} \times 100$ or **M1** for $\frac{7.7}{5.5}$ oe
1(c)(ii)	11.9 or 11.86 to 11.87	**3**	**M2** for $\sqrt[3]{\frac{7.7}{5.5}}$ oe or **M1** for $5.5 \times x^3 = 7.7$ oe
1(d)	150 [million] oe	**2**	**M1** for 390 [million] ÷ (5 + 2 + 6)
1(e)	250 nfww	**3**	**M2** for 258.25 ÷ ((100 + 3.3) ÷ 100) or **M1** for 258.25 associated with 103.3[%]
2(a)	$71 < t \leqslant 72$	**1**	
2(b)	72.3 or 72.27 to 72.28 nfww	**4**	**M1** for midpoints soi (condone 1 error or omission) **M1** for use of $\sum fx$ with x in correct interval including both boundaries **M1** (dep on 2nd **M1**) for $\sum fx \div 90$
2(c)(i)	41, 62, 80, 90	**2**	**B1** for 2 correct values

Question	Answer	Marks	Part marks
2(c)(ii)	Correct curve	**3**	**B1FT** *their* **(c)(i)** for 5 correct heights **B1** for 5 points plotted at upper ends of intervals **B1FT** (dep on at least **B1**) for increasing curve or increasing polygon through 5 points If zero scored, **SC1FT** for 4 correct points plotted
2(c)(iii)	72.1 to 72.4	**1**	
2(c)(iv)	1.9 to 2.2	**2**	**M1** for UQ = 73.2 to 73.4 or LQ = 71.2 to 71.3
2(d)	180 cao nfww	**4**	**B3** for 50 [m/s] nfww OR **M3** for $\frac{3725 \div 1000}{74.5 \div 3600}$ OR **M2** for 3725 ÷ 74.5 or **M1** for 3725 or 74.5 seen or for (3715 to 3725) ÷ (74.5 to 75.5) **M1** indep for multiply by 3.6 oe
3(a)(i)	Image at (5, 1), (7, 1), (7, 4)	**2**	**B1** reflection in $y = 4$ or $x = k$
3(a)(ii)	Image at (–1, 1), (–4, 1), (–1, 3)	**2**	**B1** correct size and correct orientation wrong position or for rotation 90° clockwise around (0, 0)
3(a)(iii)	Image at (2, – 4), (4, – 4), (2, – 1)	**2**	**B1** for translation by $\begin{pmatrix}1\\k\end{pmatrix}$ or $\begin{pmatrix}k\\-5\end{pmatrix}$
3(b)	Enlargement	**1**	
	[sf] – 0.5 oe	**1**	
	(5, 5)	**1**	
3(c)	$\begin{pmatrix}0 & -1\\1 & 0\end{pmatrix}$	**2**	**B1** for one correct column or row
3(d)(i)	(4, 2)	**2**	**M1** for $\begin{pmatrix}1 & 0\\0 & 2\end{pmatrix}\begin{pmatrix}4\\1\end{pmatrix}$ oe

Question	Answer	Marks	Part marks
3(d)(ii)	(– 4, 2)	**3**	**M2** for $\begin{pmatrix}-1 & 0\\ 0 & 2\end{pmatrix}$ or $\begin{pmatrix}1 & 0\\ 0 & 2\end{pmatrix}\begin{pmatrix}-4\\ 1\end{pmatrix}$ or **M1** for $\begin{pmatrix}1 & 0\\ 0 & 2\end{pmatrix}\begin{pmatrix}-1 & 0\\ 0 & 1\end{pmatrix}\left[\begin{pmatrix}4\\ 1\end{pmatrix}\right]$ or $\begin{pmatrix}-4\\ 1\end{pmatrix}$
3(d)(iii)	$\frac{1}{2}\begin{pmatrix}2 & 0\\ 0 & 1\end{pmatrix}$ oe isw	**3**	**M2** for det = 2 soi or $k\begin{pmatrix}2 & 0\\ 0 & 1\end{pmatrix}$ soi or **M1** for recognition that **Q** is inverse matrix of **G** or **GQ = I** or **QG = I**
4(a)	–1.6 to –1.4	**1**	
4(b)	–0.5	**1**	
4(c)	$k > -4$	**2**	**B1** for identifying the –4 or for horizontal line drawn $y = -4$
4(d)	$y = x - 5$ ruled and –2.3 to –2.1 –1.2 to –1.1 1.3 to 1.4	**3**	**B2** for correct line and 2 correct values or no line and 3 correct values or **B1** for no line and 2 correct values or **B1** for correct line
4(e)	Tangent ruled at $x = 1$	**B1**	No daylight at point of contact. Consider point of contact as midpoint between two vertices of daylight, the midpoint must be between $x = 0.8$ and 1.2
	–6 to –4	**2**	Dep on **B1** or close attempt at tangent at $x = 1$ **M1** for rise/run for *their* tangent at $x = 1$
5(a)(i)	50890 or 50893 to 50900.4	**2**	**M1** for $\pi \times 18^2 \times 50$

Question	Answer	Marks	Part marks
5(a)(ii)	20.5 or 20.52 to 20.534	**3**	**B2** for answer 29.5 or 29.46 to 29.48 OR **M2** for $(50900-30000)\div(\pi\times18^2)$ oe or **M1** for (figs 50.9 –figs 30) ÷ ($\pi\times$ figs18^2) or **M1** for $(50900-30000)=(\pi\times18^2)h$ oe OR **alternative method** **M2** for $50-\frac{30000}{\pi\times18^2}$ oe **M1** for figs $30=\pi\times$ figs $18^2\times(50-h)$ oe or for $\frac{\text{figs}\,30}{\pi\times\text{figs}18^2}$ oe OR **alternative method** **M2** for $\frac{(50.9-30)}{50.9}\times50$ oe or **M1** for $\frac{(50.9-30)}{50.9}$ or $\frac{30}{50.9}\times50$ oe or **M1** for $\frac{(\text{figs }50.9-\text{figs }30)}{\text{figs }50.9}\times50$ oe
5(a)(iii)	334 nfww	**4**	**M2** for figs $30\div\frac{2}{3}\pi\times3.5^3$ oe or **M1** for $\frac{1}{2}\times\frac{4}{3}\pi\times3.5^3$ oe and **B1** for 30 000
5(b)(i)	3.28[6..] or 3.29	**3**	**M2** for [$r^2=$] $\frac{95\times3}{8.4\pi}$ oe or **M1** for $\frac{1}{3}\pi\times r^2\times8.4$ [= 95]
5(b)(ii)	93.1 to 93.6	**4**	**M3** for $\pi\times3.3\times\sqrt{3.3^2+8.4^2}$ or **M2** for $\sqrt{3.3^2+8.4^2}$ or **M1** for $3.3^2+8.4^2$
6(a)(i)	$-7x+55$ final answer	**2**	**M1** for $8x+20$ or $-15x+35$ or answer $-7x+k$ or $kx+55$
6(a)(ii)	$x^2-14x+49$ final answer	**2**	**M1** for 3 of $x^2-7x-7x+49$

Question	Answer	Marks	Part marks
6(b)(i)	–18	**3**	**M1** for a correct first step ie correctly multiplying by 3 or correctly dividing by 2 or for correctly subtracting 5 **M1** for correctly reaching $ax = b$ from *their* first step
6(b)(ii)	15	**3**	**M2** for $6x – 4x = 21 + 9$ oe or **M1** for $6x – 21$ or correct division by 3 or for correctly reaching $ax = b$ from *their* first step
6(b)(iii)	5 and –5	**3**	**B2** for 5 or –5 or **M1** for $[x^2 =] (74 + 1) \div 3$ or better
7(a)	(–0.5, 3)	**2**	**B1** for one correct value
7(b)	$[y =] –2x + 2$ final answer	**3**	**M1** for $\frac{-2-8}{2--3}$ or better **M1** for substitution of (–3, 8) or (2, –2) or *their* midpoint into $y = mx + c$ with *their m*
7(c)	$y = –2x + 7$ oe	**2FT**	**FT** *their* **(b)** **M1** for $y = (their–2)x + k$ ($k \neq 2$) or $y = kx + 7$ ($k \neq 0$) If zero scored, **SC1** for $(their – 2)x + 7$
7(d)	$x – 2y + 9 = 0$ or $2y – x – 9 = 0$ oe	**4**	**B3** for any correct equivalent in wrong form Or **M2** for $y = ½ x + k$ oe (**FT** negative reciprocal of *their* gradient in **(b)**) or **M1** for grad = ½ (**FT** negative reciprocal of *their* gradient in **(b)**) **M1** for substitution of (1, 5) into $y = mx + c$ oe with *their m*
8(a)(i)	290	**2**	**M1** for 180 + 110 oe
8(a)(ii)	156.8 or 156.7[9..]	**5**	**B1FT** for $CBA = 10°$ (*their* **(a)** – 280) and **B3** for [angle ACB =]13.2° or **M2** for $[\sin C] = \frac{50\sin(their10)}{38}$ or **M1** for $\frac{50}{\sin C} = \frac{38}{\sin(their10)}$ oe

Question	Answer	Marks	Part marks
8(a)(iii)	8.68 or 8.677 to 8.684	**3**	**M2** for $[x =]50\sin(their10)$ oe or **M1** for $\sin(their10) = \frac{x}{50}$ oe or **M1** for a correct right-angled triangle drawn with 50 as hypotenuse
8(b)(i)	$x(x - 25) = 2200$	**1**	and no errors seen
8(b)(ii)	$\frac{-(-25) \pm \sqrt{(-25)^2 - 4(1)(-2200)}}{2(1)}$ or better	**B2**	**B1** for $\sqrt{(-25)^2 - 4(1)(-2200)}$ or better **or** for $\left(x - \frac{25}{2}\right)^2$ oe or **B1** for $\frac{-(-25) + \sqrt{q}}{2(1)}$ or $\frac{-(-25) - \sqrt{q}}{2(1)}$ or both or for $\frac{25}{2} + \text{or} - \sqrt{\left(\frac{25}{2}\right)^2 + 2200}$
	–36.04 and 61.04 final answer	**B1,B1**	If **B0B0, SC1** for values in ranges –36.042 to –36.041 **and** 61.041 to 61.042 seen or for answers –36[.0] or –36.042 to –36.041 **and** 61[.0] or 61.041 to 61.042 or –36.04 **and** 61.04 seen in working or for –61.04 **and** 36.04 as final ans
9(a)(i)	5 and 13	**1**	
9(a)(ii)	$8n - 3 = 203$	**M1**	Evaluation of 25th or 26th term with supporting evidence or explanation
	25.75 or $25\frac{3}{4}$	**A1**	Second evaluation of 25th or 26th terms with supporting evidence or explanation If zero scored, **SC1** for 25.75 or 197 and 205 with partial evidence or explanation
9(b)(i)	$6n + 7$ oe final answer	**2**	**B1** for $6n + c$ or $kn + 7$ $k \neq 0$
9(b)(ii)	$n^2 + n + 2$ oe final answer	**2**	**B1** for a quadratic expression or second difference = 2
9(c)	$[y =]$ 10	**2**	**M1** for $5(20 - y) = 50$
	[First term =] 14	**2**	**M1** for $5(x - \textit{their } y) = 20$ or for $20 \div 5 + \textit{their } y$

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

MATHEMATICS **0580/42**

Paper 4 (Extended) **May/June 2017**

MARK SCHEME

Maximum Mark: 130

Published

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Question	Answer	Marks	Part marks
1(a)(i)	600 ÷ (11+ 9) × 11 [=330] with no errors seen	**M1**	Could be in separate steps
1(a)(ii)	270	**1**	
1(b)(i)	372 cao nfww	**3**	**B2** for answer 371.7… or **M1** for $330 \times \left(1+\frac{1.5}{100}\right)^{8}$ oe not spoiled After zero scored, **SC1** for answer 42 or 41.7…
1(b)(ii)	12.6 or 12.7 or 12.63 to 12.73	**2**	**M1** for $\frac{\textit{their}\,\textbf{(b)(i)}-330}{330}$ or $\frac{\textit{their}\,\textbf{(b)(i)}}{330}\times 100$ soi by 112.7 or 113 After zero scored, **SC1** for answer 12%
1(c)(i)	$\frac{99}{280}$ cao final answer	**1**	
1(c)(ii)	27.5[0]	**3**	**M2** for $24.75 \div \frac{100-10}{100}$ oe or **M1** for recognising 24.75 as 90[%] oe
1(d)(i)	32 cao	**2**	**M1** for $\left(1-\frac{20}{100}\right)\left(1-\frac{15}{100}\right)$ [x]oe or for 0.15 × 0.8 [x] oe
1(d)(ii)	13 cao	**2**	**M1** for $\left(1-\frac{20}{100}\right)\left(1-\frac{15}{100}\right) \times x = 40.84 - 32$ oe seen or for *their* **(d)(i)** + $\left(1-\left(\frac{\textit{their}\,\textbf{(d)(i)}}{100}\right)\right)x = 40.84$ oe
2(a)(i)	Image at (8, 1), (10, 5), (8, 5)	**2**	**B1** for translation $\begin{pmatrix}6\\k\end{pmatrix}$ or $\begin{pmatrix}k\\-5\end{pmatrix}$ or 3 correct points not joined
2(a)(ii)	Image at (4, 10), (4, 8), (8, 8)	**2**	**B1** for rotation 90˚ anticlockwise but different centre or for rotation 90˚ clockwise about (4, 10) or 3 correct points not joined
2(a)(iii)	Image at (6, 3), (6, 5), (7, 5)	**2**	**B1** for enlargement factor $\frac{1}{2}$ but incorrect centre or 3 correct points not joined
2(b)	Reflection	**1**	
	$y=-x$ oe	**1**	If zero scored, **M1** for correct use of matrix product

Question	Answer	Marks	Part marks
2(c)(i)(a)	$\begin{pmatrix}13\\16\end{pmatrix}$	**2**	**B1** for each in a 2 by 1 matrix or **SC1** for (13 [,] 16)
2(c)(i)(b)	$\begin{pmatrix}2 & 10\\3 & 15\end{pmatrix}$	**2**	**B1** for answer any 2 by 2 matrix
2(c)(i)(c)	$\frac{1}{2}\begin{pmatrix}4 & -3\\-2 & 2\end{pmatrix}$ oe isw	**2**	**B1** for $k\begin{pmatrix}4 & -3\\-2 & 2\end{pmatrix}$ oe soi $(k \neq 0)$ or for determinant = 2 oe soi
2(c)(ii)	**NM** or **MP** or $\mathbf{N}^2$ oe or $\mathbf{P}^2$ oe	**1**	
3(a)(i)	175.5 nfww	**4**	**M1** for at least four of 50, 125, 175, 225, 325 soi **M1** for Σfx with x inside or on boundary of each interval **M1** (dep on second **M1**) for $\frac{their\ \Sigma fx}{200}$
3(a)(ii)	Fully correct histogram	**4**	**B1** for each correct bar If zero scored, **B1** for 0.2, 1.32, 0.7, 0.16 seen
3(b)(i)	Fully correct cumulative frequency diagram	**3**	**B1** for correct horizontal plots **B1** for correct vertical plots **B1FT** dep on at least **B1** earned for points joined with smooth increasing curve or polygon If zero scored, **SC1** for 4 correct plotted points
3(b)(ii)(a)	170 to 175	**1**	
3(b)(ii)(b)	152 to 158	**2**	**M1** for 42 to 48 written
4(a)	–1.75 to –1.7	**1**	
	1.7 to 1.75	**1**	
4(b)(i)	Correct ruled solid tangent at (–1.5, 3.5)	**1**	
4(b)(ii)	–7 to –5	**2 dep**	**dep** on close attempt at ruled solid tangent at $x = -1.5$ in part **(b)(i)** **M1** for rise/run dep on close attempt at ruled solid tangent at $x = -1.5$
4(c)(i)	1	**1**	
4(c)(ii)	Correct curve	**3**	**B2** for 4 or 5 correct points or **B1** for 2 or 3 correct points

Question	Answer	Marks	Part marks
4(d)(i)	–0.95 to –0.8	**1**	
	1.1 to 1.45	**1**	
4(d)(ii)	*their* (–0.95 to –0.8)< x < *their*(1.1 to 1.45) oe	**1FT**	correct or **FT** their **(d)(i)**
4(e)(i)	0.125 oe and 0.03125 oe and 0.000976 to 0.000977 oe	**1**	
4(e)(ii)	0	**1**	accept zero, nought, etc
5(a)(i)	94.2 or 94.3 or 94.24 to 94.26	**2**	**M1** for $\pi \times 3 \times 10$
5(a)(ii)	9.54 or 9.539…	**3**	**M2** for $\sqrt{10^2 - 3^2}$ or **M1** for $h^2 + 3^2 = 10^2$ oe
5(a)(iii)	89.9 or 89.90 to 89.92…	**2**	**M1** for $\frac{1}{3} \times \pi \times 3^2 \times$ *their* **(a)(ii)**
5(b)	108 or 107.9 to 108.1 nfww	**4**	**M3** for $\frac{\pi \times 3 \times 10}{\pi \times 10^2} \times 360$ oe or $\frac{\textit{their}\ \textbf{(a)(i)}}{\pi \times 10^2} \times 360$ oe or $\frac{2 \times \pi \times 3}{2 \times \pi \times 10} \times 360$ oe or **M2** for $\frac{x}{360} \times \pi \times 10^2 = \textit{their}$ **(a)(i)** oe or $\frac{x}{360} \times 2 \times \pi \times 10 = 2 \times 3 \times \pi$ oe or **M1** for $\frac{x}{360} \times \pi \times 10^2$ seen or $\frac{x}{360} \times 2 \times \pi \times 10$ seen
5(c)	46.6 to 46.8	**4**	**M3** for $\frac{\textit{their}\ \textbf{(b)}}{360} \times \pi \times 10^2 - \frac{1}{2} \times 10 \times 10 \times \sin(\textit{their}\ \textbf{(b)})$ oe or **M1** for $\frac{\textit{their}\ \textbf{(b)}}{360} \times \pi \times 10^2$ or *their* **(a)(i)** soi and **M1** for $\frac{1}{2} \times 10 \times 10 \times \sin(\textit{their}\ \textbf{(b)})$ soi
6(a)	$\frac{1}{3}, \frac{6}{7}$ correctly placed	**1**	
	$\frac{4}{7}, \frac{3}{7}$ correctly placed	**1**	

Question	Answer	Marks	Part marks
6(b)	$\frac{2}{21}$ oe	**2**	**M1** for $\frac{2}{3}\times\frac{1}{7}$
6(c)(i)	$\frac{15}{21}$ oe	**3**	**M2** for $\frac{2}{3}\times\frac{6}{7}+\frac{1}{3}\times\frac{3}{7}$ oe or **M1** for $\frac{2}{3}\times\frac{6}{7}$ oe or $\frac{1}{3}\times\frac{3}{7}$ oe seen
6(c)(ii)	50	**2FT**	**FT** (70 × *their* **(c)(i)**) rounded up or down to integer **M1** for 70 × *their* **(c)(i)**
6(d)	$\frac{10}{243}$ oe	**2**	**M1** for $\frac{2}{3}\times\frac{1}{3}\times\frac{1}{3}\times\frac{1}{3}\times\frac{1}{3}[\times k]$ oe nfww where k is positive integer less than 5
7(a)(i)	4.5 or $4\frac{1}{2}$ or $\frac{9}{2}$ final answer	**3**	**M2** for [2](4x + 7) = [2](6x – 2) oe or **M1** for 2(2x + 6) + 2(2x + 1) oe or 4(3x – 1) oe or **M1** for correctly reaching $ax = b$ from *their* linear equation
7(a)(ii)	$(2x+6)(2x+1)=(3x-1)^2$	**M1**	May be seen in different stages
	$5x^2-20x-5\ [=0]$ oe	**B3**	**B1** for 4x² + 2x + 12x + 6 or better **B1** for 9x² – 3x – 3x + 1 or better
	$\frac{-(-20)\pm\sqrt{(-20)^2-4(5)(-5)}}{2(5)}$ oe	**M2**	**FT** their 3 term quadratic provided formula used or complete the square **M1** for $\sqrt{(-20)^2-4(5)(-5)}$ oe or if in form $\frac{-(-20)+\sqrt{q}}{2(5)}$ or $\frac{-(-20)-\sqrt{q}}{2(5)}$ **FT**± *their* quadratic or for completing the square **M2** for $2\pm\sqrt{1+2^2}$ or **M1** for $(x-2)^2$
	4.24 or 4.236… cao	**B1**	
7(b)(i)	$(x+5)(x-1)$ final answer	**2**	**B1** for $x(x-1)+5(x-1)$ or $x(x+5)-[1](x+5))$ or for $(x+a)(x+b)$ where $ab = -5$ or $a + b = 4$

Question	Answer	Marks	Part marks
7(b)(ii)	$5(x+1)-8x=x(x+1)$ or $5x+5-8x=x^2+x$	**M2**	Could be seen in different stages **M1** for $5(x+1)-8x$ seen or for common denominator of $x(x+1)$ for LHS or both sides soi
	–5 and 1 cao	**A2**	**A1** for $x^2+4x-5\,[=0]$ oe
8(a)	66[.0] or 66.03 to 66.04	**2**	**M1** for tan = $\frac{9}{4}$ oe
8(b)	$\sqrt{3^2+4^2}$ or $\frac{1}{2}\sqrt{6^2+8^2}$	**M1**	Any alternative method must be full and complete and result in exactly 5
8(c)	60.9 or 60.94 to 60.95	**2**	**M1** for tan = $\frac{9}{5}$ oe
8(d)	5.83 or 5.84 or 5.827 to 5.840	**6**	**M1** for [PB or PC =] $\sqrt{9^2+5^2}$ or [XC =] $\sqrt{9^2+5^2}-7.5$ **M1** for angle $BPX = 2\times$ invsin $\frac{3}{\textit{their } PB}$ oe **B1** for [PB or PC =] $\sqrt{106}=10.29$ to 10.30 or XC = 2.79 to 2.8[0] or angle BPX = 33.9 or 33.86 to 33.90… **M2** for $\sqrt{(\textit{their } PB)^2+7.5^2-2\times\textit{their } PB\times7.5\times\cos(\textit{their } BPX)}$ oe or **M1** for correct implicit equation
9(a)(i)	100	**1**	
9(a)(ii)	92.3 or 92.29… to 92.31	**3**	**M2** for $200\div(2+\frac{10}{60})$ oe or **M1** for 200 ÷ *their* time interval or **M1** for $\frac{10}{60}$ soi oe
9(b)(i)	240 nfww	**3**	**M2** for $\frac{V}{2}\left(\frac{30}{60}+\frac{20}{60}\right)=100$ oe or **M1** for any correct relevant area seen in terms of V
9(b)(ii)	$\frac{2}{9}$ oe	**2FT**	**FT** for *their* **(b)(i)** ÷ 1080 to 3 sf or better **M1** for *their* **(b)(i)** $\times\frac{1000}{3600}$ soi

Question	Answer	Marks	Part marks
10(a)	–11	**1**	
10(b)	7	**2**	**M1** for $3x - 2 = 19$ or better
10(c)	25	**2**	**M1** for $3 \times 3^x - 2$ oe
10(d)	$9x^2 - 8x + 2$ final answer	**3**	**M1** for $(3x-2)^2 + 3x - 2 + x$ oe **B1** for $\left[(3x-2)^2 =\right] 9x^2 - 6x - 6x + 4$ oe
10(e)	$\frac{x+2}{3}$ oe final answer	**2**	**M1** for $x = 3y - 2$ or $y + 2 = 3x$ or $\frac{y}{3} = x - \frac{2}{3}$ or better

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

MATHEMATICS **0580/43**

Paper 4 (Extended) **May/June 2017**

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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Abbreviations

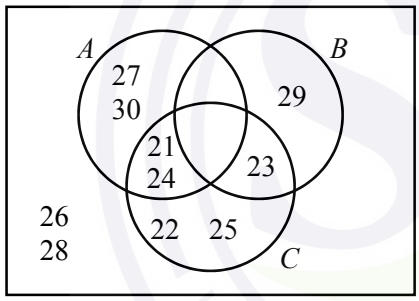
cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

Question	Answer	Marks	Part marks
1(a)(i)	9550	**1**	
1(a)(ii)	23 158 750	**2FT**	**FT** *their* **(a)(i)** × 2425 correctly evaluated **M1** for *their* lower bound × 2425
1(a)(iii)	23 160 000	**1FT**	**FT** *their* **(a)(ii)** rounded to 4 sf
1(a)(iv)	2.316×10^7	**1FT**	**FT** *their* **(a)(iii)** or *their* **(a)(ii)** rounded to 3sf or more and in standard form
1(b)	520 nfww	**3**	**M2** for $546 \times \frac{100}{(100+5)}$ oe or **M1** for 105[%] associated with 546 oe
1(c)	3380 or 3376 to 3377	**2**	**M1** for $3\,000 \times \left(1+\frac{3}{100}\right)^4$ oe
2(a)	38	**1**	
	118	**1**	
	62	**1FT**	**FT** 180 – *their y*
2(b)	69	**3**	**B2** for *ACB* = 42 or **B1** for *ADB* = 42 If zero scored, **SC1** for *ACB* = *their ADB*
2(c)	107	**2**	**B1** for *QPS* = 73 or [reflex] *QOS* = 214
3(a)	0 2.25 2 1.25	**4**	**B1** for each
3(b)	Fully correct smooth curve	**4**	**B3 FT** for 7 or 8 points **or B2 FT** for 5 or 6 points **or B1 FT** for 3 or 4 points

Question	Answer	Marks	Part marks
3(c)	1	**1**	
3(d)(i)	[$y =$] $x + 1$	**1**	
3(d)(ii)	–2.2 to –2.1	**1**	
	–0.45 to –0.4	**1**	
	0.51 to 0.6	**1**	If zero scored, **SC1** for *their* line in **(d)(i)** drawn. It must be of the form $y = mx + c$ ($m \neq 0$) and drawn 'fit for purpose'
3(e)	$-1.33 < k < 0$ to 0.1	**2FT**	**FT** Strict ft of *their* max point and min point dep on cubic graph or accept correct answer from calculus **B1** for each If zero scored, **SC1** for two correct values reversed
4(a)(i)	17.5 or 17.46....nfww	**6**	**B3** for triangle height 3.46[4...] or $\sqrt{12}$ oe or **M2** for $\sqrt{4^2 - 2^2}$ or **M1** for $h^2 + 2^2 = 4^2$ **and M2** for $2 \times 7 + \frac{1}{2} \times 2 \times$ *their* h oe or **M1** for $\frac{1}{2} \times 2 \times$ *their* h
4(a)(ii)	140 or 139.6 to 139.7...	**1FT**	**FT** *their* **(a)** × 8
4(b)(i)	2.62 or 2.618…	**3**	**M2** for [$r^2 =$] $\frac{280}{13\pi}$ oe or **M1** for $280 = \pi \times r^2 \times 13$
4(b)(ii)	10.2 or 10.20… or $10\frac{10}{49}$	**3**	**M2** for $\frac{280}{14^3}$ [×100] oe or **B1** for 2744 or 14^3 seen
5(a)(i)	80 33 20	**1, 1, 1**	
5(a)(ii)	17.3 nfww	**4**	**M1** for 5, 15, 22.5, 27.5, 40 soi **M1** for $\sum fx$ with *their f* 's and x in correct interval including both boundaries **M1** (dep on 2nd **M1**) for $\sum fx \div 200$

Question	Answer	Marks	Part marks
5(b)(i)	$\frac{30}{210}$ oe	**2**	**M1** for $\frac{6}{15}\times\frac{5}{14}$ If zero scored, **SC1** for answer $\frac{36}{225}$ oe
5(b)(ii)	$\frac{108}{210}$ oe	**3**	**M2** for $\frac{6}{15}\times\frac{9}{14}+\frac{9}{15}\times\frac{6}{14}$ oe or $1-\frac{9}{15}\times\frac{8}{14}-\frac{6}{15}\times\frac{5}{14}$ or **M1** for $\frac{6}{15}\times\frac{9}{14}$ or $\frac{9}{15}\times\frac{6}{14}$ or $\frac{9}{15}\times\frac{8}{14}+\frac{6}{15}\times\frac{5}{14}$ If zero scored, **SC1** for answer $\frac{108}{225}$ oe
5(c)	150	**1**	
6(a)(i)	Translation	**1**	
	$\begin{pmatrix}3\\-13\end{pmatrix}$ oe	**1**	
6(a)(ii)	Enlargement	**1**	
	[sf] $-\frac{1}{2}$ oe	**1**	
	(0, –4)	**1**	
6(b)	Image at (0, 0) (0, 6) (–4, 6) (–4, 2)	**2**	**B1** for rotation of 90º anticlockwise about the wrong centre or 90º clockwise about (3, –1) or 4 points correct but not joined.
6(c)	Image at (4, 0) (10, 0) (10, –4) (6, –4)	**2**	**B1** for reflection in $y = k$ or in $x = 1$ or 4 points correct but not joined
6(d)	Enlargement	**1**	
	[sf] 3	**1**	
	Origin oe	**1**	

Question	Answer	Marks	Part marks
7(a)	[x =] –5 [y =] 7 with correct working	**4**	**M1** for correctly equating one set of coefficients **M1** for correct method to eliminate one variable OR **M1** for correctly rearranging one equation **M1** for correct method to eliminate one variable **A1** $x = -5$ **A1** $y = 7$ both dep on **M2** If zero scored, **SC1** for 2 values satisfying one of the original equations **SC1** if no correct working shown, but 2 correct answers given
7(b)	[a =] 36 [b =] –6	**3**	**B2** for either correct or **M1** for $a = b^2$ or for $x^2 + bx + bx + b^2$ or better or for $(x-6)^2$ seen and **M1** for $2b = -12$ soi
7(c)	$\frac{7x^2 - 12x - 10}{(2x-5)(x-1)}$ oe final answer nfww	**4**	**B1** for common denom $(2x-5)(x-1)$ seen oe isw **M1** for $x(x-1) + (3x+2)(2x-5)$ soi isw **B1** for $6x^2 - 15x + 4x - 10$ soi
8(a)(i)	4 points correctly plotted	**2**	**B1** for 2 or 3 points correctly plotted
8(a)(ii)	Positive	**1**	
8(b)	mean 3.1	**3**	**M2** for $\frac{\text{sum of products}}{30}$ or **M1** for at least 4 correct products soi
	median 3	**2**	**M1** for 15.5 oe indicated
	mode 5	**1**	
	range 5	**1**	
8(c)	24 nfww	**3**	**M1** for $\frac{x \times 52 + 45 \times 75 + 11 \times 91}{x + 45 + 11}$ [= 70.3] **M1** for clearing *their* fraction

Question	Answer	Marks	Part marks
9(a)	1120 or 1121**.**	**4**	**M2** for $[AC^2 =]$ $525^2 + 872^2 - 2\times525\times872\times\cos 104$ or **M1** for implicit version **A1** for 1 257 000 to 1 258 000
9(b)	[*QB* or *x* =] 872 × tan 1 seen	**M2**	**M1** for $\tan 1 = \frac{QB}{872}$
	tan = *their QB* ÷ 525	**M1**	
	1.7 or 1.660 to 1.661 nfww	**A1**	dep on **M3**
9(c)(i)	222 000 or 222 100**.** .... or 222 101	**2**	**M1** for $\frac{1}{2}\times525\times872\times\sin104$
9(c)(ii)	5.55 or 5.550 to 5.553 nfww	**2FT**	**FT** *their* **(c)(i)** × $100^2 \div 20\,000^2$ **M1** for *their* **(c)(i)** × $100^2 \div 20\,000^2$ or restart
10(a)		**4**	All 8 regions correct **M3** for 6 or 7 regions correct **M2** for 4 or 5 regions correct **M1** for 3 regions correct
10(b)(i)	$\notin$	**1**	
10(b)(ii)	$\varnothing$	**1**	
10(c)	21, 23, 24, 29	**2FT**	Correct or **FT** **SC1** for 1 omission or 4 correct and 1 extra
10(d)(i)	5	**1FT**	Correct or **FT** if less than 10
10(d)(ii)	9	**1FT**	Correct or **FT** if less than 10
10(e)	$\subset$ or $\subseteq$	**1**	

Question	Answer	Marks	Part marks
11	64 $(n+3)^2$ oe final answer	**1, 2**	**M1** for a quadratic expression seen or second differences 2
	17 $3n+2$ oe final answer	**1, 2**	**B1** for $3n+k$ (any k) or $kn+2$ ($k \neq 0$)
	47 $(n+3)^2-(3n+2)$ oe isw	**1, 2FT**	**FT** *their* difference expressions $A - B$ **M1** for expression $an^2 + bn + c$ seen or second differences 2
	$\frac{7}{6}$ $\frac{n+2}{n+1}$ oe final answer	**1, 2**	**B1** for $\frac{n+k+1}{n+k}$ seen

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

MATHEMATICS **0580/42**

Paper 42 (Extended) **March 2017**

MARK SCHEME

Maximum Mark: 130

Published

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Abbreviations

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dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

Question	Answer	Marks	Part Marks
1 (a)	22.9 or 22.85 to 22.86	**2**	**M1** for $\frac{8}{10+17+8}$ [× 100] oe
(b)	$5635\times\frac{17}{10+17+8}$ or better [= 2737]	**2**	**M1** for $\frac{5635}{(10+17+8)}$
(c)	5000	**3**	**M2** for $5635 = k\left(1+\frac{2.42}{100}\right)^5$ oe or **B1** for $\left(1+\frac{2.42}{100}\right)$
(d)	9950	**2**	**M1** for 2 × 2500 or 3 × 1650
(e)	1.98 final answer	**2**	**B1** for 1.976 or 1.98 not final answer or **M1** for 130 × 0.0152
2 (a) (i)	Rotation	**1**	
	90° [anticlockwise] oe	**1**	
	(9, 5)	**1**	
(ii)	Translation	**1**	
	$\begin{pmatrix}-8\\-14\end{pmatrix}$ oe	**1**	
(iii)	Enlargement	**1**	
	[sf] $\frac{1}{3}$	**1**	
	(– 8, – 2)	**1**	
(b) (i)	Image at (1, – 3) (2, – 3) (2, – 5)	**2**	**M1** for triangle correct size and orientation, wrong position or **SC1** for correct reflection in $y = -x$
(ii)	$\begin{pmatrix}0 & 1\\1 & 0\end{pmatrix}$	**2**	**B1** for 1 correct column or row

Question	Answer	Marks	Part Marks
3 (a)	0 0.5 oe 1.25 oe	**1, 1, 1**	
(b)	Fully correct smooth curve	**4**	**B3 FT** for 7 or 8 points or **B2 FT** for 5 or 6 points or **B1 FT** for 3 or 4 points
(c)	3.6 to 3.8	**2**	**M1** for $y = 3.5$ soi
(d)	line $y = x + 1$ ruled	**M1**	
	−1.55 to −1.40 4.55 to 4.8	**A1 A1**	If 0 scored **SC1** for $y = x + 1$ stated or implied or for 2 correct values given
(e) (i)	Point plotted at (5, 5)	**1**	
(ii)	Tangent ruled from *A*	**1**	
(iii)	1.2 to 1.4	**B2**	B2 and M1 dep on reasonable attempt at tangent from (5, 5) **M1** for change in *y*/ change in *x* of *their* ruled line
4 (a)	$\frac{1}{8}$ oe	**3**	**M2** for $\frac{1}{2}\left(1-\frac{1}{6}-\frac{1}{4}-\frac{1}{3}\right)$ oe or **M1** for $\frac{1}{6}+\frac{1}{4}+\frac{1}{3}$ seen oe or idea that all sum to 1
(b)	$\frac{7}{12}$ oe	**2**	**M1** for $\frac{1}{3}+\frac{1}{4}$ oe
(c) (i)	$\frac{1}{16}$ oe	**2**	**M1** for $\frac{1}{4}\times\frac{1}{4}$ oe
(ii)	$\frac{2}{24}$ oe	**3**	**M2** for $2\times\frac{1}{6}\times\frac{1}{4}$ oe or **M1** for $\frac{1}{6}\times\frac{1}{4}$ oe
(d)	12	**1**	

Question	Answer	Marks	Part Marks
5 (a) (i)	$(3x-1)(x+4)$	2	**M1** for $(3x+b)(x+c)$ with $bc=-4$ or $3c+b=11$ or for $3x(x+4)-1(x+4)$ or for $x(3x-1)+4(3x-1)$
(ii)	$\frac{1}{3}$ oe and -4	1	
(b) (i)	$2\times2(x-4)-2(2x+11)=(2x+11)(x-4)$ or better	M2	**M1** for common denom $2(2x+11)(x-4)$ seen or attempt to multiply through by denoms or for $\frac{2(x-4)-(2x+11)}{(2x+11)(x-4)}\left[=\frac{1}{2}\right]$
	$2x^2+11x-8x-44$ or better	B1	or for other correct relevant 2 bracket expansion if alt method used
	$4x-16-4x-22=2x^2-8x+11x-44$ $2x^2+3x-6=0$	A1	correct solution reached with all brackets expanded and no errors or omissions seen
(ii)	$\frac{-3\pm\sqrt{(3)^2-4(2)(-6)}}{2\times2}$	2	**B1** for $\sqrt{(3)^2-4(2)(-6)}$ or better or $\left(x+\frac{3}{4}\right)^2$ oe and **B1** for $\frac{-3+\sqrt{q}}{2(2)}$ or $\frac{-3-\sqrt{q}}{2(2)}$ or better or $-\frac{3}{4}+\sqrt{\frac{57}{16}}$ oe or $-\frac{3}{4}-\sqrt{\frac{57}{16}}$ oe
	–2.64 and 1.14 final ans cao	B1B1	**SC1** for –2.6 or –2.637... **and** 1.1 or 1.137... or –2.64 and 1.14 seen in working or 2.64 and –1.14 as final answers
6 (a) (i)	27	1	
(ii)	3.89 or 3.888 to 3.889	2	**M1** for $\frac{7}{EZ}=\frac{9}{5}$ oe
(b)	76 cao	3	**B2** for *ABC* = 104 or *AOC* = 152 or *COD* = 28 or *OBA* = 52 **and** *OBC* = 52 or *BCD* = 128 **and** *OCB* = 52 or **B1** for any one of *OBA*, *OBC*, *OCB* = 52 or *BCD* = 128

Question	Answer	Marks	Part Marks
(c) (i)	90	1	
	angle in semicircle	1	
(ii)	27	1	
	tangent [perpendicular to] radius	1	
(iii)	rectangle	1	
7 (a)	72.7 or 72.70 to 72.71 nfww	4	**M1** for midpoints **soi** (condone 1 error or omission) (47.5, 55, 65, 80, 95, 110) **M1** for use of $\sum fx$ with x in correct interval including both boundaries (condone 1 further error or omission) (1092.5, 3520, 7930, 10880, 2470, 3190) **M1** (dep on 2nd M1) for $\sum fx \div 400$
(b) (i)	[23] 87 209 345 371 [400]	2	**B1** for 2 or 3 correct
(ii)	Correct graph	3	**B1FT** *their* **(b)(i)** for 6 correct heights **B1** for 6 points at upper ends of intervals on correct vertical line **B1FT** (dep on at least B1) for increasing curve or polygon through 6 points After 0 scored, **SC1FT** *their* **(b)(i)** for 5 correct points plotted
(iii) (a)	69 to 70	1	
(b)	20 to 23	2FT	**FT** *their* cumulative freq curve **M1** for correct UQ or LQ for *their* cumulative freq curve
(c)	72 to 75	2	**M1** for 240 soi
8 (a) (i)	5.14 or 5.135 to 5.142 nfww	4	**M2** for $[XY^2 =] 12.5^2 + 9.9^2 - 2 \times 12.5 \times 9.9 \times \cos 23$ or **M1** for implicit version **A1** for 26.4 to 26.5 OR **B1** for $[XYT =]$ 108 or $[TXY =]$ 49 **M2** for $\frac{12.5 \sin 23}{\sin(180-72)}$ oe or **M1** for $\frac{\sin(180-72)}{12.5} = \frac{\sin 23}{XY}$ oe

Question	Answer	Marks	Part Marks
(ii)	15.6 or 15.7 or 15.64 to 15.68	3	**M2** for $[TZ=]\frac{9.9}{\sin 37}\times\sin(72)$ oe or **M1** for $\frac{9.9}{\sin 37}=\frac{TZ}{\sin 72}$ oe OR **M2** for $\frac{12.5\times\sin(180-23-108)}{\sin 37}$ oe or **M1** for $\frac{\sin 37}{12.5}=\frac{\sin(180-23-108)}{TZ}$ oe
(b)	3.79 or 3.793 to 3.794	4	**M3** for $r=20.5\div\left(2+\frac{3\times65\times2\pi}{360}\right)$ oe or **M2** for $20.5=2r+\frac{3\times65}{360}\times2\pi r$ oe or **M1** for $[3\times]\frac{65}{360}\times2\pi r$ oe or 20.5 = 2*r* + expression involving π
9 (a)	$x<10$ oe	1	Accept $x\leqslant 9$
	$y\geqslant 2$ oe	1	Accept $y > 1$
(b)	$x+3y\leqslant 21$ oe	1	Mark answer line isw
(c)	ruled broken line $x=10$	B1	or ruled line $x = 9$
	ruled line $y = 2$	B1	or ruled broken line $y = 1$
	ruled line from (0, 7) to (21, 0)	B2	**SC1** for line with negative gradient correct only at (0, 7) or (21, 0)
	correct region indicated cao	1	
(d) (i)	4	1	
(ii)	20	1	
10 (a) (i)	(6 – 2) × 180 or (2 × 6 – 4) × 90 or (360 ÷ 6)	M1	
	(6 – 2) × 180 ÷ 6 or (2 × 6 – 4) × 90 ÷ 6 or 180 – (360 ÷ 6)	M1dep	dep on previous M1
(ii)	1.73*x* or $x\sqrt{3}$ oe	3	**M2** for $2x\sin 60$ or $2x\cos 30$ oe or for $\sqrt{x^2+x^2-2\times x\times x\times\cos 120}$ or **M1** for $x\sin 60$ or $x\cos 30$ oe or for $x^2+x^2-2\times x\times x\times\cos 120$

Question	Answer	Marks	Part Marks
(iii)	$(10-x)\sin 30$ seen oe	**M1**	
	$10+2\left((10-x)\sin 30\right)$ oe	**M1dep**	dep on previous **M1**
	$10+10-x$ or $10+2\times\frac{1}{2}\times(10-x)$	**A1**	with no errors or omissions seen
(b)	12.7 or 12.67 to 12.68.... nfww	**4**	**B3** for 7.32 to 7.33 or **M2** for $x=20\div(1+1.73)$ oe or **M1** for $20-x$ = *their* **(a)(ii)** oe
11 (a)	4 5 6 7	**1**	
	8 16 32 64 128	**3**	**B2** for 3 or 4 correct or **B1** for first 2 correct If 0 scored, **SC1** for 4 values correctly doubled **FT** one error
(b)	2^n oe	**1**	
(c) (i)	$2+4+8=14$	**1**	
	$16-2=14$	**1**	or for $14+2=16=2^4$
(ii)	62 and 6	**2**	**B1** for each
(iii)	$2^{n+1}-2$ oe	**1**	
(iv)	9	**1**	

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MATHEMATICS **0580/41**

Paper 4 Paper 4 (Extended) **October/November 2016**

MARK SCHEME

Maximum Mark: 130

Published

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oe or equivalent
SC Special Case
nfww not from wrong working
soi seen or implied

Question	Answer	Mark	Part marks
1 (a) (i)	60 and 45	2	**M1** for 105 ÷ (4 + 3)
(ii)	117.6[0] final answer	2	**M1** for 105 × 1.12 oe
(iii)	125	3	**M2** for $105 \div (1 - \frac{16}{100})$ oe or **M1** for 105 seen associated with 84%
(b)	30.68 final answer	6	**B5** for 30.7[0] or 30.68… or **B4** for 905 to 906 **and** 875 or 405 to 406… **and** 375 **OR** **M1** for $500 \times \left(1+\frac{2}{100}\right)^{30}$ [− 500] oe **M1** for [500 +] $\frac{500 \times 2.5 \times 30}{100}$ **B1** for 905 to 906 or 875 or 405 to 406 or 375
(c)	480 or 479.8 to 479.9…	3	**M2** for $1469 \div \left(1+\frac{3.8}{100}\right)^{30}$ oe or **M1** for $P \times \left(1+\frac{3.8}{100}\right)^{30} = 1469$ oe
(d)	6.5[0] or 6.500…	3	**M2** for $\sqrt[11]{\frac{120150}{60100}}$ [×100 − 100] oe or **M1** for 60100 ×($)^n = 120150$ oe where n = 5 or 11 or 55

Question	Answer	Mark	Part marks
2 (a) (i)	15 to 15.2	1	
(ii)	10.8 to 11	1	
(iii)	9 to 9.2	1FT	**FT** 20 – *their* **(a)(ii)**
(iv)	10	1	
(v)	24	2	**B1** for 176 written
(b) (i)	16.75 nfww	4	isw attempted time conversion after correct answer **M1** for 5, 12.5, 17.5, 25, 45 soi **M1** for Σfx **M1 dep** for their $\Sigma fx \div 200$
(ii)	Fully correct histogram	4	**B1** for each correct block If zero scored, **SC1** for frequency densities of 9.6, 12, 2.6 and 0.6 seen
3 (a) (i)	51.7 or 51.69 to 51.70…	4	**M3** for $(2\times\frac{2}{3}\times\pi\times13^3+\pi\times13^2\times25)\times2.3\,[\div1000]$ oe or **SC3** for figs 517 or figs 5169 to 5170… or **M2** for $(2\times\frac{2}{3}\times\pi\times13^3+\pi\times13^2\times25)$ oe **OR** **M1** for $2\times\frac{2}{3}\times\pi\times13^3$ seen or $\pi\times13^2\times25$ seen **M1indep** for *their* volume × 2.3 ÷ 1000
(ii)	1.96 or 1.957 to 1.958 …	4	**M3** for $(2\times2\times\pi\times13^2+\pi\times2\times13\times25)[\div100^2]\times4.7$ oe or **SC3** for figs 196 or figs 1957 to 1958… **M2** for $(2\times2\times\pi\times13^2+\pi\times2\times13\times25)$ oe **OR** **M1** for $2\times2\times\pi\times13^2$ seen or $\pi\times2\times13\times25$ seen **M1indep** for *their* area divided by 100^2 soi

Question	Answer	Mark	Part marks
(b)	6.2[0] or 6.203 to 6.204	**3**	**M2** for $x^3 = \frac{500}{\frac{2}{3}\pi}$ oe or better or **M1** for $\frac{1}{3} \times \pi \times x^2 \times 2x = 500$ oe
(c)	286 or 285.7…	**3**	**M2** for $\frac{180}{A} = \left(\frac{180}{360}\right)^{\frac{2}{3}}$ oe or **M1** for $\left(\sqrt[3]{\frac{360}{180}}\right)^{[2]}$ oe or $\left(\sqrt[3]{\frac{180}{360}}\right)^{[2]}$ oe seen or $\frac{A^3}{180^3} = \frac{360^2}{180^2}$
4 (a)	0.92, …., …., 0.5, – 1, …., …., – 1, 0.5, …., …., 0.92	**3**	**B2** for 4 or 5 correct or **B1** for 2 or 3 correct
(b)	Fully correct graph	**5**	**B4** for correct graph but branches joined OR **B3FT** for 11 or 12 correct points or **B2FT** for 9 or 10 correct points or **B1FT** for 7 or 8 correct points **B1indep** for a branch on each side of the *y*-axis, without touching it
(c) (i)	Correct ruled line through (–2, 1) and (2, –3)	**2**	**B1** for straight line with gradient –1 or cutting *y*-axis at –1 or correct line but freehand or short correct ruled line
(ii)	0.7 to 0.95	**1**	
(iii)	[p =] 2 and [q =] – 2	**3**	**B2** for $x^3 + 2x^2 - 2 = 0$ oe or **B1** for $x^2 - 2 = -x^3 - x^2$ oe or better or $1 + 1 - \frac{2}{x^2} + x$ [= 0] or better
(d) (i)	(1.3 to 1.6, 0)	**1**	
(ii)	Ruled line from (0, –2) to intersection of *their* graph with positive *x*-axis	**1FT**	
(iii)	Tangent [to curve] *A* or (1.3 to 1.6, 0)	**1** **1**	

Question	Answer	Mark	Part marks
5 (a) (i)	Image at (–2, – 4), (4, – 4), (4, 0)	**2**	**SC1** for translation $\begin{pmatrix}-4\\k\end{pmatrix}$ or $\begin{pmatrix}k\\-8\end{pmatrix}$
(ii)	8.94 or 8.944…	**2**	**M1** for $\sqrt{(-4)^2+(-8)^2}$ or $\sqrt{4^2+8^2}$
(b) (i)	Enlargement [factor] 0.5 oe [centre] (0, 0) oe	**1** **1** **1**	
(ii)	$\begin{pmatrix}0.5 & 0\\0 & 0.5\end{pmatrix}$ oe	**2FT**	**FT** their scale factor from **(b)(i)** dep on enlargement and centre (0, 0) **B1FT** for one row or column
(iii)	0.25 or $\frac{1}{4}$	**1FT**	**Strict FT** *their* matrix but not for identity matrix
6 (a)	126 or 126.4 to 126.5	**3**	**M2** for $\sqrt{220^2-180^2}$ oe or **M1** for $BC^2 + 180^2 = 220^2$ oe
(b)	99.9 or 99.86 to 99.87	**4**	**M2** for $180^2 + 170^2 - 2 \times 180 \times 170 \cos 33$ or **M1** for $\cos 33 = \frac{180^2+170^2-CD^2}{2\times180\times170}$ **A1** for 9970 or 9973 to 9974
(c)	92.6 or 92.58 to 92.59	**2**	**M1** for $\frac{\text{dist}}{170} = \sin 33$ oe
(d)	115.1 or 115.0 to 115.1	**3**	**M1** for $\cos = \frac{180}{220}$ oe **M1dep** for 47 + 33 + *their* angle *BAC*
(e)	19700 or 19708 to 19720	**3**	**M1** for 0.5 × 180 × 170 × sin33 oe or 0.5 × 180 × *their* **(c)** oe **M1** for 0.5 × 180 × *their* **(a)** oe or 0.5 × 180 × 220 × sin(*their BAC*) oe

Question	Answer	Mark	Part marks
7 (a)	0.7, 0.1 oe correctly placed 0.2, 0.8 oe correctly placed	1 1	
(b) (i)	0.44 nfww oe	3	**M2** for $1 - \textit{their}\ 0.7 \times \textit{their}\ 0.8$ or for $0.3 + \textit{their}\ 0.7 \times \textit{their}\ 0.2$ oe or **M1** for *their* 0.7 × *their* 0.8 or for two of 0.3 × 0.9, 0.3 × *their* 0.1, *their* 0.7 × *their* 0.2
(ii)	110	1FT	**FT** 250 × *their* **(b)(i)**
(c)	If late at first two stations then certain to be late at station *C* oe	1	Indication of certain event (allow 1 or 100% probability or sure) at third station if late at first two stations
8 (a)	$\frac{323}{x} + \frac{323}{x+2} = 36$ oe three term equation	B2	**B1** for $\frac{323}{x}$ seen oe or $\frac{323}{x+2}$ seen oe
	$323(x + 2) + 323x = 36x(x + 2)$ oe or $\frac{323x + 646 + 323x}{x(x+2)} = 36$ oe	M1	i.e. for clearing the fractions (or all still over common denominator) or reducing the two algebraic fractions to one fraction and expanding the brackets in the numerator
	$36x^2 - 574x - 646 = 0$ $18x^2 - 287x - 323 = 0$	A1	answer reached without any omissions or errors with at least one intermediate line with brackets expanded after M1
(b) (i)	17, 19	1	
(ii)	(……. + 19)(……. – 17)	2	**SC1** for (……. + *a*)(……. + *b*) where *a*, *b* are integers and *ab* = –323 or *a* + 18*b* = –287
(iii)	$17, -\frac{19}{18}$ oe	1FT	**FT** *their* **(b)(ii)**
(c)	11 cao	1	

Question	Answer	Mark	Part marks
9 (a)	236	3	**B2** for 243 and 7 or **M2** for $3^{2(2)+1} - (2(3^{[1]}) + 1)$ oe **B1** for h(5) or f(3) soi or **M1** for $3^{2x+1} - (2(3^x) + 1)$ or better
(b)	$6x + 1$ final answer	2	**M1** for $3(2x + 1) - 2$
(c)	$x < 3$ oe final answer	2	**M1** for $1 + 2 > 3x - 2x$ or $2x - 3x > -2 - 1$ oe
(d)	–2	1	
(e)	$\frac{x+2}{3}$ oe final answer	2	**M1** for $x = 3y - 2$ or $y + 2 = 3x$ or $\frac{y}{3} = x - \frac{2}{3}$
(f)	$\frac{6x^2 - x + 3}{2x + 1}$ final answer	3	**M1** for $5 + (2x + 1)(3x - 2)$ or better isw **B1** for common denominator $2x + 1$ isw
(g)	9	1	
10 (a)	115 or 114.5 to 114.6	3	**M2** for $\frac{r^2}{\frac{\pi r^2}{360}}$ or better or **M1** for $\frac{w}{360} \times \pi \times r^2 = r^2$
(b)	126	3	**M2** for $\frac{x}{360} \times 2\pi r [+2r] = [2r+] \frac{7\pi r}{10}$ or better or **M1** for $\frac{x}{360} \times 2\pi r$
(c)	120	4	**B3** for $\frac{y}{2} = 60$ or x (base angle) = 30 OR **M3** for $\cos x$ or $\sin\left(\frac{y}{2}\right) = \frac{\sqrt{3}}{2}$ oe or $\cos y = -\frac{1}{2}$ oe or **M2** for $\cos x$ or $\sin\left(\frac{y}{2}\right) = \frac{q\sqrt{3}}{2q}$ or $[\cos y] = \frac{q^2 + q^2 - \left(q\sqrt{3}\right)^2}{2 \times q \times q}$ oe or **M1** for $\left[\left(q\sqrt{3}\right)^2 =\right] q^2 + q^2 - 2 \times q \times q \cos y$ oe After **M0**, **SC1** for $[h^2 =] q^2 - \left(\frac{1}{2} q\sqrt{3}\right)^2$ or for q replaced by 1, 2, 4, etc.

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

MATHEMATICS **0580/42**

Paper 4 Paper 4 (Extended) **October/November 2016**

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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Cambridge is publishing the mark schemes for the October/November 2016 series for most Cambridge IGCSE®, Cambridge International A and AS Level components and some Cambridge O Level components.

This syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

Abbreviations

cao correct answer only
dep dependent
FT follow through after error
isw ignore subsequent working
oe or equivalent
SC Special Case
nfww not from wrong working
soi seen or implied

Question	Answer	Mark	Part marks
1 (a) (i)	11 054.25 final answer	**2**	**M1** for $18000\times\left(1-\frac{15}{100}\right)^3$ oe
(ii)	16 500	**3**	**M2** for $14025\div\left(1-\frac{15}{100}\right)$ oe or **M1** for recognition of 14 025 as 85% soi
(b)	260 final answer	**2**	**M1** for $P\left(1+\frac{5}{100}\right)^2=286.65$ oe
(c) (i)	6.18	**3**	**M2** for $\frac{224.72-200}{200\times 2}\times 100$ oe or $\frac{1}{2}\left(\frac{224.72}{200}\times 100-100\right)$ or **M1** for $\frac{200\times r\times 2}{100}$ oe or $\frac{224.72-200}{200\times 2}$ or $\frac{224.72}{200}\times 100-100$ soi by 12.36 If zero scored, **SC1** for 56.18 or 56.2 as final answer
(ii)	6	**3**	**M2** for $\sqrt{\frac{224.72}{200}}$ or $\sqrt{\frac{224.72}{2}}$ soi by 1.06 or 106 or 10.6 or **M1** for $200\left(1+\frac{r}{100}\right)^2=224.72$ oe

Question	Answer	Mark	Part marks
2 (a)	1 1	**1** **1**	
(b)	Fully correct graph	**4**	**B3FT** for 6 or 7 points plotted or **B2FT** for 4 or 5 points plotted or **B1FT** for 2 or 3 points plotted
(c) (i)	$-1 < \text{ans} < -0.8$ $1.25 < \text{ans} < 1.45$ $2.5 < \text{ans} < 2.6$	**1** **1** **1**	
(ii)	$-0.7 < \text{ans} < -0.5$	**2**	**M1** for evidence of $y = -x$ or $\frac{x^3}{3} - x^2 + 1 = -x$
(d) (i)	$y = 1$ to 1.1 oe	**1FT**	**FT** only if a clear maximum point
	$y = -0.4$ to -0.33 oe	**1FT**	**FT** only if a clear minimum point
(ii)	-0.4 to -0.33 oe	**1FT**	Correct or **FT** *their* graph
3 (a)	$\frac{240\sin 85}{\sin 50}$	**M2**	or **M1** for $\frac{\sin 50}{240} = \frac{\sin 85}{AB}$ oe
	312 or 312.1 ….	**B1**	
(b)	$\frac{1}{2} \times 180 \times 240 \times \sin A = 12000$	**M1**	
	33.748 to 33.749	**A2**	**A1** for $\sin = \frac{24000}{43200}$ or better or 0.555 or 0.556 or $0.5\dot{}$ or 0.5555 to 0.5556
(c)	328 or 328.3 to 328.5	**5**	**B1** for [angle A =] 78.75 seen **M2** for $180^2 + (\textit{their } AB)^2 - 2 \times 180 \times \textit{their } AB \times \cos 78.75$ or **M1** for $\cos 78.75 = \frac{180^2 + (\textit{their} AB)^2 - x^2}{2 \times 180 \times (\textit{their} AB)}$ **A1** for 107 800 to 107 900
(d) (i)	108.75 or 108.7 or 108.8	**1**	
(ii)	288.75 or 288.7 or 288.8	**2FT**	**FT** 180 + *their* **(d)(i)** **M1** for 180 + *their* **(d)(i)** or 360 – (180 – *their***(d)(i)**)

Question	Answer	Mark	Part marks
4 (a)	15	2	**M1** for 10 ÷ 40 [× 60]
(b)	49.2 nfww	4	**M1** for 35, 42.5, 47.5, 52.5, 57.5, 70 soi **M1** for Σfx $8 \times 35 + 22 \times 42.5 + 95 \times 47.5 + 55 \times 52.5 + 14 \times 57.5 + 6 \times 70$ **M1 dep** for *their* $\Sigma fx \div 200$
(c)	Fully correct histogram	4	**B3** for 4 correct blocks or **B2** for 2 or 3 correct blocks or **B1** for 1 correct block If zero scored, **SC1** for correct frequency densities 0.8, 19, 11, 2.8, 0.3 soi
(d) (i)	125, 180	1	
(ii)	Correct diagram	3	**B1FT** *their* **(d)(i)** for 6 correct heights within correct square(including boundaries) or touching correct line if should be on a grid line and **B1** for 6 points at upper ends of intervals on correct vertical line and **B1FT** (dep on at least B1) for increasing curve or polygon through 6 points If zero scored, **SC1FT** for 5 correct points plotted
(iii) (a)	48 to 49	1	
(b)	55	1	
(c)	8 to 14	2FT	**B1FT** for 186 to 192 seen

Question	Answer	Mark	Part marks
5 (a) (i)	$\frac{3}{4}$, $\frac{1}{4}$ $\frac{7}{8}$, $\frac{1}{8}$	2	**B1** for any 2 correct
(ii)	$\frac{21}{32}$ oe	2	**M1** for $\frac{7}{8}\times\frac{3}{4}$ oe
(iii)	$\frac{441}{1024}$ oe	2FT	**M1** for $\left(\frac{7}{8}\times\frac{3}{4}\right)^2$ or *their* **((a)(ii))**^{2} oe
(b)	175	2	**M1** for $200 \times \frac{7}{8}$
(c)	2400	2	**M1** for 1575 ÷ *their***(a)(ii)**

Question	Answer	Mark	Part marks
6 (a) (i)	1.32	2	**M1** for $0.8 \times 1.5 \times 1.1$
(ii)	0.725 or 0.7246 to 0.7247…	2	**M1** for $\pi r^2 \times 0.8 = \textit{their}$**(a)(i)** or $\pi r^2 = 1.5 \times 1.1$ oe
(iii)	0.513 to 0.518 nfww	5	**M1** for $2(1.5 \times 1.1 + 1.5 \times 0.8 + 1.1 \times 0.8)$ **M1** for [2 ×] $\pi \times (\textit{their}$ **(a)(ii)**$)^2$ **M2** for $\pi \times 2 \times (\textit{their}$ **(a)(ii)**$) \times 0.8$ or **M1** for $\pi \times 2 \times (\textit{their}$ **(a)(ii)**$)$
(b) (i)	$x + y \geqslant 9$ oe $y \geqslant 2$ oe	1 1	If zero scored, **SC1** for $x + y > 9$ **and** $y > 2$
(ii)	Fully correct diagram with **unwanted** region shaded	4	**B1** for $2x + 3y = 24$ ruled **B1** for $x + y = 9$ ruled **B1** for $y = 2$ ruled
(iii)	20 [x =] 7 [y =] 2	1 1 1	If zero scored, **SC1** for $2x + 3y$ evaluated from integers

7	**(a)**	54.50 final answer	**2**	**B1** for 54.495 to 54.496 or 54.5 or **M1** for 200 ÷ 3.67
	(b) (i)	$\frac{1000}{x(x+1)}$ final answer	**3**	**M1** for $1000(x + 1) – 1000x$ **M1** for denominator $x(x + 1)$
	(ii)	$\frac{1000}{x} - \frac{1000}{x+1} = 4.5[0]$ oe or $\frac{1000}{x(x+1)} = 4.5$	**M1**	Allow *their* **(b)(i)** for first **M1** only for a single fraction
		$1000 = 4.5x\,(x + 1)$ $4.5x^2 + 4.5x – 1000 = 0$ $9x^2 + 9x – 2000 = 0$	**M1dep** **A1**	Correctly multiplying by algebraic denominator Equation reached without any errors or omissions and at least one step after clearing the denominators of the fractions still with brackets included
	(iii)	$\frac{-9 \pm \sqrt{9^2 - 4(9)(-2000)}}{2(9)}$	**2**	**B1** for $\sqrt{9^2 - 4(9)(-2000)}$ If in form $\frac{p+\sqrt{q}}{r}$ or $\frac{p-\sqrt{q}}{r}$ then **B1** for $p = – 9$ and $r = 2(9)$
		– 15.42 14.42	**B1** **B1**	**SC1** for answers – 15.4 or – 15.42 to – 15.41 **and** 14.4 or 14.41 to 14.42 or for – 14.42 **and** 15.42 or – 15.42 **and** 14.42 seen but not final answer **Answers without working only score B1, B1 or SC1**
	(iv)	69.34 to 69.37 final answer **must be 2 dp**	**2FT**	**FT** 1000 ÷ *their* positive x with final answer rounded up or down to 2 dp or **M1** for 1000 ÷ *their* positive x

8	**(a)**	$[u =]$ 80 $[v =]$ 160	**1** **1**	
	(b)	6.24 or 6.244 to 6.245	**3**	**M2** for $\sqrt{8^2 - 5^2}$ oe or **M1** for $l^2 + 5^2 = 8^2$ oe or **B1** for suitable right angled triangle drawn with 5 on correct side
	(c)	5.05 or 5.052….	**2**	**M1** for $\frac{4.8}{2.5} = \frac{9.7}{MN}$ oe
	(d)	4 nfww	**4**	**M3** for $[x^n](x+1) = 4 \times \frac{5}{12}[x^n](x-1)$ oe, n = 1, 2 or 3 or **M2** for $\frac{[x](x+1)}{\frac{5}{12}[x](x-1)} = \left(\frac{2[x]}{[x]}\right)^2$ oe or **M1** for 2^2 or $\left(\frac{1}{2}\right)^2$ soi
9	**(a)** **(i)**	1.5 oe	**1**	
	(ii)	$\frac{3}{y-2}$ oe final answer	**3**	**M1** for correct removal of fraction **M1** for collection of terms in x **and** factorises OR **M1** subtracts 2 from both sides **M1** multiplies by x to remove fraction and **M1** for correct division by expression of the form $ay + b$, a and $b \neq 0$
	(b) **(i)**	–3	**1**	
	(ii)	65 536 final answer	**2**	**B1** for h(16) oe e.g. h(2^4)
	(iii)	–6	**2**	**M1** for $2 - x = 2^3$ oe
	(iv)	3	**1**	
10	**(a)**	7.5	**2**	**M1** for $3x + x + 3x + x = 60$ oe
	(b)	5	**3**	**B2** for $3x + 4x + 5x$ [= 60] or better or **M1** for $(3x)^2 + (4x)^2$ oe
	(c)	16.8 or 16.80….	**3**	**M2** for $x + x + \frac{90}{360} \times \pi \times 2 \times x$ [= 60] oe or **M1** for $\frac{90}{360} \times \pi \times 2 \times x$ oe

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

MATHEMATICS **0580/43**

Paper 4 (Extended) **October/November 2016**

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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Abbreviations
cao correct answer only
dep dependent
FT follow through after error
isw ignore subsequent working
oe or equivalent
SC Special Case
nfww not from wrong working
soi seen or implied

Question	Answer	Mark	Part marks
1 (a) (i)	1050	2	**M1** for $924 \div 22$ oe or $924 \div 0.88$ oe If zero scored, **SC1** for 126 seen
(ii)	12	1	
(iii)	5 ¼ hrs or 5.25 hrs	2	**M1** for $9 \div (7 + 5)$ or $540 \div (7 + 5)$ If zero scored, **SC1** for answer 3.75h or 3h 45 mins
(b)	24.6[0]	3	**M2** for $15.99 \div \left(1 - \frac{35}{100}\right)$ oe or **M1** for 65% associated with 15.99
(c)	63	3	**M2** for $35 \times \sqrt{\frac{2835}{875}}$ oe or **M1** for $\sqrt{\frac{2835}{875}}$ or $\sqrt{\frac{875}{2835}}$ or better or $\frac{\sqrt{2835}}{?} = \frac{\sqrt{875}}{35}$ oe OR **M2** for $\sqrt{2835 \times \frac{35}{their(875 \div 35)}}$ oe or **M1** for $\frac{35}{their(875 \div 35)}$ or $\frac{their(875 \div 35)}{35}$
(d) (i)	0.661[0]	1	
(ii)	48	3	**M2** for $\frac{18.50 - 12.50}{12.50} \times 100$ or **M1** for $\frac{18.50 - 12.50}{12.50}$ or $\frac{18.50}{12.50} \times 100$

Question	Answer	Mark	Part marks
2 (a)	–4.5 and 10.5	2	**B1** for each value
(b)	Correct curve	5	**B4** for correct curve with branches joined OR **B3 FT** for 9 or 10 points or **B2 FT** for 7 or 8 points or **B1 FT** for 5 or 6 points **and** **B1** independent for one branch on each side of the y-axis and **not touching** or crossing the y-axis
(c)	5	1	
(d) (i)	Line $y = 15 - 3x$ ruled and –0.4 to –0.31 0.35 to 0.45 2.2 to 2.3	4	**B3** for correct line and 2 correct values or **B2** for correct line or **M1** for ruled line with gradient –3 or through (0, 15) or **SC2** for no/wrong line and three correct values or **SC1** for no/wrong line and two correct values or for correct freehand line
(ii)	$[a =]$ 6 $[b =]$ –14 $[c =]$ 0	3	**B2** for $6x^3 - 14x^2 + 2 = 0$ oe or **M1** for correct removal of denominator or collection of terms on one side
3 (a)	2.25 oe	2	**M1** for $8x + 4x = 22 + 5$ or better
(b)	$x \geqslant 3.5$ final answer	2	**M1** for $6x - 2x \geqslant 14$ or better
(c)	$(x - 7)(x + 3)$ final answer	2	**M1** for $x(x + 3) - 7(x + 3)$ or $x(x - 7) + 3(x - 7)$ or for $(x + a)(x + b)$ where $ab = -21$ or $a + b = -4$
(d)	$12x^2 + xy - 6y^2$ final answer	3	**M2** for $12x^2 + 9xy - 8xy - 6y^2$ or **M1** for any two of the four terms correct
4 (a)	Triangle drawn at (–4, 3), (–1, 3), (–1, 4)	2	**SC1** for correct reflection in $x = k$ or $y = 1$
(b)	Triangle drawn at (1, 7), (1, 6), (4, 6)	2	**SC1** for translation by $\begin{pmatrix} -2 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ 3 \end{pmatrix}$
(c)	Triangle drawn at (2, 3), (2, 1), (8, 1)	2	**M1** for two correct vertices or **SC1** for correct enlargement about the wrong centre
(d)	Rotation 90º clockwise oe (7, 4)	1 1 1	Accept –90°

Question	Answer	Mark	Part marks
5 (a)	$\frac{1}{64}$	2	**M1** for $\frac{1}{8} \times \frac{1}{8}$
(b)	$\frac{63}{64}$	1FT	**FT** 1 – *their* **(a)**
(c)	$\frac{30}{64}$ oe	2	**M1** for [2 ×] $\frac{3}{8} \times \frac{5}{8}$ oe
(d)	$\frac{7}{64}$	3	**M2** for $\frac{1}{8} \times \frac{1}{8} + \frac{1}{8} \times \frac{3}{8} + \frac{3}{8} \times \frac{1}{8}$ oe or **M1** for identifying combinations required, (8, 8) and (8, 6) and (8, 5) or identifying 6 out of the 7 possible outcomes
(e)	$\frac{24}{64}$ oe	3	**M2** for $\frac{1}{8} \times \frac{7}{8} + \frac{3}{8} \times \frac{4}{8} + \frac{2}{8} \times \frac{2}{8} + \frac{1}{8} \times \frac{1}{8}$ oe or $\frac{7}{8} \times \frac{1}{8} + \frac{6}{8} \times \frac{1}{8} + \frac{4}{8} \times \frac{2}{8} + \frac{1}{8} \times \frac{3}{8}$ oe or **M1** for the sum of any two correct products from above oe isw
6 (a)	[cosABL =] $\frac{40^2 + 61.1^2 - 92.1^2}{2 \times 40 \times 61.1}$	M2	**M1** for correct implicit version
	130.11…	A2	**A1** for [cosABL =] –0.644… or $-\frac{7873}{12220}$ or $-\frac{3149.2}{4888}$
(b)	[0]59.5 or 59.50 to 59.511	4	**M2** for $\frac{40\sin 130.1}{92.1}$ or $\frac{61.1\sin 130.1}{92.1}$ or **M1** for $\frac{\sin A}{40} = \frac{\sin 130.1}{92.1}$ or $\frac{\sin L}{61.1} = \frac{\sin 130.1}{92.1}$ **and** **A1** for 19.39 to 19.4… or 30.48 to 30.49…

Question	Answer	Mark	Part marks
(c)	1h 50min	5	**M2** for $[BC =]\ 2 \times 40 \times \cos(180 - 130.1)$ oe or **M1** for $\frac{x}{40} = \cos(180 - 130.1)$ oe OR **M2** for $[BC =]\ \sqrt{\{40^2 + 40^2 - 2 \times 40 \times 40\cos(\textit{their}\ 80.2)\}}$ or **M1** for correct implicit version OR **M2** for $[BC =]\ \frac{40\sin(\textit{their}\ 80.2)}{\sin 49.9}$ or **M1** for correct implicit version **and** **M1** for $\frac{\textit{their}\ BC}{28}$ **A1** for 1.84[0…] to 1.841
7 (a) (i)	6000 [7600] 10200 4200	2	**B1** for 6000 or 10200 If **B0** then **B1FT** for *their* (UQ – LQ)
(ii)(a)	True, median price is lower	1	No inclusion of other statistic
(ii)(b)	False, A's UQ < 13 600 oe	1FT	**FT** *their* UQ in **(a)(i)**
(b)	11 025	4	Listed values are in thousands **M1** for 3, 7, 9, 11, 13, 18 soi **M1** for Σfm [1323] **M1** (dep on second **M1**) for *their* $\Sigma fm \div 120$
(c)	323.25 nfww	3	**M2** for $9948 - 0.25 \times 8760$ or **M1** for 0.25×8760
8 (a)	Attempt to use $18 - r$ in Pythagoras'	M1	
	$144 = r^2 - 324 + 18r + 18r - r^2$ oe	B2	or **B1** for $324 - 18r - 18r + r^2$
	$468 = 36r$ oe	A1	Correct simplification with no errors
(b)	$[2 \times]\ \sin^{-1}\left(\frac{12}{13}\right)$ oe	M1	or $\cos = \left(\frac{13^2 + 13^2 - 24^2}{2 \times 13 \times 13}\right)$ or better or $[180 -]\ 2 \times \sin^{-1}\left(\frac{5}{13}\right)$
	134.76…	A1	Not 67.4×2

Question	Answer	Mark	Part marks
(c) (i)	332 or 332.1 to 332.2…	3	**M2** for $\frac{(360-134.8)}{360} \times \pi \times 13^2$ or **M1** for $\frac{134.8}{360} \times \pi \times 13^2$
(ii)	392 or 392.0 to 392.2…	3	**M2** for ½ × 24 × 5 + *their* **(c)(i)** or ½ × 13^2 × sin134.8 + *their* **(c)(i)** or **M1** for ½ × 24 × 5 or ½ × 13^2 × sin134.8
(iii)	15 700 or 15 670 to 15 690	1FT	**FT** for answer to 40 × *their* **(c)(ii)**
(d)	29.5 or 29.6 or 29.51 to 29.57…	2FT	**M1** for $\pi \times 13^2 \times h$ = *their* **(c)(iii)** or better
9 (a) (i)	$\begin{pmatrix} 12 \\ -5 \end{pmatrix}$	2	**M1** for $\begin{pmatrix} 12 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ -5 \end{pmatrix}$
(ii)	13 nfww	2FT	**M1FT** for $\sqrt{their\,12^2 + their\,(-5)^2}$ **FT** dep on *their* **(a)** being $\begin{pmatrix} a \\ b \end{pmatrix}$ where a, b are both non-zero
(b)(i)(a)	**b** – **a**	1	
(i)(b)	$\frac{3}{5}(\mathbf{b}-\mathbf{a})$ or $\frac{3}{5}\mathbf{b}-\frac{3}{5}\mathbf{a}$ final answer	1FT	**FT** $\frac{3}{5}$ *their* vector, in terms of **a** and **b**, in **(b)(i)(a)**
(i)(c)	$\frac{1}{5}(2\mathbf{a}+3\mathbf{b})$ or $\frac{2}{5}\mathbf{a}+\frac{3}{5}\mathbf{b}$ final answer	2	**M1** for **a** + *their* vector in **(b)(i)(b)** or any correct route
(ii)	$\frac{3}{2}$ oe	1	

Question	Answer	Mark	Part marks
10 (a)	A: 14 $3n - 1$ oe	**3**	**B1** for 14 **B2** for $3n - 1$ oe or **M1** for $3n + k$, for any k oe
	B: –4 $26 - 6n$ oe	**3**	**B1** for –4 **B2** for $26 - 6n$ oe or **M1** for $k - 6n$, for any k oe
	C: 25 n^2 oe	**2**	**B1** for 25 **B1** for n^2 oe
	D: 20 $n^2 - n$ oe	**2**	**B1** for 20 **B1** for $n^2 - n$ oe
(b) (i)	$\frac{n(3n+1)}{2} = 155$	**M1**	Accept $\frac{3n^2+n}{2} = 155$
	$3n^2 + n = 310$		Intermediate step must include elimination of fraction eg $n(3n + 1) = 310$
	$3n^2 + n - 310 = 0$	**A1**	With no errors or omissions
(ii)	10 , $-\frac{31}{3}$ oe	**3**	**M2** for $(3n + 31)(n - 10)$ [= 0] or **M1** for $3n(n - 10) + 31(n - 10)$ or $n(3n + 31) - 10(3n + 31)$ or $(3n + a)(n + b)$ where $ab = -310$ or $a + 3b = 1$
(iii)	10	**1FT**	**FT** *their* **b(ii)** if only one positive integer solution

Question	Answer	Mark	Part marks
11	5 and $-\frac{27}{2}$ oe	**7**	**M2** for $12 \times 2(2x - 1) + (x + 3)(2x - 1) = 12 \times 3(x + 3)$ oe or **M1** for a common denominator with 2 or more of the terms and **B2** for $2x^2 + 17x - 135$ [= 0] oe or **B1** for $48x - 24$ or $2x^2 - x + 6x - 3$ or $36x + 108$ or $2x^2 - x + 54x - 27$ or $132 - 12x$ or $37x + 111 - 2x^2 - 6x$ and **M2** for $(2x + 27)(x - 5)$ or *their* correct factors or formula or **M1** for $2x(x - 5) + 27(x - 5)$ or $x(2x + 27) - 5(2x + 27)$ or $(2x + a)(x + b)$ where $ab = -135$ or $a + 2b = 17$

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

MATHEMATICS **0580/41**

Paper 4 (Extended) **May/June 2016**

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the May/June 2016 series for most Cambridge IGCSE®, Cambridge International A and AS Level components and some Cambridge O Level components.

This syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

Abbreviations

cao correct answer only
dep dependent
FT follow through after error
isw ignore subsequent working
oe or equivalent
SC Special Case
nfww not from wrong working
soi seen or implied

Question	Answer	Mark	Part marks
1 (a) (i)	48	2	**M1** for $\frac{72}{3}$
(ii)	32.4[0]	1	
(iii)	$\frac{13}{30}$	2	**M1** for $\frac{72 - their(ii) - 8.4}{72}$ oe
(iv)	24	3	**M2** for $\frac{19.2}{0.8}$ oe or **M1** for recognising 19.2 is 80%
(b)	660	3	**M2** for $\frac{550 \times 2 \times 10}{100} + 550$ oe or **M1** for $\frac{550 \times 2 \times 10}{100}$ oe
(c)	663.9[0]	2	**M1** for 550×1.019^{10} oe
(d)	1.5[0]	3	**M2** for $\sqrt[10]{\frac{638.3[0]}{550}}$ oe or **M1** for $550 \times m^{10} = 638.3[0]$
2 (a) (i)	Triangle drawn, vertices (2, – 4), (2, – 5), (4, – 4)	2	**SC1** for translation $\begin{pmatrix} 5 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ -2 \end{pmatrix}$ or correct points not joined
(ii)	Triangle drawn, vertices (– 3, 4), (– 3, 5), (– 1, 4)	2	**SC1** for reflection in line $y = k$ or line $x = 1$ or correct points not joined
(iii)	Enlargement	1	
	[factor] 3	1	
	[centre] (– 6, – 5)	1	
(b) (i)	$\begin{pmatrix} 2 & 5 \\ 3 & 10 \end{pmatrix}$	1	

Question	Answer	Mark	Part marks
(ii)	$\begin{pmatrix}10 & 14\\ 18 & 24\end{pmatrix}$ final answer	2	**SC1** for one row or one column correct
(iii)	$\frac{1}{4}$ oe	3	**M2** for $1\times4-2\times3=4\times k-3\times1$ or better or **B1** for $1\times4-2\times3$ or $4\times k-3\times1$ seen
(c) (i)	Rotation	1	
	90° [anti-clockwise] oe	1	
	(0, 0) oe	1	
(ii)	$\begin{pmatrix}0 & 1\\ 1 & 0\end{pmatrix}$	2	**SC1** for one correct row or column
3 (a) (i)	400	1	
(ii)	350	1	
(iii)	70	1	
(iv)	170	2	**B1** for 30 seen
(b) (i)	Mid-values 40, 80, 125, 200 soi	M1	
	Σfx with correct frequencies and x's in correct intervals or on boundaries of correct intervals	M1	
	÷ 200	M1(dep)	Dependent on second M1
	106 nfww	A1	**SC2** for correct answer without working
(ii)	Correct histogram	4	**B1** for correct widths **and B1** for each rectangle of correct height at 0.8, 1.6, 1.6 (up to **B3**) After 0 scored, **SC1** for 3 correct frequency densities seen
(iii)	$\frac{10712}{39800}$ oe isw	2	**M1** for $\frac{104}{200}\times\frac{103}{199}$ oe
4 (a)	14 137 to 14 137.2 or 14 139	2	**M1** for $\frac{4}{3}\times\pi\times15^3$
(b) (i)	104 000 or 103 600 to 103 700	3	**M2** for $\pi\times25^2\times60-14140$ or **M1** for $\pi\times25^2\times60$

Question	Answer	Mark	Part marks
(ii)	52.8 or 52.75 to 52.81…	2	**M1** for *their* (b)(i) ÷ ($\pi \times 25^2$) or $14\,140 \div (\pi \times 25^2)$
(c) (i)	15.8 or 15.81…..	3	**M2** for $[r^2 =]\ \frac{14140}{\frac{1}{3} \times \pi \times 54}$ or **M1** for $\frac{1}{3} \times \pi \times r^2 \times 54 = 14\,140$ oe
(ii)	3580 or 3576 to 3581 nfww	4	**M1** for (*their* (c)(i))^2 + 54^2 **M1** for $\pi \times$ (*their* (c)(i)) $\times \sqrt{\{}$(*their* (c)(i))^2 + $54^2\}$ **M1** for $\pi \times$ (*their* (c)(i))^2
5 (a)	9 10.5	1 1	
(b)	Fully correct curve	5	**SC4** for correct curve, but branches joined **B3 FT** for 9 or 10 points plotted or **B2 FT** for 7 or 8 points plotted or **B1 FT** for 5 or 6 points plotted and **B1** for two separate branches not touching or cutting *y*-axis
(c)	2.1 to 2.6 8.5 to 9	1 1	
(d)	2, 3, 5, 7	2	**SC1** for correct 4 values and no more than one extra positive integer or ±2, ±3, ±5, ±7 or 3 correct values and no extras
(e)	(– 2, – 12)	1	
(f) (i)	$20 + x^2 = x^3$ $x^3 - x^2 - 20 = 0$	M1 A1	Multiplication by *x* No errors or omissions
(ii)	Fully correct curve $y = x^2$	2	**SC1** for U – shaped parabola, vertex at origin
(iii)	2.5 to 3.5	1	
(iv)	3.[0] to 3.1 or FT their answer to (iii)	1FT	**FT** dep on (iii) > 0

Question	Answer	Mark	Part marks
6 (a) (i)	$[y =]\ \frac{1}{2}(80-2x)$	M1	$40 - x$ is enough
	$A = their\frac{1}{2}(80-2x)\times x$ oe	M1	
	$A = 40x - x^2$ and $x^2 - 40x + A = 0$	A1	No errors or omissions
(ii)	$(x-30)(x-10)$	B2	**B1** for $x(x-30) - 10(x-30)$ [= 0] or $x(x-10) - 30(x-10)$ [= 0] or **SC1** for $(x+a)(x+b)$ where $ab = 300$ or $a + b = -40$
	30, 10	B1	
(iii)	$\sqrt{(-40)^2 - 4(1)(200)}$ or better	B1	or for $(x-20)^2$
	$p = --40$ and $r = 2(1)$	B1	Must see $\frac{p+\sqrt{q}}{r}$ or $\frac{p-\sqrt{q}}{r}$ or both or for $20 \pm \sqrt{200}$
	5.86 34.14	B1 B1	If B0, **SC1** for 5.9 or 5.857 to 5.858 **and** 34.1 or 34.14… or 5.86 **and** 34.14 seen in working or –5.86 **and** –34.14 as final answers
(b) (i)	$\frac{200}{x} - \frac{200}{x+10}$	M2	or **M1** for $\frac{200}{x}$ or $\frac{200}{x+10}$ soi
	$\frac{200(x+10)-200x}{x(x+10)} = \frac{2000}{x(x+10)}$	A1	No errors or omissions
(ii)	16 [min] 40 [s]	3	**B2** for $0.2\dot{7}$ or 0.278 or 0.2777 to 0.2778 or $\frac{5}{18}$ [h] oe or $16.\dot{6}$ or 16.7 or 16.66 to 16.67 or $\frac{50}{3}$ [min] or **M1** for $2000 \div 80(80+10)$ or $\frac{200}{80} - \frac{200}{90}$

Question	Answer	Mark	Part marks
7 (a) (i)	$\frac{1}{2}\mathbf{p}$	1	
(ii)	$\frac{1}{2}\mathbf{p} - \frac{1}{3}\mathbf{r}$	1	
(iii)	$\mathbf{p} + \frac{2}{3}\mathbf{r}$	1	
(b)	$\mathbf{r} + \frac{3}{2}\mathbf{p}$	2	**M1** for correct unsimplified answer or for correct route or for recognising $\overrightarrow{OU}$ as position vector
(c)	6 nfww	3	**B2** for $(2k)^2 + ([-]k)^2 = 180$ oe or **M1** for $(2k)^2 + ([-]k)^2$ oe
8 (a)	2	2	**M1** for $2x + 1 = 1 + 4$
(b)	17	2	**B1** for [h(3) =] 8 soi or $2\times2^x + 1$ oe
(c)	$\frac{x-1}{2}$ oe final answer	2	**M1** for $y - 1 = 2x$ or $\frac{y}{2} = x + \frac{1}{2}$ or $x = 2y + 1$
(d)	$4x^2 + 4x + 5$ final answer	3	**M1** for $(2x+1)^2 + 4$ and **B1** for $[(2x+1)^2 =] 4x^2 + 2x + 2x + 1$ or better
(e)	$\sqrt{2}$ or 1.41 or 1.414....	1	
(f)	–1	1	
9 (a) (i)	$-\frac{1}{2}x + 2$ oe	3	**SC2** for $y = -\frac{1}{2}x + c$ oe or **SC1** for $y = kx + 2$ oe, $k \neq 0$ or **M1** for [gradient =] $\frac{-2}{4}$ and **M1** for substituting (4, 0) or (0, 2) into $y =$ (*their m*)$x + c$
(ii)	$\frac{16}{a^2}\left[+\frac{0^{[2]}}{b^2}\right] = 1$ or $\frac{4^2}{a^2}\left[+\frac{0^{[2]}}{b^2}\right] = 1$ and $a^{[2]} = 4^{[2]}$	1	
	$\left[\frac{0^{[2]}}{a^2}\right] + \frac{4}{b^2} = 1$ or $\left[\frac{0^{[2]}}{a^2}\right] + \frac{2^2}{b^2} = 1$ and $b^{[2]} = 2^{[2]}$	1	

Question	Answer	Mark	Part marks
(b) (i)	1.73 or 1.732.. or $\sqrt{3}$	3	**M2** for $\frac{k^2}{4}=\frac{3}{4}$ or better or **M1** for $\frac{2^2}{16}+\frac{k^2}{4}=1$ oe
(ii)	81.8 or 81.78 to 81.79	3	**M2** for $2\times\tan^{-1}\left(\frac{their\sqrt{3}}{2}\right)$ oe or **M1** for tan = $\frac{their\sqrt{3}}{2}$ oe
(c) (i)	8π final answer	1	
(ii)	72π final answer	2FT	FT *their* (c)(i) × 9 in terms of π **M1** for area factor of 3^2 or 9 or [new *a*] = 12, [new *b*] = 6

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

MATHEMATICS **0580/42**

Paper 4 (Extended) **May/June 2016**

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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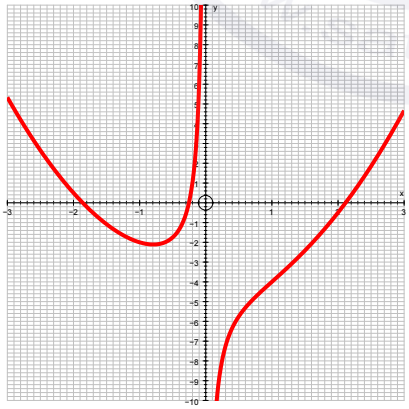
Abbreviations

cao correct answer only
dep dependent
FT follow through after error
isw ignore subsequent working
oe or equivalent
SC Special Case
nfww not from wrong working
soi seen or implied

Question	Answer	Mark	Part marks
1 (a) (i)	12 45 [pm]	2	**B1** for 20 45 seen or 8 45 pm seen or [0]1 35 seen
(ii)	788 or 787.8 to 788.1	2	**M1** for 8800 ÷ 11h 10 mins oe
(b) (i)	4230[.00]	2	**M1** for 2350 ÷ 5 oe
(ii)	22.2 or 22.2…	1	
(c) (i)	3808 final answer	2	**M1** for $2240 \times \frac{100+70}{100}$ oe
(ii)	800	3	**M2** for $2240 \div \frac{100+180}{100}$ oe or **M1** for 2240 associated with 280%
(d) (i)	1130	4	**M3** for (826.5[0] – 12 × (28 + 6.5[0])) ÷ 1.25 seen or **M2** for 826.5[0] – 12 × (28 + 6.5[0]) seen or **M1** for 12 × (28 + 6.5[0]) seen
(ii)	$146.9[0] final answer	2FT	**FT** *their*(d)(i) × 0.13 correctly evaluated If answer not exact to at least 3 sf or better **M1** for *their* (d)(i) ÷ 10 × 1.3
2 (a) (i)	5	1	
(ii)	$\frac{1}{2}$ oe	1	
(iii)	$\frac{5}{3}$ oe	2	**M1** for $2^{3x} = 2^5$ oe or better or **SC1** for either denominator or numerator of index correct in final answer
(iv)	$-\frac{2}{3}$ oe	2	**M1** for $3^{3x} = 3^{-2}$ oe or better or $\left(\frac{1}{3}\right)^{-3x} = \left(\frac{1}{3}\right)^{2}$ or better or **SC1** for $\frac{2}{3}$ or any negative index

Question	Answer	Mark	Part marks
(b)	$(y - 10)(y + 3)$ seen	B2	**B1** for $y(y - 10) + 3(y - 10)$ [= 0] or $y(y + 3) - 10(y + 3)$[= 0] or for $(y + a)(y + b)$ [= 0] where $ab = -30$ or $a + b = -7$ or for $y - 10$ [= 0] and $y + 3$ [= 0]
	10 and – 3 final answers	B1	
3 (a) (i)	Image at (3, 1), (5, 1), (5, 4), (4, 4), (4, 2), (3, 2)	2	**SC1** reflection in $y = 1$ or $x = k$ or 6 correct points not joined
(ii)	Image at (2, 1), (6, 1), (6, – 5), (4, – 5), (4, – 1), (2, – 1)	2	**SC1** for other enlargement of scale factor –2, correct size and correct orientation **or** 6 correct points but not joined
(iii)	Image at (– 1, – 1), (– 2, – 1), (– 2, – 2), (– 4, – 2), (– 4, – 3), (– 1, – 3)	3	**M2** for 6 correct points shown in working or plotted correctly but not joined or **M1** for $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}\begin{pmatrix} -1 & -1 & -2 & -2 & -3 & -3 \\ 1 & 2 & 2 & 4 & 4 & 1 \end{pmatrix}$ or for rotation 90° [anticlockwise] centre (0, 0) stated
(b)	Enlargement [sf] 3 origin oe	3	**B1** for each
4 (a) (i)	– 2, – 0.5 or $-\frac{1}{2}$	2	**B1** for each
(ii)	Complete correct curve 	5	**SC4** for correct curves but branches joined or touching y-axis or **B3FT** 9 or 10 points or **B2FT** for 7 or 8 points or **B1FT** for 5 or 6 points and **B1indep** two separate branches not touching or crossing y-axis
(b)	– 1.95 to – 1.8 – 0.4 to – 0.2 2.05 to 2.2	3	**B1** for each
(c)	Any integer k where $k \leqslant -3$	1	

Question	Answer	Mark	Part marks
(d) (i)	Correct line $y = -5x - 2$ ruled and – 0.4 to – 0.2 0.55 to 0.75	**4**	**M2** for correct ruled line or **M1** for correct line but freehand or for ruled line gradient – 5 or ruled line y-intercept – 2, but not $y = -2$ and **A1** for each correct solution dependent on at least M1 If 0 scored, **SC1** for both correct with no line drawn
(ii)	[a =] 5 and [b =] – 2	**2**	**B1** for one correct value or **M1** for $x^3 + 5x^2 - 2x - 1 = 0$ seen
5 (a)	0.05 oe	**2**	**M1** for 1 – (0.2 + 0.3 + 0.45) oe
(b)	15	**1**	
(c) (i)	0.75 oe	**2**	**M1** for 0.45 + 0.3 oe
(ii)	0.135 oe	**2**	**M1** for 0.45 × 0.3 oe
(iii)	0.12 oe	**3**	**M2** for 2(0.3 × 0.2) oe or **M1** for 0.3 × 0.2 or 0.06 oe nfww
(d)	0.243 oe	**5**	**M4** for 3(0.45 × 0.45 × 0.2) + 3(0.3 × 0.3 × 0.45) oe or **M3** for 3(0.45 × 0.45 × 0.2) **or** 3(0.3 × 0.3 × 0.45) oe or **M2** for 0.45 × 0.45 × 0.2 **and** 0.3 × 0.3 × 0.45 or **M1** for 0.45 × 0.45 × 0.2 **or** 0.3 × 0.3 × 0.45 oe or for identifying the correct 6 outcomes e.g. 10 0 0, 0 0 10, 0 10 0, 5 5 0, 5 0 5, 0 5 5
6 (a)	3	**1**	
(b) (i)	9900	**3**	**M2** for 2(60 × 35) + 2(60 × 30) + 2(30 × 35) oe or **M1** for one correct rectangle
(ii)	0.99 oe	**1FT**	FT *their*(b)(i) ÷ 10 000

Question	Answer	Mark	Part marks
(c) (i)	75.7 or 75.66 to 75.67	4	**M3** for $\sqrt{60^2+30^2+35^2}$ oe could be in stages or **M2** for $60^2+30^2+35^2$ oe or **M1** for 60^2+30^2 or 60^2+35^2 or 35^2+30^2 oe
(ii)	23.4 or 23.3 or 23.34 to 23.36…	3	**M2** for $\sin^{-1}(30 \div \sqrt{60^2+35^2+30^2})$ oe or for $\sin^{-1}(30 \div$ *their* (c)(i)$)$ or **M1** for $\sin = 30 \div \sqrt{60^2+35^2+30^2}$ oe or for $\sin = 30 \div$ *their* (c)(i)
(d) (i)	$30 \times 35 \times 60$ [= 63 000]	1	With no errors seen
(ii)	22.4 or 22.38 to 22.391	3	**M2** for $\sqrt{\frac{63\,000}{40\pi}}$ oe or **M1** for $40\,\pi r^2 = 63\,000$ oe
7 (a)	360 – 210 [= 150] (180 – 150) ÷ 2 [= 15] **or** 150 ÷ 2 [=75] and 180 – 75 – 90 [=15]	**M1** **M1**	
(b)	15.5 or 15.45 to 15.46 nfww	4	**M3** for $2 \times 8 \cos 15$ oe or **M2** for $8 \cos 15$ oe or **M1** for $\frac{x}{8} = \cos 15$ oe
(c)	29.5 or 29.4 or 29.39 to 29.50..	3	**M2** for [$\sin ABC =$] $\frac{8 \times \sin 72}{their(b)}$ or **M1** for $\frac{\sin ABC}{8} = \frac{\sin 72}{their(b)}$ oe
(d)	194 or 193.7 to 194.1 nfww	6	**M2** for $\frac{210}{360} \times \pi \times 8^2$ or **M1** for $[k]\,\pi \times 8^2$ seen **and** **M1** for ½ × 8^2 × sin 150 oe **and M2** for ½ × 8 × *their* (b) × sin(108 – *their* (c)) oe or **B1** for [angle *CAB*=] 108 – *their* (c)
(e)	12.1 or 12.11 to 12.13	2FT	**FT** *their* (d) ÷ 4^2 oe **M1** for 4^2 or $\left(\frac{1}{4}\right)^2$ soi

Question	Answer	Mark	Part marks
8 (a) (i)	–3	2	**M1** for [g(1)=] –2 provided not used in a product or for $5\left(\frac{4}{x-3}\right)+7$ or better
(ii)	$\frac{4}{5x+4}$ final answer	2	**M1** for $\frac{4}{5x+7-3}$
(iii)	$\frac{4+3x}{x}$ or $\frac{4}{x}+3$ final answer	3	**M2** for $xy = 4 + 3x$ or $y - 3 = \frac{4}{x}$ or $x = \frac{4}{y} + 3$ or $x = \frac{4+3y}{y}$ or **M1** for $x = \frac{4}{y-3}$ or $y(x – 3) = 4$ or $x – 3 = \frac{4}{y}$ or $x(y – 3) = 4$
(iv)	2	1	
(b) (i)	$(5x + 7)(x – 3) = 4$	M1	
	$5x^2 – 15x + 7x – 21 = 4$ oe $5x^2 – 8x – 25 = 0$	B1 A1	Condone omission of ' = 4' for the B mark Dep on **M1B1** and no errors or omissions at any stage seen
(ii)	$\sqrt{(-8)^2 - 4(5)(-25)}$ or better	B1	or for $\left(x-\frac{4}{5}\right)^2$ oe
	$p = –(–8)$ and $r = 5 \times 2$ oe	B1	must see $\frac{p+\sqrt{q}}{r}$ or $\frac{p-\sqrt{q}}{r}$ or both or for $\frac{4}{5}+\sqrt{\left(\frac{4}{5}\right)^2+5}$ or $\frac{4}{5}-\sqrt{\left(\frac{4}{5}\right)^2+5}$
	–1.57 and 3.17	B1B1	**SC1** for final answers –1.6 or –1.574 to –1.575 **and** 3.2 or 3.174 to 3.175 or –1.57 **and** 3.17 seen in working or for –3.17 **and** 1.57 as final ans
9 (a)	19[.0] or 18.97.. nfww	3	**M2** for $\sqrt{(4--2)^2+(13--5)^2}$ oe or **M1** for $(4– – 2)^2 + (13 – – 5)^2$ oe

Question	Answer	Mark	Part marks
(b)	$[y =] 3x + 1$	**3**	**B2** for answer $[y =]3x + c$ oe or answer $kx + 1$ ($k \neq 0$) or **M1** for $\frac{13 - -5}{4 - -2}$ oe or 3 **and M1** for correct substitution of (–2, –5) or (4, 13) into $y =$ (*their m*)$x + c$ oe
(c)	$y = 3x - 5$ oe	**2FT**	FT *their* gradient from (b) **M1** for $y = mx - 5$ with other m, $m \neq 0$ or $y =$ {*their* gradient from (b)}$x + c$ If 0 scored, **SC1** for answer $3x - 5$
(d)	$y = -\frac{1}{3}x + \frac{13}{3}$ oe isw	**5**	**B2FT for** $-\frac{1}{3}x + c$ (c can be numeric or algebraic) **FT** –1/ *their* gradient from (b) or **M1** for –1/ *their* gradient from (b) soi **and** **B1** for [midpoint of AB =] (1, 4) and **M1** for substitution of (1, k) or (k, 4) into a linear equation

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

MATHEMATICS **0580/43**

Paper 4 (Extended) **May/June 2016**

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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Cambridge is publishing the mark schemes for the May/June 2016 series for most Cambridge IGCSE®, Cambridge International A and AS Level components and some Cambridge O Level components.

This syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

Abbreviations

cao correct answer only
dep dependent
FT follow through after error
isw ignore subsequent working
oe or equivalent
SC Special Case
nfww not from wrong working
soi seen or implied

Question	Answer	Mark	Part marks
1 (a) (i)	36 600	3	**M2** for $6100 \div 2 \times (2 + 7 + 3)$ oe or **M1** for $6100 \div 2$ soi
(ii)	$16\frac{2}{3}$ or 16.7 [16.66 to 16.67]	1	
(b)	1 231 708 final answer nfww	5	**M4** for $5964 \times 15 + 28400 \times 35 + 8236 \times 18$ or **M3** for 5964×15 **and** $28\,400 \times 35$ or for $5964 \times 15 + 42\,600 \times$ *their* decimal $\frac{2}{3}$ $\times 35 + (42\,600 - 5964 - 42\,600 \times$ *their* decimal $\frac{2}{3}) \times 18$ or **M2** for 5964×15 **or** $28\,400 \times 35$ or for $42\,600 \times$ *their* decimal $\frac{2}{3} \times 35$ or **M1** for $0.14 \times 42\,600$ or $42\,600 \div 3 \times 2$
(c)	27.2[0] nfww	5	**M2** for $23.80 \div 0.7$ oe or **M1** for 23.80 associated with 70% oe and **M2** for *their* $(23.80 \div 0.7) \times 0.8$ or **M1** for *their* $(23.80 \div 0.7) \times 0.2$
2 (a)	$x > \frac{12}{5}$ oe final answer	2	**B1** for $\frac{12}{5}$ oe in answer with incorrect or no sign or **M1** for one correct step e.g. $5x > 9 + 3$
(b) (i)	$(y - 6)(x + 3)$ final answer	2	**M1** for $y(x + 3) - 6(3 + x)$ or $x(y - 6) + 3(y - 6)$
(ii)	$8(x + 3y)(x - 3y)$ final answer	3	**M2** for $2(2x + 6y)(2x - 6y)$ or $(8x + 24y)(x - 3y)$ or $(8x - 24y)(x + 3y)$ or $4(2x - 6y)(x + 3y)$ or $4(2x + 6y)(x - 3y)$ or $(4x - 12y)(2x + 6y)$ or $(4x + 12y)(2x - 6y)$ or **M1** for $8(x^2 - 9y^2)$ or $(x + 3y)(x - 3y)$

Question	Answer	Mark	Part marks
(c)	$r = \frac{1}{p+7}$ final answer nfww	4	**M1** removes fraction correctly **M1** collects terms in r **M1** removes r as a factor from their terms in r **M1dep** divides by bracket to leave r and denominator simplified
3 (a) (i)	10	1	
(ii)	–3.4 to –3.3 and –0.4 to –0.3 and 1.6 to 1.7	3	**B1** for each
(iii)	y = –2.3 to –2.1oe y = 10 to 10.1oe	2	**B1** for each
(b) (i)	2, –1, 4	3	**B1** for each
(ii)	Fully correct curve drawn	4	**SC3** for correct curves but branches joined or touching y-axis or **B2FT** for 8 or 9 correct plots or **B1FT** for 6 or 7 correct plots and **B1** indep for two separate branches not touching or crossing y- axis
(iii)	–3.4 to –3.2 and 1.8 to 1.9	2	**B1** for each
(c)	3.2 oe	2FT	**FT** 2 ÷ *their* (a)(i) + 3 **M1** for f(–2) = 10 or *their* (a)(i) used
(d)	1	1	
4 (a) (i)	0.0025 or $\frac{1}{400}$ oe	2	**M1** for 0.05^2 oe
(ii)	0.9975 or $\frac{399}{400}$ oe	1FT	**FT** for 1 – (*their* (a)(i)) oe
(b)	0.171 or 0.1714 to 0.1715 or $\frac{6859}{40\,000}$	3	**M2** for $4(0.05 \times 0.95^3)$ oe **M1** for 0.05×0.95^3 oe seen or for the 4 combinations correctly identified

Question	Answer	Mark	Part marks
(c)	376 nfww	4	**M1** for midpoints soi (condone 1 error or omission) (225, 275, 325, 375, 425, 475) and **M1** for use of Σfx with x in correct interval including both boundaries (condone 1 further error or omission) and **M1** (dependent on second M) for $\Sigma fx \div 200$
(d) (i)	16	1	
(ii)	33	2	**M1** for $0.8 \times 50 + 0.26 \times 100$
5 (a) (i)	275	2	**M1** for $360 - 40 - 45$ oe
(ii)	095	2FT	**FT** *their* (a) – 180 **M1** for *their* (a) – 180 oe or 180 – 40 – 45
(b)	464.66 to 464.67 [= 464.7]	4	**M2** for $510^2 + 720^2 - 2 \times 510 \times 720 \cos 40$ or **M1** for correct implicit equation **A1** for 215 900 to 215 920
(c)	44.9 or 44.86 to 44.87…	3	**M2** for $\frac{510 \sin(40)}{464.7}$ or **M1** for correct implicit equation
6 (a) (i)	Correct image (2, –5) (4, –5) (4, –1)	2	**SC1** for reflection in $y = 0$ or 3 correct points not joined
(ii)	Correct image (–2, 1) (–6, 1) (–6, –1)	2	**SC1** for rotation 90 clockwise any centre or 3 correct points not joined
(iii)	Translation by $\begin{pmatrix} 1 \\ 9 \end{pmatrix}$	2	**B1** for each
(iv)	Enlargement [SF] – ½ oe [Centre] (2, 1)	1 1 1	
(b) (i)	$\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$	2	**B1** for one correct row or column but not the identity matrix
(ii)	Reflection $x = 0$ oe	1 1	

Question	Answer	Mark	Part marks
7 (a) (i)	$\frac{12}{x-1}-\frac{10}{x}=0.5$ oe	M2	**M1** for $\frac{12}{x-1}$ or $\frac{10}{x}$
	$12x - 10(x - 1) = 0.5x(x - 1)$ or better	M1	**FT** $\frac{10}{x}-\frac{12}{x-1}=0.5$ only
	Brackets expanded		
	$x^2 - 5x - 20 = 0$ with no errors or omissions seen	A1	Dep on **M3** and brackets expanded
(ii)	$\sqrt{(-5)^2 - 4(1)(-20)}$ or better	B1	Seen anywhere or $(x-\frac{5}{2})^2$ oe
	$p = –(– 5)$, $r = 2(1)$ or better	B1	Must be in the form $\frac{p+\sqrt{q}}{r}$ or $\frac{p-\sqrt{q}}{r}$ or for $\frac{5}{2}+\sqrt{\left(\frac{5}{2}\right)^2+20}$ or $\frac{5}{2}-\sqrt{\left(\frac{5}{2}\right)^2+20}$
	– 2.62, 7.62 final answers	B1B1	**SC1** for – 2.6 or – 2.623 to – 2.624 and 7.6 or 7.623 to 7.624 or –2.62 and 7.62 seen in working or answers 2.62 and – 7.62
(iii)	1 [hr] 49 [mins]	2FT	**FT** 12 ÷ (*their* +ve root – 1) or 0.5 + 10 ÷ (*their* 7.62) in hrs and mins, rounded to nearest min **M1** for 12 ÷ (*their* +ve root – 1) or 0.5 + 10 ÷ (*their* 7.62)
(b) (i)	2.5	1	
(ii)	1312.5 final answer	3	**M2** for any complete correct method e.g 25 × 10 ÷ 2 + 45 × 25 + 5 × 25 ÷ 2 **M1** for any correct method for a relevant area under the graph
8 (a) (i)	Not possible	1	
(ii)	$\begin{pmatrix} 4 & 0 \\ -2 & 10 \\ 6 & -8 \end{pmatrix}$ final answer	1	
(iii)	$\begin{pmatrix} 14 & 35 \\ -8 & -20 \end{pmatrix}$ final answer	2	**M1** for one correct column or row
(iv)	(–6) final answer	2	**M1** for 14 – 20
(v)	$\begin{pmatrix} -2 & 18 \\ -6 & 22 \end{pmatrix}$ final answer	2	**M1** for one correct column or row

Question	Answer	Mark	Part marks
(b)	$\frac{1}{8}\begin{pmatrix}5 & -3\\ 1 & 1\end{pmatrix}$ or better isw	2	**B1** for $k\begin{pmatrix}5 & -3\\ 1 & 1\end{pmatrix}$ seen or implied, $k \neq 0$ or $\frac{1}{8}\begin{pmatrix}a & b\\ c & d\end{pmatrix}$ seen
9 (a)	270 or 270.17 to 270.22	3	**M2** for $\frac{360-145}{360}\times\pi 12^2$ oe or **B1** for 215 seen or **M1** for $\frac{\theta}{360}\times\pi 12^2$ used
(b)	518 or 517.6 to 517.8 nfww	6	**B4** for vertical height = 9.62 to 9.63 or **B3** for radius = 7.166 to 7.17 or **B2** for length of sector = 45.[0] or 45.02 to 45.04 or **M1** for $\frac{360-145}{360}\times 2\times\pi\times 12$ oe or for $\sqrt{12^2 - \textit{their radius}^2}$ and **M1** indep for $\frac{1}{3}\pi\times \textit{their radius}^2\times \textit{their } h$ ($h \neq 12$ or $r \neq 12$)
10 (a)	10 15 15 21 35 48	6	**B1** for each correct entry
(b) (i)	3	2	**M1** for any correct substitution in $n^2 + 4n + p$ = number of tiles eg $2^2 + 4(2) + p = 15$
(ii)	143	1FT	**FT** 140 + *their* (b)(i)
(c)	$a = \frac{1}{2}$ oe $b = \frac{3}{2}$ oe nfww	5	**B1** for a correct simplified equation e.g. $a + b + 1 = 3$, $4a + 2b + 1 = 6$, $9a + 3b + 1 = 10$ etc **B1** for a 2nd correct simplified equation **M1** for correctly eliminating one variable for *their* equations in a and b **A1** for $a = \frac{1}{2}$ nfww **A1** for $b = \frac{3}{2}$ nfww

Question	Answer	Mark	Part marks
(d) (i)	171	2FT	**FT** *their a* $\times 17^2$ + *their b* $\times 17 + 1$ **M1** for *their a* $\times 17^2$ + *their b* $\times 17 + 1$
(ii)	673	1FT	**FT** *their* (d)(i) $\times 4 - 11$

CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International General Certificate of Secondary Education

MARK SCHEME for the March 2016 series

0580 MATHEMATICS

0580/42 Paper 4 (Extended), maximum raw mark 130

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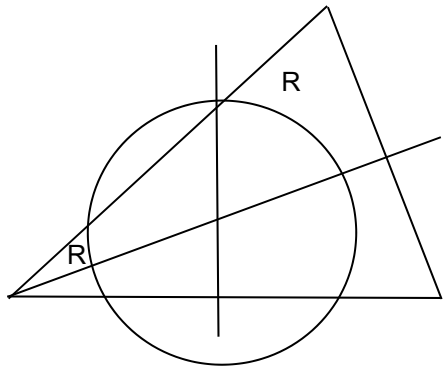
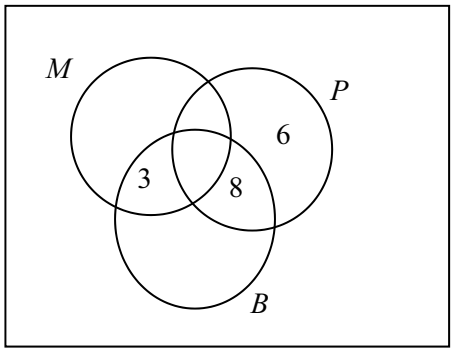
Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

Qu.		Answers	Mark	Part Marks
1	(a)	$\frac{8}{8+15+9} \times 640$ oe	1	With no errors seen
	(b)	300 and 180	2	**B1** for each or **SC1** for answers reversed
	(c)	10 nfww	2	**M1** for 160 ÷ 15.25 implied by 10.5 or 10.49... nfww
	(d)	$\frac{7}{24}$	3	**M1** for $\frac{3}{8}+\frac{1}{3}$ oe **M1dep** on previous **M1** for 1 – *their* $(\frac{3}{8}+\frac{1}{3})$ oe
2	(a)	Correct perpendicular bisector of *AB* with 2 pairs of correct arcs isw	2	**B1** for accurate with no/wrong arcs or **M1** for correct intersecting arcs with no or wrong line
	(b)	Correct angle bisector at *A* with two pairs of correct arcs isw	2	**B1** for accurate with no/wrong arcs or **M1** for two pairs of correct arcs with no or wrong line
	(c)	Circle centre *E* radius 5 cm isw	2FT	**FT** circle centre *their E* radius 5 cm provided (a) and (b) attempted **M1** for 250 ÷ 50 oe soi e.g. from arc If 0 scored **SC1** for circle centre *their E*
	(d)		2	cao **B1** for each If **0** scored, **SC1** for two 'correct' regions but in part **(c)**, centre correct but radius incorrect

Qu.	Answers	Mark	Part Marks
3 (a) (i)		3	**B1** for each
(ii)	46	1FT	**FT** 29 + *their* 3 values from **(a)**
(iii)	11	1	
(iv)	$\frac{7}{19}$ oe	2	**M1** for $\frac{n}{16+their3}$ $(0 < n <$ (16 + *their* 3)) or $\frac{4+their3}{k}$ $(k >$ (4 + *their* 3))
(b) (i)	$\frac{9}{200}$ or 0.045	1	
(ii)	10800	3	**M2** for ½ (900 + 1500) × 9 oe or **M1** for method of finding a relevant area
(iii)	7.2	1FT	**FT** (*their* 10800) ÷ 1500
4 (a) (i)	64	1	
(ii)	16 to 16.5	2	**M1** for UQ = 71 to 71.5 or LQ =55
(iii)	62	2	**B1** for 24 indicated
(iv)	6	2	**B1** for 54 seen
(b)	[8] 12 23 11 [4] 2	3	**B2** for 1 incorrect reading FT others **B1** for 2 correct
(c)	Blocks of height 0.6 2.3 1.1 0.4 with correct widths	4FT	**FT** *their* **(b)** for heights **B1FT** for each correct block If **B0, SC1** for blocks of widths 20, 10, 10, 10 or for *their* correct frequency densities
5 (a)	6250	3	**M2** for $\frac{6000}{100-4}\times 100$ oe or **M1** for 6000 associated with 96 [%]
(b)	4441	3	**B2** for 4441.1 to 4441.2 or 4440 or **M1** for $\frac{6000}{1.351}$

Qu.	Answers	Mark	Part Marks
(c)	1.58 or 1.581…	5	**M1** for $6000\times\left(1+\frac{1.5}{100}\right)^8$ oe **A1** for 6758.95…..... or 6758.96 to 3 sf or better or 758.95 or 758.96 rounded or truncated to 3 sf and **M2** for $\{their(6000\times1.015^8)-6000\}\times\frac{100}{6000\times8}$ oe or **M1** for $\frac{6000\times r\times8}{100}$ oe
6 (a) (i)	Rotation	1	
	90° [anticlockwise] oe	1	
	(4 , 4)	1	
(ii)	Enlargement	1	
	[centre] (5 , 1)	1	
	[scale factor] 2	1	
(b) (i)	Image at (–2, 5) (–2, 7) (–1, 7)	2	**B1** for translation by $\begin{pmatrix}-5\\k\end{pmatrix}$ or $\begin{pmatrix}k\\3\end{pmatrix}$
(ii)	Image at (–2, 1) (–2, –1) (–1, –1)	2FT	**FT** *their* triangle *P* reflected in line $y = 3$ **B1** for reflection of **triangle *P*** in the line $x = 3$ or $y = k$
(c)	Image at (–2, 3) (–4, 3) (–4, 4)	3	**B2** for 2 vertices correct in triangle or 3 correct co-ordinates soi in working or **B1** for 1 vertex in triangle correct soi or **M1** for $\begin{pmatrix}0&-1\\1&0\end{pmatrix}\begin{pmatrix}3&3&4\\2&4&4\end{pmatrix}$ shown or statement rotation 90° [anticlockwise] about (0, 0)
7 (a)	3.5[0] 1.94 3.11	3	**B1** for each
(b)	Fully correct curve	5	**B3 FT** for 10 or 11 points or **B2 FT** for 8 or 9 points or **B1 FT** for 6 or 7 points **B1 indep** two separate branches not touching or cutting *y*-axis **SC4** for correct curve, but branches joined
(c)	– 0.7 to – 0.6	1	

Qu.	Answers	Mark	Part Marks
(d) (i)	– 1	1	
	2.5	1	If 0,0, **M1** for $y = 2.5 - x$ oe seen in working
(ii)	– 0.6 to – 0.5 with correct ruled line	3	**B2FT** for drawing *their* ruled line from **(d)(i)** or **M1** for ruled line through (0, 2.5)FT or gradient –1 FT
(e)	Correct tangent and $0.5 \leqslant$ grad $\leqslant 0.85$	3	**B2** for close attempt at tangent at $x = 2$ and answer in range OR **B1** for ruled tangent at $x = 2$, no daylight at $x = 2$ Consider point of contact as midpoint between two vertices of daylight, the midpoint must be between $x = 1.8$ and 2.2 **and M1** (dep on **B1** or close attempt at tangent [at any point] for $\frac{rise}{run}$
8 (a)	15 nfww	3	**M1** for $y = k\sqrt{(x+2)}$ oe **A1** for $k = 3$
(b)	$\frac{x+6}{x-2}$ nfww final answer	5	**B2** for $(x+6)^2$ oe or **SC1** for $(x+a)(x+b)$ where $ab = 36$ or $a + b = 12$ or $x(x + 6) + 6(x + 6)$ **B2** for $(x-2)(x+6)$ or **SC1** for $(x+a)(x+b)$ where $ab = -12$ or $a + b = 4$ or $x(x + 6) – 2(x + 6)$ or $x(x – 2) + 6(x – 2)$
(c)	$\frac{X}{W^2+1}$ nfww final answer	5	**M1** for $W^2 = \frac{X-a}{a}$ **or** $W\sqrt{a} = \sqrt{X-a}$ **M1** for next productive step **M1** for 2nd productive step **M1** for 3rd productive step **M1** for final step leading to $a =$
(d)	$\frac{-7x-1}{x^2-1}$ or $\frac{-7x-1}{(x-1)(x+1)}$ final answer	5	**M1** for common denominator $(x-1)(x+1)$ isw **M1** for $(x-2)(x-1)-(x+3)(x+1)$ **B2** for $x^2 - 2x - x + 2 - (x^2 + 3x + x + 3)$ oe or **B1** for either expansion

Qu.	Answers	Mark	Part Marks
9 (a) (i)	$\mathbf{y}$	1	
(ii)	$\mathbf{x} + \mathbf{y}$	1	
(iii)	$\mathbf{x} + 2\mathbf{y}$	2	**M1** for a correct unsimplified route or identifying $\overrightarrow{OS}$
(b)	$-(\frac{1}{2}\mathbf{x} + \mathbf{y})$ oe	2	**M1** for a correct unsimplified route or $\overrightarrow{GR} = -\frac{1}{2}\mathbf{x}$ or $\overrightarrow{RG} = \frac{1}{2}\mathbf{x}$
(c) (i)	$\overrightarrow{MG} = 2\mathbf{x} + 2\mathbf{y}$	2	**M1** for a correct unsimplified route e.g. $2\overrightarrow{PQ}$
(ii)	$\overrightarrow{MH} = \mathbf{x} + \mathbf{y}$ or $\overrightarrow{HG} = \mathbf{x} + \mathbf{y}$	M1	Accept $\overrightarrow{HM} = -\mathbf{x} - \mathbf{y}$ or $\overrightarrow{GH} = -\mathbf{x} - \mathbf{y}$
	$\overrightarrow{MG} = 2\overrightarrow{MH}$ oe	A1	Dep on **(c)(i)** correct, arrows essential
10 (a)	5.2[0] or 5.196...	3	**M2** for $[h^2=]\ 6^2 - 3^2$ or better or **M1** for $h^2 + 3^2 = 6^2$ or **B1** for PR (or PQ or QR) = 6
(b) (i)	7.2[0] or 7.196...	1FT	**FT** *their* **(a)** + 2
(ii)	62.4 or 62.35...	5	**M4** for $12 \times 6 \times \frac{1}{2} \tan 60$ oe or **M3** for $6 \times \frac{1}{2} \tan 60$ oe or **M2** for realising that ½ base $= 1 \times \tan 60$ oe or **B1** for angle 30 or 60 in correct position on diagram or in a calculation If **0** scored, **SC1** for volume = an area × 12 seen
11 (a) (i)	11	1	
(ii)	$14x + 3$ final answer	1	
(b)	$17 - 21x$ final answer	2	**M1** for $7(2 - 3x) + 3$ oe
(c)	$-\frac{1}{9}$	3	**M1** for $3(2 - 3x) = 7$ oe **M1** for correct first step
(d)	-1.3	3	**M1** for $2 - 3(x + 4) - (7x + 3) = 0$ **M1** for $-10x - 13 = 0$ oe If **0** scored, **SC1** for answer -0.7 oe after $2 - 3(x + 4) - 7x + 3 = 0$ shown previously

CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International General Certificate of Secondary Education

MARK SCHEME for the October/November 2015 series

0580 MATHEMATICS

0580/41 Paper 4 (Extended), maximum raw mark 130

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Question	Answer	Mark	Part marks
1 (a)	6	3	**B2** for $5\frac{1}{4}$ or 5.25 shown in working isw **or M1** for $\frac{3}{4} \times 7$ soi by answer 5
(b)	21.45 cao final answer	2	**M1** for 17.16 × 0.25 or 17.16 × 1.25
(c)	16.5[0] nfww	3	**M2** for 17.16 ÷ 1.04 oe or **M1** for 17.16 associated with 104[%] oe isw
(d)	1.34 cao final answer	2	**M1** for 13.32 ÷ 0.72 soi by 18.5[0] or for any correct complete longer method If zero scored, **SC1** for 0.96 [euros] seen
(e) (i)	750	1	
(ii)	4.7 cao	3	**B2** for 4.658 to 4.66 or **M2** for $\sqrt{\textit{their}\ \textbf{(e)(i)} \div 11\pi}$ or **M1** for $11\pi r^2 =$ *their* **(e)(i)**
(iii)	6	2	**M1** for 2^3 or $\frac{1}{2^3}$ oe seen or for $\pi \times (2 \times \textit{their}\ \textbf{(e)(ii)})^2 \times 22$ If zero scored, **SC1** for answer 6 000
(f)	8 950	1	
(g)	210	2	**M1** for 0.07 × 3 000
(h)	160 000	3	**M2** for $2 \times 60 \times 100^3 \div 750$ oe or **M1** for figs 16 as answer or 100^3 seen
2 (a)	1.62 or 1.62…	1	
(b) (i)	7	1	
(ii)	4	1	
(iii)	7	1	
(iv)	$\frac{1}{3}$ oe	1	

Qu	Answers	Mark	Part Marks
(c) (i)	0.25 oe and 1	2	**B1** for each
(ii)	Correct curve	4	**B3FT** for 6 or 7 correct plots or **B2FT** for 4 or 5 correct plots or **B1FT** for 2 or 3 correct plots
(iii)	2.3	1FT	Correct or **FT** where $y = 5$ on *their* graph
(iv)	$y = 3x - 1$ oe 3 term equation	3	**B2** for $3x - 1$ or $y = 3x$ [+ c]oe or for $m = 3$ and $c = -1$ or **M1** for [gradient =] $\frac{8-2}{3-1}$ oe soi by $3x$ **and M1** for substitution of (1, 2) or (3, 8) into *their* $y = mx + c$
(v)	–1.7 to –1.5 and 2	2	**B1** for either or **M1** for $y = x + 2$ seen or drawn
3 (a) (i)	25.4 or 25.35… nfww	5	**M2** for $\sqrt{60^2 - 50^2}$ oe soi by 33.1 to 33.2 or **M1** for $TB^2 + 50^2 = 60^2$ oe **and** **M2** for tan = $\frac{theirTB}{70}$ oe or **B1** for recognising angle TCB as required angle
(ii)	109 or 109.0 to 109.1	4	**M2** for $50^2 + 70^2 - 2 \times 50 \times 70 \times \cos 130$ **M1** for implicit cos rule **A1** for 11 899 to 11 900
(iii)	1 340 or 1 340.0 to 1 341	2	**M1** for $\frac{1}{2} \times 50 \times 70 \times \sin 130$ oe
(b)	51.5 or 51.50 to 51.51	4	**M3** for $[XY] = \sqrt{45^2 + 22^2 + 12^2}$ or **M2** for $[XY^2 =] 45^2 + 22^2 + 12^2$ soi by 2 653 or **M1** for $45^2 + 22^2$ oe or $45^2 + 12^2$ oe or $12^2 + 22^2$ oe

Qu	Answers	Mark	Part Marks
4 (a) (i)	$x \geqslant 5$ oe $y \leqslant 8$ oe $x + y \leqslant 15$ oe $y > x$ oe or $y \geqslant x + 1$	**4**	Condone $5 \leqslant x \leqslant 15$ Condone $0 < y \leqslant 8$ **B1** for each – 1 for first occurrence of strict inequalities used in first 3 inequalities
(ii)	$x = 5$ ruled $y = 8$ ruled $x + y = 15$ ruled $y = x$ ruled broken line	**1** **1** **1** **1**	Allow $y = x + 1$ ruled only after $y \geqslant x + 1$ in **(a)(i)**
	Correct region indicated	**1dep**	Dependent on all marks for lines earned Accept R written in correct quadrilateral or any other unambiguous indication or accept in triangle if $y = x + 1$ used and all marks for lines earned
(b)	78	**2**	**B1** for (7, 8) chosen or **M1** for a calculation shown of the form $6x + 4.5y$ where (x, y) is clearly in *their* region and both x and y are integers
5 (a)	37 or [angle] *BAD*	**1**	
	[Angles in] same segment [are equal]	**1dep**	Dependent on 37 or [angle] *BAD*
(b)	74 or 2 [× angle] *BAD* or 2 [× angle] *BED*	**1**	
	Angle at <u>centre</u> is twice angle at <u>circumference</u>	**1dep**	Dependent on 2 × 37 or 2 [× angle] *BAD* or 2 [× angle] *BED* Must use the terms circumference, centre and angle
(c)	143 or 180 – [angle] *BAD* or 180 – [angle] *BED*	**1**	
	[Opposite angles of] cyclic quad [are supplementary]	**1dep**	Dependent on 180 – 37 or 180 – [angle] *BAD* or 180 – [angle] *BED*

Qu	Answers	Mark	Part Marks
6 (a)	1.35 nfww	4	**M1** for 0.5, 1.5, 2.5, 3.5, 4.5, 5.5 soi, **M1** for Σfm soi by 162 where m is in correct interval including boundaries **M1**dep for $\Sigma fm \div 120$ or $\Sigma fm \div \Sigma f$ dependent on **second M1** earned
(b) (i)	93, 102, 113, 118	2	**SC1FT** for 1 error
(ii)	Correct diagram	3	**B1FT** for correct vertical plots and **B1** for correct horizontal plots and **B1FT dep on at least B1** for reasonable increasing curve or polygon through *their* 6 points If zero scored, **SC1FT** for 5 out of 6 correct plots
(iii) (a)	0.6 to 0.85	1	
(b)	1.3 to 1.7	2	**B1** for UQ = 1.7 to 1.9 or LQ = 0.2 to 0.4
(c)	0.3 to 0.6	2FT	Allow in correct range provided there is no evidence of reading at 35 or **FT** *their* reading at 42 **B1** for 42 soi
(c) (i)	30 and 18	2	**B1** for each
(ii)	0.75 and 0.3	3FT	**FT** (*their* 30) ÷ 40 and (*their* 18) ÷ 60 **B2FT** for either 0.75 or 0.3 or **M1** for *their* 30 ÷ 2 or ÷ 20 or for *their* 18 ÷ 3 or ÷ 20
7 (a)	123 to 127	1	
(b)	288 to 292	1	
(c)	[1:] 1 000 000	1	

Qu	Answers	Mark	Part Marks
(d)	Correct ruled perpendicular bisector of *CB* with correct arcs Correct two pairs of arcs	**2**	**B1** for correct perpendicular bisector without/wrong arcs
	Correct ruled bisector of angle *ACB* with correct pair of arcs	**2**	**B1** for correct bisector of angle *ACB* without/wrong arcs
	Ruled line parallel to *CB* in triangle	**1**	Provided this line is not the perpendicular bisector of *AC*
	1.3 to 1.7 cm from *CB* in triangle	**1**	
	Correct region indicated	**1dep**	Dependent on at least B1,B1,1,1 earned
(e)	40	**2**	**M1** for 0.4×10^2 oe
8 (a)	$(x - 5)(x + 2)$ final answer	**2**	**B1** for $(x - 5)(x + 2)$ seen and then spoiled or **M1** for $(x + a)(x + b)$ where $a + b = -3$ or $ab = -10$ [a, b integers]
(b) (i)	$x(x + 2) + 3(x + 1) = 3x(x + 1)$ or $x^2 + 2x + 3x + 3 = 3x^2 + 3x$	**M2**	**M1** for $x(x + 2) + 3(x + 1)$ or better seen Allow recovery of omitted brackets for M marks but not A mark
	$0 = 2x^2 - 2x - 3$	**A1**	Brackets expanded correctly and/or no errors or omission of brackets seen
(ii)	$\frac{[--]2 \pm \sqrt{([-]2)^2 - 4(2)(-3)}}{2(2)}$ or $0.5 \pm \sqrt{1.75}$	**B2**	**B1** for $\sqrt{([-]2)^2 - 4(2)(-3)}$ or $\sqrt{28}$ or $\sqrt{1.75}$ oe in completion of square **and B1** for in form $\frac{p + \sqrt{q}}{r}$ or $\frac{p - \sqrt{q}}{r}$, $p = - -2$ **and** $r = 2(2)$ or better or $(x - 0.5)^2$ oe in completion of square
	– 0.823 and 1.823 final answer	**B1 B1**	If **B0B0** for answers, **SC1** for – 0.82 or – 0.822… and 1.82 or 1.822.. as final answers or – 0.823 and 1.823 seen or –1.823 and 0.823 as final answers

Qu	Answers	Mark	Part Marks
(c)	$\frac{x^2+3x+3}{(x+2)(x+1)}$ or $\frac{x^2+3x+3}{x^2+3x+2}$ final answer nfww	**4**	**M1** for $(2x + 3)(x + 1) - x(x + 2)$ oe isw **B1** for common denominator $= (x + 2)(x + 1)$ isw or $x^2 + 3x + 2$ isw **B1** for $2x^2 + 2x + 3x + 3$ or better or $-x^2 - 2x$ or $x^2 + 3x + 3$
9 (a) (i)	16	**1**	
(ii)	n^2	**1**	
(b) (i)	43	**1**	
(ii)	7	**1**	
(c)	$a = \frac{5}{2}$ oe, $b = \frac{5}{6}$ oe with supporting working	**6**	**M1** for any correct substitution eg $\frac{2}{3}(2)^3 + 2^2a + 2b$ **A1** for **one** of eg $\frac{2}{3} + a + b = 4$ or better eg $\frac{16}{3} + 4a + 2b = 17$ or better eg $\frac{54}{3} + 9a + 3b = 43$ or better **A1** for **another** of eg $\frac{2}{3} + a + b = 4$ or better eg $\frac{16}{3} + 4a + 2b = 17$ or better eg $\frac{54}{3} + 9a + 3b = 43$ or better **M1** for correctly eliminating one variable from two of *their* equations in a and b **A1** for $a = \frac{5}{2}$ oe **A1** for $b = \frac{5}{6}$ oe After zero scored, **SC2** for 2 correct answers without supporting working or **SC1** for 2 of 17, 43, 86, 150, 239 seen

Qu	Answers	Mark	Part Marks
10 (a)	$\mathbf{b} - \mathbf{a}$ or $-\mathbf{a} + \mathbf{b}$	1	
(b)	$\frac{4}{5}\mathbf{b} - \frac{3}{10}\mathbf{a}$ or $\frac{1}{10}(8\mathbf{b} - 3\mathbf{a})$	4	**B3** for correct unsimplified expression in **a** and **b** or **M1** for $\overrightarrow{XA} + \overrightarrow{AC} + \overrightarrow{CM}$ or $\overrightarrow{XB} + \overrightarrow{BM}$ or $-\frac{1}{5}$(*their* **(a)**) + **b** – $\frac{1}{2}$ **a** or $\frac{4}{5}$(*their* **(a)**) + $\frac{1}{2}$ **a** **and M1** indep for $\pm\frac{1}{5}$ oe or $\pm\frac{4}{5}$ oe used After zero scored**, SC2** for answer $\frac{1}{4}(3\mathbf{b} - \mathbf{a})$ or $\frac{3}{4}\mathbf{b} - \frac{1}{4}\mathbf{a}$

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0580 MATHEMATICS

0580/42 Paper 4 (Extended), maximum raw mark 130

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Abbreviations

cao correct answer only
dep dependent
FT follow through after error
isw ignore subsequent working
oe or equivalent
SC Special Case
nfww not from wrong working
soi seen or implied

Question	Answer	Mark	Part marks
1 (a) (i)	$\frac{512}{7+11+14} \times 14$	M2	or **M1** for $\frac{512}{7+11+14}$
(ii)	112	1	
(b)	10 100	2	**M1** for 224×45 soi by 10080
(c)	19	2	**M1** for $224 \div 12$ soi by 18.66 to 18.67 or 18.7 or $18\frac{2}{3}$
(d) (i)	4093000	1	
(ii)	4.093×10^6	1FT	**FT** *their* **(d)(i)**
(e)	198 or 198.1 to 198.2	3	**M2** for $\frac{8.2-2.75}{2.75} \times 100$ oe or **M1** for $\frac{8.2}{2.75} \times 100$ or $\frac{8.2-2.75}{2.75}$
2 (a)	0 4 0.625 0.875	1,1,1,1	
(b)	Fully correct smooth curve	4	**B3 FT** for 8 or 9 points or **B2 FT** for 6 or 7 points or **B1 FT** for 4 or 5 points
(c)	line $y = x + 1$ ruled and 0.2 to 0.3 and 1.8 to 1.95	3	Line must be fit for purpose ie at least from $x = 0$ to $x = 2$ **B2** for correct line and 1 correct value or **B1** for correct line or **SC1** for no/wrong line and 2 correct values

	(d)	Tangent ruled at $x = -1.5$	**B1**	No daylight between tangent and curve at point of contact. Consider point of contact as midpoint between two vertices of daylight, the midpoint must be between $x = -1.6$ and $x = -1.4$
		2.2 to 5	**2**	**dep** on **B1** **M1** for $\frac{rise}{run}$ **also dep on** any tangent drawn or close attempt at tangent at any point Must see correct or implied calculation from a drawn tangent
3	**(a)**	Correct diagram	**3**	**B1** for correct vertical plots and **B1** for correct horizontal plots and **B1 dep on at least B1** for reasonable <u>increasing</u> curve or polygon through *their* 6 points If zero scored, **SC1** for 5 out of 6 correct plots
	(b) (i)	32 to 34	**1**	
	(ii)	120 – reading at $r = 50$	**2FT**	**B1FT** for reading at $r = 50$ seen
	(c)	8 18 27	**2**	**B1** for 2 correct
	(d)	35.2 or $35\frac{1}{6}$ or 35.16 to 35.17 nfww	**4**	**M1** for mid-values soi **M1 FT** for $\sum fx$ with x in the correct interval including boundaries **M1dep** for $\sum fx \div 120$ dependent on second **M1** earned
	(e)	1.6 1.35 0.3	**4FT**	**FT** from **(c)** *their* $8 \div 5$ and *their* $27 \div 20$ **B3FT** for any 2 correct or **B2FT** for first **or** second answer correct or **B1** for 0.3 only
4	**(a)**	1.6[0] or 1.601 to 1.602	**3**	**M2** for $\frac{0.6}{\cos 68}$ oe or **M1** for $\cos 68 = \frac{0.6}{AC}$
	(b)	43.5 or 43.6 or 43.49 to 43.56	**4**	**M2** for $\frac{1.9^2 + 2.3^2 - their 1.6^2}{2 \times 1.9 \times 2.3}$ or **M1** for implicit statement **A1** for [cos =] 0.724 to 0.726

(c)	1.33 or 1.332...nfww	**4**	**M2** for $\sqrt{2.3^2-\left(\frac{1}{2}\times1.2\right)^2}$ or **M1** for $2.3^2=h^2+\left(0.5\times1.2\right)^2$ **and M1** for $\frac{1}{2}\times1.2\times$ *their* 2.22 (*their* 2.22 must come from attempt at Pythag or from trig in triangle *BCD*)
(d)	41.1 or 41.13 to 41.14	**3**	**M2** for $\sin=\frac{1.25}{1.9}$ oe or **M1** for correct angle identified
5 (a) (i)	$4x(3x+13)-2x(4x-\{3x-9\})=24$ oe	**M1**	
	$12x^2+52x-2x^2-18x$	**M1**	Correct removal of all *their* brackets Dep on two **areas** added or subtracted
	$5x^2+17x-12=0$	**A1**	with no errors or omissions seen and at least one more line of working showing collection of like terms or division by 2
(ii)	$(5x-3)(x+4)$ [= 0]	**M2**	**M1** for $(5x+a)(x+b)$ where $ab = -12$ or $5b + a = 17$ [a, b integers]
	$\frac{3}{5}$ oe , -4	**A1**	If zero scored **SC1** for correct answers with no working or from other methods.
(b)	For correctly eliminating one variable	**M1**	
	$x = 3$ $y = -7$	**A1** **A1**	**SC1** if no working shown, but 2 correct answers given If zero scored **SC1** for 2 values satisfying one of the original equations
(c)	$t = -2$ nfww	**5**	**M1** for $2(t+3)(t+3)-t^2$ or better seen **M1** for denominator[s] $t(t+3)$ isw or for $t(t+3)$ isw on RHS **M1dep** for $2t^2+12t+18-t^2=t^2+3t$ oe dependent on both numerators and denominator expanding to give quadratics **A1** for $9t+18=0$ oe

6	(a) (i)	43	1	
	(ii)	62	1	
		Isosceles triangle or *OYZ* is isosceles	1	
		Angle at centre is twice angle at circumference	1	
	(iii)	30	2	**M1** for $p + 5p = 180$ oe
		[Opposite angles of a]cyclic quadrilateral [add up to 180°]	1	
	(b) (i)	1 : 2 oe	1	
	(ii)	*OQ*	1	
		$MQ = NQ$	1	
		$OM = ON$	1	
		Centre or *O*	1	Not origin
7	(a) (i)	Rotation	1	
		[+]90 or 90 anticlockwise oe	1	
		(0 , 2)	1	Not as column vector
	(ii)	Reflection	1	
		$y = 1$ oe	1	
	(iii)	Enlargement	1	
		[s f] $-\frac{1}{2}$ oe	1	
		Origin oe	1	
	(b)	$\begin{pmatrix} -\frac{1}{2} & 0 \\ 0 & -\frac{1}{2} \end{pmatrix}$ oe	2FT	**FT** *their* s f from **(a)(iii)** **SC1** for $\begin{pmatrix} k & 0 \\ 0 & k \end{pmatrix}$, $k \neq 1$ or 0
	(c)	Image at (4 , 1) (6, 1) (6 , 5) (4 , 3)	2	ruled or good freehand **SC1** for translation $\begin{pmatrix} 2 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ -3 \end{pmatrix}$ or for 4 correct vertices not joined
	(d)	Reflection	1	
		$y = x$ oe	1	

8	**(a)**	(4 , 6)	**1, 1**	
	(b)	4.47 or 4.472	**3**	**M2** for $\sqrt{(8-4)^2+(5-3)^2}$ or better or **M1** for $(8-4)^2+(5-3)^2$ or better
	(c)	$y = 2x - 2$ oe	**3**	**B2** for $2x-2$ or $y = 2x + c$ oe or **M1** for [m =] $\frac{8-4}{5-3}$ oe soi by $2x$ **and M1** for (3, 4) or (5, 8) or *their* midpoint substituted into *their* $y = mx + c$ with m numerical
	(d)	– 3	**3**	**M1** for use of gradient × *their* m = – 1 soi by $-\frac{1}{2}$ **M1** for r = *their* gradient × 6 [+0]
9	**(a) (i)**	11	**1**	
	(ii)	256	**2**	**M1** for [g(3) =] 8 or 2^3 or 2^{2^x}
	(b)	$\frac{x-5}{2}$ oe final answer	**2**	**M1** for $x = 2y + 5$ or $2x = y - 5$ or better or $\frac{y}{2} = x + \frac{5}{2}$
	(c)	$19 - 6x$ final answer	**2**	**M1** for $2(7 - 3x) + 5$
	(d)	– 1, 0, 1, 2	**3**	Additional values count as errors **B2** for one error /omission or **B1** for two errors/omissions or **M2** for $-2 < x \leqslant 2$oe seen or **M1** for $-2 < x$ **or** $x \leqslant 2$ **or** $x = -2$ **and** $x = 2$ **or** $-4 < 2x \leqslant 4$
10	**(a)**	8 25 17	**2**	**B1** for 2 correct
	(b)	$n + 2$ oe	**1**	
	(c) (i)	$(n - 1)^2$ oe	**2**	**M1** for $(n + k)^2$ for integer k
	(ii)	92	**2**	**M1** for $\sqrt{8281}$ or 91 seen
	(d) (i)	$n^2 - 3n - 1$ final answer	**2**	**M1** for *their* $(n - 1)^2$ – *their* $(n + 2)$ soi
	(ii)	39	**1**	

(e)	1 and $-\frac{1}{2}$ oe	**1**	
	$\frac{1}{4}$ oe	**1**	
	$-\frac{1}{8}$ oe	**1**	

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0580 MATHEMATICS

0580/43 Paper 4 (Extended), maximum raw mark 130

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Abbreviations

cao correct answer only
dep dependent
FT follow through after error
isw ignore subsequent working
oe or equivalent
SC Special Case
nfww not from wrong working
soi seen or implied

Question	Answer	Mark	Part marks
1 (a) (i)	3.9[0]	**2**	**M1** for $2.6 \div 2$
(ii)	$\frac{13}{18}$ cao	**2**	**B1** for any correct unsimplified fraction
(iii)	24	**3**	**M2** for $9 \div 0.375$ oe or **M1** for associating 9 with $(100 - 62.5)\%$
(b)	109 cao	**3**	**B2** for 108.5 to 108.6 or **M1** for $250 \times \left(1 - \frac{8}{100}\right)^{10}$ oe
2 (a) (i)	Image at (–2, 5), (1, 5), (1, 7)	**2**	**SC1** for translation $\begin{pmatrix} -4 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ 4 \end{pmatrix}$ or 3 correct vertices plotted but not joined
(ii)	Image at (2, –3), (5, –3), (5, –5)	**2**	**SC1** for a reflection in a horizontal line or in the line $x = -1$ or 3 correct vertices plotted but not joined
(b)	Rotation	**1**	Alt Enlargement SF –1 (–1, 0)
	180 oe	**1**	
	(–1, 0)	**1**	Not as column vector
(c) (i)	Reflection	**1**	
	$y = -x$ oe	**1**	
(ii)	$\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$	**2**	**SC1** for a correct row or column

3	(a)	43 200	3	**M2** for 0.5 × (35 + 25) × 12 × 120 oe or **M1** for 0.5 × (35 + 25) × 12 oe
	(b) (i)	0.5 × (25 + 30) × 6 ×120 [= 19 800]	**M2**	Dep on a valid method for obtaining the width of 30 cm **B1** for 0.5 × (25 + 35) oe
	(ii)	45.8 or 45.83…	**1FT**	**FT** for $\frac{19\,800}{\textit{their}\ \textbf{(a)}} \times 100$
	(c)	1 hr 39 min	**4**	**B3** for 1.65 [h] or 99 mins or $\frac{33}{20}$ or **M2** for $\frac{19\,800}{12 \times 1000}$ oe or **M1** for $\frac{19\,800}{12}$ or $\frac{19\,800}{1000}$ or 12 × 1000 If zero scored then **SC1** for figs 165 **and** **B1** for converting their time (in hours) into hours and minutes
	(d)	12.8 or 12.80 to 12.81	**3**	**M2** for $\sqrt[3]{\frac{19\,800}{3\pi}}$ or **M1** for $\pi r^2\, 3r = 19\,800$
	(e)	21[.0]	**2**	**M1** for $\frac{19\,800}{1000} + 1.2$

4	**(a)**	–1.5, 0.5	**2**	**B1**, **B1**
	(b)	Correct curve	**5**	**B3 FT** for 10 or 11 points or **B2FT** for 8 or 9 points or **B1FT** for 6 or 7 points and **B1** independent for two branches **SC4** for correct curve but branches joined
	(c)	1.25 to 1.35	**1**	
	(d)	–1	**1**	
	(e) **(i)**	$2 - x$	**1**	
	(ii)	Ruled line with gradient –1 through (0, 2) and fit for purpose	**2FT**	**SC1** for **ruled** line, with gradient –1 or through (0, 2), but not $y = 2$ **FT** *their* $y = mx + c$ from **(e)(i)**, if $m \neq 0$ **SC1FT** for **ruled** line either with correct gradient or through $(0, c)$, but not $y = c$
		1.15 to 1.25 cao	**1**	
5	**(a)**	2180 or 2181…. nfww	**4**	**M2** for $680^2 + 2380^2 - 2 \times 680 \times 2380 \cos 65$ oe or **M1** for correct implicit cosine formula **A1** for 4 760 000 or 4 758 000 to 4 759 000
	(b)	78.7 or 78.71…	**3**	**M2** for $\frac{2380 \sin 40}{1560}$ or **M1** for $\frac{1560}{\sin 40} = \frac{2380}{\sin M}$ oe
	(c)	309 or 308.7…	**2FT**	**FT** 230 + *their* **(b)** **B1FT** 50 + *their* **(b)** for 129 or 128.7… [i.e. for C from M]
	(d) **(i)**	23 39 oe	**1**	
	(ii)	650	**2**	**M1** for 1560 ÷ journey time

6	**(a)**	101.5625 or 102 or 101.5 to 101.6 nfww	**4**	**M1** for 55, 90, 110, 160 soi **M1** for Σfm with frequencies and each m in or on a boundary of a correct interval 2750, 2700, 4400, 6400 **M1 dep on 2nd M** for ÷ 160
	(b)	Correct histogram drawn with correct widths and heights 1, 1.5 and 2 (no gaps)	**3**	**B1** for each correct block If zero scored, **SC1** for correct heights or frequency densities
	(c)	$\frac{40}{160}$ oe	**1**	
	(d) **(i)**	$\frac{1560}{25440}$ oe	**2**	**M1** for $\frac{40}{160} \times \frac{39}{159}$
	(ii)	$\frac{4000}{25\,440}$ oe	**3**	**M2** for $\frac{40}{160} \times \frac{50}{159} + \frac{50}{160} \times \frac{40}{159}$ oe or **M1** for one of these products soi
7	**(a)**	83 nfww	**4**	**B3** for $17x = 1411$ or $17x = 14.11$ oe in form $ax = b$ or final answer of 0.83 or **B2** for $6x + 11x - 55 = 1356$ oe or $6x + 11x - [0.]\,55 = 13[.]56$ or **M1** for $6x + 11(x - [0.0]5) = 13[.]56$
	(b)	$\frac{1}{3}$ oe nfww	**4**	**M1** for $y(y+3)$ oe or $\frac{1}{2}(2y+1)(y+1)$ oe and **B2** for $2y^2 + 6y = 2y^2 + 2y + y + 1$ oe or better or **B1** for $(2y+1)(y+1) = 2y^2 + 2y + y + 1$ soi

	(c)	25 nfww	**4**	**M1** for $\frac{4[.]80}{w-1}$ or $\frac{7[.]80}{2w-11}$ **M1** for $\frac{4[.]80}{w-1} = \frac{7[.]80}{2w-11}$ oe **M1** for $480(2w-11) = 780(w-1)$ oe or ALT **M1** for $n(w-1) = 4[.]80$ or $n(2w-11) = 7[.]80$ **M1** for $2wn - 11n = 7[.]80$ $2wn - 2n = 9[.]60$ oe **M1** for $9n = 180$ oe or better or ALT **M1** for $n(w-1) = 4[.]80$ or $n(2w-11) = 7[.]80$ **M1** for $\frac{4[.]80+n}{n} = \frac{7[.]80+11n}{2n}$ **M1** for $9n = 180$ oe or better
	(d) (i)	$\frac{1}{2}u(3u-2) = 2.5$ One further correct step leading to $3u^2 - 2u - 5 = 0$ with no errors	**M1** **A1**	First step must involve $\frac{1}{2}u(3u-2)$
	(ii)	$(3u-5)(u+1)$	**2**	**SC1** for $(3u+a)(u+b)$ where $ab = -5$ or $a+3b = -2$ [a, b integers]
	(iii)	29.1 or 29.05…	**3**	**M2** for tan = $\frac{their\ \frac{5}{3}}{3 \times their\ \frac{5}{3} - 2}$ or **M1** for substituting *their* positive value of u into [u and] $3u-2$
8	**(a) (i)**	Angle A is common to both triangles oe $ADB = ABC$ Third angle of triangles equal oe	**1** **1dep**	Accept $DAB = CAB$ oe Dep on previous mark
	(ii)	Similar	**1**	
	(iii)	8.25	**2**	**M1** for $\frac{16}{12} = \frac{11}{BD}$ oe or better
	(b) (i)	38	**1**	
	(ii)	38	**1**	
	(iii)	78	**1**	
	(iv)	26	**1**	

	(c)	36 nfww	**5**	**B4** for an equation in m that simplifies to $5m = 180$ or **B1** for each of 3 of the listed angles expressed in terms of m, in it's simplest form, stated or labelled on diagram Angle $PQO = m$ Angle $QOR = m$ Angle $OQR = 2m$ Angle $PQR = 3m$ or $180 - 2m$ or $90 + \frac{m}{2}$ Angle $POR = 180 - m$ or $4m$ or $360 - 6m$ Reflex angle $POR = 360 - 4m$ or $6m$ or $180 + m$
9	**(a)**	8	**1**	
	(b)	3	**2**	**B1** for [g(0.5) =] 2 soi or **M1** for $2\left(\frac{1}{x}\right) - 1$ or better
	(c)	$\frac{x+1}{2}$ final answer	**2**	**M1** for $x = 2y - 1$ or $y + 1 = 2x$ or better or $\frac{y}{2} = x - \frac{1}{2}$
	(d)	$4x - 3$	**2**	**M1** for $2(2x - 1) - 1$
	(e)	$4x^2 - 4x + 7$	**2**	**B1** for $\left[(2x-1)^2\right] = 4x^2 - 2x - 2x + 1$
	(f)	x	**1**	
	(g)	$g^{-1}(x) = g(x)$	**1**	
	(h)	$fh(x)$	**1**	

10	**A** –13, –20	**1**	
	$-7n + 22$ oe	**2**	**SC1** for $-7n + k$ or $kn + 22$ oe
	B $\frac{9}{22}, \frac{10}{23}$	**1**	
	$\frac{n+4}{n+17}$ oe	**2**	**B1** for $n + 4$ oe or $n + 17$ oe seen, but not in wrong position
	C 26, 37	**1**	
	$n^2 + 1$ oe	**1**	
	D 162, 486	**1**	
	$2 \times 3^{n-1}$ oe	**2**	**SC1** for $k \times 3^{n+p}$ [k, p integers] Accept $2 \times \frac{3^n}{3}$

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cao correct answer only
dep dependent
FT follow through after error
isw ignore subsequent working
oe or equivalent
SC Special Case
nfww not from wrong working
soi seen or implied

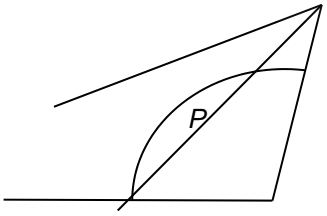
Question	Answers	Mark	Part Marks
1 (a) (i)	$\frac{13}{13+8+3} \times 12000$ with no subsequent errors	1	
(ii)	4000	1	
(b)	$2 \times 6500 + 5 \times$ *their* **(a)(ii)** + $(12000 - 6500 -$ *their* **(a)(ii)**$)$ or $(13 \times 2 + 8 \times 5 + 3 \times 1) \times 500$	2	**B1** for any two of 2×6500, $5 \times$ *their* **(a)(ii)**, $(12000 - 6500 -$ *their* **(a)(ii)**$)$ seen or $13 \times 2 + 8 \times 5 + 3 \times 1$
(c)	37 500	3	**M2** for $\frac{34500}{100-8} \times 100$ oe or **M1** for 34500 associated with (100 – 8)%
(d)	$\frac{11}{26}$ cao	2	**M1** for any correct simplified version of $\frac{2750}{6500}$
(e)	89 500	1	
2 (a)	1.5 1.25 –0.75 0.5	4	**B1** for each
(b)	Fully correct curve	5	**B5** for correct curve over full domain or **B3 FT** for 11 or 12 points or **B2 FT** for 9 or 10 points or **B1 FT** for 7 or 8 points **and** **B1** independent for one complete branch on each side of the *y*-axis and **not touching** or crossing the *y*-axis **SC4** for correct curve with branches joined

Question	Answers	Mark	Part Marks
(c)	−1.35 to −1.25	1	
	–0.27 to –0.251	1	
	1.51 to 1.55	1	
(d)	$k < 1.2$ or 1.15 to 1.25	2	**SC1** for 1.15 to 1.25 seen or horizontal line drawn at min point
(e)	tangent ruled at $x = -1$	B1	No daylight at $x = -1$ Consider point of contact as midpoint between two vertices of daylight, the midpoint must be between $x = -1.1$ and -0.9
	−1.7 to −1.3	2	**dep on B1** or a close attempt at tangent at $x = -1$ **or** **M1** for rise/run **also dep on** any tangent drawn or close attempt at tangent at any point. Must see correct or implied calculation from a drawn tangent
3 (a) (i)	image at (1, 4) (1, 5) (2, 5) (4, 4)	2	**SC1** for translation by $\begin{pmatrix}-1\\k\end{pmatrix}$ or $\begin{pmatrix}k\\3\end{pmatrix}$ or 4 correct vertices plotted but not joined
(ii)	image at (–2, –1) (–5, –1) (–2, –2) (–3, –2)	2	**SC1** for correct size and orientation, wrong position or 4 correct vertices plotted but not joined
(iii)	image at (2, –1) (2, –2) (3 ,–2) (5, –1)	3	**B2** for 3 correct vertices plotted or if no / wrong plots allow **SC2** for 4 correct coordinates in column matrix or shown in working or **SC1** for any 3 correct coordinates or **M1** for $\begin{pmatrix}1 & 0\\0 & -1\end{pmatrix}\begin{pmatrix}2 & 2 & 3 & 5\\1 & 2 & 2 & 1\end{pmatrix}$ oe
(b)	enlargement	B1	
	[centre] (1, 0)	B1	not as column vector
	[scale factor] − 3	B1	
(c)	$\begin{pmatrix}0 & -1\\1 & 0\end{pmatrix}$	2	**B1** for one correct row or column or $\begin{pmatrix}0 & 1\\-1 & 0\end{pmatrix}$

Question	Answers	Mark	Part Marks
4 (a)	5	1	
(b)	$C \cap M$ oe	1	Allow e.g. $(B \cap C \cap M) \cup (C \cap M)$
(c)	3	1	
(d) (i)	$\frac{8}{30}$ oe	1	0.267 or better
(ii)	$\frac{14}{30}$ oe	1	0.467 or better
(e)	$\frac{30}{272}$ oe	3	**M2** for $\frac{6}{17} \times \frac{5}{16}$ or **M1** for $\frac{6}{17}$ seen 0.110[2…] or better
5 (a) (i)	10.6 or 10.59...	2	**M1** for tan = $\frac{55}{294}$ oe
(ii)	175 or 174.9[…] to 175.[1…]	4	**M2** for [adj =] $\frac{55}{\tan 24.8}$ oe or **M1** for implicit version **and** **M1** dep on at least **M1** for 294 – *their* adj
(b) (i)	4.9 or 4.89 to 4.9	4	**M3** for $\sqrt{4^2 + \left(\frac{1}{2}\sqrt{4.8^2 + 3^2}\right)^2}$ or **M2** for $\frac{1}{2}\sqrt{4.8^2 + 3^2}$ or **M1** for $\sqrt{4.8^2 + 3^2}$ or $2.4^2 + 1.5^2$
(ii)	54.7 or 54.71 to 54.722	2	**M1** for sin = $\frac{4}{\textit{their}\ 4.9}$

6 (a) (i)	$24 < t \leqslant 30$	**1**	
(ii)	30.9 or 30.875 nfww	**4**	**M1** for midpoints **soi** (condone 1 error or omission) 5, 17, 27, 35, 50, 65 soi **M1** for use of $\sum fx$ with x in correct interval including both boundaries (condone 1 further error or omission) (50, 1530, 3645, 2975, 3500, 650) and **M1** (dep on 2nd **M1**) for $\sum fx \div 400$
(b) (i)	[10 100] 235 320 390 [400]	**2**	**B1** for any two correct **SC1** for 235, n, $n + 70$ $n > 235$
(ii)	Correct curve or polygon	**3**	**B1** for correct horizontal placement **B1FT** for correct vertical placement **B1FT dep on at least B1** for reasonable increasing curve or polygon through their 6 points If zero scored **SC1** for 5 out of 6 points correctly plotted
(c) (i)	27.5 to 29	**1**	
(ii)	12 to 14	**2**	**B1** for 36 to 38 or 24 seen
(iii)	18 to 20	**2**	**B1** for 60 seen or marked on grid
(iv)	30 to 45	**2**	**B1** for 355 to 370 seen

7	**(a) (i)**	8.27 or 8.269... nfww	**4**	**M2** for $7.6^2 + 8.4^2 - 2 \times 7.6 \times 8.4 \times \cos(62)$ oe or **M1** for implicit form **A1** for $[PQ^2 =]$ 68.3 to 68.5
	(ii)	28.2 or 28.18..	**2**	**M1** for $0.5 \times 7.6 \times 8.4 \times \sin 62$ oe
	(b)	55.8 or 55.78 to 55.79 nfww	**5**	**B1** for $[HGJ] = 81$ **B1** for $[GHJ] = 61$ **M2** for $[GJ =] \frac{63}{\sin(their\ 81)} \times \sin(their\ 61)$ or **M1** for implicit form After **M0, SC1** for final answer of 68.1…
8	**(a)**	$5x = 75$ or $5x + 48 = 123$	**B2**	**M1** for $x + (x + 12) + 3(x + 12) = 123$ oe
		15	**B1**	
	(b)	6, 7	**3**	**B2** for answer of 6 or 7 OR **M1** for $t < 8$ **M1** for $t \geqslant \frac{37}{7}$ OR **SC2** for final answer of 5, 6, 7 or 6, 7, 8 or **SC1** for final answer of 5, 6, 7, 8
	(c) (i)	1.8 oe	**3**	**M1** for $21 - x = 4(x + 3)$ or better **B1** for $[\pm]5x = k$ or $kx = [\pm]9$
	(ii)	$\sqrt{7^2 - 4 \times 3 \times (-5)}$ or better nfww	**B1**	or for $\left(x + \frac{7}{6}\right)^2$
		and		
		$\frac{-7 + \sqrt{q}}{2(3)}$ or $\frac{-7 - \sqrt{q}}{2(3)}$ oe	**B1**	or for $-\frac{7}{6} \pm \sqrt{\frac{5}{3} + \left(\frac{7}{6}\right)^2}$
		– 2.91 and 0.57 final ans cao	**B1B1**	**SC1** for 0.6 or 0.573… **and** – 2.9 or – 2.907 or –2.906… or – 0.57 and 2.91 or 0.57 and – 2.91 seen in working

9	**(a) (i)**	42	**2**	**B1** for $BAC = 90 - 48$
	(ii)	111	**2**	**B1** for 111 or 69 or $ACD = 27$ correctly placed on diagram or indicated
	(b) (i)	37.7 or 37.69 to 37.704 nfww	**2**	**M1** for $6\pi + 4\pi \pm 2\pi$ oe
	(ii)	12100, 12060, 12070, 12062.4 to 12065.6 nfww	**5**	**SC4** for answer with figs 121 or 1206 to 1207 **OR** **M2** for total area = $\frac{1}{2}\pi 6^2 + \frac{1}{2}\pi 4^2 - \frac{1}{2}\pi 2^2$ or $\frac{1}{2}\pi 60^2 + \frac{1}{2}\pi 40^2 - \frac{1}{2}\pi 20^2$ or **M1** for $\frac{1}{2}\pi 6^2$ or $\frac{1}{2}\pi 4^2$ or $\frac{1}{2}\pi 2^2$ or $\frac{1}{2}\pi 60^2$ or $\frac{1}{2}\pi 40^2$ or $\frac{1}{2}\pi 20^2$ **A1** for area = 75.39 to 75.41 or 7539 to 7541 **and** **M1 dep** for volume = *their* area × thickness
10	**(a)**	475 or 465 to 485	**2**	**B1** for 9.3 to 9.7 [cm] seen
	(b)	Correct perpendicular bisector with two pairs of intersecting arcs	**2**	**B1** for accurate with no/wrong arcs or **M1** for correct intersecting arcs
	(c)	Compass drawn arc centre *B* radius 5.8	**2**	**M1** for compass drawn arc centre *B* or **B1** for 5.8 cm stated or used
		Accurate angle bisector at *C* with correct intersecting arcs	**2**	**B1** for accurate with no/wrong arcs or **M1** for correct intersecting arcs
			**1**	cao

11	**(a)**	$\frac{At}{t+r}$ final answer oe nfww	**4**	**B1** for $t(A-x) = xr$ or $tA - tx = xr$ or $A = \frac{xr}{t} + x$ **M1** for correctly completing multiplication by t (eliminating any bracket) and x terms isolated **M1** for correct factorisation **M1** dep for correct division
	(b)	$[a =]$ 64 $[b =]$ -8	**3**	**B1** for $2b = -16$ or $(x-8)^2$ **B1** for $a = (\text{their } b)^2$ If **0** scored, **SC1** for $x^2 + 2bx + b^2$ soi
	(c)	$\frac{13x+8}{(x-4)(3x-2)}$ final answer nfww	**3**	**B1** for $6(3x-2) - 5(x-4)$ or better seen **B1** for $(x-4)(3x-2)$ oe seen as denom or **SC2** for final answer $\frac{13x-32}{(x-4)(3x-2)}$

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Question	Answer	Mark	Part marks
1 (a)	1848 final answer	**2**	**M1** for $1650 \times \left(1+\frac{12}{100}\right)$ oe
(b) (i)	1750	**2**	**M1** for $\frac{500}{9-5}$ [×5] or [×9] or any equation which would lead to $4x = 500$ or $4x = 2500$ or $4x = 4500$ or $4x = 7000$ when simplified
(ii)	$64\frac{2}{7}$ or 64.3 or 64.28 to 64.29	**1**	
(c) (i)	33 : 20 oe	**2**	**B1** for 33 : 6 or 20 : 6 or 5.5 oe seen or 3.33…oe seen or **M1** for two ratios with a common number of children implied by $20k$ **and** $33k$ seen, $k > 0$
(ii)	236	**3**	**M2** for $\frac{24}{2} \times 11 + \frac{24}{3} \times 10$ oe or $((3 \times 11) + (2 \times 10)) \times 24 \div 6$ or $\frac{6}{6+20+33} \times x = 24$ or **M1** for $\frac{24}{2} \times 11$ or $\frac{24}{2} \times 13$ soi or $\frac{24}{3} \times 10$ or $\frac{24}{3} \times 13$ soi oe or $24 \div 6$ soi
(d)	17[.00]	**3**	**M2** for $20.40 \div \left(1+\frac{20}{100}\right)$ oe or **M1** for (100 + 20)% oe associated with 20.40 seen

Question	Answer	Mark	Part marks
2 (a) (i)	66	1	
(ii)	24	1FT	**FT** 90 – *their* **(a)(i)**
(iii)	66	2FT	**FT** 90 – *their* **(a)(ii)** **M1** for [*BOD* =] 180 – 48 or 180 – 2 × *their* **(a)(ii)**
(iv)	114	1FT	**FT** 180 – *their* **(a)(iii)**
(b)	83.6 or 83.60[…]	2	**M1** for $\frac{1}{2} \times 15 \times 15 \times \sin(180 - 48)$ oe or $\frac{1}{2} \times 15 \times 15 \times \sin(180 - 2 \times$ *their* **(a)(ii)**$)$ oe
(c)	Opposite angles add up to 180 OR Angle in a semicircle [=90]	1	

Question	Answer	Mark	Part marks
3 (a) (i)	$\frac{600}{x+20}$ final answer	1	
(ii)	$\frac{600}{x} - \textit{their}\ \frac{600}{x+20} = 1.5$ oe	M1	
	$600(x + 20) – 600x = 1.5x(x + 20)$ or $\frac{600(x+20)-600x}{x(x+20)}$ [= *their* 1.5]	M1	Correctly clearing, or correctly collecting into a single fraction, two fractions both with algebraic denominators, one being $\frac{600}{x}$
	$600x + 12\,000 – 600x = 1.5x^2 + 30x$ [$0 = 1.5x^2 + 30x – 12\,000$]	M1	Dep on previous **M1**, correctly multiplying *their* brackets **and** clearing fraction
	$0 = x^2 + 20x – 8000$	A1	With no errors or omissions seen, dep on **M3**
(b)	–100, 80	3	**M2** for $(x + 100)(x – 80)$ or **M1** for $(x + a)(x + b)$ where $ab = –8000$ or $a + b = 20$ OR **B1** for $\sqrt{20^2 - 4\times1\times(-8000)}$ or better and **B1** for $\frac{-20+\sqrt{q}}{2\times1}$ or $\frac{-20-\sqrt{q}}{2\times1}$
(c)	6.67 or 6.666 to 6.667 oe	2FT	**FT** $\frac{12}{2(\textit{their}\ 80)+20} \times 100$ correctly evaluated to at least 3 sf **M1** for choosing and using *their* positive root

Question	Answer	Mark	Part marks
4 (a) (i)	9π final answer	2	**M1** for $\frac{135}{360} \times 2 \times \pi \times 12$ oe
(ii)	**(a)** 4.5[0] or 4.497 to 4.504…	2FT	**FT** *their* 9 ÷ 2 **M1** for $2\pi r =$ *their* 9π or $12\pi r = \frac{135}{360}\pi 12^2$ oe
	(b) 11.1 or 11.12[…]	3FT	**FT their** $\sqrt{12^2 - \textit{their}\,4.5^2}$ to 3 sf or better (*their* 4.5 < 12) **M2** for $\sqrt{12^2 - \textit{their}\,4.5^2}$ (*their* 4.5 < 12) or **M1** for $12^2 = h^2 +$ *their* 4.5^2 oe (*their* 4.5 < 12)
(b) (i)	75 nfww	3	**M2** for $l = \frac{35}{7} \times 15$ or $x = \frac{35}{7} \times 8$ oe or for 40 seen nfww or correct trig or Pythagoras' method leading to value rounding to 40.0 **M1** for $\frac{l}{15} = \frac{35}{7}$ oe or $\frac{x}{8} = \frac{35}{7}$ oe or $\frac{l-35}{8} = \frac{35}{7}$ oe or $\frac{l-35}{l} = \frac{8}{15}$ oe
(ii)	2730 or 2730.0 to 2730.4 nfww	3	**M2 dep** for $\pi \times 15 \times$ *their* $75 - \pi \times 8 \times$ (*their* $75 - 35$) [$+ \pi \times 8^2$] dep their 75 > 35 or 805π [2527.7 to 2530] nfww or $869\,\pi$ [2728.6 to 2731.2] nfww or **M1** for $\pi \times 15 \times$ *their* 75 or $1125\,\pi$ [3532.5 to 3535.8] nfww seen or $\pi \times 8 \times$ (*their* $75 - 35$) or $320\,\pi$ [1004.8 to 1005.8] nfww seen or $\pi \times 8^2$ or 64π [200.9 to 201.2] nfww seen
(c) (i)	$16r^3$	2	**M1** for [$M =$] $k \times r^3$ or $1458 = k \times 4.5^3$ oe or $\frac{M}{1458} = \frac{r^3}{4.5^3}$ oe After **M0**, **SC1** for 16 seen
(ii)	8 : 27 oe	1	Must be numeric, e.g. 128:432

5	**(a)**	2 and 7	**2**	**B1** for each value
	(b)	Complete correct curve	**5**	**B3 FT** for *their* 9 or 10 points or **B2 FT** for *their* 7 or 8 points or **B1 FT** for *their* 5 or 6 points and **B1** independent for one branch on each side of the y-axis and **not touching** the y-axis **SC4** for correct curve with branches joined
	(c)	Correct tangent and $-13 \leqslant$ grad $\leqslant -8$	**3**	**B2** for close attempt at tangent at $x = 1$ and answer in range OR **B1** for ruled tangent at $x = 1$, no daylight at $x = 1$ Consider point of contact as midpoint between two vertices of daylight, the midpoint must be between $x = 0.8$ and 1.2 **and M1** (dep on **B1** or close attempt at tangent [at any point] for $\frac{rise}{run}$
	(d) (i)	5 to 6	**1**	
	(ii)	2 to 2.35 and –2.55 to –2.35	**2FT**	**FT** *their k* **B1FT** for each correct solution
	(e)	$[a =] -5$ $[b =] -1$ $[c =] 12$	**3**	**B2** for two correct values or for $x^3 - 5x^2 - x + 12$ [= 0] oe or **M1** for $x^2 - 2x + \frac{12}{x} = 3x + 1$

6	**(a)**	$95.5^2 + 83.1^2 - 2 \times 95.5 \times 83.1 \times \cos 101$	**M2**	**M1** for $\cos 101 = \dfrac{95.5^2 + 83.1^2 - AB^2}{2 \times 95.5 \times 83.1}$
		138.0…	**A2**	**A1** for 19054.[…] also implies **M2**
	(b)	110 or 109.7 to 109.8	**4**	**B3** for 36.2 or 36.20 to 36.24[1..] or **M2** for [sin =] $\dfrac{83.1 \times \sin 101}{138[.0..]}$ oe or **M1** for correct implicit version After **M0**, **SC1** for angle ABC = 42.76 to 42.8
	(c)	18.8 or 18.79[…]	**2**	**M1** for 46.2 × cos(45 + 21) oe After **M0**, **SC1** for answer 42.2 or 42.20 to 42.21
7	**(a)** **(i)**	316	**4**	**M1** for 100, 250, 325, 375, 450 soi **M1** for Σ*fm* with *m*'s in intervals including boundaries [15800] **M1** (dep on 2nd **M1**) for *their* Σ*fm* ÷ 50
	(ii)	Three correct blocks with heights 0.09, 0.36, 0.24 with correct widths and no gaps	**3**	**B2** for two correct blocks or **B1** for one correct block or three correct frequency densities soi
	(b)	Students have a greater range of estimates oe	**B1**	
		[On average] adults estimated a greater mass oe	**B1**	

8	(a) (i)	$x \geqslant 100$ final answer	1	
	(ii)	$y \geqslant 120$ final answer	1	
	(iii)	$x + y \leqslant 300$ final answer	1	
	(iv)	$40x + 80y \geqslant 16000$ or $0.4x + 0.8y \geqslant 160$	M1	with no errors seen but isw substitution of values after correct inequality
	(b)	$x = 100$ ruled	B1	
		$y = 120$ ruled	B1	
		$x + y = 300$ ruled	B1	
		$x + 2y = 400$ ruled	B2	Allow **B1** for line with negative gradient passing through (400, 0) or (0, 200) when extended
		Correct shading	B1	Dep on all previous marks earned Condone any clear indication of the required region
	(c)	200	2	**M1** for $x = 100$ and $y = 200$ selected or for $x \times 0.4 + y \times 0.8$ oe evaluated where (x, y) is an integer point in *their* [unshaded] region

9	**(a)**	$4x - 3x^2$ or $x(4 - 3x)$ nfww final answer	**3**	**B2** for $3x^2 - 6x - 6x^2 + 10x$ or **M1** for $3x^2 - 6x$ or $-6x^2 + 10x$
	(b) (i)	$(2 + y)(3w - 2x)$ oe final answer	**2**	**M1** for $3w(2 + y) - 2x(2 + y)$ or $2(3w - 2x) + y(3w - 2x)$
	(ii)	$(2x + 5y)(2x - 5y)$ final answer	**2**	**M1** for $(2x \pm 5y)(2x \pm 5y)$ or $(2x + ky)(2x - ky)$ or $(kx + 5y)(kx - 5y)$, $k \neq 0$ or $(2x + 5)(2x - 5)$ or $(2 + 5y)(2 - 5y)$
	(c)	$\frac{27x^6}{64}$ final answer	**2**	**B1** for 2 [out of 3] elements correct in the right form in final answer or final answer contains 27 and 64 and $x^{[-]6}$ or $\frac{3x^2}{4}$ seen or $\frac{729x^{12}}{4096}$ seen
	(d) (i)	$2n$ is even and subtracting 1 gives an odd number	**1**	Must interpret the $2n$ as even or not odd and then the -1 oe
	(ii)	$2n + 1$ oe final answer	**1**	
	(iii)	*their*$(2n + 1)^2 - (2n - 1)^2$	**M1**	Could use alternate correct expressions for consecutive **odd** numbers. Allow method and accuracy marks if correct. Could reverse the algebraic terms *their*$(2n - 1)^2 - (2n + 1)^2$ leading to $-8n$. Allow method and accuracy marks if correct.
		$4n^2 + 4n + 1 - 4n^2 + 4n - 1$	**M1**	**Dep on M1** for expanding brackets in *their* expressions. If seen alone and completely correct then implies previous **M1** Allow $4n^2 + 4n + 1 - (4n^2 - 4n + 1)$
		$8n$	**A1**	With no errors seen. After **0** scored, allow **SC1** for two correctly evaluated numeric examples of subtracting consecutive odd squares isw

10	**(a) (i)**	9.43[…]	**2**	**M1** for $5^2 + ([-]8)^2$ or better
	(ii)	(–3, 5)	**1**	
	(b) (i)	**(a)** $\frac{1}{2}(\mathbf{a} + \mathbf{b})$ or $\frac{1}{2}\mathbf{a} + \frac{1}{2}\mathbf{b}$	**2**	**M1** for $\mathbf{a} + \frac{1}{2}\boldsymbol{AB}$ oe, e.g $\mathbf{a} + \boldsymbol{AM}$, $\boldsymbol{OA} + \frac{1}{2}\boldsymbol{AB}$
		(b) $\frac{1}{4}(\mathbf{a} + \mathbf{b})$ or $\frac{1}{4}\mathbf{a} + \frac{1}{4}\mathbf{b}$	**1FT**	**FT** $\frac{1}{2}$ *their* **(b)(i)(a)** <u>in terms of **a** and/or **b**</u> in simplest form
		(c) $\frac{1}{4}(\mathbf{b} - 3\mathbf{a})$ or $\frac{1}{4}\mathbf{b} - \frac{3}{4}\mathbf{a}$	**2**	**M1** for $-\mathbf{a}$ + *their* **(b)(i)(b)** or any correct route
	(ii)	3 : 4 final answer	**3**	**M1** for $[\boldsymbol{AN} =] -\mathbf{a} + \frac{1}{3}\mathbf{b}$ **A1** for $\frac{1}{4} : \frac{1}{3}$ oe or $\boldsymbol{AN} = \frac{1}{3}(-3\mathbf{a} + \mathbf{b})$ or $3k$ to $4k$ After **0** scored **SC1** for final answer 4 : 3
	(c) (i)	Triangle drawn at (–3, –3), (–6, –3), (–6, $-4\frac{1}{2}$)	**3**	**B2** for 2 vertices correct in triangle or 3 correct co-ordinates soi in working or **B1** for 1 vertex in triangle correct soi or triangle of correct size and orientation but wrong position or **M1** for correct set up e.g. $\begin{pmatrix} -1.5 & 0 \\ 0 & -1.5 \end{pmatrix}\begin{pmatrix} 2 & 4 & 4 \\ 2 & 2 & 3 \end{pmatrix}$
	(ii)	$\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$	**2**	**SC1** for 1 correct row or column or for $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$

11 **(a)**	$\frac{38}{56}$ or $\frac{19}{28}$ oe	**4**	[0.679 or 0.6785 to 0.6786] **M3** for $\frac{4}{8} \times \frac{4}{7} + \frac{3}{8} \times \frac{5}{7} + \frac{1}{8}$ [$\times \frac{7}{7}$] oe or **M2** for sum of two of the products isw $\frac{4}{8} \times \frac{4}{7}$, $\frac{3}{8} \times \frac{5}{7}$, $\frac{1}{8}$ [$\times \frac{7}{7}$] oe or **M1** for $\frac{4}{8} \times \frac{4}{7}$ or $\frac{3}{8} \times \frac{5}{7}$ oe isw or $\frac{1}{8} \times \frac{7}{7}$ isw After **0** scored, **SC1** for answer of $\frac{38}{64}$ oe
(b)	$\frac{60}{336}$ or $\frac{5}{28}$ oe	**2**	**M1** for $\frac{5}{8} \times \frac{4}{7} \times \frac{3}{6}$ or $\left(\frac{4}{8}\times\frac{3}{7}\times\frac{2}{6}\right) + 3\left(\frac{4}{8}\times\frac{1}{7}\times\frac{3}{6}\right)$ oe

CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International General Certificate of Secondary Education

MARK SCHEME for the May/June 2015 series

0580 MATHEMATICS

0580/43 Paper 4 (Extended), maximum raw mark 130

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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Cambridge is publishing the mark schemes for the May/June 2015 series for most Cambridge IGCSE®, Cambridge International A and AS Level components and some Cambridge O Level components.

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Abbreviations

cao correct answer only
dep dependent
FT follow through after error
isw ignore subsequent working
oe or equivalent
SC Special Case
nfww not from wrong working
soi seen or implied

Qu		Answers	Mark	Part Marks
1	(a) (i)	Triangle at (–3, 1), (–3, 3), (–4, 3)	2	**SC1** for reflection in line $y = -1$ at (1, –3), (1, –5), (2, –5) or reflection in any vertical line or three correct points not joined
	(ii)	Triangle at (–1, –1), (–2, –3), (–1, –3)	2	**SC1** for rotation 180° but other centre or three correct points not joined
	(b) (i)	Translation	1	
		$\begin{pmatrix} -2 \\ 2 \end{pmatrix}$ oe	1	
	(ii)	Enlargement	1	
		(0, 3)	1	
		[factor] 3	1	
2	(a) (i)	640×1.02^6 oe = 720.7…	M1 B1	Must be seen
	(ii)	3.02 or 3.020 to 3.024… nfww	4	**M3** for [$x =$] $\sqrt[4]{721 \div 640}$ or better (implied by answer of 1.03[02…] or $r = 0.0302$[4…] or **M2** for (*their* x)$^4 = 721 \div 640$ or **M1** for $640 \times$ (*their* x)$^4 = 721$ oe
	(b)	874.8[0] final answer	2	**M1** $1200 \times (1 - 0.1)^3$ oe

Qu		Answers	Mark	Part Marks
3	(a)	1 3 2.5	**1** **1** **1**	
	(b)	Fully correct graph	**5**	**B3FT** for 11, 12 points correct or **B2FT** for 9, 10 correct points or **B1FT** for 7, 8 correct points **B1** for branch each side of y-axis and not touching y-axis **SC4** for correct graph but branches joined
	(c)	–2.6 to –2.4	**1**	
	(d)	Correct ruled line fit for purpose –1.6 to –1.5	**2** **1**	**SC1** for ruled line through (0, 1) but not $y = 1$ or ruled line with gradient –1 or for correct line but freehand
	(e)	Correct tangent and $0.9 \leqslant \text{grad} \leqslant 1.5$	**3**	Consider point of contact as midpoint between two vertices of daylight, the midpoint must be between $x = –3.4$ and –2.6 **B2** if close attempt at correct tangent and answer in range (may be small amount of daylight) or **B1** for ruled tangent at $x = –3$ within tolerance, no daylight at the point of contact **and M1** (**dep** on **B1** or close attempt at tangent) for a tangent at any point and $\frac{rise}{run}$ used
4	(a)	72.5	**3**	**M1** for Σfm with correct frequencies and correct mid-interval values **M1** for ÷ 200 **dep** on first **M1**
	(b)	Correct histogram	**4**	**B1** four correct widths – no gaps **B3** for blocks of correct heights 0.5, 5, 16, 4 or **B2** for 3 blocks of correct heights or **B1** for 2 blocks of correct heights If 0 scored for the heights then **SC1** for all four frequency densities soi

Qu		Answers	Mark	Part Marks
5	(a) (i)	$\frac{4}{7}$ oe	1	
	(ii)	$\frac{6}{7}$ oe	1	
	(iii)	$\frac{5}{7}$ oe	1	
	(b) (i)	$\frac{12}{42}$ oe nfww	2	**M1** for $\frac{4}{7}\times\frac{3}{6}$
	(ii)	$\frac{28}{42}$ oe nfww	3	**M2** for $\frac{4}{7}\times\frac{3}{6}+\frac{2}{7}\times\frac{5}{6}+\frac{1}{7}$ or $1-\frac{4}{7}\times\frac{3}{6}-\frac{2}{7}\times\frac{1}{6}$ oe or **M1** for the sum of two terms of $\frac{4}{7}\times\frac{3}{6}, \frac{2}{7}\times\frac{5}{6}, \frac{1}{7}$
	(c)	$\frac{120}{210}$ oe nfww	2	**M1** for $\frac{6}{7}\times\frac{5}{6}\times\frac{4}{5}$ or $\left(\frac{4}{7}\times\frac{3}{6}\times\frac{2}{5}\right)+3\left(\frac{4}{7}\times\frac{3}{6}\times\frac{2}{5}\right)+3\left(\frac{4}{7}\times\frac{2}{6}\times\frac{1}{5}\right)$ oe

Qu		Answers	Mark	Part Marks
6	(a)	100 nfww	4	**M3** for a correct calculation that would lead to the answer or **B2** two correct relevant different size angles in *their* diagram or one relevant angle **and** total in *their* polygon or angle *EDA* + angle *FAD* = 140 or **B1** for one relevant angle or total in *their* polygon
	(b) (i)	50	2	**B1** for angle *ADC* = 80 or angle *BAC* = 30 or angle *ADB* = 50 soi
	(ii)	41	2FT	**FT** 91 – *their* **(b)(i)** **B1** for angle *XBC* = 41
	(iii)	Similar	1	
	(c)	27.8 or 27.83	2	**M1** for evidence of $\left(\frac{11}{10}\right)^2$ or 1.21 or $\left(\frac{10}{11}\right)^2$ or 0.826(4…)
	(d) (i)	60	3	**M2** for $\frac{n}{10}=\frac{360}{n}$ oe e.g. $\frac{180(n-2)}{n}=180-\frac{n}{10}$ or **B1** for exterior sum = 360 or 180(n – 2) seen
	(ii)	174	2	**M1** for $\frac{\text{their } n}{10}$ or $\frac{360}{\text{their } n}$ for *their* $n < 1800$

Qu		Answers	Mark	Part Marks
7	(a) (i)	331 or 331.1 to 331.2	2	**M1** for $\pi \times 6.2 \times 10.8 + \pi \times 6.2^2$
	(ii)	$\frac{A - \pi r^2}{\pi r}$ oe final answer	2	**M1** for correct re-arrangement isolating term in l **M1** for correct division by πr
	(b) (i)	4.39 or 4.390…	3	**M2** for $18 \div \left(\frac{10}{4} + \frac{8}{5}\right)$ or **M1** for $\frac{10}{4}$ or $\frac{8}{5}$
	(ii)	$x + x + 4$ oe	**B1**	Must be seen
		$\frac{x}{5}$ or $\frac{x+4}{10}$	**B1**	Must be seen
		$\frac{x + x + 4}{\frac{x}{5} + \frac{x+4}{10}} = 7$ oe	**M2**	or **M1** for evidence of total distance ÷ *their* total time
		12	**B1**	
	(c) (i)	16.5[0] final answer	3	**M2** for $19.8 \div \left(1 + \frac{20}{100}\right)$ oe or **M1** for evidence of (100 + 20)% associated with 19.8
	(ii)	$\frac{100x}{100 + y}$ final answer	3	**B2** for $\frac{x}{1 + \frac{y}{100}}$ or $\frac{x}{1 + 0.01y}$ oe or **B1** for $1 + \frac{y}{100}$ or $100 + y$ or $1 + 0.01y$ seen

Qu		Answers	Mark	Part Marks
8	(a)	28.3 or 28.29…	2	**M1** for $180\,000 \div (\pi \times 45^2)$
	(b) (i)	360 000	3	**M2** for $\frac{1}{2}(70+50)\times 40\times 150$ oe or **M1** for $\frac{1}{2}(70+50)\times 40$ oe or *their* area of *ABCD* × 150 dependent on *their* area being two dimensional
	(ii)	360	1FT	**FT** *their* **(b)(i)** ÷ 1000
	(c)	3 h 20 min	3	**M2** for 180 000 ÷ 15 ÷ 60 (implied by 200) or **M1** for 180 000 ÷ 15 (implied by 12000) or correct conversion of *their* seconds into h and min
	(d) (i)	$\frac{h}{40} = \frac{\frac{1}{2}(x-50)}{10}$ oe	M1	i.e. a correct statement from similar figures which must contain *h, x* and numbers
		$h = 2(x-50)$	A1	Answer established with at least one more step and no errors or omissions
	(ii)	$\frac{1}{2}(x+50)\ 2(x-50)$	M1	
	(iii)	60.8 or 60.82 to 60.83	2	**M1** for $(x^2-2500)\times 150 = 180000$ or better
	(iv)	21.7 or 21.65 to 21.66	1FT	**FT** for 2(*their* **(d)(iii)** – 50) evaluated only if $x > 50$

Qu		Answers	Mark	Part Marks
9	(a)	$\begin{pmatrix} 2 & 13 \\ 1 & 14 \end{pmatrix}$	2	**SC1** for one correct column or row
	(b)	$\frac{1}{3}\begin{pmatrix} 3 & -2 \\ 0 & 1 \end{pmatrix}$ oe isw	2	**B1** for $k\begin{pmatrix} 3 & -2 \\ 0 & 1 \end{pmatrix}$ oe for $k \neq 0$ or $\frac{1}{3}\begin{pmatrix} a & c \\ b & d \end{pmatrix}$
	(c)	$[u =] 3$ $[v =] 2$	3	**B2** for two of $3 = u$, $2u + 3v = 4u$, $4 = 2 + v$, $u + 4v = 3 + 4v$ or **B1** for one or **M1** for $\begin{pmatrix} 2 & 3 \\ 1 & 4 \end{pmatrix}\begin{pmatrix} 0 & u \\ 1 & v \end{pmatrix} = \begin{pmatrix} 0 & u \\ 1 & v \end{pmatrix}\begin{pmatrix} 2 & 3 \\ 1 & 4 \end{pmatrix}$ **B1** for $\begin{pmatrix} 3 & 2u+3v \\ 4 & u+4v \end{pmatrix}$ or $\begin{pmatrix} u & 4u \\ 2+v & 3+4v \end{pmatrix}$
	(d)	12 nfww	2	**M1** for $w \times 2 - 8 \times 3$ [= 0] oe
10	(a)	9	2	**B1** for [f(3) =] 5 or $2(2x - 1) - 1$
	(b)	$4x^2 - 2x$ or $2x(2x - 1)$ final answer	3	**M1** for $(2x - 1)^2 + (2x - 1)$ **B1** for $[(2x - 1)^2 =] 4x^2 - 2x - 2x + 1$ or $(2x - 1)(2x - 1 + 1)$
	(c)	$\frac{x+1}{2}$ oe final answer	2	**M1** for $x = 2y - 1$ or $y + 1 = 2x$ or $\frac{y}{2} = x - \frac{1}{2}$
	(d)	$\frac{4x+4}{x(x+2)}$ or $\frac{4x+4}{x^2+2x}$ or $\frac{4(x+1)}{x(x+2)}$ or $\frac{4(x+1)}{x^2+2x}$ final answer	4	**B1** for $x(x + 2)$ oe isw as common denominator **B2** for $4x + 4$ as numerator or **B1** for $2(x + 2) + 2x$ or better as numerator

Qu		Answers	Mark	Part Marks
11	(a)	$\frac{5}{7}$ $\frac{n}{n+2}$ oe 7 $n+2$ oe 3 $n-2$ oe 21 n^2-4 oe	8	**B1** each
	(b)	72	2	**M1** for $\frac{72}{74}$ or *their* $\frac{n}{n+2}=\frac{36}{37}$
	(c)	27	2	**M1** for *their* $(n^2 - 4) = 725$ or 25×29 [= 725]

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0580 MATHEMATICS

0580/42 Paper 4 (Paper 42 – Extended), maximum raw mark 130

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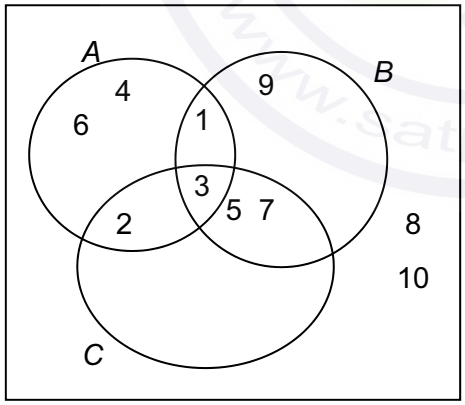
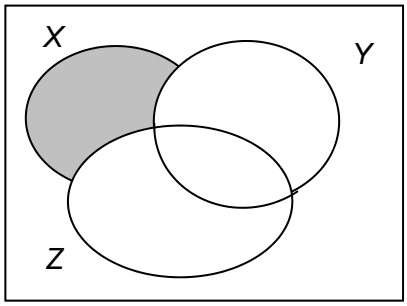
Abbreviations

cao correct answer only
dep dependent
FT follow through after error
isw ignore subsequent working
oe or equivalent
SC Special Case
nfww not from wrong working
soi seen or implied

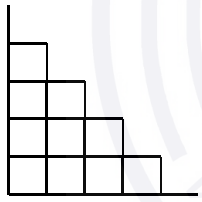
Qu.		Answers	Mark	Part Marks
1	(a)	$\frac{1.5}{100} \times 450000$ oe	1	Accept equivalent methods
	(b)	6000	3	**M2** for $\frac{6750}{112.5} \times 100$ oe or **M1** for 112.5% associated with 6750 oe
	(c)	376.25 cao final answer	2	**B1** for 21.5 and 17.5 seen
	(d)	22.4	2	**M1** for 200^2 or 2^2 seen oe
	(e)	5184	2	**M1** for $12 \times 16 \times 27$
	(f)	9023	3	**M1** for $12000 \div 1.33$ **A1** for 9022.55 to 9022.56 or 9022.6 or 9020 **B1indep** for their answer rounded to the nearest euro if possible
2	(a) (i)		3	**B2** for 8 or 9 numbers correct **B1** for 6 or 7 numbers correct
	(ii)	$\in$ cao	1	
		{3}	1FT	FT *their* intersection of all 3 sets – *their* diagram
		$\varnothing$ or {}	1	
	(iii)	5	1FT	FT *their* set *B* on diagram
	(b) (i)	$\subset$	1	

	(ii)		**1**	
3	**(a)**	2 0 – 2 2	**3**	**B2** for 3 correct **B1** for 2 correct
	(b)	smooth correct curve through correct points	**4**	**B3FT** for 8 or 9 correct plots **B2FT** for 6 or 7 correct plots **B1FT** for 4 or 5 correct plots FT *their* table
	(c)	line $y = \frac{1}{2}(x+1)$ ruled and –2.85 to –2.95 –1 0.85 to 0.95	**4**	Line must be fit for purpose **B3** for correct line and 2 correct values or **B2** for correct line and 1 correct value or **B1** for correct line or **SC2** for no/wrong line and 3 correct values or **SC1** for no/wrong line and 2 correct values
	(d)	tangent ruled	**B1**	No daylight between tangent and curve at point of contact. Consider point of contact as midpoint between two vertices of daylight, the midpoint must be between $x = -1.85$ and $x = -1.65$
		– 1.1 to – 1.5	**2**	dep on **B1** **M1** for rise/run **also dep on** any tangent drawn or close attempt at tangent at any point Must see correct or implied calculation from a drawn tangent Accept **M1** for answer in range 1.1 to 1.5 after **B1**
4	**(a)**	$(11y-m)(11y+m)$ final answer	**2**	**B1** for $11y$ seen
	(b)	$\frac{3x^2+5x-14}{(3x-5)(x-1)}$ final answer	**3**	**B1** for denom $(3x-5)(x-1)$ oe isw and **B1** for $3x^2+6x-5x-10$ soi

(c)	$\frac{-2\pm\sqrt{2^2-4(3)(-7)}}{2\times3}$	**2**	**B1** for $\sqrt{2^2-4(3)(-7)}$ or better seen and if in form $\frac{p+or-\sqrt{q}}{r}$ **B1** for $p = -2$ **and** $r = 2\times3$
	– 1.90 1.23 final answers	**1, 1**	**SC1** for –1.9, –1.896 or –1.897 and 1.2 or 1.230 or –1.23 and 1.90 final answers or –1.90 and 1.23 seen in working
(d) (i)	$\frac{1}{2}(x+4+3x+2)(x+1)=15$	**M1**	Allow $\frac{1}{2}(4x+6)(x+1)=15$
	$4x^2+4x+6x+6 = 30$ or $2x^2+2x+3x+3 = 15$	**M1**	Dep on 1st **M1**
	$2x^2+5x-12=0$	**A1**	With no errors or omissions
(ii)	1.5 or $\frac{3}{2}$, –4	**3**	**B2** for $(2x-3)(x+4)$ or $\frac{-5\pm\sqrt{5^2-4(2)(-12)}}{2\times2}$ **or SC1** for $(2x+a)(x+b)$ where a and b are integers and $a + 2b = 5$ or $ab = -12$ or $\sqrt{5^2-4(2)(-12)}$ or $\frac{p+or-\sqrt{q}}{r}$ where $p = -5$ and $r = 2\times2$
(iii)	6.5 or $\frac{13}{2}$	**1FT**	FT 3 × *their* pos root from **(d)(ii)** + 2
5 (a)	$\frac{1}{2}\times16\times5.4\times\sin62$ oe	**M1**	
	38.14...	**A1**	
(b)	95.6 or 95.64 to 95.65	**4**	**M2** for $\frac{6.7\times\sin48}{8.4}$ **or M1** for implicit form **and M1dep** for 180 – 48 – *their* 36.4

	(c)	286 or 285.7 to 285.8	**5**	**B1** for [Angle *APB*=] 83° **M2** for $180^2 + 245^2 - 2\times180\times245\times\cos$ *their* 83 **or M1** for implicit form **and A1** for [AB^2 =] 81676[.1...] After 0 scored, **SC2** for ans 406.87 to 406.88 or 406.9 or 407 if 146° used in cos rule Or **SC1** for $180^2 + 245^2 - 2\times180\times245\times\cos 146$
6	**(a)**	$\frac{4}{15}$	**1**	
	(b)	80	**1FT**	FT 300 × *their* **(a)**
	(c) (i)	$\frac{40}{225}$ oe $\left[\frac{8}{45}\right]$	**3**	**M2** for $\frac{5}{15}\times\frac{4}{15}\times 2$ oe or **M1** for $\frac{5}{15}\times\frac{4}{15}$
	(ii)	$\frac{121}{225}$	**3**	**M2** for $\frac{11}{15}\times\frac{11}{15}$ oe or **M1** for $\frac{11}{15}$ or $1-\frac{4}{15}$ seen
	(d) (i)	$\frac{108}{210}$ oe $\left[\frac{18}{35}\right]$	**3**	**M2** for $\frac{6}{15}\times\frac{9}{14}+\frac{9}{15}\times\frac{6}{14}$ oe or **M1** for $\frac{6}{15}\times\frac{9}{14}$ oe or $\frac{9}{15}\times\frac{6}{14}$ oe or $\frac{6}{15}\times\frac{5}{14}$ oe or $\frac{6}{15}\times\frac{4}{14}$ oe
	(ii)	$\frac{148}{210}$ oe $\left[\frac{74}{105}\right]$	**4**	**M3** for $\frac{5}{15}\times\frac{10}{14}+\frac{6}{15}\times\frac{9}{14}+\frac{4}{15}\times\frac{11}{4}$ oe or $1-\frac{5}{15}\times\frac{4}{14}-\frac{6}{15}\times\frac{5}{14}-\frac{4}{15}\times\frac{3}{14}$ or **M2** for equivalent of 2 of above products added together oe or **M1** for one correct relevant product oe
7	**(a) (i)**	Rotation [centre] (0, 0) or origin 90° [anticlockwise] oe	**1** **1** **1**	

	(ii)	Enlargement [centre] (–2, 1) [s.f.] – 2	**1** **1** **1**	
	(b)	vertices at (–3, 4) (–3, 5) (–3, 6) (–2, 6)	**2**	**SC1** for translation by $\begin{pmatrix}2\\k\end{pmatrix}$ or $\begin{pmatrix}k\\1\end{pmatrix}$
	(c)	vertices at (7, 3) (7, 4) (7, 5) (6, 5)	**2**	**SC1** for reflection in $y = 1$ or reflection in any vertical line
	(d)	reflection x-axis oe	**1** **1**	
8	**(a) (i)**	47.7 or 47.74 to 47.75	**3**	**M1** for [arc =] $68 - 2 \times 24$ or $24 + 24 + \frac{x}{360} \times 2\pi \times 24 = 68$ **M1** for [x =] *their* arc $\times$ 360 ÷ (2 $\times$ π $\times$ 24)
	(ii)	252 or 252.3 to 252.4....	**6**	**M1** for $r = \frac{20}{2\pi}$ or $\left(\frac{their 47.7}{360} \times 2 \times \pi \times 24\right) \div (2\pi)$ **A1** for r = 3.18 or 3.182 to 3.183... or $\frac{10}{\pi}$ **M1** for $h^2 = 24^2 - their\ r^2$ **A1** for h = 23.8 or 23.78... to 23.79 **M1dep** on M1 earned for $V = \frac{1}{3}\pi \times their\ h \times their\ r^2$
	(b)	139 or 139.3 to 139.4... nfww	**5**	**M4** for $8^2 + \frac{1}{4}\pi \times 8^2 + \frac{1}{2}\pi \times \left(\frac{8}{2}\right)^2$ **or M1** for $\frac{1}{4}\pi \times 8^2$ **and M1** for $\frac{1}{2}\pi \times \left(\frac{8}{2}\right)^2$ **and M1** for 8^2 added to at least one term with π
9	**(a)**	$140 < h \leqslant 144$	**1**	
	(b)	144.875 nfww	**4**	**M1** for at least 4 correct mid-values soi **M1** for $\sum fx$ where x is in the correct interval, allow one further error/omission **M1 dep** for ÷ 40 dependent on second method mark

	(c)	4 correct blocks	**4**	**B3** for 3 correct blocks **B2** for 2 correct blocks **B1** for 1 correct block or at least 3 correct frequency densities (1.4, 1, 1, 0.65)
10	**(a)**	$4x + 10y < 80$	**1**	With no errors seen
	(b)	$y > x$	**1**	
		$y \leqslant 6$ or $y < 7$	**1**	Accept $0 \leqslant y \leqslant 6$ or $0 < y \leqslant 6$ or $0 \leqslant y < 7$ or $0 < y < 7$
	(c)	ruled broken line through (5, 6) to (10,4)	**B2**	**SC1** for correct only at (5, 6) or (10, 4)
		ruled broken line $y = x$	**B1**	
		ruled solid line $y = 6$ or broken $y = 7$	**B1**	Must be consistent with *their* **(b)**
		correct region indicated	**B1**	
	(d)	76	**2**	**SC1** for (4, 6) indicated or $4x + 10y$ evaluated for (x, y) in *their* region, x, y integers
11	**(a)**		**1**	
	(b)	30	**1**	
		10	**1**	
	(c)	$n(n+1)$ oe	**2**	**B1** for $an^2 + bn + c$ a, b, c numeric $a \neq 0$
	(d)	$\frac{1}{2}n(n-1)$ oe	**2**	**B1** for using $\frac{1}{2}$ oe in expression of form $\frac{1}{2}(an^2 + bn + c)$ $a \neq 0$ or $kn(n-1)$ $k \neq 0$

CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International General Certificate of Secondary Education

MARK SCHEME for the October/November 2014 series

0580 MATHEMATICS

0580/42 Paper 4 – Extended, maximum raw mark 130

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Abbreviations

cao correct answer only
dep dependent
FT follow through after error
isw ignore subsequent working
oe or equivalent
SC Special Case
nfww not from wrong working
soi seen or implied

Qu.	Answer	Mark	Part marks
1 (a) (i)	49.5[0]	3	**M2** for 16.5[0] ÷ 5 × (5 + 3 + 7) or **M1** for 16.5[0] ÷ 5
(ii)	66	1FT	**FT** *their* **(a)(i)** ÷ 75 × 100 to 3 sf or better
(b)	2 hours 39 mins 45 secs	3	**B2** for 159.75 oe, e.g. 2.6625 [h] 9585 [s] or **M1** for 3 hrs 33 mins oe / (2 + 9 + 1) oe
(c)	18.75 **final answer**	3	**M2** for 16.5[0] ÷ 0.88 oe or **M1** for 16.5[0] associated with 88[%]
2 (a)	$x > 0.5$ oe **final answer nfww**	3	**B2 nfww** for 0.5 with no/incorrect inequality or equals sign as answer or **M2** for $7x + 15x > 6 + 5$ or better or $–6 – 5 > –7x – 15x$ or better or **M1** for $6 – 15x$ seen
(b) (i)	$(p – 2)(q + 4)$ **final answer**	2	**M1** for $q(p – 2) + 4(p – 2)$ or $p(q + 4) – 2(q + 4)$
(ii)	$(3p – 5)(3p + 5)$ **final answer**	1	
(c)	$(5x – 9)(x + 2)$	M2	**M1** partial factorisation, e.g. $x(5x – 9) + 2(5x – 9)$ or **SC1** for $(5x + a)(x + b)$ where $ab = –18$ or $a + 5b = 1$
	$\frac{9}{5}$ oe and –2 **final answer**	B1	

3	**(a)**	$35 < t \leqslant 40$	**1**	
	(b)	22.5, 27.5, 32.5, 37.5, 42.5, 47.5	**M1**	At least 4 correct mid-values soi
		$(2 \times 22.5 + 6 \times 27.5 + 7 \times 32.5 + 19 \times 37.5 + 9 \times 42.5 + 7 \times 47.5)$	**M1**	$\sum fx$ where x is in the correct interval allow one further slip [45 + 165 + 227.5 + 712.5 + 382.5 + 332.5 = 1865]
		÷ 50 or their $\sum f$	**M1dep**	**Dependent** on second method
		37.3	**A1**	**SC2** for correct answer with no working
	(c) (i)	15, 19, 16	**1**	
	(ii)	rectangular bars of height 1, 3.8 and 1.6	**B2FT**	**FT** their **(c)(i)**, on correct boundary lines **B1FT** for 2 correct heights If 0 scored for heights then **SC1** for 3 correct frequency densities soi
		correct widths of 15, 5,10 and no gaps	**B1**	
4	**(a)**	Enlargement [SF] – ½ oe [centre] (2, 5)	**3**	**B1** for each
	(b) (i)	Image at (–2, 6), (–8, 3), (–4, 3)	**2**	**SC1** for reflection in any vertical line or for 3 correct points not joined
	(ii)	Image at (3, –2), (3, 2), (6, 4)	**2**	**SC1** for rotation 90° [anti clockwise] around origin at (–3, 2) (–3, –2) (–6, –4) or for 3 correct points not joined
	(iii)	Image at (–5, 1), (–3, –2), (1, –2)	**2**	**SC1** for translation by $\begin{pmatrix} -1 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ -5 \end{pmatrix}$ or for 3 correct points not joined
	(c) (i)	$\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$	**2**	**B1** for a correct row or column
	(ii)	Rotation, 90° [anticlockwise] oe origin oe	**2**	**B1** for two elements correct

5	(a) (i)	8	1	
	(ii)	4	2	**M1** for [g(17) =] $\frac{7}{14}$ or $2\left(\frac{7}{x-3}\right)^2+7\left(\frac{7}{x-3}\right)$
	(b)	4 or – 4	3	**M2** for $x^2 = 16$ or $x^2 – 16 = 0$ or **M1** for $7 = (x – 3)(x + 3)$ or better
	(c)	$2x^2 + 7x – 11$ [= 0] soi	B1	
		$\frac{-7\pm\sqrt{(7)^2-4(2)(-11)}}{2(2)}$	B1FT B1FT	**FT** $2x^2 + 7x \pm$ their k [$k \neq 0$] oe **B1FT** for $\sqrt{7^2-4(2)(-11)}$ or better or $\left(x+\frac{7}{4}\right)^2$ oe If in form $\frac{p+\sqrt{q}}{r}$ or $\frac{p-\sqrt{q}}{r}$, **B1FT f**or -7 and $2(2)$ or better or $-\frac{7}{4}+$ *or* $-\sqrt{\frac{137}{16}}$ oe
		–4.68, 1.18 **final answers**	B1B1	If **B0**, **SC1** for answers –4.7 and 1.2 or –4.676... and 1.176.. seen or for –4.68 and 1.18 seen or for answer 4.68 and –1.18
	(d)	$\frac{x+2}{5}$ or $\frac{x}{5}+\frac{2}{5}$	2	**M1** for correct first step or better, e.g. $5y = x + 2$ or $x=\frac{y+2}{5}$ or $x = 5y – 2$ or $y + 2 = 5x$ or $\frac{y}{5}=x-\frac{2}{5}$
	(e)	– 2	1	

6	**(a)**	–3, 7.375, 8.875	**1, 1, 1**	Accept 7.4 or 7.37 or 7.38 for 7.375 and 8.9 or 8.87 or 8.88 for 8.875
	(b)	Correct curve	**4**	**B3FT** for 8 or 9 correct plots **B2FT** for 6 or 7 correct plots **B1FT** for 4 or 5 correct plots Point must touch line if exact or be in correct square if not exact (including boundaries)
	(c) **(i)**	Any integer less than 7 or greater than 10	**1**	
	(ii)	7, 8 or 9	**1**	
	(d)	$y = 15x + 2$ ruled and fit for purpose	**B2**	**B1** for short line but correct or freehand full length correct line or for ruled line through (0, 2) (but not $y = 2$) or for ruled line with gradient 15 (acc ±1 mm vertically for 1 horizontal unit)
		–1.45 to –1.35 and 0.4 to 0.5	**B2**	**B1** for each
	(e)	Tangent ruled at $x = 1.5$	**B1**	No daylight at point of contact. Consider point of contact as midpoint between two vertices of daylight, the midpoint must be between $x = 1.4$ and 1.6
		7 to 12	**2**	**Dep** on **B1** or close attempt at tangent at $x = 1.5$ **M1** for y – step/x – step for their tangent
7	**(a)** **(i)**	120 × 55 × 75 [= 495000]	**M1**	
		÷ 1000 [= 495] or 495[l] × 1000 = 495000[ml]	**M1**	
	(b) **(i)**	11	**2**	**M1** for 495000 ÷ 750 [÷ 60] oe [660] After 0 scored, **SC1** for answer figs 11
	(ii)	37.5 or 37.50 to 37.51	**3**	**M2** for $\sqrt{\frac{figs495}{112\pi}}$ oe or **M1** for $[112r^2 =] \frac{figs495}{\pi}$ or $[\pi r^2 =] \frac{figs495}{112}$ or better

	(c)	15	**4**	**B3** for answer 60 or **M3** for $75 - \sqrt{145^2 - (55^2 + 120^2)}$ oe **M2** for $\sqrt{145^2 - (55^2 + 120^2)}$ oe or **M1** for $\sqrt{55^2 + 120^2}$
	(d)	24.4[4..] to 24.45	**3**	**M2** for $\cos^{-1}(\sqrt{55^2 + 120^2}/145)$ oe, e.g. or $\sin^{-1}(75 - \text{their (c)})/145$ or $\tan^{-1}((75 - \text{their (c)})/\sqrt{55^2 + 120^2})$ or **M1** for cos = $\sqrt{55^2 + 120^2}/145$ oe or sin = (75 – their **(c)**)/145 or tan = (75 – their **(c)**)/$\sqrt{55^2 + 120^2}$
8	**(a)**	Angle $LPQ = 32$ soi $58^2 + 74^2 - 2 \times 58 \times 74 \cos$ *their P*	**B1** **M2**	 **M1** for correct implicit cos rule
		39.50[1...]	**A2**	**A1** for 1560.3 to 1560.4 or 1560
	(b)	$\sin PQL = \frac{58 \sin \text{their } P}{39.5}$ oe	**M2**	**M1** for $\frac{\sin PQL}{58} = \frac{\sin(\text{their } P)}{39.5}$ oe
		51.1 or 51.08 to 51.09	**B1**	
	(c) (i)	322	**2**	**M1** for 180 + 142 oe
	(ii)	[0]13[.1] or 13.08 to 13.09	**1FT**	**FT** *their* **(b)** – 38
	(d)	17.8 or 17.77 to 17.78	**3**	**M1** for 74 ÷ 2.25 oe soi by 32.888… to 3 sf or better **M1** for dist or speed ÷ 1.85
	(e)	30.7 or 30.73 to 30.74…	**3**	**M2** for 58 sin *their P* oe or 39.5 sin *their* **(b)** or **M1** for $\frac{x}{58}$ = sin *their P* oe or $\frac{x}{39.5}$ = sin *their* **(b)**
9	**(a)**	28 45 17 21 45 66	**1, 1** **1** **1**	
	(b) (i)	$4n - 3$ oe	**2**	**M1** for $4n + k$
	(ii)	237	**1**	
	(iii)	50	**2FT**	**FT** *their* **(b)(i)** = 200 solved and then answer truncated **dep** on linear expression of form $an + k$ **M1** for *their* $4n - 3 = 200$ or *their* $4n - 3 \leqslant 200$

(c)	$p = 2$ and $q = -5$ with some correct supporting working leading to the solutions	**5**	**M2** for any 2 of $p + q + 3 = 0$ oe, $2^2 p + 2q + 3 = 1$ oe, $3^2 p + 3q + 3 = 6$ oe, $4^2 p + 4q + 3 = 15$ oe , $5^2 p + 5q + 3 =$ *their* 28 oe, etc. or **M1** for any one of these **M1** indep for correctly eliminating p or q from pair of linear equations **A1** for one correct value If 0 scored **SC1** for 2 values that satisfy one of their original equations After **M0**, 2 correct answers **SC1**
(d)	$2n^2 - n$ or $n(2n - 1)$	**2**	**B1** for answer $2n^2 + k[n]$ or **M1** for *their quadratic* from **(c)** + *their linear* from **(b)(i)**
10 (a) (i)	$\frac{1}{36}$ **final answer**	**2**	**M1** for $\frac{1}{6} \times \frac{1}{6}$
(ii)	$\frac{1}{12}$ **final answer**	**3**	**M2** for $3\left(\frac{1}{6} \times \frac{1}{6}\right)$ oe or **M1** for identifying 3 correct pairs (4, 6), (6, 4) and (5, 5)
(b)	7	**1**	
	Refers to most combinations oe	**1**	**Dependent** on previous mark
(c)	$\frac{141}{1296}$ oe $\left[\frac{47}{432}\right]$	**5**	**M4** for $\frac{2}{36} + \left(\left[1 - \frac{3}{36}\right] \times \frac{2}{36}\right) + \left(\frac{1}{36} \times \frac{3}{36}\right)$ oe or **M3** for 2 correct probabilities shown <u>added</u> from those above or **M1** for $\left(1 - \frac{3}{36}\right) \times \frac{2}{36}$ seen oe And **M1** for $\frac{1}{36} \times \frac{3}{36}$ seen oe or $\frac{1}{6} \times \frac{1}{6} \times \frac{1}{6} \times \frac{1}{6}$ oe alone or added to a probability not of the form $\frac{n}{36}$

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0580/43 Paper 4 (Extended), maximum raw mark 130

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Abbreviations

cao correct answer only
dep dependent
FT follow through after error
isw ignore subsequent working
oe or equivalent
SC Special Case
nfww not from wrong working
soi seen or implied

Qu.	Answers	Mark	Part Marks
1 (a) (i)	5.37[1...]	**2**	**M1** for [AD^2 =] $2.6^2 + 4.7^2$ oe or better
(ii)	54.1 or 54.11 to 54.12	**3**	**M2** for tan [BCD =] $\frac{4.7}{(17-11-2.6)}$ oe or **B1** for 3.4 seen
(iii)	65.8	**2**	**M1** for $\frac{11+17}{2} \times 4.7$ oe
(b)	263.2 or 263	**3FT**	**FT** *their* **(a)(iii)** × 4 correctly evaluated **M2** for *their* **(a)(iii)** × $\left(\frac{9.4}{4.7}\right)^2$ oe or **M1** for [scale factor =] $\left(\frac{9.4}{4.7}\right)^2$ or $\left(\frac{4.7}{9.4}\right)^2$ soi
2 (a) (i)	$\frac{920}{8} \times 7$ [=805] oe	**1**	$\frac{2990}{26} \times 7$ [= 805]
(ii)	30.8 or 30.76 to 30.77	**2**	**M1** for $\frac{8}{(11+8+7)}$ [× 100]
(b)	1211 final answer	**5**	**B4** for 13 926.5[0] [area A total sales] or **B3** for 11 040 [area B] **and** 10 867.50 [area C] or 21 907.5 [area B + area C] or **B2** for 11 040 [area B] **or** 10 867.50 [area C] or **M1** for 736 [B tickets] and **M1** for 483 [C tickets] After 0 scored **SC2** for answer of 1196 or **SC1** for 13754 (A total sales)

	(c)	37 720	**3**	**M2** for $\frac{35834}{0.95}$ oe or **M1** for 35834 associated with 95[%]
3	**(a) (i)**	52 Angles in **same segment**	**1** **1dep**	Accept same arc, same side of same chord
	(ii)	104 **Angle** at **centre** is **twice** angle at **circumference**	**1** **1**	Accept double, 2 × but not middle, edge
	(iii)	34 Angle between **tangent** and **radius = 90°**	**1** **1**	Accept right angle, perpendicular
	(b) (i)	7.65 to 7.651	**4**	**M2** for $8.9^2 + 7^2 - 2 \times 8.9 \times 7 \times \cos 56$ or **M1** for correct implicit formula and **A1** for 58.5 to 58.6
	(ii)	49.3 or 49.33 to 49.34…	**3**	**M2** for $[\sin BEC =] \frac{7 \sin 56}{\textit{their}\ \textbf{(b)(i)}}$ oe or **M1** for $\frac{\sin 56}{\textit{their}\ \textbf{(b)(i)}} = \frac{\sin BEC}{7}$ oe
4	**(a) (i)**	Ariven with comparable form for both shown or difference between the two fractions shown	**1**	Accept probabilities changed to decimals or percentages (to 2sf or better)
	(ii)	$\frac{6}{15}$ oe	**2**	**M1** for $\frac{3}{5} \times \frac{2}{3}$
	(iii)	$\frac{7}{15}$ oe	**3**	**M2** for $\frac{3}{5} \times \frac{1}{3} + \frac{2}{5} \times \frac{2}{3}$ oe $1 - \textit{their}\ \textbf{(a)(ii)} - \frac{2}{5} \times \frac{1}{3}$ or **M1** for $\frac{3}{5} \times \frac{1}{3}$ or $\frac{2}{5} \times \frac{2}{3}$ seen
	(b) (i)	Completes tree diagram correctly	**3**	**B2** for 5 values correct or **B1** for 1 value correct
	(ii)	$\frac{126}{350}$ oe $\left[\frac{9}{25}\right]$	**2**	**M1** for $\frac{3}{5} \times \frac{6}{7} \times \frac{7}{10}$

	(iii)	$\frac{344}{350}$ oe	**3**	**M2** for $1-their\frac{2}{5}\times their\frac{1}{7}\times their\frac{3}{10}$ oe or $\frac{3}{5}+\frac{2}{5}\times\frac{6}{7}+\frac{2}{5}\times\frac{1}{7}\times\frac{7}{10}$ **M1** for $their\frac{2}{5}\times their\frac{1}{7}\times their\frac{3}{10}$ oe or identifies the 7 routes or attempt to add 7 probabilities with at least 5 correct $\frac{9}{25}+\frac{27}{175}+\frac{3}{50}+\frac{9}{350}+\frac{6}{25}+\frac{18}{175}+\frac{1}{25}$ oe
5	**(a) (i)**	$\begin{pmatrix}0 & -4\\ 4 & 0\end{pmatrix}$	**1**	
	(ii)	$\begin{pmatrix}-1 & 1\\ 1 & -1\end{pmatrix}$	**1**	
	(iii)	$\begin{pmatrix}-1 & 0\\ 0 & -1\end{pmatrix}$	**2**	**B1** for three correct elements
	(iv)	$\begin{pmatrix}-13\\ 5\end{pmatrix}$	**2**	**B1** for either correct in this form
	(b)	$\begin{pmatrix}1 & 2\\ 0 & 1\end{pmatrix}$	**3**	**M1** for understanding to find the inverse of **Q** **and M1** for det = 1 or for $k\begin{pmatrix}1 & 2\\ 0 & 1\end{pmatrix}$ $k\neq 0$ Alternative $\begin{pmatrix}1 & -2\\ 0 & 1\end{pmatrix}\begin{pmatrix}a & b\\ c & d\end{pmatrix}=\begin{pmatrix}1 & 0\\ 0 & 1\end{pmatrix}$ Leading to $a - 2c = 1$ and $c = 0$ then $a = 1$ and $b - 2d = 1$ and $d = 1$ then $b = 2$ **M2** all four equations, **M1** for a pair of correct equations
6	**(a) (i)**	$\frac{x^8}{3}$ final answer	**1**	
	(ii)	$15x^7y^3$ final answer	**2**	**M1** for 2 elements correct
	(iii)	$16x^8$ final answer	**2**	**M1** for $16x^k$ or kx^8

	(b)	$\sqrt{([-]7)^2 - 4.3 - 12}$ or better and $p = [--]7$ and $r = 2(3)$ oe	**B1** **B1**	or for $\left(x - \frac{7}{6}\right)^2$ Must see $\frac{p+\sqrt{q}}{r}$ or $\frac{p-\sqrt{q}}{r}$ or both or for $\frac{7}{6} \pm \sqrt{4 + \left(\frac{7}{6}\right)^2}$
		3.48, –1.15 cao	**B1B1**	After **B0**, **SC1** for answer 3.5 and –1.1 or 3.482… and –1.149 to –1.148 seen or for 3.48, –1.15 seen or for answer –3.48 and 1.15
	(c)	$\frac{x+5}{x^2}$ or $\frac{1}{x} + \frac{5}{x^2}$ final answer nfww	**3**	**B1** for $(x + 5)(x – 5)$ and **B1** for $x^2(x – 5)$
7	**(a)**	$\frac{1}{2} \times 8 \times 8 \times \sin 56$ oe 26.52 to 26.53	**M1** **A1**	or [½ × 2] 8sin28 × 8cos28 or [½ × 2] × 7.06… × 3.75…
	(b) (i)	72.[0] or 71.87 to 72.0	**3**	**M2** for $26.5/(\pi \times 6.5^2) \times 360$ oe or **M1** for $\frac{x}{360} \times \pi \times 6.5^2 = 26.5$ or better
	(ii)	21.1 or 21.2 or 21.14 to 21.17	**3**	**M2** for $\frac{\textit{their}\ \textbf{(b)(i)}}{360} \times \pi \times 2 \times 6.5 + 2 \times 6.5$ oe or **M1** for $\frac{\textit{their}\ \textbf{(b)(i)}}{360} \times \pi \times 2 \times 6.5$ oe or $\frac{\textit{their}\ \textbf{(a)}}{0.5 \times 6.5}$
	(c) (i)	$\frac{30}{360} \times \pi \times r^2 - \frac{1}{2} \times r^2 \times \sin 30$ oe $\frac{1}{12} \times \pi \times r^2 - \frac{1}{4} \times r^2$ $\frac{1}{4} r^2 \left(\frac{1}{3}\pi - 1\right)$	**M2** **A1** **A1**	**M1** for $\frac{30}{360} \times \pi \times r^2$ or $\frac{1}{2} \times r^2 \times \sin 30$ Dep on **M2 A1** and no errors seen
	(ii)	20.6 or 20.7 or 20.55 to 20.71	**3**	**M2** for $[r^2 =] \frac{5}{\frac{1}{4}\left(\frac{1}{3}\pi - 1\right)}$ or **M1** for one correct rearrangement step to r from $\frac{1}{4} r^2 \left(\frac{1}{3}\pi - 1\right) = 5$

8	**(a) (i)**	(1, 2)	**1+1**	
	(ii)	$y = 3x - 1$ cao final answer	**3**	**M1** for gradient = $\frac{8--4}{3--1}$ oe and **M1** for substituting (3, 8) or (–1, –4) into *their* $y = 3x + c$ or for finding y-intercept is –1
	(b) (i)	$(x + 5)(x - 2)$ isw solutions	**2**	**SC1** for $(x + a)(x + b)$ where $ab = -10$ or $a + b = 3$
	(ii)	$[a =]$ –5 $[b =]$ 2 $[c =]$ –10	**3FT**	**B1FT** for each of *their* 5 and *their* –2 from **(b)(i)** and **B1** for c = –10
	(iii)	$x = -1.5$	**1FT**	**FT** $x = (\textit{their}\ (a + b))/2$
	(c)	Inverted parabola	**B1**	
		x-axis intercepts at –2 and 9	**B2**	**B1** for each After **B0** allow **SC1** for $(9 - x)(2 + x)$ oe
		y-axis intercept at 18	**B1**	
	(d) (i)	$p = 6$ $q = 43$	**3**	**B2** for $(x + 6)^2 - 43$ or $p = 6$ or $q = 43$ or **M1** for $(x + 6)^2$ or $x^2 + px + px + p^2$ and **M1** for $-7 - (\textit{their}\ 6)^2$ or $p^2 - q = -7$ or $2p = 12$
	(ii)	–43	**1FT**	**FT** – *their q*
9	**(a) (i)**	7	**4**	**M2** for $\frac{16\times11+17\times10+18p+19\times4+20\times8}{11+10+4+8+p} = 17.7$ or better or **M1** for sum of two correct products or better or for [total =] $11 + 10 + 4 + 8 + p$ and **B1** for $582 + 18p = 17.7\ (33 + p)$
	(ii)	17	**1FT**	**STRICT FT** median for *their p* if integer
	(b) (i)	64	**2**	**M1** for $\frac{320}{6.4} \times 1.28$ oe
	(ii)	40	**2**	**M1** for $\frac{320}{480} \times 60$ oe
	(iii)	1.6[0]	**2FT**	FT *their* **(b)(i)** / *their* **(b)(ii)** evaluated correctly to 2dp **M1** for *their* **(b)(i)** / *their* **(b)(ii)** or $\frac{480}{6.4} \times 1.28 \div 60$

(c)	9.9125 cao	**5**	**B4** for answer 9912.5 or **M1** for 25 to 35 × 290 to 310 oe and **B1** for 32.5 used and **B1** for 305 or 5 mins 5 secs used and **M1** indep for any correct conversion seen m to km
10 (a) (i)	$5x + 14$ final answer	**2**	**M1** for $5x + k$ or $kx + 14$
(ii)	14.2	**3**	**M1** for $5x = 32 - 14$ **FT** *their* expression in **(a)(i)** **A1FT** for $x = 3.6$
(b)	$8a - 3b + 14 = 32.5$ or better $5a + 4b + 13.5 = 39.75$ or better	**B1** **B1**	$8a - 3b = 18.5$ $5a + 4b = 26.25$
	Equates coefficients of either a or b $40a - 15b = 92.5$ $40a + 32b = 210$ or $32a - 12b = 74$ $15a + 12b = 78.75$	**M1**	or rearranges one of *their* equations to make a or b the subject e.g. $a = \frac{3b + 18.5}{8}$
	Adds or subtracts to eliminate $47b = 117.5$ $47a = 152.75$	**M1**	**Dep** on previous method or correctly substitutes into the second equation e.g. $\frac{5(3b + 18.5)}{8} + 4b = 26.25$
	$[a =]$ 3.25	**A1**	
	$[b =]$ 2.5	**A1**	After **M0** scored **SC1** for 2 correct values with no working or for two values that satisfy one of their original equations

CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2014 series

0580 MATHEMATICS

0580/41 Paper 4 (Extended), maximum raw mark 130

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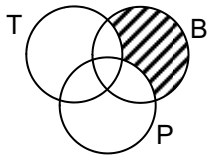
Abbreviations

cao correct answer only
dep dependent
FT follow through after error
isw ignore subsequent working
oe or equivalent
SC Special Case
nfww not from wrong working
soi seen or implied

Qu		Answers	Mark	Part Marks
1	(a) (i)	$\begin{pmatrix} 6 & 4 \\ -2 & 2 \end{pmatrix}$	1	
	(ii)	Not possible	1	
	(iii)	$\begin{pmatrix} 6 & 4 \\ -2 & 2 \end{pmatrix}$	2	**B1** for one row or column correct
	(iv)	$\frac{1}{5}\begin{pmatrix} 1 & -2 \\ 1 & 3 \end{pmatrix}$ oe isw	2	**B1** for $\frac{1}{5}\begin{pmatrix} a & c \\ b & d \end{pmatrix}$ seen or $k\begin{pmatrix} 1 & -2 \\ 1 & 3 \end{pmatrix}$ seen
	(b)	1 column in **C** and 2 rows in **D**	1	Any clear indication
	(c)	Enlargement [Factor] 2 [Centre] (0, 0) oe	1 1 1	
2	(a)	8	2	**M1** for 12 ÷ 1.5 oe
	(b)	[Distance =] 36 *their*36 ÷ 3 [= 12] oe	B1 M1	
	(c)	200	2	**M1** for 12 × 1000 ÷ 60 oe e.g. 36 000 ÷ 180
	(d)	Horizontal line at 36 to 13 45 (*their* 13 45, 36) joined to (16 42, 0)	1 1FT	
3	(a)	62 705	2	**M1** for 75 246 ÷ 6 soi by 12 541 or 75 246 × 5
	(b)	10.9 or 10.88…	3	**M2** for $\frac{(150\,675 - 135\,890)}{135\,890} \times 100$ oe **or** **M1** for correct fraction soi by 0.1088… or $\frac{150\,675}{135\,890} \times 100$ soi by 110.88…

Qu		Answers	Mark	Part Marks
	(c)	127 000	**3**	**M2** for 135 890 ÷ 1.07 oe **or** **M1** for 135 890 associated with 107%
	(d) (i)	59 112 to 59 113 or 59 100 or 59 110 or 59 119 to 59 120 or 59 100 nfww	**3**	**M2** for $\pi \times 21 \times (30^2 - 2^2)$ oe **Or** **M1** for $\pi \times 21 \times 30^2$ or $\pi \times 21 \times 2^2$
	(ii)	(a) 0.0125	**1**	
		(b) 7580 or 7582 or 7581 or 7583 nfww	**4**	**M1** for 21 × 29.7 × *their* 0.0125 [=7.796 or 7.8[0]] **and** **M1** for *their* **(d)(i)** ÷ (21 × 29.7 × *their* 0.0125) **A1** for 7580 to 7583.2 (non integer) If 0 then **SC1** for *their* **(d)(i)** ÷ (21 × 29.7 × 0.125)
4	**(a)**	$4 - x$ correctly placed $5 - x$ correctly placed 7 correctly placed	**1** **1** **1**	**SC3** for 1, 2 and 7 all correctly placed instead of expressions in x
	(b)	$4 + 11 + (6 - x) + x + 9 + (4 - x) + (5 - x) + 7 = 40$ oe	**M1**	FT from their Venn diagram, condone omission of one subset
		$46 - 2x = 40$ nfww	**A1**	Must be in the form $a + bx = c$, ie each side simplified, or better
		$x = 3$	**B1**	
	(c) (i)	$\frac{9}{40}$ or 0.225 or 22.5%	**1**	ISW cancelling or conversion after correct answer seen
	(ii)	2	**1FT**	FT from their Venn diagram and their x provided $n(B \cap P \cap T') \neq 5$
	(iii)	15	**1FT**	FT from their Venn diagram
	(iv)	25	**1FT**	FT from their Venn diagram
	(v)	4	**1**	
	(d)	Correct region shaded.  	**1**	

Qu		Answers	Mark	Part Marks
5	(a)	[0]44 to [0]48	1	
	(b)	12.6 to 13.2	2	**B1** for 8.4 to 8.8 seen
	(c)	340	1	
	(d)	1 : 150 000	2	**M1** for × 100 000 soi
	(e)	Arcs for perp bisector of *SL*	1	Two pairs of correct arcs
		Ruled perp bisector of *SL*	1	Within tolerance of overlay
		Arcs for bisector of angle *PSL*	1	Marks on *PS* and *SL* plus one pair of correct arcs
		Ruled bisector of angle *PSL*	1	Within tolerance of overlay
		B marked within accuracy	1	Within tolerance of overlay Dep on two correct bisectors drawn
	(f)	3.375	2	**M1** for 1.5×1.5^2 or $(2/3)^2$ seen
6	(a) (i)	0.6 oe	2	**M1** for 0.2 + 0.4
	(ii)	1500	1	
	(iii)	0.03 oe	2	**M1** for 0.1 × 0.3
	(b)	$\frac{112}{132}$ oe $\frac{28}{33} = 0.848[4\ldots]$	3	**M2** for $1 - \frac{5}{12} \times \frac{4}{11}$ or $\frac{7}{12} \times \frac{5}{11} + \frac{5}{12} \times \frac{7}{11} + \frac{7}{12} \times \frac{6}{11}$ or $\frac{7}{12} + \frac{5}{12} \times \frac{7}{11}$ **or** **M1** for addition of any two of $\frac{7}{12} \times \frac{5}{11}$, $\frac{5}{12} \times \frac{7}{11}$, $\frac{7}{12} \times \frac{6}{11}$ or sum of 3 products with an error in the numerator of one product or for $\frac{5}{12} \times \frac{4}{11}$ identified

Qu		Answers	Mark	Part Marks
7	(a) (i)	Image: (–4, –3), (–4, –1), (–3, –1)	2	**SC1** for translation $\begin{pmatrix}-5\\k\end{pmatrix}$ or $\begin{pmatrix}k\\-4\end{pmatrix}$
	(ii)	Image: (1, –1), (3, –1), (3, –2)	2	**SC1** for rotation about the origin but 90º anticlockwise
	(b) (i)	Image: (2, 1), (2, 3), (4, 3)	3	**B2** for 2 correct vertices plotted **or** **SC2** for 3 vertices shown in working **or** **SC1** for 2 vertices shown in working **or** **M1** $\begin{pmatrix}2&0\\0&1\end{pmatrix} \times \begin{pmatrix}1&1&2\\1&3&3\end{pmatrix}$
	(ii)	Stretch [factor] 2 Invariant line *y*-axis oe	1 1 1	 Accept $x = 0$, stays the same
8	(a)	2.125 and 2.375	2	**B1** for one correct value
	(b)	Correct curve	B4	**B3FT** for 11 correct plots **or** **B2FT** for 9 or 10 correct plots **or** **B1FT** for 7 or 8 correct plots
	(c)	Ruled tangent at $x = 2$	B1	No daylight at $x = 2$. Consider point of contact as midpoint between two vertices of daylight, this must be between $x = 1.8$ and 2.2
		Gradient from 7.8 to 10.2	2	**Dep** on B1 awarded Allow integer/integer or a mixed number if within range **or** **M1 dep** for (change in y) ÷ (change in x) Dependent on any tangent drawn or close attempt at a tangent at <u>any</u> point Must see correct or implied calculation from a drawn tangent
	(d)	0 and –1.75 to –1.65 and 1.65 to 1.75	2	**B1** for two correct values
	(e)	-1.2 to $-0.8 < k < 2.8$ to 3.2	2	**B1** for each correct or **SC1** for reversed answers

Qu		Answers	Mark	Part Marks
9	(a) (i)	37.5 to 38.5	1	
	(ii)	19.5 to 20.5 nfww	2	**B1** for [LQ =] 23.5 to 24 or [UQ =] 43.5 to 44
	(iii)	43	2	**B1** for 56 seen or horizontal line drawn at cf = 56
	(b) (i)	31.8[4…] nfww	4	**M1** for midpoints soi (condone 1 error or omission) and **M1** for use of $\sum ft$ with t in correct interval including both boundaries (condone 1 further error or omission) and **M1** (**dep** on 2nd M1) for $\sum ft \div 80$ (2547.5 ÷ 80)
	(ii)	Correct histogram	4	**B1** for each correct block with correct width and height If **B0** then **SC1** for four correct f.d.s or four correct widths
10	(a) (i)	5	1	
	(ii)	$-2\frac{1}{3}$ oe	2	**B1** for [h(– 1) =] $\frac{1}{3}$ soi or **M1** for $2(3^x) - 3$
	(iii)	$\frac{x+3}{2}$ or $\frac{x}{2} + 1.5$ as final ans	2	**M1** for $y + 3 = 2x$ or $x = 2y - 3$ or $\frac{y}{2} = x - 1.5$ or better or correct reverse flowchart
	(iv)	$4x - 9$ as final answer nfww	2	**M1** for $2(2x - 3) - 3$
	(v)	$(2x - 3)(x + 1) = 1 + 2(x + 1)$	M1	$(2x - 5)(x + 1) = 1$ (eliminate fractions)
		$2x^2 - 3x + 2x - 3$ or better seen	B1	$2x^2 - 5x + 2x - 5$ or better seen
		$2x^2 - 3x - 6 = 0$	A1	No errors or omissions seen

Qu		Answers	Mark	Part Marks
	(vi)	$\frac{-(-3)\pm\sqrt{(-3)^2-4\times2\times-6}}{2\times2}$	B2	**B1** for $\sqrt{(-3)^2-4\times2\times-6}$ or better [$\sqrt{57}$] and if in form $\frac{p+\sqrt{q}}{r}$ or $\frac{p-\sqrt{q}}{r}$ **B1** for $p = -(-3)$ and $r = 2\times2$ or better
		2.64 and – 1.14 cao	B1B1	**SC1** for 2.64 **and** –1.14 seen in working or 2.6 **and** –1.1 as final ans or 2.637. **and** –1.137.. as final ans or –2.64 **and** 1.14 as final ans
	(b)	$\frac{x-1}{x+5}$ as final answer nfww	4	**B3** for $(x-1)(x-2)$ and $(x+5)(x-2)$ **or B2** for $(x-1)(x-2)$ or $(x+5)(x-2)$ **or SC1** for $(x+a)(x+b)$ where $a+b = 3$ or -3 or $ab = 2$ or -10
11	**(a) (i)**	(– 5, 7)	**1**	
	(ii)	5	**2**	**M1** for $\sqrt{(-3)^2+4^2}$ or better
	(b) (i)	(a) $\frac{3}{5}\mathbf{a}+\frac{2}{5}\mathbf{b}$ or $\frac{1}{5}(3\mathbf{a}+2\mathbf{b})$ final answer	**2**	**M1** for any correct vector path for $\overrightarrow{ON}$
		(b) $\frac{2}{5}\mathbf{a}$	**2**	**M1** for any correct vector path for $\overrightarrow{NY}$
	(ii)	$NY = \frac{2}{5}BC$ oe	**1dep**	**dep** on **(b)(i)(b)** correct
		[NY] parallel to [BC]	**1dep**	**dep** on $\overrightarrow{NY} = k\mathbf{a}$, $k \neq 1$

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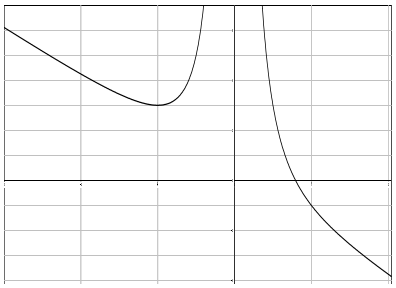
cao correct answer only
dep dependent
FT follow through after error
isw ignore subsequent working
oe or equivalent
SC Special Case
nfww not from wrong working
soi seen or implied

Qu		Answers	Mark	Part Marks
1	**(a)**	$240 \div (5+7) \times 7$ [=140] oe	**M2**	**M1** for 240 ÷ (5 + 7) or 240 × 7
	(b)	2 : 3 final answer	**2**	**B1** for ratio of form $2x$: $3x$ seen or **SC1** for 3 : 2
	(c)	144	**3**	**M2** for $120 + \frac{120 \times 4 \times 5}{100}$ oe **or M1** for $\frac{120 \times 4 \times 5}{100}$
	(d)	89.99 cao mark final answer	**3**	**B2** for 89.9[8…] shown but not spoiled or answer 90[.0..] nfww or **M1** for $80 \times \left(\frac{104}{100}\right)^3$ oe If **M1** spoiled by adding 80 or subtracting 80 then **SC1** for answers 169.99 or 9.99
	(e)	4.08	**3**	**M2** for $\frac{200 \times r \times 2}{100} = 200 \times 1.04^2 - 200$ oe **or M1** for 200×1.04^2 [216.3[2]] oe **or** $\frac{200 \times r \times 2}{100}$ oe

Qu		Answers	Mark	Part Marks
2	(a)	3, 3, – 1	3	**B1 B1 B1**
	(b)	Complete correct curve 	5	**B3FT** 11 points **or B2FT** for 9 or 10 points **or B1FT** for 7 or 8 points **And B1indep** two separate branches not touching or crossing y-axis
	(c)	0.5 to 0.6	1	
	(d)	Correct line and 0.4 to 0.5 **or** no line and 0.4 to 0.5 nfww	3	Must check line - not if wrong line **B2** for $y = 2x + 3$ ruled correctly **or SC1** for correct freehand line **or** ruled line with either gradient 2 or y-intercept 3 but not $y = 3$
	(e) (i)	Tangent at $x = – 1.5$	1	No daylight at $x = –1.5$. Consider point of contact as midpoint between two vertices of daylight, the midpoint must be between $x = – 1.7$ and $–1.3$
	(ii)	– 2 to – 1	2	**Dependent on** tangent mark awarded Allow integer/integer if in range **Or M1** for rise/run **also dep on** any tangent drawn or close attempt at tangent at any point Must see correct or implied calculation from a drawn tangent

Qu		Answers	Mark	Part Marks
3	(a)	86.8 or 86.83….	3	**M2** for $\frac{80\sin 55}{\sin 49}$ or **M1** for $\frac{80}{\sin 49}=\frac{x}{\sin 55}$ oe
	(b)	51.2 or 51.15 to 51.16	4	**M2** for [cos =] $\frac{95^2+90^2-80^2}{2.95.90}$ oe **or M1** for $80^2=95^2+90^2-2.90.95.\cos BCD$ **A1** for $\frac{10\,725}{17\,100}$ or $\frac{143}{228}$ etc. or 0.627…..
	(c)	6700 or 6698 to 6703	3	**M2** for 0.5 × 80 × *their*(a) × sin(180-55-49) oe [3368 – 3370…] [If *AB* used then *AB*= 102.8 to 103] + 0.5 × 90 × 95 × sin(*their*(b)) oe [3329 – 3332] **or M1** for one of these triangle area methods oe
	(d)	2180 or 2176 to 2179	3FT	**FT** *their* (c) × 0.325 correctly evaluated to 3 sf or better **M2** for *their* (c) × $\frac{3250}{10\,000}$ **or SC1 FT** for figs 218 or figs 2176 to 2179

Qu		Answers	Mark	Part Marks
4	(a)	Image at (–3, 2), (–5, 2), (–5, 4), (–3, 3)	2	**SC1** reflection in $y = -1$ or $x = k$ **or** 4 correct points not joined
	(b) (i)	Image at (–2, –4), (–6, –4), (–6, –8), (–2, –6)	2	**SC1** other enlargement of scale factor -2, correct size and correct orientation **or** 4 correct points not joined
	(ii)	$\begin{pmatrix} -2 & 0 \\ 0 & -2 \end{pmatrix}$	2	**SC1** for $\begin{pmatrix} k & 0 \\ 0 & k \end{pmatrix}$, k may be algebraic or numeric but not 0 or 1
	(c) (i)	Image at (1, 4), (3, 4), (3, 8), (1, 6)	2	**SC1** for trapezium with vertices at (1, 6) and (3, 8) or correct stretch with y-axis invariant **or** 4 correct points not joined
	(ii)	$\begin{pmatrix} 1 & 0 \\ 0 & 2 \end{pmatrix}$	2	**SC1** for $\begin{pmatrix} 1 & 0 \\ 0 & k \end{pmatrix}$ k may be algebraic or numeric but not 0 or 1 **or** for $\begin{pmatrix} 2 & 0 \\ 0 & 1 \end{pmatrix}$
	(iii)	$\frac{1}{2}\begin{pmatrix} 2 & 0 \\ 0 & 1 \end{pmatrix}$ oe isw	2FT	FT inverse of their (c)(ii) (algebraic or numeric) **B1FT** *their* (c)(ii) for $\frac{1}{2}\begin{pmatrix} a & c \\ b & d \end{pmatrix}$ or $p\begin{pmatrix} 2 & 0 \\ 0 & 1 \end{pmatrix}$ ie **FT** *their* correct fraction or *their* transposed matrix **FT** for **2** and **1** mark dependent on det $\neq 0$
	(iv)	Stretch, [factor] $\frac{1}{2}$, invariant [line] x-axis oe	3	**B1 B1 B1** each independent cao

Qu		Answers	Mark	Part Marks
5	**(a) (i)**	2412 to 2413….	**B2**	Must be at least 4 figures shown **M1** for $\pi \times 8^2 \times 12$ oe
	(ii)	2.41[0]	**B1**	
	(b)	1 min 24 s	**4**	**B3** for 83.76 to 83.8[0] or 84 or 1.396 to 1.397 or 1.4 or 1 min 23.76 to 1 min 23.8 seen **or M2** for $\frac{1}{3}\pi \times 4^2 \times 10 \div 2$ [$80/3\,\pi$] **or M1** for $\frac{1}{3}\pi \times 4^2 \times 10$ [$160/3\,\pi$ or 167.5 to 167.6]
	(c)	14	**3**	**M1** for $\frac{2410}{\frac{1}{3}\pi \times 4^2 \times 10}$ or $\frac{2410}{\textit{their cone vol from part (b)}}$ **A1** for 14.3 to 14.4….
6	**(a) (i)**	[x =] 21, [y =] 42	**2**	**B1 B1**
	(ii)	3.79 or 3.8[0] or 3.792 to 3.802	**2**	**M1** for $\frac{3.31}{TQ} = \frac{8.23}{9.43}$ oe or $\frac{\sin 21 \textit{ or } \sin \textit{their } x}{TQ} = \frac{\sin 117}{9.43}$ oe
	(b)	40	**4**	**B3** for angle between HE and tangent = 25 **or** GFH = 40 **or** EGH = 25 **and** angle EHG = 115 (accept 90 and 25 at H for 115) **B2** for angle EGH = 25 **or** angle EHG = 115 (accept 90 and 25 at H for 115) **B1** for angle FEG = 25 **or** angle EFG = 65
	(c)	38	**5**	**B4** for angle ADC = 104 or **M4** for $x + 14 + 20 + x + 70 = 180$ or better **or B3** for angle OBA = 20 **and** angle OBC = 56 **or** angle CBA = 76 **or** reflex angle AOC = 208 **or B2** for angle OAB or OBA = 20 **and** angle ACB = 70 **or** obtuse angle AOC = 152 **or** angle BOC = 68 **or B1** for angle OAB or OBA = 20 **or** angle ACB = 70

Qu		Answers	Mark	Part Marks
7	(a) (i)	(100 – 70) × 0.4 [= 12] or better	1	Accept $\frac{24}{78} \times 39$ oe
	(ii)	60.9 or 60.89… nfww	5	**B1** for 3 or 4 correct extra frequencies 3, 6, 10, 8 soi **M1** for at least 4 of mid-interval values 15, 40, 55, 65, 85 soi **M1** for Σfx where x is any value in each interval allow *their* frequencies provided integers and they must be shown [3 × 15 + 6 × 40 + 10 × 55 + 8 × 65 + 12 × 85] [2375] **M1** (**dependent on second M1**) for ÷ 39 **or** ÷ (3 + 6 + 10 + 8 +12)
	(b)	60.5	3	**M2** for 20 × 70 – 19 × 70.5 oe **or M1** for either 20 × 70 or 19 × 70.5
8	(a) (i)	$\frac{600}{x}$	1	Not $x = \frac{600}{x}$
	(ii)	$\frac{600}{x+1}$	1	Not $x = \frac{600}{x+1}$
	(b) (i)	$\frac{600}{x} - \frac{600}{x+1} = 20$ oe	M1FT	**FT** *their* (a)(i) – *their* (a)(ii) = 20 oe If **M0, SC1FT** for *their*(a)(ii) – *their* (a)(i) = 20 oe
		$600(x+1) - 600x = 20x(x+1)$ or better	A1	May still be over common denominator and can be implied by third line. Allow recovery if bracket omitted
		$600x + 600 - 600x = 20x^2 + 20x$ $0 = 20x^2 + 20x - 600$ $x^2 + x - 30 = 0$	A1	**Dep on M1A1** and conclusion reached with at least one of the interim lines and without any errors or omissions

Qu		Answers	Mark	Part Marks
	(ii)	$x = 5$	B3	**B2 for** $(x+6)(x-5)$ [= 0] oe **or SC1** for $(x+a)(x+b)$ where $ab = -30$ or $a+b=1$ **or B2** for $\frac{-1+or-\sqrt{1^2-4.1.-30}}{2.1}$ or $\sqrt{30+\left(\frac{1}{2}\right)^2}-\frac{1}{2}$ **or B1 for** $\frac{-1+or-\sqrt{q}}{2.1}$ **or** $\sqrt{1^2-4.1-30}$ **or** $\left(x+\frac{1}{2}\right)^2$
		100	B1FT	**FT** 600 ÷ (*their* x + 1) if $x > 0$ correctly evaluated
9	(a)	$\frac{1}{4}, \frac{9}{10}, \frac{1}{3}, \frac{2}{3}$	3	**B1** for $\frac{1}{4}$ **B1** for $\frac{9}{10}$ **B1** for $\frac{1}{3}$ **and** $\frac{2}{3}$
	(b)	45	1	
	(c)	$\frac{3}{40}$ oe	2	**M1** for $\frac{3}{4}\times\frac{1}{10}$ oe
	(d)	$\frac{101}{120}$ oe	3	**M2** for $\frac{3}{4}\times\frac{9}{10}+\frac{1}{4}\times\frac{2}{3}$ only or $1-$ *their* (c) $-\frac{1}{4}\times\frac{1}{3}$ only **or M1** for $\frac{3}{4}\times\frac{9}{10}$ or $\frac{1}{4}\times\frac{2}{3}$ or *their* (c) + $\frac{1}{4}\times\frac{1}{3}$
	(e)	$\frac{781}{1024}$ oe	2	**M1** for $1-\left(\frac{3}{4}\right)^5$ oe

Qu		Answers	Mark	Part Marks
10	(a)	2	2	**B1** for g $\left(\frac{1}{2}\right)=\frac{1}{2}$ soi or [fg=] $\frac{1}{1-x}$
	(b)	$1-x$	1	Accept equivalents e.g. $-(x-1)$
	(c)	x^2-2x+2	3	**M1** for $(1-x)^2+1$ **B1** for $(1-x)^2=1-x-x+x^2$ or better
	(d)	– 6	1	
	(e)	$\sqrt{(-3)^2-4(1)(1)}$ or better	B1	**or** for $\left(x-\frac{3}{2}\right)^2$
		$p=-(-3)$ and $r=2\times1$ oe	B1	Must see $\frac{p+\sqrt{q}}{r}$ or $\frac{p-\sqrt{q}}{r}$ or both **or** for $\frac{3}{2}+or-\sqrt{\left(\frac{3}{2}\right)^2-1}$
		0.38, 2.62	B1B1	**SC1** for answers 0.4 **and** 2.6 or 0.3819 to 0.3820 **and** 2.618… or 0.38 **and** 2.62 seen in working or for –0.38 and –2.62 as final ans
	(f)	f(x) and g(x)	1	Accept f and g or $1/x$ and $1-x$

Qu		Answers	Mark	Part Marks
11		$\frac{1}{3}$	1	Allow equivalent decimal throughout (3sf or better where necessary)
		$\frac{72}{360}$ oe	1	
		$\frac{1}{4}$	2	**M1** for $\left(\frac{1}{2}\right)^2$ or $(2)^2$ or $1^2 : 2^2$ or $2^2 : 1^2$ oe seen
		$\frac{1}{6}$	2	**M1** for $[X = 6 \times]\ 0.5 \times l^2 \times \sin 60$ or $[X = 6 \times]\ 0.5 \times l^2 \times \sin 120$ Or recognition that the area of the obtuse-angled triangle shaded is equal to the area of one of the 6 equilateral triangles from the centre
		$\frac{\pi - 2}{\pi}$ or $1 - \frac{2}{\pi}$ or 0.363 or 0.3630 to 0.3635	4	If fraction given as answer, check if it falls into range **B1** for [sector=] $\frac{1}{4}\pi r^2$ oe **B1** for [triangle =] $\frac{1}{2}r^2$ oe **M1dep** for $\frac{\text{their sector} - \text{their triangle}}{\text{their sector}}$ dep on **B1B1** earned

CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2014 series

0580 MATHEMATICS

0580/43 Paper 4 (Extended), maximum raw mark 130

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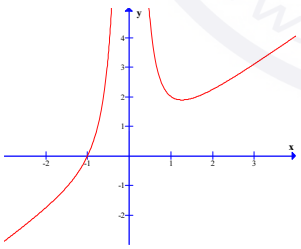
Abbreviations

cao correct answer only
dep dependent
FT follow through after error
isw ignore subsequent working
oe or equivalent
SC Special Case
nfww not from wrong working
soi seen or implied

Qu		Answers	Mark	Part Marks
1	(a)	62100[.00] Final answer	2	**B1** for 62074[. 35] or 62070
	(b)	39300	3	**M2** for 45981÷ 1.17 oe **or M1** for 45981 associated with 117 [%]
	(c)	20436	2	**M1** for 45981÷ (3+4+2) or 45981 × 4
	(d)	4	3	**M2** for $\frac{1.5\times1000}{330}$ oe **or M1** for figs 4545... or 455
	(e)	25545	2	**M1** for 45981 × $\frac{5}{9}$
2	(a)	$10 < x \leq 25$ $25 < x \leq 30$ $30 < x \leq 35$ $35 < x \leq 50$ $50 < x \leq 60$	2	5 correct **B1** for 3 or 4 correct **or SC1** for all correct but in the form 10 to 25 or 10 – 25
		13 33 19 [4] 15 6	3	**B2** for 4 correct **or B1** for 3 correct
	(b)	25.1[0] or 25.13 to 25.14 nfww	4	**M1** for mid-values soi, condone one error or omission 5 17.5 27.5 32.5 42.5 55 soi **and M1** for $\sum fx$ for any x in intervals including boundaries, but all fs must be integers, condone one further error or omission **and M1 dep** for $\sum fx \div 90$ **Dep** on 2nd **M** mark earned

Qu		Answers	Mark	Part Marks
3	(a) (i)	72[.0] or 71.98 to 71.99 nfww	3	**M2** for [sin P =] $\frac{97}{\frac{1}{2}\times 12\times 17}$ oe **or M1** for implicit version
	(ii)	16.2 or 16.18 to 16.19 nfww	4	**M2** for $6^2+17^2-2\times 6\times 17\times\cos(\textit{their}\ 72)$ **or M1** for implicit form **and A1** for [XR^2 =] 261.8 to 262
	(b)	7.61 or 7.612... nfww	4	**M3** for [a =] 9.4 × sin 37 ÷ cos 42 oe or [a =] 9.4sin37/sin(90–42) **or M2** for [a =] their height ÷ cos 42 oe or $\frac{a}{\sin 37}=\frac{9.4}{\sin(90-42)}$ oe **or M1** for their height ÷ a = cos 42 or for [their height =] 9.4 × sin 37 oe **or B1** for 48° correctly used or seen in correct position on diagram
	(c)	50	1	
		130	1	
4	(a)	0, 4.5, 3.11[1…]	3	**B1, B1, B1**
	(b)	Complete correct curve with minimum below $y = 2$ 	5	**B3 FT** for 9 points correctly plotted **B2 FT** for 7 or 8 points correctly plotted **or B1 FT** 5 or 6 points correctly plotted **and B1 indep** two separate branches not touching or cutting y-axis
	(c)	– 0.5 to – 0.6 0.6 to 0.7 2.8 to 2.9	1 1 1	if 0 **SC1** for $y = 3$ indicated
	(d)	Correct line or no line **and** – 0.7 to – 0.6 nfww	3	Must check line - not if wrong line **B2** for $y = 1 - x$ ruled correctly **or SC1** for ruled line with either gradient –1 or y-intercept 1 but not line y = 1 or correct freehand line

Qu		Answers	Mark	Part Marks
	(e)	tangent ruled at $x = 2$ and 0.62 to 0.8	**3**	Accept integer/integer provided in range **B1** for correct tangent drawn **and M1** for change in y / change in x dep on any tangent or close attempt at tangent at any point Must see correct or implied calculation from a drawn tangent
	(f)	$\frac{1}{x^2} = -x$ or $1 + x^3 = 0$	**M1**	
		$1 = -x^3$ or $x^3 = -1$	**M1**	**dep M1**
		$x = \sqrt[3]{-1}$	**A1**	**dep M2**
5	**(a) (i)**	$\begin{pmatrix} 2 \\ 4 \end{pmatrix}$	**1**	
	(ii)	5.83 to 5.831	**2**	**M1** for $3^2 + 5^2$ seen
	(b) (i)	$-2\mathbf{p} + \mathbf{q}$ oe	**1**	accept unsimplified
	(ii)	$\overrightarrow{PS} = -\mathbf{p} + 2\mathbf{q}$ or $\overrightarrow{SP} = \mathbf{p} - 2\mathbf{q}$	**B1**	
		$\overrightarrow{MS} = -\frac{2}{3}\mathbf{p} + \frac{4}{3}\mathbf{q}$ seen or $\overrightarrow{SM} = \frac{2}{3}\mathbf{p} - \frac{4}{3}\mathbf{q}$ seen or $\overrightarrow{RM} = \frac{2}{3}(-2\mathbf{p} + \mathbf{q})$ soi or $\overrightarrow{MR} = \frac{2}{3}(2\mathbf{p} - \mathbf{q})$ soi or $\overrightarrow{MQ} = \frac{1}{3}(-2\mathbf{p} + \mathbf{q})$ soi or $\overrightarrow{QM} = \frac{1}{3}(2\mathbf{p} - \mathbf{q})$ soi	**B1**	
		$\overrightarrow{PM} = \mathbf{p} + \overrightarrow{RM}$ or $\mathbf{p} - \overrightarrow{MR}$ or $-\mathbf{p} + \mathbf{q} + \overrightarrow{QM}$ or $-\mathbf{p} + \mathbf{q} - \overrightarrow{MQ}$ $[= -\frac{1}{3}\mathbf{p} + \frac{2}{3}\mathbf{q}]$	**M1**	Any correct route for $\overrightarrow{PM}$ eg $\overrightarrow{PR} + \overrightarrow{RM}$
		1 : 3 nfww	**A1**	After 0 scored, **SC1** for 1 : 3

Qu		Answers	Mark	Part Marks
6	(a) (i)	$\frac{1}{6}$	1	
	(ii)	$\frac{4}{6}$ oe	1	
	(iii)	$\frac{2}{6}$ oe	1	
	(b)	$\frac{16}{36}$ oe	3	**M2** $\frac{2}{6}\times\frac{4}{6}+\frac{4}{6}\times\frac{2}{6}$ only oe **or M1** for one of $\frac{2}{6}\times\frac{4}{6}$ or $\frac{4}{6}\times\frac{2}{6}$ soi by $\frac{2}{9}$
	(c)	$\frac{48}{360}$ oe	3	**M2** for $\frac{4}{6}\times\frac{3}{5}\times\frac{2}{4}\times\frac{2}{3}$ only oe **or M1** for denominators 6, 5, 4, 3 soi in product of four fractions
7	(a) (i)	148	1	
	(ii)	122	2	**B1** for 58 seen at *A* or 32 seen at *Y*
	(iii)	148	1	
	(iv)	106 nfww	3	**B1** for [sum of interior angles =] 720 **and M1** for $\frac{1}{2}$ {(*their* 720) – (*p*+*q*+*t*+90)}
	(b) (i)	63	2	**B1** for angle *RPS* = 27 or 90 at *P* or at *S* seen or stated
	(ii)	54	2	**B1** for *their x* or 63 or letter *x* at *Q* seen or state

Qu		Answers	Mark	Part Marks
8	(a) (i)	$7\times 2+(2x-3)(x+4)=2(x+4)$	M1	Allow if bracket[s] omitted but recovers
		$2x^2+8x-3x-12$ or better seen	B1	
		$2x^2+3x-6=0$	A1	with no errors seen and brackets correctly expanded on both sides and no omission of brackets
	(ii)	$\sqrt{(3)^2-4(2(-6))}$ or better	B1	or $\left(x+\frac{3}{4}\right)^2$
		$p=-3$ and $r=2(2)$	B1	Must see $\frac{p+\sqrt{q}}{r}$ or $\frac{p-\sqrt{q}}{r}$ or both
				Or $-\frac{3}{4}$ + or $-\sqrt{\frac{57}{16}}$
		1.14 and – 2.64 cao	B1B1	**SC1** for 1.1 and – 2.6 final answer or 1.137 and – 2.637 final answer or 1.14 and – 2.64 seen in working or for -1.14 and 2.64 as final ans
	(b)	$\pi\times x^2+\pi\times x\times 3x$	M2	or **M1** for $\pi\times x\times 3x$
		$4[\pi]x^2=[\pi]r^2$	M1	**Dep on M2**
		$2x=r$	A1	with no errors seen
9	(a)	$4-6x$ final answer	1	
	(b)	$9x-8$ final answer	2	**M1** for $4-3(4-3x)$ seen
	(c)	$\frac{1}{27}$ final answer	3	**M2** for 3^{-3} soi by final answer 0.037037… to 3sf or better **or M1** for [g(– 1) =] 3 soi
	(d)	$\frac{4-x}{3}$ oe final answer	2	**M1** for a correct first step $3x=4-y$ oe or $x=4-3y$ or $\frac{y}{3}=\frac{4}{3}-x$
	(e)	$\frac{4}{3}$ or $1\frac{1}{3}$ or 1.33 or better	3	**M2** for $3x-4=0$ or better **or M1** for $3^{-(4-3x)}$

Qu		Answers	Mark	Part Marks
10	(a)	[r =] 2.30[9...]	3	**B2** for [r =] 2.31 **or M2** for $4\tan 30$ **or M1** for $\frac{r}{4} = \tan 30$
	(b)	333 or 332.5 to 332.6	4	**M3** for $0.5 \times 8 \times 8 \times \sin 60 \times 12$ oe **or M2** for $0.5 \times 8 \times 8 \times \sin 60$ oe **or M1** for *their* triangle area × 12 shown dep on '$\frac{1}{2}$' used within *their* area of triangle method
	(c) (i)	30	3	**M2** for $12 \div 0.4$ or $120 \div 4$ **or SC1** for figs 3
	(ii)	6.65 or 6.647 to 6.648[...]	2	**M1** for $\pi \times 2.3^2 \times 0.4$ **or SC1** for $\pi \times 2.3^2 \times 4$ soi by 66.5 or 66.47 to 66.48[…]
	(iii)	40[.0] or 40.1 or 40.0 to 40.2 nfww	3	**M2** for $100 - \frac{their(c)(i) \times their(c)(ii)}{their(b)} \times 100$ or $\frac{their(b) - their(c)(i) \times their(c)(ii)}{their(b)} \times 100$ **or M1** for $\frac{their(c)(i) \times their(c)(ii)}{their(b)} \times 100$ or $\frac{their(b) - their(c)(i) \times their(c)(ii)}{their(b)}$
11	(a)	$\frac{1}{8}\ \frac{1}{16}\ \frac{1}{32}$	2	**B1** for 2 correct
		$\frac{1}{2^{n-1}}$ oe	2	**SC1** for $\frac{1}{2^n}$ oe
		$2^{-3}\ 2^{-4}\ 2^{-5}$	1	
		2^{1-n} or $2^{-(n-1)}$	1	
	(b) (i)	64 256 1024	1	
		$2^6\ 2^8\ 2^{10}$	1	
	(ii)	$2^{2(n-1)}$ or 2^{2n-2}	1	
	(c)	16384	2	**B1** for $n = 8$

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Abbreviations

cao correct answer only
cso correct solution only
dep dependent
ft follow through after error
isw ignore subsequent working
oe or equivalent
SC Special Case
www without wrong working
art anything rounding to
soi seen or implied

Qu	Answers	Mark	Part Marks
1	**(a) (i)** $\frac{2}{5}$ cao	1	
	(ii) 3 : 2 cao	1	
	(b) (i) 1.22	2	**M1** for 86.38 – 28 × 1.56
	(ii) 1.3 [0] nfww	3	**M2** for 1.56 ÷ 1.2 oe **or M1** for 1.56 = 120% soi
	(c) 33.6[0]	2	**M1** for (667 – 314.2) ÷ 10.5 oe
2	**(a)** 3 correct lines on grid (0, 0) to (40, 5) (40, 5) to (100, 5) (100, 5) to (120, 0)	2	Allow good freehand **SC1FT** for 2 lines correct, **FT** from an incorrect line
	(b) $\frac{5}{40}$ oe	1	
	(c) 3.75	4	**M2** for 0.5 × 40 × 5 + 60 × 5 + 0.5 × 20 × 5 oe [450] or **M1** for evidence of a relevant area = distance and **M1**dep *their* area (or distance) ÷ 120

Qu	Answers	Mark	Part Marks
3	**(a) (i)** 204 or 204.2 to 204.23	**2**	**M1** for $\pi \times 5 \times 13$ implied by answer in range 204.1 to 204.3
	(ii) 12 cao	**3**	**M2** for $\sqrt{13^2 - 5^2}$ or states 5, 12, 13 triangle or **M1** for $13^2 = 5^2 + h^2$ or better
	(iii) 314 or 314.1 to 314.2	**2**	**M1** for $\frac{1}{3} \times \pi \times 5^2 \times$ *their* **(a) (ii)** implied by answer in range 314 to 314.3
	(iv) 3.14×10^{-4} or 3.141 to 3.142×10^{-4}	**2FT**	**FT** *their* **(a) (iii)** $\div 100^3$ correctly evaluated **and** given in standard form to 3 sig figs or better or **M1 FT** for *their* **(a) (iii)** $\div 100^3$ or **SC1** for conversion of *their* m^3 into standard form only if negative power
	(b) 138 or 138.3 to 138.5	**4**	**M3** for $\frac{10\pi}{26\pi} \times 360$ oe or $\frac{\pi \times 5 \times 13 \textbf{ or } \textit{their} \textbf{ (a)(i)}}{\pi \times 13^2} \times 360$ oe or **M2** for a correct fraction without $\times 360$ or **M1** for $\pi \times 2 \times 13$ oe [81.6 to 81.8] seen or $\pi \times 13^2$ oe [530.6 to 531.2] seen
4	**(a)** 45.[0] or 45.01 to 45.02 nfww	**4**	**M2** for $55^2 + 70^2 - 2.55.70 \cos 40$ or **M1** for correct implicit equation **A1** for 2026. ….
	(b) 84.9 or 84.90 to 84.92	**4**	**B1** for angle BDC = 40 soi **M2** for $\frac{70 \sin (\textit{their } 40)}{\sin 32}$ or M1 for correct implicit equation
	(c) (i) 4060 or 4063 to 4064 nfww	**3**	**M2** for $\frac{1}{2}(55 \times 70 \sin 40) + \frac{1}{2}$ $(70 \times \textit{their}(b) \sin(180 - \textit{their } 40 - 32))$ oe or **M1** for correct method for one of the triangle areas
	(ii) 1020 or 1015 to 1016	**2FT**	**FT** *their* **(c) (i)** $\div 4$ oe correctly evaluated or **M1** *their* **(c) (i)** $\div$ figs 4 oe
	(d) 35.4 or 35.35… nfww	**2**	**M1** for $\sin 40 = \frac{\textit{distance}}{55}$ or better or for $\frac{1}{2}$ (55 × 70 sin 40) = (70 × distance) ÷ 2 or better

Qu	Answers	Mark	Part Marks
5	**(a) (i)** Correct reflection to (4, 8) (2, 9) (4, 9)	**2**	**SC1** for reflection in line $x = 5$ or reflection in $y = k$ Ignore additional triangles
	(ii) Correct rotation to (4, 2), (4, 3) (6, 3)	**2**	**SC1** for rotation 180° with incorrect centre Ignore additional triangles
	(iii) Shear, x-axis oe invariant, [factor] 2	**3**	**B1** each (independent)
	(iv) $\begin{pmatrix} 1 & 2 \\ 0 & 1 \end{pmatrix}$	**2FT**	**FT** *their* shear factor **B1FT** for one correct column or row in 2 by 2 matrix but not identity matrix or **SC1FT** for $\begin{pmatrix} 1 & 0 \\ 2 & 1 \end{pmatrix}$
	(b) (i) $\mathbf{p} + 2\mathbf{s}$ final answer	**2**	**M1** for recognising $\overrightarrow{OQ}$ as position vector soi
	(ii) $\mathbf{s} + \frac{1}{2}\mathbf{p}$ final answer	**2**	**B1** for $\mathbf{s} + k\mathbf{p}$ or $k\mathbf{s} + \frac{1}{2}\mathbf{p}$ or correct route ($k \neq 0$)
	(c) parallel **and** $OQ = 2SR$ oe	**1**	
6	**(a) (i)** 1.4 to 1.6	**1**	
	(ii) 1.15 to 1.25	**1**	
	(iii) – 1	**1**	
	(iv) – 2.25 to – 2.1 – 0.9 to – 0.75 2.2 to 2.35	**3**	**B2** for 2 correct or **B1** for one correct or **B1** for $y = x$ drawn ruled to cut curve 3 times
	(b) (i) – 15	**2**	**B1** for [h(3) =] 8 seen or **M1** for $1 - 2(x^2 - 1)$ or better
	(ii) $\frac{1-x}{2}$ or $\frac{1}{2} - \frac{x}{2}$ oe final answer	**2**	**M1** for $2x = 1 - y$ or $x = 1 - 2y$ or better
	(iii) – 2, 2	**3**	**M1** for $x^2 - 1 = 3$ or better **B1** for one answer
	(iv) $\frac{1}{8}$ oe nfww	**3**	**M2** for $8x = 1$ or $8x - 1 = 0$ or **M1** for $1 - 2(3x)$ [$= 2x$]

Qu	Answers	Mark	Part Marks
7	**(a)** 24.7 or 24.66 to 24.67	**4**	**M1** for midpoints soi (condone 1 error or omission) (5, 15, 25, 35, 45, 55) **and** **M1** for use of $\sum fx$ with x in correct interval including both boundaries (condone 1 further error or omission) **and** **M1** (dependent on second **M**) for $\sum fx \div 120$
	(b) **(i)** 50, 90, 114	**2**	**B1** for 2 correct
	(ii) Correct curve or ruled polygon	**3**	Ignore section to left of $t = 10$ **B1** for 6 correct horizontal plots **and B1FT** for 6 correct vertical plots If 0 scored **SC1** for 5 out of 6 correct plots **and** **B1FT** for curve or polygon through at least 5 of *their* points dep on an increasing curve/polygon that reaches 120 vertically
	(iii) 21.5 to 23 15 to 16.5 24 to 26	 **4**	**B1** **B1** **B2** or **B1** for 72 or 72.6 seen
	(c) **(i)** 50, 30	**2**	**B1** each
	(ii) Correct histogram	**3FT**	**B1** for blocks of widths 0 – 20, 30 – 60 (no gaps) **B1FT** for block of height 2.5 or *their* 50 ÷ 20 **and B1FT** for block of height 1 or *their* 30 ÷ 30

Qu	Answers	Mark	Part Marks
8	**(a)** $\sqrt{(-11)^2 - 4(8)(-11)}$ or better	**B1**	Seen anywhere or for $\left(x - \frac{11}{16}\right)^2$
	$p = -(-11)$, $r = 2(8)$ or better	**B1**	Must be in the form $\frac{p+\sqrt{q}}{r}$ or $\frac{p-\sqrt{q}}{r}$ or **B1** for $\sqrt{\frac{11}{8} + \left(\frac{11}{16}\right)^2} + \frac{11}{16}$
	– 0.67, 2.05 final answers	**B1B1**	**SC1** for – 0.7 or – 0.672 to – 0.671 **and** 2.0 or 2.046 to 2.047 or answers 0.67 **and** – 2.05
	(b) 132	**3**	**M1** for $y = k\sqrt{x}$ oe or $\sqrt{x = ky}$ oe **A1** for k = 6 oe or better or for k = 0.1666 to 0.167 [k = 6 implies M1A1] oe
	(c) 20 with supporting algebraic working	**6**	**B2** for $\frac{x}{2.5} + \frac{x-14.5}{0.5} = 19$ oe or **B1** for $\frac{x}{2.5}$ or $\frac{x-14.5}{.5}$ **M1dep on B2** for first completed correct move to clear both fractions **M1** for second completed correct move to collect terms in x to a single term **M1** for third completed correct move to collect numeric term[s] leading to $ax = b$ **SC1** for 20 with no algebraic working
9	**(a)** $y = 2$ oe $y = 2x$ oe $y = -\frac{1}{2}x + 5$ oe	**1** **2** **2**	**M1** for $y = kx$, $k \neq 0$ or gradient 2 soi **M1** for gradient – ½ soi or $y = kx + 5$oe or $x + 2y = k$ $k \neq 0$ oe If L^2 **and** L^3 both correct but interchanged then **SC3**
	(b) $y \geq 2$ oe $y \leq 2x$ oe $y \leq -\frac{1}{2}x + 5$ oe	**3**	**B1** for each correct inequality, allow in any order After 0 scored, **SC1** for all inequalities reversed
	(c) **(i)** 4 [bushes], 3 [trees]	**2**	**M1** for any correct trial using integer coordinates in region or $30x + 200y = 720$ seen
	(ii) 2 [bushes], 4 [trees]	**2**	**M1** for any correct trial using integer coordinates in region
	860	**1**	

Qu	Answers	Mark	Part Marks
10	**(a) (i)** $1 + 2 + 3 + 4 + 5 = 15$	**1**	
	(ii) Correct substitution equating to sum e.g. $\frac{2(2+1)}{k} = 3$ **and** $k = 2$ stated with no errors seen	**2**	**M1** for using a value of n in $\frac{n(n+1)}{k}$ e.g. $\frac{2(2+1)}{k} = 3$ or for a verification using $k = 2$ e.g. $\frac{2(2+1)}{2} = 3$
	(iii) 1830	**1**	
	(iv) 30	**2**	**M1** for $\frac{n(n+1)}{2} = 465$ or better
	(v) $n - 8$	**1**	
	(b) (i) 225, 15	**2**	**B1** either
	(ii) $\frac{n^2(n+1)^2}{4}$ oe	**1**	
	(iii) 36100	**2**	**M1** for $\frac{19^2(19+1)^2}{4}$ oe or 190^2

CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the October/November 2013 series

0580 MATHEMATICS

0580/42 Paper 4 (Extended), maximum raw mark 130

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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Abbreviations

cao correct answer only
cso correct solution only
dep dependent
ft follow through after error
isw ignore subsequent working
oe or equivalent
SC Special Case
www without wrong working
art anything rounding to
soi seen or implied

	Correct answer	Mark	Part marks
1	**(a) (i)** 3216 Final answer	**2**	**M1** for (18900 – 5500) × 0.24 oe
	(ii) 1307 Final answer	**2FT**	**FT** (18900 – *their* **(a)(i)**) ÷ 12 correctly evaluated **M1** for (18900 – *their* **(a)(i)**) ÷ 12
	(b) 4.5[%] nfww	**2**	**M1** for $\frac{19750.50\,[-18900]}{18900}\times 100$ or $\frac{19750.50-18900}{18900}$
	(c) A by 31.05… or 31.04 to 31.05 or 31.[0] 31.1[0]	**5**	**M1** for 1500 × 4.1/100 × 3 [+ 1500] oe **M1** for 1500 × 1.033^3 [– 1500] oe **A1** for 1684.5 or 184.5 **or** 1653[.45..] or 153[.45..] **and M1dep** for subtraction of *their* amounts or *their* interests
2	**(a)** 36.9° or 36.86 to 36.87	**2**	**M1** for tan[*DBC*] = 1.8/2.4 oe
	(b) (i) $1.8^2 + 2.4^2$ leading to $\sqrt{9}$	**2**	**M1** for $1.8^2 + 2.4^2$ or better
	(ii) [cos*ABD*) =] $\frac{6.46^2+3^2-8.6^2}{2\times 6.46\times 3}$ 127 or 126.8…	**M2** **A2**	**M1** for correct cos rule but implicit version **A1** for –0.599… After **0** scored, **SC2** nfww for answer 127 or 126.8 to 126.96 from other methods or no working shown
	(c) 39.6 or 39.7 or 39.59 to 39.68	**3**	**M2** for ½ (2.4 + 8.6) × 1.8 × 4 oe **Or M1** for $\frac{1.8}{2}(2.4+8.6)$ oe soi by 9.9 to 9.92

3	**(a)** $\frac{4x-7}{10}$ final answer nfww	**3**	**M2** for $\frac{5(2x-1)-2(3x+1)}{2\times5}$ or $\frac{5(2x-1)}{5\times2}-\frac{2(3x+1)}{5\times2}$ **or M1** for attempt to convert to common denominator of 10 or multiple of 10 with one error in numerator
	(b) $x^2 + 9$ final answer nfww	**4**	**B3** for $4x^2 – 6x – 6x + 9 – 3x^2 +12x$ or correct answer given and then spoilt **or B1** for $4x^2 – 6x – 6x + 9$ seen **and B1** for $– 3x^2 +12x$ or $– (3x^2 – 12x)$ seen
	(c) **(i)** $(2x – 1)(x + 3)$ isw solving	**2**	**M1** for $(2x + a)(x + b)$ where $ab = –3$ or $2b + a = 5$ with integers a and b
	(ii) $\frac{2x-1}{2(x-3)}$ or $\frac{2x-1}{2x-6}$ final answer nfww	**3**	**M2** for $2(x + 3)(x – 3)$ or $(2x – 6)(x + 3)$ or $(2x + 6)(x – 3)$ seen **or M1** for $2(x^2 – 9)$ seen
4	**(a)** **(i)** $90 \div (42/360 \times \pi \times 8^2)$ o.e.	**M3**	**M2** for $42/360 \times \pi \times 8^2 \times h = 90$ **or M1** for $42/360 \times \pi \times 8^2$
	3.836 to 3.837	**A1**	
	(ii) 131 or 130.75 to 130.9 nfww	**5**	**M2** for $42/360 \times \pi \times 2 \times 8 \times 3.84$ oe [22.48 to 22.53] **or M1** for $42/360 \times \pi \times 2 \times 8$ oe soi [5.86 to 5.87] **and M1** for $2 \times (8 \times 3.84)$ [61.37 to 61.44] **and M1** for $2 \times (42/360 \times \pi \times 8^2)$ [46.88 to 47]
	(b) 2.42 or 2.416 to 2.419	**3**	**M2** for $3.84 \times \sqrt[3]{\frac{22.5}{90}}$ oe or $h = \sqrt[3]{\frac{3.84^3 \times 22.5}{90}}$ **or M1** for $\sqrt[3]{\frac{22.5}{90}}$ oe or $\sqrt[3]{\frac{90}{22.5}}$ oe seen or $\frac{3.84^3}{h^3} = \frac{90}{22.5}$ oe

5	**(a)** 7, 11.5, 4.5	**1,1,1**	
	(b) Correct curve cao	**5**	**B3FT** for 10 correct plots, on correct vertical grid line and within correct 2 mm square vertically **Or B2FT** for 8 or 9 correct plots **Or B1FT** for 6 or 7 correct plots **and B1 indep** for two separate branches on either side of y-axis
	(c) (i) $0.69 < x < 0.81$	**1**	
	(ii) $-2.3 < x < -2.2$ $-0.8 < x < -0.6$ $0.35 < x < 0.5$	**3**	**B1** for each correct After 0 scored, allow **SC1** for drawing line $y = 7.5$ long enough to cross curve at least once
	(d) (i) $y = 10 - 3x$ ruled correctly	**B2**	long enough to cross curve twice. **B1** for ruled line gradient –3 or y intercept at 10 but not $y = 10$ **Or B1** for 'correct' but freehand
	$-0.55 < x < -0.45$	**B1dep**	Dependent on at least **B1** scored for line
	$0.35 < x < 0.45$	**B1dep**	After 0 scored, **SC2** for –0.5 **and** 0.4 [from solving equation]
	(ii) 10 1 –2 **or** –10 –1 2	**3**	**B2** for $2 - x - 10x^2$ [= 0] oe Or **B1** for $\frac{2}{x^2} - \frac{1}{x} - 10 = 0$ oe Correctly eliminating $-3x$ Or **B1** for $2 - x - 3x^3 = 10x^2 - 3x^3$ oe Correctly clearing fractions

6	**(a) (i)** $\frac{1}{110}$ oe	**2**	**M1** for $\frac{1}{11}\times\frac{1}{10}$
	(ii) $\frac{6}{110}$ oe $\left[\frac{3}{55}\right]$	**2**	**M1** for $\frac{3}{11}\times\frac{2}{10}$
	(iii) $\frac{8}{110}$ oe $\left[\frac{4}{55}\right]$	**2FT**	**FT** *their* **(a)(ii)** + $\frac{2}{11}\times\frac{1}{10}$ correctly evaluated **or M1** *their* **(a)(ii)** + $\frac{2}{11}\times\frac{1}{10}$
	(b) (i) $\frac{6}{990}$ oe $\left[\frac{1}{165}\right]$	**2**	**M1** for $\frac{3}{11}\times\frac{2}{10}\times\frac{1}{9}$
	(ii) $\frac{336}{990}$ oe $\left[\frac{56}{165}\right]$	**2**	**M1** for $\frac{8}{11}\times\frac{7}{10}\times\frac{6}{9}$
	(iii) $\frac{198}{990}$ oe $\left[\frac{1}{5}\right]$	**5**	**M4** for $3\left(\frac{3}{11}\times\frac{2}{10}\times\frac{8}{9}\right)+3\left(\frac{2}{11}\times\frac{1}{10}\left[\times\frac{9}{9}\right]\right)$ oe **or M3** for $3\left(\frac{3}{11}\times\frac{2}{10}\times\frac{8}{9}\right)$ *or* $3\left(\frac{2}{11}\times\frac{1}{10}\left[\times\frac{9}{9}\right]\right)$ oe **Or** **M1** for $\frac{3}{11}\times\frac{2}{10}\times\frac{8}{9}$ oe seen **and M1** for $\frac{2}{11}\times\frac{1}{10}\left[\times\frac{9}{9}\right]$ oe seen

7	**(a)** 14 10 or 2 10 pm final answer	**2**	**M1** for (0)8 10 oe or answer 14 hours and 10 minutes or answer 2 10 [am]
	(b) 5 hours 45 minutes cao	**2**	**M1** for 345 [mins] seen or for 805 /7 × 3 oe or 5.75 seen
	(c) **(i)** 798 or 798.2 to 798.4….	**2**	**M1** for 10712 / $13\frac{25}{60}$ or 10712 ÷ 13.4…
	(ii) 1.82×10^5 or 1.815×10^5 to 1.816×10^5	**4**	**B3** for 182000 or 181500 to 181600 seen **or M2** for 10712000/59 oe **or M1** for figs 10712/figs 59 soi by figs 182 or figs 1815 to 1816 **and B1 FT** for their number of litres correctly converted to standard form rounded to 3sf or better
	(d) 8600	**3**	**M2** for 10148 ÷ 1.18 oe **or M1** for 10148 associated with 118[%]
8	**(a)** **(i)** –6	**1**	
	(ii) 2.75 oe	**2**	**M1** for [g(x) =] 0.5 or 7/14 Or $\left(\frac{7}{x+1}\right)^2 + 5\left(\frac{7}{x+1}\right)$ oe
	(b) $\frac{x-3}{4}$ or $\frac{x}{4} - \frac{3}{4}$ Final answer	**2**	**M1** for $y - 3 = 4x$ or better or $x = 4y + 3$ or better or $\frac{y}{4} = \frac{3}{4} + x$ or flowchart with – 3 then ÷ 4
	(c) **(i)** 5	**2**	**M1** for $4x = 23 - 3$ or $x + \frac{3}{4} = \frac{23}{4}$ or better
	(ii) $x^2 + 5x - 7 = 0$	**B1**	May be implied by correct values in formula
	$\frac{-5 \pm \sqrt{5^2 - 4(1)(-7)}}{2(1)}$ oe	**B1** **B1**	**B1** for $\sqrt{5^2 - 4(1)(-7)}$ or better [53] If in form $\frac{p + \sqrt{q}}{r}$ or $\frac{p - \sqrt{q}}{r}$, **B1** for –5 and 2(1) or better **No** recovery of full line unless **seen**
	1.14 and –6.14 final answers	**B1** **B1**	**Or SC1** for 1.1 or 1.140…. and –6.1 or – 6.140 … Or answers –1.14 and 6.14

9	**(a) (i)** Reflection $x = -2$ oe	**2**	**B1** for either
	(ii) Translation $\begin{pmatrix} -7 \\ 2 \end{pmatrix}$ oe	**2**	**B1** for either
	(iii) Stretch x-axis oe invariant [factor] 3	**3**	**B1** for each
	(b) (i) Triangle with coords at (8, 2) (7, 3) and (7, 5)	**2**	**B1** for rotation about (6, 0) but 90° anticlockwise Or for rotation 90° clockwise around any point
	(ii) Triangle with coords at (–2, –5) (–6, –5) and (–8, –7)	**2**	**B1** for 2 correct points or for enlargement of SF –2 any centre
	(iii) Triangle with coords at (1, –1) (4, –6) and (3, –5)	**2**	**B1** for 2 correct points or coordinates of 2 points shown
	(c) $\begin{pmatrix} 1 & 0 \\ -2 & 1 \end{pmatrix}$	**2**	**B1** for one row or one column correct but not identity matrix. **Or SC1** for $\begin{pmatrix} 1 & -2 \\ 0 & 1 \end{pmatrix}$
10	**(a)** 48 and 57, $9n + 3$ oe	**1 2**	**B1** for $9n + k$ oe
	(b) 56 and 50, $86 - 6n$ oe	**1 2**	**B1** for $k - 6n$ oe
	(c) 125 and 216, n^3 oe	**1 1**	
	(d) 130 and 222 $n^3 + n$ oe	**1 1FT**	FT *their* **(c)** + n dep on expression in n in **(c)**

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0580 MATHEMATICS

0580/43 Paper 4 (Extended), maximum raw mark 130

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Abbreviations

cao correct answer only
cso correct solution only
dep dependent
ft follow through after error
isw ignore subsequent working
oe or equivalent
SC Special Case
www without wrong working
art anything rounding to
soi seen or implied

Qu.	Answers	Mark	Part Marks
1 (a) (i)	45	2	**M1** for $5 \times 63 \div 7$
(ii)	20	2	**M1** for $5 \times 56 \div 14$
(iii)	23.4 or 23.38 to 23.41	3	**M2** for $\frac{13 \times 4.9 - 48.8}{13 \times 4.9} \times 100$ or $\frac{4.9 - 48.8 \div 13}{4.9} \times 100$ Or **M1** for $\frac{13 \times 4.9 - 48.8}{13 \times 4.9}$ or $\frac{48.8}{13 \times 4.9} \times 100$ or 76.6[…]
(b)	128	4	Using fractions (percentages / decimals): **M1** for $\frac{3}{4} \times \frac{3}{8} \left[= \frac{9}{32}\right]$ or $\frac{75}{100} \times 37.5$ [= 28.125%] **A1** for $\frac{9}{32}$ or 28.125[%] **M1** for $36 \div \frac{9}{32}$ oe or $36 \times \frac{100}{28.125}$ oe Partial percentages **M1** for (Remaining) $\frac{100 \times 36}{37.5}$ [= 96] **A1** for 96 **M1** for $96 \div \frac{75}{100}$ oe **SC1** for 288

2	**(a)**	119.94[…] nfww	**3**	**M2** for $\frac{62 \times \sin 122}{\sin 26}$ or **M1** for $\frac{AC}{\sin 122} = \frac{62}{\sin 26}$ oe **SC2** for correct answer from alternative methods
	(b)	109 or 108.7 to 108.8 nfww	**4**	**M2** for $119.9..^2 + 55^2 - 2 \times 119.9.. \times 55\cos 65$ **A1** for 11827[·…] or 11834 to 11835[·…] or **M1** for implicit version
	(c)	1970 or 1969 to 1970.4	**2**	**M1** for ½ × 119.9.. × 62 × sin 32
	(d)	22300 or 22310 to 22320	**3**	**M2** for (*their* (c) + 0.5 × 55 × 119.9.. × sin65) × 4.5 or **M1** for *their* (c) + 0.5 × 55 × 119.9.. × sin65
3	**(a)**	$9 - 2x$, $7 - 2x$ oe	**2**	**B1** for each, accept in any order
	(b)	$x(9 - 2x)(7 - 2x)$ $4x^3 - 32x^2 + 63x$	**M1FT** **A1**	Correct expansion and simplification with no errors
	(c)	24 20	**2**	**B1** for each correct value
	(d)	Correct curve	**3**	**B2FT** for 5 correct plots or **B1FT** for 3 or 4 correct plots
	(e)	0.65 to 0.75 $\leq x \leq$ 2 oe	**2**	**B1** for 0.65 to 0.75 seen
	(f) (i)	36 to 37	**1**	
	(ii)	1.2 to 1.4	**1**	
4	**(a)**	48 and 84 66 and 66	**2**	**B1** for each pair
	(b)	540	**2**	**M1** for 3 × 180 or (2 × 5 – 4) × 90 or 5 × (180 – 360 ÷ 5) oe
	(c)	1620	**2**	**M1** for 7 × 360 – *their* 540 – 360
	(d) (i)	$2x + 5 + 3y - 20 + 4x - 5 + x + y - 10 = 360$ oe	**1**	Allow partial simplification but not $7x + 4y - 30 = 360$
	(ii)	$2x + 5 + 3y - 20 = 180$	**1**	
	(iii)	$[x =]$ 30, $[y =]$ 45 nfww	**4**	**M1** for correct multiplication **M1** for correct elimination **A1** $x = 30$ or $y = 45$ If 0 scored **SC1** for correct substitution to find the other variable
	(iv)	65, 115, 115, 65	**1**	Accept in any order

5	(a) (i)	3.81 or 3.812 to 3.813 or 3h 49min nfww	4	**M1** for midpoints soi (condone 1 error or omission and **M1** for use of $\sum fx$ with x in correct interval including both boundaries (condone 1 further error or omission) and **M1** (**dep** on 2nd M1) for $\sum fx \div 80$ $(305 \div 80)$
	(ii)	Correct histogram	4	**B1** for each correct block and **B1** for correct widths
	(b) (i)	$\frac{2}{5}$, $\frac{1}{4}$, $\frac{3}{4}$, $\frac{1}{4}$ oe	2	**B1** for $\frac{2}{5}$ or both $\frac{1}{4}$s in correct place
	(ii)	$\frac{18}{20}$ nfww $\left[\frac{9}{10}\right]$	3	**M2 FT** for $1 - \textit{their}\ \frac{2}{5} \times \textit{their}\ \frac{1}{4}$ or $\frac{3}{5} \times \frac{3}{4} + \frac{3}{5} \times \textit{their}\ \frac{1}{4} + \textit{their}\ \frac{2}{5} \times \frac{3}{4}$ oe or **M1 FT** for $\textit{their}\ \frac{2}{5} \times \textit{their}\ \frac{1}{4}$ or $\frac{3}{5} \times \textit{their}\ \frac{1}{4} + \textit{their}\ \frac{2}{5} \times \frac{3}{4}$ oe
	(iii)	$\frac{27}{125}$ [0.216]	2	**M1** for $\frac{3}{5} \times \frac{3}{5} \times \frac{3}{5}$
6	(a)	329.7 to 330	3	**M2** for $\frac{1}{2}\pi(12^2 + 8.75^2 - 3.25^2)$ oe or **M1** for $\frac{1}{2}\pi 12^2$ or $\frac{1}{2}\pi 8.75^2$ or $\frac{1}{2}\pi 3.25^2$ **SC2** for answer 1318 to 1320
	(b)	2970 or 2967 to 2969.[…]	4	**M3** for $\frac{1}{2}\pi(24 + 17.5 + 6.5) \times 35 + \textit{their}$ **(a)** or **M2** for $\frac{1}{2}\pi(24 + 17.5 + 6.5) \times 35$ or **M1** for $\frac{1}{2}\pi \times 24$ or $\frac{1}{2}\pi \times 17.5$ or $\frac{1}{2}\pi \times 6.5$ **SC3** for 3955 to 3960 dep on **SC2** in **(a)**
	(c)	11.5 or 11.6 or 11.53 to 11.55	3FT	**M1** for *their* **(a)** × 35 **A1** for 11500 or 11530 to 11550

	(d) (i)	$\frac{r}{h} = \frac{20}{40}$ or $\frac{r}{20} = \frac{h}{40}$	**1**	Accept $20 : 40 = r : h$ leading to $40r = 20h$ $[r = h/2]$ $\frac{20}{40} = \frac{1}{2}$ and $\frac{r}{h} = \frac{1}{2}$
	(ii)	35.3 or 35.31 to 35.34	**3**	**M2** for $\sqrt[3]{\frac{their\ 11545 \times 12}{\pi}}$ oe or $2 \times$ *their* r or **M1** for *their* $11545 = \frac{1}{3} \times \pi \times \left(\frac{h}{2}\right)^2 \times h$ oe or *their* $11545 = \frac{1}{3} \times \pi \times r^2 \times 2r$ oe
7	**(a) (i)**	$\frac{3}{2}$ or 1.5	**2**	**M1** for $\frac{14 - (-4)}{8 - (-4)}$ oe
	(ii)	$y = \frac{3}{2}x + 2$ oe	**2**	**B1** for $y =$ *their* $\frac{3}{2}x + c$ o.e. or $y = mx + 2,\ m \neq 0$ **SC1** for $\frac{3}{2}x + 2$
	(iii)	$\begin{pmatrix}12\\18\end{pmatrix}$	**1**	
	(iv)	21.6 or 21.63[…]	**2**	**M1 FT** for *their* $12^2 +$ *their* 18^2 oe
	(b) (i)	**(a)** $3\mathbf{b} - 4\mathbf{a}$	**1**	
		(b) $\frac{1}{5}(6\mathbf{b} - 8\mathbf{a})$ oe simplified	**2**	**M1** for $\frac{1}{5}(12\mathbf{a} + 6\mathbf{b}) - 4\mathbf{a}$ or $AR = AO + OR$
		(c) $6\mathbf{a} + 3\mathbf{b}$ oe simplified	**1**	
	(ii)	OR is parallel to OT	**1**	Dep on $\overrightarrow{OT}$ correct
	(iii)	$\frac{9}{4}$ or 2.25	**2**	**M1** for $\left(\frac{3}{2}\right)^2$

8	**(a)**	$\frac{2(s-ut)}{t^2}$ oe nfww	**3**	**M1** for a correct rearrangement to isolate the *a* term and **M1** for a correct multiplication by 2 and **M1** for a correct division by t^2
	(b)	36.75 cao	**3**	**M2** for $15.5 + 2.5 \times 8.5$ **B1** for two of 15.5, 2.5, 8.5 seen
	(c) (i)	$\frac{16}{5}$ or better [3.2]	**1**	
	(ii)	11.2	**4**	**M2** for ½(25 + 10)16 (= 280) or **M1** for appreciation of distance from area and **M1** for *their* 280 ÷ 25 (dep on M1)
9	**(a)**	15 18 $3n + 3$ or $3(n + 1)$ 6 10 25 36 $(n + 1)^2$	**9**	**B2** for 15, 6, 25 or **B1** for two correct values **B3** for 18, 10, 36 or **B1** for each correct value **B2** for $3n + 3$ oe or **M1** for $3n + k$, for any k **B2** for $(n + 1)^2$ oe or **M1** for a quadratic expression
	(b)	14	**2**	**M1** for $(n + 1)(n + 2) = 240$ or better or $15 \times 16 = 240$
	(c) (i)	$½ + p + q = 9$	**1**	
	(ii)	$[p =] 3$ $[q =] \frac{11}{2}$	**5**	**B2** for $4p + 2q = 23$ or **B1** for $½ \times 2^3 + p \times 2^2 + q \times 2$ oe **M1** for correct multiplication and subtraction of *their* equations **A1** for $[p =] 3$ or $[q =] \frac{11}{2}$ If 0 scored then **SC1** for either correct

10	**(a)**	$\frac{x}{x+3}$ cao	**3**	**B1** for $(x + 3)(x – 3)$ **B1** for $x(x – 3)$
	(b)	$\frac{3}{2}$ and –5	**7**	**M2** for $15(x + 1) – 20x = 2x(x + 1)$ or **M1** for multiplication by one denominator only or $\frac{15(x+1)-20x}{x(x+1)}$ and **B2** for $2x^2 + 7x – 15$ [= 0] or **B1** for $15x + 15 – 20x$ or $2x^2 + 2x$ and **M2** for $(2x – 3)(x + 5)$ or *their* correct factors or formula or **M1** for $(2x + a)(x + b)$ where $ab = –15$ or $a + 2b = 7$ **A1** for $x = \frac{3}{2}$ and –5

CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2013 series

0580 MATHEMATICS

0580/41 Paper 4 (Extended), maximum raw mark 130

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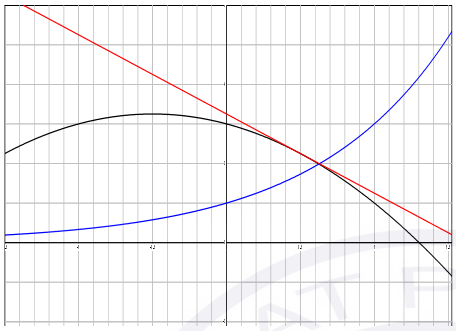
Abbreviations

cao correct answer only
cso correct solution only
dep dependent
ft follow through after error
isw ignore subsequent working
oe or equivalent
SC Special Case
www without wrong working
art anything rounding to
soi seen or implied

Qu.	Answer	Mark	Part marks
1 (a) (i)	[0]8 15	1	
(ii)	$\frac{1.8}{27} \times 60$ [= 4] oe	M2	**M1** for $\frac{1.8}{27}$ oe [0.0667 or better]
(b) (i)	275	3	**M2** for $\frac{15-4}{4} \times 100$ or $\frac{15}{4} \times 100 - 100$ oe or **M1** for $\frac{15-4}{4}$ or $\frac{15}{4} \times 100$ or oe 375
(ii)	73.3[3…]	3	**M2** for $\frac{1.8}{15} \times 60$ [=7.2 min] and $\frac{27 - \textit{their}\ 7.2}{27} \times 100$ oe or **M1** for $\frac{1.8}{15} \times 60$ [=7.2 min] or final answer of 26.6[6…] or 26.7
(iii)	25	2	**M1** for $\frac{9}{\textit{figs}\ 36}$ oe

Qu.		Answer	Mark	Part marks
2	(a)	3, 0.33[3…], 1	3	**B1** for each correct value
	(b)	Correct quadratic curve	3	**B2FT** for 7 correct points or **B1FT** for 5 or 6 correct points
		Correct exponential curve 	3	**B2FT** for 7 correct points or **B1FT** for 5 or 6 correct points
	(c) (i)	Answer in range $1.2 < x < 1.4$	1	
	(ii)	Answer in range $1.2 < x < 1.35$	1	Not from a line other than $y = 4$ (±1mm)
	(iii)	Answer in range $0.55 < x < 0.7$	1	
	(d)	Correct tangent drawn And answer in range $-2.5 < m < -1.5$	3	**B1** for correct tangent at $x = 0.5$ **B2** for answer in range dep on close attempt at tangent **M1** for $[-]\frac{rise}{run}$ used with values soi from tangent, dep on close attempt at tangent or answer in range $1.5 < m < 2.5$ or **SC1** for close attempt at tangent to exponential curve and answer in the range $1.6 < m < 2.2$
3	(a) (i)	3.2	1	
	(ii)	4.2	1	
	(iii)	4.6	1	
	(iv)	196	1	
	(b) (i)	100, 46, 12	2	**B1** for 2 correct
	(ii)	4	2	**M1** for frequency of 60 or 140 seen in workspace

Qu.		Answer	Marks	Part marks
4	(a)	Enlargement	1	
		[centre] (–3, 4)	1	Do not allow column vector for coordinates
		[scale factor] 3	1	
	(b) (i)	Image at (1 5), (4, 5), (4, 6), (1, 7)	2	**SC1** for translation by $\begin{pmatrix}5\\k\end{pmatrix}$ or $\begin{pmatrix}k\\4\end{pmatrix}$
	(ii)	Image at (5, 1), (8, 1), (8, 3), (5, 2)	2	**SC1** for reflection in $y = 2$
	(iii)	Image at (– 4, 3), (– 1, 3), (– 1, 6), (– 4, 9)	2	**SC1** for three correct vertices or shape with vertices at (–4, 1) and (–1, 1), (–1, 4) and (–4, 7)
	(iv)	$\begin{pmatrix}1 & 0\\0 & 3\end{pmatrix}$	2	**SC1** for $\begin{pmatrix}1 & 0\\0 & k\end{pmatrix}$, $k \neq \pm 1$ or $\begin{pmatrix}3 & 0\\0 & 1\end{pmatrix}$
	(c)	Reflection $y = x$ oe	2	**B1 B1** independent
5	(a)	171.25 (or 171 or 171.2 or 171.3) www	3	**M1** for $5 \times 155 + 9 \times 162.5 + 18 \times 172.5 + 10 \times 185$ [= 7192.5] and **M1** (dep on **M1**) for *their* $\Sigma fx \div 42$
	(b)	$160 < x \leq 165$ oe	1	
	(c)	Blocks with heights of 1.8, 1.2, 1, with correct interval widths and no gaps	4	**B3** for 2 correct blocks or **B2** for 1 correct block or **B1** for 3 correct frequency densities or heights or 3 correct widths

Qu.	Answer	Marks	Part marks
6 (a)	31.4	3	**M2** for $\frac{15.7}{\sin 30}$ or **M1** for correct implicit statement
(b)	[sin$E$ =] $\frac{15.7 \times \sin 52}{16.5}$	M2	**M1** for correct implicit statement
	48.573…	A1	
(c) (i)	[$\angle ACE$ =] 180 – 52 – 48.57	M1	
	[= 79.43]		
	[$\angle ECD$ =] 40.57…	A1	
(ii)	15.3 or 15.27 to 15.281 www	4	**M2** for [$(DE)^2$ =] $16.5^2 + 23.4^2 - 2 \times 16.5 \times 23.4\cos(40.6$ or $40.57)$ or **M1** for full correct implicit statement **A1** for 233 to 234
(d)	466 or 466.34 to 466.5	4	**M1** for $0.5 \times 15.7 \times$ *their* 31.4 sin(90 – 30) oe **M1** for $0.5 \times 15.7 \times 16.5$ sin(128 – *their* 48.6 or 48.57) oe **M1** for $0.5 \times 16.5 \times 23.4$ sin (40.6 or 40.57) oe

Qu.	Answer	Mark	Part marks
7 (a)	6.61 (6.614…) www	6	**B1** for $\frac{x+2}{2x+3} = \frac{9}{16}$ oe **M1** for $16(x + 2) = 9(2x + 3)$ or better **A1** for [x =] 2.5 **M2** for $\sqrt{\{(2 \times \textit{their } x + 3)^2 - (\textit{their } x + 2)^2\}}$ or **M1** for $(2 \times \textit{their } x + 3)^2 - (\textit{their } x + 2)^2$ or **SC2** for final answer of $4\sqrt{13}$ or $\frac{7\sqrt{15}}{2}$ or better **SC1** for final answer of $5\sqrt{7}$ or better
(b) (i)	White = 8.5, red = 11	5	**B3** for $7w + 5(w + 2.5) = 114.5$ or for $7(r - 2.5) + 5r = 114.5$ oe **B1** for 8.5 or 11 or **SC2** for $7w + 5 \times w + 2.5 = 114.5$ leading to 9.33[3…] or **SC1** for $7w + 5 \times w + 2.5 = 114.5$ OR **B1** for $r = w + 2.5$ oe **B1** for $7w + 5r = 114.5$ oe **M1** for elimination of a variable **A1** for 8.5 or 11
(ii) (a)	$\frac{42}{132}$ or $\frac{21}{66}$ or $\frac{14}{44}$ or $\frac{7}{22}$ (0.318 or 0.3181 to 0.3182)	2	**M1** for $\frac{7}{12} \times \frac{6}{11}$
(ii) (b)	$\frac{70}{132}$ or $\frac{35}{66}$ (0.53[0] or 0.5303…)	3	**M2** for $\frac{7}{12} \times \frac{5}{11} + \frac{5}{12} \times \frac{7}{11}$ or $1 - \textit{their}$ (a) $- \frac{5}{12} \times \frac{4}{11}$ or **M1** for $\frac{7}{12} \times \frac{5}{11}$ or $\frac{35}{132}$ or **SC1** for $\frac{70}{144}$ oe from replacement

Qu.	Answer	Mark	Part marks
8 (a) (i)	118	2	**M1** for $(3 \times 180 - 2 \times 110 - 84)$ [÷ 2] or better
(ii)	31	1FT	FT $(180 - \textit{their}$ (i)$) \div 2$
(iii)	22	1FT	FT $84 - 2 \times$ *their* (ii) or $2 \times$ *their* (ii) $- 40$, only if positive answer and less than 84
(b)	32	4	**B2** for $360 - 3y = 2(4y + 4)$ oe and **B1** for $11y = 352$ oe or **M1** for angle at centre = 2 × angle at circumference soi
(c) (i)	Opposite angles [cyclic quad] add to 180	1	
(ii)	68	3	**M1** for [angle *PRS* =] $102 \div 3 \times 2$ and **M1** for angle *PQS* = angle *PRS* or angle *PRQ* = angle *PSQ*
(d)	5.75	3	**M2** for $6.9 \times \sqrt{\frac{5}{7.2}}$ oe or **M1** for evidence of ratio of areas = (ratio of sides)^2 or sf = 1.2
9 (a)	$\frac{-1 \pm \sqrt{1^2 - 4 \times 1 \times (-3)}}{2}$	2	**B1** for $\sqrt{1^2 - 4 \times 1 \times (-3)}$ or better and if in the form $\frac{p + \sqrt{q}}{r}$ or $\frac{p - \sqrt{q}}{r}$
	–2.30, 1.30 final answer	2	then **B1** for $p = -1$ and $r = 2(1)$ or better **B1 B1** **SC1** for –2.30 and 1.30 seen or –2.3 or –2.303 to – 2.302 **and** 1.3 or 1.302 to 1.303 or final answer –1.30 and 2.30
(b)	4, 30, 53	3	**M1** for $(2x + 7)^2 + (2x + 7) - 3$ and **B1** for $(2x + 7)^2 = 4x^2 + 14x + 14x + 49$ oe

Qu.	Answer	Mark	Part marks
(c)	$\frac{x-7}{2}$	2	**M1** for $y - 7 = 2x$ or $x = 2y + 7$ or -7 **then** $\div 2$ clearly seen in correct order with arrow or better or $\frac{y-7}{2}$
(d)	–2	1	
(e)	1.158×10^{77}	4	**B3** for 1.16×10^{77} or $1.1579\ldots \times 10^{77}$ or 1.157×10^{77} or **B2** for 2^{256} seen or **B1** for 2^8 seen or 256
10 (a)	50, 70	1	
	$10n$ oe	1	
	51, 71	1	
	$10n + 1$ oe	1	
(b) (i)	212	1	
(ii)	$20n + 12$	1	
(iii)	$20n + 152$	1	
(c) (i)	$5 \times 3^2 + 6 \times 3 = 63$	1	
	and $11 + 21 + 31 = 63$		
	or $32 + 31 = 63$ or $11 + 52 = 63$	1	
(ii)	560	1	
(d)	Complete solution with no errors seen and a conclusion e.g. $5n^2 + 6n + 10(n + 1) + 1$ $= 5n^2 + 6n + 10n + 10 + 1$ $= 5n^2 + 10n + 5 + 6n + 6$ $= 5n^2 + 10n + 5 + 6n + 6$ $= 5(n + 1)^2 + 6(n + 1)$	4	**B1** for $5n^2 + 6n + 10n + 10 + 1$ or better **B1** for use of $5(n + 1)^2 = 5n^2 + 10n + 5$ oe at any stage **B1** for use of $6n + 6 = 6(n + 1)$ oe at any stage

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0580 MATHEMATICS

0580/42 Paper 4 (Extended), maximum raw mark 130

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Abbreviations

cao correct answer only
cso correct solution only
dep dependent
ft follow through after error
isw ignore subsequent working
oe or equivalent
SC Special Case
www without wrong working
art anything rounding to
soi seen or implied

Qu	Answers	Mark	Part Marks
1 (a) (i)	$\frac{6}{5+6+3}\times 560$ [= 240]	**2**	Accept 'of' used instead of × **M1** for 560 ÷ (5 + 6 + 3)
(ii)	120	**1**	
(b)	90	**2**	**M1** for $\frac{3}{8}\times 240$ oe
(c) (i)	96120 final answer	**2**	**M1** for *their*(*a*)(ii) × 75 + (560 – *their* (*a*)(ii)) × 198 oe
(ii)	187.5[0] final answer	**3**	**M2** for $\frac{198}{1+0.056}$ oe or **M1** for (100 + 5.6)[%] = 198 oe seen
(d)	184[.2....]	**3**	**M2** for $\frac{36\times 0.75-9.5}{9.5}\times 100$ oe **or M1** for $\frac{36\times 0.75}{9.5}\times 100$ or $36\times 0.75-9.5$ [17.5] used implied by answer 84.2 or **SC1** for final answer 284[.2..]
(e)	69.4 and 69[.0] cao	**3**	**SC2** for one correct or both correct but reversed **M1** for two of 10.85, 10.95, 23.65 or 23.75 seen or 2(23.7 + 10.9) + 4(0.05) or 2(23.7 + 10.9) – 4(0.05)

2	**(a) (i)**	Translation, $\begin{pmatrix}-5\\8\end{pmatrix}$ oe	**1,1**	Brackets needed for vector Not (–5, 8), (–5 8)
	(ii)	correct trapezium at (2, 2) (4 , 3) (4 , 5) (2, 5)	**2**	**SC1** for reflection in $x = -1$ or vertices only
	(iii)	correct trapezium at (4, 2) (5, 4) (7, 4) (7, 2)	**3**	**M2** for 4 correct vertices on grid or in working or **M1** for $\begin{pmatrix}0 & -1\\1 & 0\end{pmatrix}\begin{pmatrix}2 & 2 & 4 & 4\\-4 & -7 & -7 & -5\end{pmatrix}$ **or SC1** for 3 vertices correct **or** complete shape in correct orientation but wrong position
	(b) (i)	Shear	**1**	
		x –axis (oe) invariant	**1**	
		2	**1**	
	(ii)	rectangle at (–3, 2) (1, 2) (1, 8) (–3, 8)	**2**	**SC1** for all vertices only **or** correct orientation and size, wrong position
3	**(a)**	0, 2, 0, – 3	**3**	**B2** for 3 correct or **B1** for 2 correct
	(b)	Correct curve	**B4**	**B3FT** for 8 points **B2FT** for 7 or 6 points **B1FT** for 5 or 4 points
	(c)	$y = -1$ indicated	**B1**	e.g. Could be mark[s] on curve isw other lines if not clearly used
		x = 1.3 to 1.4 and 4.1 to 4.2	**B1**	
	(d) (i)	line drawn from (0, 2) to touch curve	**M1**	No daylight at point of contact If short, must cross at (0, 2) within ½ small square when extended
		(2.5 to 2.75, 3 to 3.4)	**A1**	
	(ii)	rise/run e.g. (their y – 2)/their x	**M1**	dep on attempt at a tangent from (0, 2) in (d)(i) and uses scales correctly Can be implied from answer– check on tangent for their rise for a run of 1 (½ small square)
		0.4 to 0.48	**A1**	**ww2** dep on attempt at a tangent from (0, 2) in (d)(i)

4	**(a)**	227 or 226.95 to 227.01	**2**	**M1** for $\pi \times 8.5^2$
	(b)	5.35	**1**	
	(c)	39.0[0] to 39.0[1]	**2**	**M1** for sin [*MOB*]= $\frac{their\ b}{8.5}$ oe Dep on their $b < 8.5$
	(d)	30.2 or 30.3 or 30.24 to 30.27	**3**	**M2** for $\frac{360-4\times39}{360}\times2\times\pi\times8.5$ oe or **M1** for $\frac{a}{360}\times2\times\pi\times8.5$ oe where $0 < a < 360$ Implied by 5.78 to 5.79 or 11.5 to 11.6 or 23.14 to 23.15 or 23.1 or 23.2 or 41.83 to 41.84 or 41.8
	(e)	*AB* = *BC* *TA* = *TC* *TB* = *TB*	**1** **1** **1**	isw comments or reasons If **0** scored **SC1** for "all <u>three sides</u> the same" oe [SSS] and no mention of angles
5	**(a)**	$\frac{27}{x}$ final answer	**1**	
	(b)	$\frac{25}{x-2}$ final answer	**1**	
	(c)	$\frac{25}{x-2}-4=\frac{27}{x}$ oe	**M1**	**FT** *their* (b) – 4 = *their* (a) oe must be eqn in *x*
		$25x-4x(x-2)=27(x-2)$ oe	**M1**	**FT** $\frac{25}{x-2}+4=\frac{27}{x}$ oe **<u>only</u>** for 2nd and 3rd M mark If all on one side then condone omission of '= 0'
		$4x^2+27x-25x-8x-54[=0]$ oe	**M1dep**	Dep on 2nd M1 Must see brackets expanded before this award and terms on one side of eqn
		$2x^2-3x-27=0$ without error seen	**A1**	Must see $4x^2-6x-54=0$ first
	(d)	– 3, 4.5	**3**	**B2** for $(2x-9)(x+3)$ **or SC1** for $(2x+a)(x+b)$ where *a* and *b* are integers and $a + 2b = -3$ or $ab = -27$
	(e)	6 cao	**1**	

6	(a) (i)	$\frac{12^2+21^2-15^2}{2\times12\times21}$ 44.41 to 44.42	M2 A2	**M1** for $15^2 = 12^2 + 21^2 - 2.12.21\cos M$ **A1** for [cos =] 0.714 or 0.7142 to 0.7143 or $\frac{360}{504}$ oe
	(ii)	88.2 or 88.15 to 88.19	2	**M1** for $0.5 \times 12 \times 21 \times \sin(44.4)$ oe
	(b)	7.74 or 7.736 to 7.737…. www	4	**B1** for 55 soi **M2** $\frac{6.4}{\sin(their\ R)}\times\sin 82$ oe **or M1** for $\frac{6.4}{\sin(their R)}=\frac{PR}{\sin 82}$ oe
7	(a) (i)	$\begin{pmatrix}15\\21\end{pmatrix}$	1	
	(ii)	not possible oe	1	
	(iii)	(2) final answer	2	**M1** for 30 – 28
	(iv)	$\begin{pmatrix}4 & 13\\0 & 0\end{pmatrix}$	1	
	(v)	$\begin{pmatrix}-5 & -9\\1 & 0\end{pmatrix}$	2	**B1** for one correct row or column
	(b)	$\frac{1}{2}\begin{pmatrix}3 & -4\\-1 & 2\end{pmatrix}$ or better isw	2	**B1** for $k\begin{pmatrix}3 & -4\\-1 & 2\end{pmatrix}$ seen or implied or $\frac{1}{2}\begin{pmatrix}a & b\\c & d\end{pmatrix}$ seen
8	(a)	hat $\frac{5}{8}, \frac{3}{8}$ scarf $\frac{2}{3}\ \ \frac{1}{3}$ $\frac{1}{6}\ \ \frac{5}{6}$	1 1 1	1 mark per pair in correct place
	(b) (i)	$\frac{15}{48}$ oe $\left[\frac{5}{16}\right]$	2FT	**FT** *their* $\frac{3}{8}\times\frac{5}{6}$ correctly evaluated **M1** $\frac{3}{8}\times\frac{5}{6}$ FT from *their* tree
	(ii)	$\frac{5}{24}$	2FT	**FT** *their* $\frac{5}{8}\times\frac{1}{3}$ correctly evaluated **M1** $\frac{5}{8}\times\frac{1}{3}$ FT from *their* tree

(iii)	$\frac{13}{48}$ cao	**2**	**M1** for *their* $\frac{3}{8}\times\frac{1}{6}$ + *their* (b)(ii) soi
(c)	$\frac{170}{240}$ or $\frac{85}{120}$ *or* $\frac{34}{48}$ *or* $\frac{17}{24}$ cao	**3**	**M2** for $1-\frac{5}{8}\times\frac{2}{3}\times\frac{7}{10}$ FT *their* tree or $\frac{3}{8}+\frac{5}{8}\times\frac{1}{3}+\frac{5}{8}\times\frac{2}{3}\times\frac{3}{10}$ oe **or M1** for ["wears all" =] $\frac{5}{8}\times\frac{2}{3}\times\frac{7}{10}$ FT *their* tree seen
9 (a)	371 or 371.1...	**4**	**M3** for $(6\times4\times12)+(2\times6\times0.5\times4\times4\times\sin60)$ oe **or M2** for area of 1 or 2 hexagons **or M1** for area of one relevant triangle or trapezium or rectangle within hexagon If **0** scored **SC1** for 288 shown
(b) (i)	1740 or 1743.6 to 1744.2	**4**	**M3** for $\frac{12000}{4}\div(\pi\times0.74^2)$ oe or **SC2** for figs 174[3..] or 174[4..] or **B1** for $\pi\times0.74^2$ seen [1.72..] or **B1** for 12000 / 4 soi by 3000
(ii)	87 cao www 5	**5**	**B4** for 87.39 to 87.43 or **M3** for [r=] $\sqrt{\frac{figs\,12}{\pi\times figs\,5}}$ oe or **M2** for [r^2 =] = $\frac{figs\,12}{\pi\ figs\,5}$ oe or **M1** for figs$12=\pi r^2\times figs5$
10 (a) (i)	final answer $\frac{25-8x}{20}$	**2**	**M1** for $\frac{5\times5-4\times2x}{5\times4}$ or better seen
(ii)	final answer $\frac{2x^2+5x+9}{3(x+3)}$	**3**	**B1** for $2x^2+6x-x-3$ soi **and B1** for denom $3(x+3)$ or $3x+9$ seen
(b)	$x = \frac{2}{3}$ oe or 0.667 or 0.6666 to 0.6667 $y = -3$	**3**	**M1** for correct method to eliminate one variable **A1** for $x = \frac{2}{3}$ oe or 0.667 or 0.6666 to 0.6667 or $y = -3$

	(c)	final answer $\frac{7}{2x+3}$ www	**4**	**B1** for $7(x+3)$ in numerator and **B2** for $(2x+3)(x+3)$ in denominator or **SC1** for $(2x+a)(x+b)$ where a and b are integers and $a + 2b = 9$ or $ab = 9$ After **B1** scored, **SC1** for final answer $\frac{7}{2(x+1.5)}$ *or* $\frac{3.5}{x+1.5}$
11	**(a)**	$3^2 + 1^2$	**1**	Ignore attempt to evaluate $\sqrt{10}$
	(b) (i)	$\frac{\sqrt{10}}{3}$ final answer	**1**	
	(ii)	$\frac{10}{3}$ final answer	**2**	**M1** for *their* $\frac{\sqrt{10}}{3} \times \sqrt{10}$ or *their* $\left(\frac{\sqrt{10}}{3}\right)^2 + \left(\sqrt{10}\right)^2$ implied by 3.33 seen
	(c)	$\frac{100}{27}$ or $3\frac{19}{27}$ isw conversion or 3.7[03] to 3.7[04]	**2**	**M1** for $3 \times \left(\frac{\sqrt{10}}{3}\right)^n$ oe where n is 3 or 4 or for $[OP_4 =] \sqrt{\frac{1000}{81}}$ or for their (b)(ii) $\times \left(\frac{\sqrt{10}}{3}\right)^n$ where n is 1 or 2
	(d) (i)	18.43...	**2**	**M1** for $\tan [P_1OP_2] = \frac{1}{3}$ oe
	(ii)	18.4[3…]	**1**	
	(iii)	20	**3**	**SC2** for 19 **or M1** for $\frac{360}{18.4[3...]}$

CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2013 series

0580 MATHEMATICS

0580/43 Paper 4 (Extended), maximum raw mark 130

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the May/June 2013 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary Level components.

Abbreviations

cao correct answer only
cso correct solution only
dep dependent
ft follow through after error
isw ignore subsequent working
oe or equivalent
SC Special Case
www without wrong working
art anything rounding to
soi seen or implied

1	**(a)**	2814 final answer	2	**M1** for 2345 ÷ 5 soi by 469 or ans = 2810
	(b)	257.95 final answer	2	**M1** for 2345 × 0.11 oe or ans = 258
	(c) (i)	280.5[0] final answer	2	**M1** for 330 × (1 – 0.15) oe or ans = 281
	(ii)	375	3	**M2** for 330 ÷ (1 – 0.12) oe Or **M1** for 330 = (100 – 12)% oe
	(d)	1605.89 or 1605.9[0]	3	**M2** for $1500 \times (1 + 0.023)^3$ oe soi by 1605.898751 or 1500 × 1.07(05…) Or **M1** for $1500 \times (1 + 0.023)^2$ oe
	(e)	23.1 or 23.07 to 23.08	3	**M2** for $\frac{325 - 250}{325} \times 100$ oe Or **M1** for $\frac{325 - 250}{325}$ soi by 0.2307… 3sf or better or $\frac{250}{325} \times 100$ soi by 76.9…

2	(a) (i)	Perpendicular bisector of QR ruled with 2 correct sets of arcs centred Q and R	2	**B1** for correct bisector ruled
		Bisector of angle SPQ ruled with correct arcs. (Marks on PS and PQ and correct pair of arcs)	2	**B1** for correct angle bisector ruled
		Compass drawn arc centre R with radius 6 cm (±2 mm)	B2	**B1** for any compass drawn arc centre R not used in any construction with no feathering
		Correct region shaded cao	1dep	Dependent on all **B4** marks for the correct loci
	(ii)	217 to 221	1	
	(b) (i)	6360 or 6361 to 6363	2	**M1** for $\pi \times 45^2$
	(ii)	165 or 164.9 to 165	2	**M1** for $\frac{210}{360} \times 2\pi \times 45$
3	(a) (i)	$x \geq 5$	1	–1 once for strict inequalities in (i) to (iii)
	(ii)	$y \geq 11$	1	
	(iii)	$x + y \geq 20$	1	
	(b)	$4x + 8y \leq 160$ **and** divide by 4	1	If there is a final inequality it must be the given one
	(c) (i)	$x = 5$ ruled	1	Must be on correct grid line
		$y = 11$ ruled	1	Must be on correct grid line
		$x + y = 20$ ruled	2	**B1** for one axis intercept correct when extended if necessary but not parallel to an axis
		$x + 2y = 40$ ruled	2	**B1** for one axis intercept correct when extended if necessary but not parallel to an axis
		Correct shading of **unwanted** region	1dep	Dependent on 6 marks earned for the boundaries
	(ii)	29	2	**M1** for $x + y$ evaluated where (x, y) is a point in their **quadrilateral and** x and y are integers

4	**(a)**	3080	2	**M1** for ½ × 7 × 22 × 40
	(b)	46.2 or 46.18 to 46.2 www	4	**M3** for $\sqrt{7^2 + 22^2 + 40^2}$ **or M2** for $7^2 + 22^2 + 40^2$ soi by 2133 **or M1** for correct Pythagoras on one face
	(c)	8.7 or 8.7 to 8.72 www	3	**M2** for $\sin^{-1}\frac{7}{their(b)}$ oe **or M1** for $\sin = \frac{7}{their(b)}$ oe
	(d)	217	3	**M1** for $\frac{4}{3}\times\pi\times1.5^3$ soi by 14.1 to 14.14 **and M1 dep** for *their* (a) ÷ *their* 14.14 soi by 218. Dependent on **M1** earned
	(e) (i)	25.13875 final answer	2	**B1** for 4.55 **and** 11.05 seen or 25.13875 seen and then spoiled
	(ii)	25.14	1FT	**Strict FT** *their* (e)(i) correct to 4s.f. if rounding is possible
5	**(a)**	–5.04, 1.75, 0	3	**B1** for each correct value
	(b)	Fully correct curve	5	**B3FT** for 10 correct plots from *their* (a) **B2FT** for 8 or 9 correct plots **or B1FT** for 6 or 7 correct plots **and SC1** for two branches not joined
	(c)	–1.6 to – 1.5 –0.4 to –0.3 1.8 to 1.9	1 1 1	
	(d)	–2.6 to –2.5 www –0.4 to –0.3 1	1 1 1	After **0** scored, **M1** for $y = 2x - 2$ drawn
	(e)	3.25 to 4.25 with correct tangent	3	**B1** for correct tangent **B2** for answer in range dep on close attempt at tangent **M1dep** for $[-]\frac{\text{rise}}{\text{run}}$ used with values soi from tangent, dep on correct or close attempt at tangent

6	**(a)**	$\frac{3}{10}$ correctly placed	1	Accept 0.3
		$\frac{6}{9}$ and $\frac{3}{9}$ correctly placed	1	Accept 0.667 or better and 0.333 or better
		$\frac{7}{9}$ and $\frac{2}{9}$ correctly placed	1	Accept 0.778 or better and 0.222 or better
	(b)	$\frac{42}{90}$ or $\frac{21}{45}$ or $\frac{14}{30}$ or $\frac{7}{15}$	3	**M2** for $\frac{7}{10} \times \frac{3}{9} + \frac{3}{10} \times \frac{7}{9}$ soi by 0.467 or better **or M1** for $\frac{7}{10} \times \frac{3}{9}$ **or** $\frac{3}{10} \times \frac{7}{9}$ soi by 0.233 or better
7	**(a) (i)**	Triangle at (1, 3) (1, 9) (3, 3)	2	**SC1** for correct vertices not joined or triangle(1, 1) (3, 1) (1, 7)
	(ii)	$\begin{pmatrix} 1 & 0 \\ 0 & 3 \end{pmatrix}$	2	**SC1** for $\begin{pmatrix} 1 & 0 \\ 0 & k \end{pmatrix}$, $k \neq \pm 1$ or 0 or $\begin{pmatrix} 3 & 0 \\ 0 & 1 \end{pmatrix}$
	(b) (i)	Shear *x*-axis oe invariant [factor] 2	1 1 1	
	(ii)	$\begin{pmatrix} 1 & 2 \\ 0 & 1 \end{pmatrix}$	2FT	**FT** from *their* 2 in (b)(i) **SC1** for $\begin{pmatrix} 1 & k \\ 0 & 1 \end{pmatrix}$, $k \neq 0$ or $\begin{pmatrix} 1 & 0 \\ 2\text{FT} & 1 \end{pmatrix}$
8	**(a) (i)**	27	1	
	(ii)	54	1	
	(iii)	153	1	
	(b) (i)	59.6 or 59.57… www	4	**M2** for $45^2 + 32^2 - 2 \times 45 \times 32 \times \cos 100$ **or M1** for implicit cos rule **and A1** for 3549….
	(ii)	22.[0] or 21.99… www	3	**M2** for $324 \div (\frac{1}{2} \times 32 \times \sin 67)$ **or M1** for [324 =] $\frac{1}{2} \times 32 \times x \times \sin 67$
	(iii)	81[.0]	2	**B1** for 2^2 or $(\frac{1}{2})^2$ oe seen or $\frac{1}{2} \times 16 \times \frac{1}{2}$ *their*(b)(ii) × sin67

9	**(a) (i)**	14	1	
	(ii)	8	1	
	(iii)	30 – *their* (ii)	1FT	
	(b)	$\frac{11}{80}$	2	**SC1** for $\frac{69}{80}$
	(c)	16, 4	2	**B1** for each correct value
	(d)	18.0625 rot to 3sf or better or 18.1 www	3	**M1** for Σmf for m as mid values of 5, 12.5, 22.5, 35 and 45 (= 1445) **and M1 dep** for $\Sigma mf \div 80$, dep on **M1** earned
	(e)	Correct widths with no gaps 2nd block w = 5, fd = 2.4 3rd block w = 15 fd = 1.2 4th block w = 10 and fd = 1.6 5th block w = 10 and fd = 0.4	1 1 1 1FT 1FT	 **Strict FT** from *their* (c) **Strict FT** from *their* (c) After **0** scored for blocks, **SC1** for 4 correct fds soi by correct heights
10	**(a) (i)**	4.5 or 4½	3	**M2** for a complete correct method **or M1** for one correct step at any stage.
	(ii)	$(x – 6)(x – 1)$	M2	**M1** for $(x + a)(x + b)$ where $ab = 6$ **or** $a + b = -7$
		1, 6	A1FT	**FT** their brackets **dep** on **M1** earned After **M0** scored **SC1** for 1, 6 as answer
	(iii)	6	4	**B1** for $2(3x – 2) + x + 2 = 4 \times 10$ oe **and B1** for correct multiplication of a bracket **and M1** for correct rearrangement of their linear equation without brackets to $ax = b + c + d$ or better
	(b)	$a = 1/3$ oe, $b = 1/2$ oe	6	**B1** for any one of $1 = a + b + 1/6$ oe $5 = 8a + 4b + 2/6$ oe $14 = 27a + 9b + 3/6$ oe $30 = 64a + 16b + 4/6$ oe Or any other correct equation **and B1** for another of the above equations **and M1** for equating one coefficient or correct rearrangement to give a or b as subject **and M1** for subtracting to eliminate a or b or correct substitution for *their* a or their b **A1** for $a = 1/3$ oe or $b = 1/2$ oe