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International Education

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MATHEMATICS **0580/21**

Paper 2 (Extended) **October/November 2024**

MARK SCHEME

Maximum Mark: 70

Published

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GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

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

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Mathematics-Specific Marking Principles

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5 Where a candidate has misread a number or sign 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 A or B mark for the misread.

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Abbreviations
cao – correct answer only
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FT – follow through after error
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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	22 32 or 10 32 pm	**1**	
2	$\frac{4}{5}$ or 0.8	**1**	
3	< = =	**2**	**B1** for two correct
4	3.2	**2**	**M1** for $\frac{5.6}{3+4}[\times k]$ where k = 1, 3 or 4
5(a)	$\begin{pmatrix}18\\-12\end{pmatrix}$	**1**	
5(b)	$\begin{pmatrix}-3\\4\end{pmatrix}$	**1**	
6(a)	58	**1**	
6(b)	39	**1**	
6(c)	251	**1**	
7	$7(4x – 5)$ final answer	**1**	
8	234	**2**	**M1** for $\frac{3000 \times 2.6[\times 3]}{100}$
9	15	**3**	**B2** for [x =] 24 OR **M1** for $x + x + 132 = 180$ oe soi **M1** for $\frac{360}{\textit{their } x}$ oe provided this gives an integer answer
10(a)	0.24 oe	**2**	**M1** for 1 – 0.28 oe
10(b)	42	**1**	

Question	Answer	Marks	Partial Marks
11	$\frac{16}{3}$ or $\frac{25}{7}$ | $2\frac{1}{3}-\frac{4}{7}$	**B1**	Correct step for dealing with mixed numbers Allow $\frac{16k}{3k}$ or $\frac{25k}{7k}$
	$\frac{112}{21}$ and $\frac{75}{21}$ | $[2]\frac{7}{21}$ and $\frac{12}{21}$	**M1**	Correct method to find common denominator e.g. $5\frac{7}{21}$ and $3\frac{12}{21}$
	$1\frac{16}{21}$ cao	**A1**	
12	Correctly eliminating one variable	**M1**	
	$x = -3$	**A1**	If A0 scored **SC1** for 2 values satisfying one of the original equations.
	$y = 4$	**A1**	
13(a)	11	**1**	
13(b)	$4n - 10$ oe final answer and $2n^3 + 1$ oe final answer	**4**	**B2** for $4n - 10$ oe final answer or **B1** for $4n + j$ or $kn - 10$ ($k \neq 0$) or $4n - 10$ seen then spoilt **B2** for $2n^3 + 1$ oe final answer or **B1** for any cubic expression in n or 3rd difference = 12 or for correct answer seen then spoilt
14	160	**4**	**M3** for $V \div \frac{2500}{8} = \frac{12^3}{15^3}$ oe or for answer figs 16 from $\frac{figs25}{8} \times \frac{12^3}{15^3}$ or **B2** for 1.28 [kg] OR **M1** for 2500 ÷ 8 oe or 312.5 seen **M1** for $\left(\frac{12}{15}\right)^3$ or $\left(\frac{15}{12}\right)^3$ oe
15(a)	Correct box-and-whisker plot L = 15 LQ = 38 Median = 53 UQ = 66 H = 96	**3**	**B1** for UQ = 66 or Lowest = 15 soi **M1** for at least 3 values correct within box and whisker plot

Question	Answer	Marks	Partial Marks
15(b)	Class Q scored fewer marks on average [as median is lower] oe Class Q have a larger spread of marks [as IQR is higher] oe	**2**	**B1** for each
16	144π cao	**4**	**M2** for [R^2 =] $\dfrac{\frac{4}{3}\times\pi\times6^3}{18\times\pi}$ oe or **M1** for $\frac{4}{3}\times\pi\times6^3=\pi\times R^2\times18$ oe **M1** for $2\times\pi\times theirR\times18$ oe
17	$\dfrac{[--]7\pm\sqrt{([-]7)^2-4(3)(-16)}}{2\times3}$ oe	**B2**	**B1** for $\sqrt{([-]7)^2-4(3)(-16))}$ or better and if in the form $\frac{p+\sqrt{q}}{r}$ or $\frac{p-\sqrt{q}}{r}$ then **B1** for p = – (–7) and r = 2(3)
	3.75 and –1.42	**B2**	**B1** for each or **SC1** for answers 3.8 or 3.754… **and** –1.4 or –1.42… or –1.421 or 3.75 and –1.42 seen in working or –3.75 and 1.42 as final answers
18(a)	–3	**1**	
18(b)	–5	**2**	**M1** for $\frac{1}{4^2}$ or 4^{-2}
19(a)	9	**1**	
19(b)(i)	1, 3, 4, 6, 9	**1**	
19(b)(ii)	2	**1**	**FT** 5 – numbers of odds in **(b)(i)**
20	63.7 or 63.68 to 63.69	**5**	**M4** for tan [QTR] = $\dfrac{9}{18\sin28-4}$ oe OR **M3** for 18sin28 – 4 or **M2** for 18sin28 or **M1** for $\frac{QS}{18}=\sin28$ oe and **M1** for tan [QTR] = $\dfrac{9}{theirQT}$ oe

Question	Answer	Marks	Partial Marks
21	126.9 and 306.9	**3**	**B2** for one correct answer or **M1** for tan $x = -\frac{4}{3}$ oe If M1 or 0 scored, **SC1** for two angles with a difference of 180
22(a)	$x^2 - x - x + 1$ or $x^2 + 2x - x - 2$	**M1**	
	A correct unsimplified expansion e.g. $x^3 + 2x^2 - x^2 - 2x - x^2 - 2x + x + 2$ oe leading to [$y =$] $x^3 - 3x + 2$	**A1**	
22(b)	$y = 2 - 0.5x$ ruled	**B2**	**B1** for [$y =$] $2 - 0.5x$ soi or for $y = 2 - kx$ drawn or for $y = k - 0.5x$ drawn
	–1.5 to –1.6 0 1.5 to 1.6	**B2**	**B1** for two correct values
23	[$p =$] 10 [$k =$] –46	**2**	**B1** for each

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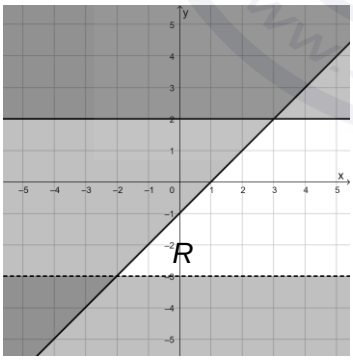
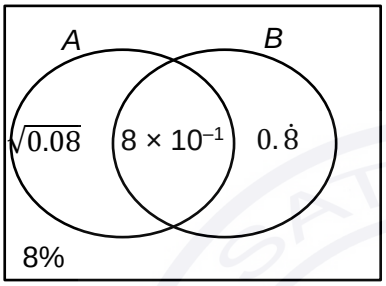
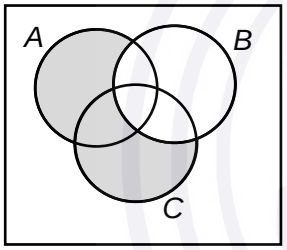
Question	Answer	Marks	Partial Marks
1	[c =] 3 [k =] –39	**2**	**B1** for each or **SC1** for $c = -39$ and $k = 3$
2	94	**2**	**M1** for $x + 2 \times 43 = 180$ oe
3	24 $\sqrt{3}$ 0.25	**3**	**B1** for each
4(a)	76	**1**	
4(b)	Point correctly plotted at (42, 33)	**1**	
4(c)(i)	Correct ruled line of best fit	**1**	
4(c)(ii)	An integer in the range 27 to 33	**1**	**FT** *their* line of best fit provided line shows positive correlation and answer is an integer
4(d)	Positive	**1**	
5	75 100	**1**	
6	4.5 oe	**2**	**M1** for $\frac{1}{2} \times 6 \times (x + 9.5) = 42$ oe or $42 \times \frac{2}{6} - 9.5$ oe
7	$\frac{2}{7} \times \frac{11}{6}$ or $\frac{22}{77} \div \frac{42}{77}$ oe with common denominator	**M1**	
	$\frac{11}{21}$ cao	**A1**	
8	70	**4**	**B3** for $x = 11$ OR **M1** for $132 - 2x + 15 + 5x = 180$ oe **M1** for collecting x terms on one side and number terms on the other for *their* equation. **M1** for $15 + 5 \times$ *their* x oe where $-3 <$ *their* $x < 15$ or for $132 - 2 \times$ *their* x oe where $21 <$ *their* $x < 66$

Question	Answer	Marks	Partial Marks
9	36π cao	**3**	**B2** for answer 113 or 113.0 to 113.1… or an answer in terms of π which rounds to 113 or **M1** for correct first step for finding d or r e.g. $72 + 72 = d^2$ oe $72 = r^2 + r^2$ oe or $\left(\frac{\sqrt{72}}{2}\right)^2 + \left(\frac{\sqrt{72}}{2}\right)^2 = r^2$ oe $\sqrt{72} = \frac{r}{sin45}$ oe $\frac{1}{2} \times r \times r = \frac{72}{4}$ oe
10	1.4 oe	**1**	
11(a)	$3x(8x – 3y)$ final answer	**2**	**B1** for $3(8x^2 – 3xy)$ or $x(24x – 9y)$ or $3x(8x – 3y)$ seen then spoilt
11(b)	$7(3x + 2y)(3x – 2y)$ final answer	**3**	**B2** for $(21x + 14y)(3x – 2y)$ or $(3x + 2y)(21x – 14y)$ or $7(3x + 2y)(3x – 2y)$ seen then spoilt or **M1** for $7(9x^2 – 4y^2)$ or $[...](3x + 2y)(3x – 2y)$
12	5.6 oe	**3**	**M1** for $y = k\sqrt{x+1}$ oe **M1** for $y =$ *their* $k\sqrt{1.56+1}$ oe
13		**4**	**B1** for $y = 2$ solid line **B1** for $y = x – 1$ solid line **B1** for $y = –3$ dashed line **B1** for correct region identified satisfying the given inequalities
14(a)	2	**1**	
14(b)	240	**3**	**M2** for correct complete area statement e.g. $\frac{1}{2} \times 20 \times 10 + 7 \times 20$ oe or **M1** for one correct area

Question	Answer	Marks	Partial Marks
15	60835	**2**	**M1** for $40\,000\times\left(1+\frac{15}{100}\right)^3$ oe
16	$\frac{17}{20}$ oe	**1**	
17	52	**2**	**M1** for 360 – 90 – 90 – 128 oe or **B1** for [obtuse angle] *AOC* = 128 or *AOD* or *COD* = 64 or *DAO* or *DCO* = 90
18(a)		**3**	**B2** for three correctly placed or **B1** for two correctly placed or correct conversion of 8×10^{-1}, 8% and $\sqrt{0.08}$ to 0.8, 0.08, 0.2[8…] or 0.3
18(b)		**1**	
19(a)	858 or 857.7 to 857.9	**3**	**M2** for $\left[\frac{1}{2}\times\right]\frac{4}{3}\times\pi\times4.3^3+\pi\times4.3^2\times11.9$ oe or **M1** for $\left[\frac{1}{2}\times\right]\frac{4}{3}\times\pi\times4.3^3$ or $\pi\times4.3^2\times11.9$
19(b)	496 or 495.7 to 495.8…	**4**	**M3** for $\frac{1}{2}\times4\times\pi\times4.3^2+\pi\times4.3^2+2\times\pi\times4.3\times11.9$ oe OR **M1** for $\pi\times4.3^2\times k$ where k is a whole number **M1** for $2\times\pi\times4.3\times11.9$
20	7^{n-2} oe final answer	**2**	**M1** for recognition of terms being powers of 7

Question	Answer	Marks	Partial Marks
21	$2x^3 + 17x^2 + 38x + 15$ final answer	**3**	**B2** for correct expansion of the three brackets unsimplified or for simplified four-term expression of correct form with three terms correct or **B1** for correct expansion of two of the given brackets with at least three terms out of four correct
22	$[y =] -\frac{1}{5}x + 28$ final answer	**5**	**B1** for midpoint (20, 24) soi **M1** for [gradient =] $\frac{39-9}{23-17}$ oe **M1** for $\frac{-1}{\textit{their gradient}}$ **M1** for substitution of *their* midpoint into *their* $y = mx + c$ oe
23	4.2 oe	**3**	**M2** for $\sqrt[3]{1+\frac{72.8}{100}} \times 3.5$ oe or **M1** for $\frac{\sqrt[3]{172.8}}{\sqrt[3]{100}}$ oe or $\frac{\sqrt[3]{100}}{\sqrt[3]{172.8}}$ oe or $\frac{x^3}{3.5^3} = \frac{172.8}{100}$ oe

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MARK SCHEME NOTES

The following notes are intended to aid interpretation of mark schemes in general, but individual mark schemes may include marks awarded for specific reasons outside the scope of these notes.

Types of mark

M Method marks, awarded for a valid method applied to the problem.

A Accuracy mark, awarded for a correct answer or intermediate step correctly obtained. For accuracy marks to be given, the associated Method mark must be earned or implied.

B Mark for a correct result or statement independent of Method marks.

When a part of a question has two or more 'method' steps, the M marks are in principle independent unless the scheme specifically says otherwise; and similarly where there are several B marks allocated. The notation 'dep' is used to indicate that a particular M or B mark is dependent on an earlier mark in the scheme.

Abbreviations

awrt answers which round to
cao correct answer only
dep dependent
FT follow through after error
isw ignore subsequent working
nfww not from wrong working
oe or equivalent
rot rounded or truncated
SC Special Case
soi seen or implied

Question	Answer	Marks	Partial Marks
1(a)	64	**1**	
1(b)	61 or 67 or both	**1**	
2	7[h] 45 [min]	**1**	
3	$2p - 5t$ final answer	**2**	**B1** for $2p$ or $-5t$ in final answer or for $2p - 5t$ seen then spoilt
4(a)	85	**2**	**B1** for 8.5 or **M1** for *their* 8.5 × 10
4(b)	065	**1**	
5(a)	2	**1**	

Question	Answer	Marks	Partial Marks
5(b)	2.25	**3**	**M1** for [3×0] + 1×1 + 7×2 + 8×3 + [0×4] + [0×5] + 1×6 oe or for 45 **M1 dep** for $\frac{their\Sigma fx}{20}$ dep on first M1
6	190	**1**	
7	–1	**2**	**M1** for $5h - h = 3 - 7$ or $7 - 3 = h - 5h$ or better
8	$12b + 5m$	**2**	**B1** for $12b + km$ or $kb + 5m$ or correct answer seen and spoilt
9	156	**2**	**M1** for $180 - 360 \div 15$ oe or $\frac{180\times(15-2)}{15}$ oe
10	$\frac{9}{4}$ oe or $\frac{23}{12}$ oe | $1\frac{1}{4} - \frac{11}{12}$	**B1**	Correct step for dealing with mixed numbers Allow $\frac{9k}{4k}$ or $\frac{23k}{12k}$
	$\frac{27}{12}$ and $\frac{23}{12}$ | $[1]\frac{3}{12}$ and $\frac{11}{12}$	**M1**	Correct method to find common denominator e.g. $2\frac{3}{12}$ and $1\frac{11}{12}$
	$\frac{1}{3}$ cao	**A1**	
11	[p =] 2 [q =] $-\frac{1}{2}$ oe	**2**	**B1** for each
12	V^3y final answer	**2**	**M1** for $V^3 = \frac{x}{y}$
13(a)	$29 - 8n$ oe final answer	**2**	**B1** for $k - 8n$ or $29 - cn$ $c \neq 0$, or $29 - 8n$ seen then spoilt
13(b)	$5\times 2^{n-2}$ oe final answer	**2**	**B1** for 2^k or correct answer seen and spoilt
14(a)(i)	41	**1**	
14(a)(ii)	37	**1**	

Question	Answer	Marks	Partial Marks
14(b)	130	**2**	**M1** for $2(180-115)$ or $360-2\times115$ or for reflex $POR = 230$ or for an opposite angle in cyclic quad drawn in and labelled 65
15(a)	28	**1**	
15(b)	33	**1**	
16	9.4[0] or 9.403...	**3**	**M2** for $\sin 33.14 = \frac{\text{dist}}{17.2}$ oe or **M1** for recognition that the line from C is perpendicular to AB
17(a)	$6x^{15}$ final answer	**2**	**B1** for kx^{15} or $6x^{c}$ as final answer or correct answer seen and spoilt
17(b)	$25y^{50}$ final answer	**2**	**B1** for ky^{50} or $25y^{c}$ as final answer or correct answer seen and spoilt
18	7.2	**3**	**M2** for $4.8\times\sqrt[3]{\frac{81}{24}}$ oe or **M1** for $\sqrt[3]{\frac{81}{24}}$ oe or for $\left(\frac{4.8}{h}\right)^3 = \frac{24}{81}$ oe
19	$[y =]\ \frac{6}{\sqrt{x+2}}$ oe final answer	**2**	**M1** for $y = \frac{k}{\sqrt{x+2}}$ oe
20	116.6 and 296.6	**3**	**B2** for one correct answer or **M1** for $\tan x = -2$ If 0 or M1 scored, **SC1** for two angles with a difference of 180 in range from 0 to 360
21(a)	$(B\cup C)\cap A'$ oe	**1**	
21(b)	5	**1**	

Question	Answer	Marks	Partial Marks
22	17.1 or 17.10...	**4**	**M3** for $\tan = \frac{4}{\sqrt{12^2+5^2}}$ oe or **M2** for $12^2 + 5^2$ oe or $12^2+5^2+4^2$ oe or **M1** for recognising angle *PBD*
23	$(x+4)^2-23$ final answer	**2**	**B1** for $(x+4)^2$
24	7 nfww	**3**	**M2** for $\frac{150\text{to}151}{22-0.5}$ or for $\frac{150+0.5}{21\text{to}22}$ oe or **M1** for 150 + 0.5 or 150 – 0.5 or 22 + 0.5 or 22 – 0.5 oe seen
25	$\frac{3x-2}{1+y}$ final answer	**4**	**B2** for $(3x-2)(1-y)$ or $(2-3x)(y-1)$ or **B1** for $3x-2-y(3x-2)$ or for $3x(1-y)-2(1-y)$ **B1** for $(1-y)(1+y)$ or $(y-1)(-1-y)$ or $-(y-1)(1+y)$
26	$-\frac{1}{3}\mathbf{a} + \frac{4}{3}\mathbf{b}$ oe final simplified answer	**4**	**B3** for correct unsimplified answer or **B2** for $\overrightarrow{OK}$ or $\overrightarrow{KC} = \frac{1}{3}\mathbf{a} + \frac{2}{3}\mathbf{b}$ oe or **M1** for $\overrightarrow{AK} = \frac{2}{3}$ (–**a** + **b**) oe or $\overrightarrow{BK} = \frac{1}{3}$ (–**b** + **a**) oe or a correct vector route for $\overrightarrow{AC}$ along lines in diagram

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MATHEMATICS **0580/21**

Paper 2 (Extended) **May/June 2024**

MARK SCHEME

Maximum Mark: 70

Published

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GENERIC MARKING PRINCIPLE 2:

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

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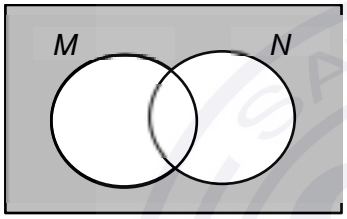
Question	Answer	Marks	Partial Marks
1	(–3, 7)	**2**	**B1** for correct diagram or correct coordinates for *their* point *D* or for $(-3,k)$ or $(k,7)$
2(a)	0.4 oe	**1**	
2(b)	42 0.2 0.2	**2**	**B1** for 42 **B1** for 0.2 and 0.2 If B0 scored **SC1** for *their* two probabilities being half *their* **(a)**
3(a)	40 –275	**2**	**B1** for each
3(b)	24	**2**	**B1** for 324 or 289 or $\sqrt{300}$ or 17.3…
4	35	**2**	**B1** for answer 5, 7 or 70 or **M1** for 2 × 2 × 5 × 7 and 2 × 3 × 5 × 7 or two correct factor trees or tables or 5 × 7 × *k* seen
5(a)	0.6 or $\frac{3}{5}$	**1**	
5(b)	1024	**1**	
6	145	**3**	**M1** for 180 ÷ 6 or any angle congruent to *BCD* = 30 **M1** for (360 – 40 – *their* 30) ÷ 2 oe
7(a)	146 or 146.2 to 146.3	**3**	**M1** for $\frac{1}{2}\times 12.8\times 12.8$ **M1** for $\left[\frac{1}{2}\times\right]\pi\times\left(\frac{12.8}{2}\right)^2$

Question	Answer	Marks	Partial Marks
7(b)	51[.0] or 51.00 to 51.01…	**4**	**M1** for $\frac{1}{2}\times\pi\times12.8$ **M2** for $\sqrt{12.8^2+12.8^2}$ or $\frac{12.8}{\sin 45}$ oe or **M1** for $12.8^2+12.8^2$ oe or $\sin 45=\frac{12.8}{KL}$ oe
8	$7n + 4$ oe final answer	**2**	**B1** for $7n + j$ or $kn + 4$ $k \neq 0$, or $7n + 4$ seen then spoilt
9	3375	**2**	**M1** for $8000\times\left(1-\frac{25}{100}\right)^3$ oe
10	1.25 or 1.250…	**3**	**M2** for $\sqrt[8]{\frac{1656.73}{1500}}$ oe or **M1** for $1656.73 = 1500(k)^8$ oe for any k
11	$y < x$ $x < 6$ $1 \leqslant y \leqslant 5$ oe	**4**	**B1** for $y < x$ **B1** for $x < 6$ **B2** for $1 \leqslant y \leqslant 5$ or **B1** for $y \geqslant 1$ or $y \leqslant 5$ If B0 scored, **SC2** for $y \leqslant x$, $x \leqslant 6$ and $1 < y < 5$ oe or **SC1** for three correct from $y = x$, $x = 6$, $y = 1$ and $y = 5$
12	Correctly equating one set of coefficients	**M1**	
	Correct method to eliminate one variable	**M1**	
	$x = 10$, $y = –2$	**A2**	**A1** for $x = 10$ **A1** for $y = –2$ If M0 scored **SC1** for 2 values satisfying one of the original equations.
13	62	**3**	**B2** for $m = 20$ or **M1** for $5m + 4m = 180$ soi or $p + 4m + 38 = 180$ soi

Question	Answer	Marks	Partial Marks
14	221 or 220.5 to 220.6	**3**	**M2** for $\frac{360-48}{360}\times\pi\times9^2$ or **M1** for $\frac{k}{360}\times\pi\times9^2$ where $k < 360$ or **B1** for 312
15	$146.\dot{4}\dot{6} - 1.\dot{4}\dot{6}$ oe	**M1**	
	$\frac{29}{198}$ cao	**A2**	**Al** for $\frac{145}{990}$ oe If M0 scored **SC1** for $\frac{k}{990}$ with insufficient working.
16(a)		**1**	
16(b)	17	**1**	
17	19.5 or 19.52…	**2**	**M1** for $\frac{1}{2}$ × 6.7 × 5.9 × sin 81 oe
18	$y = 2x$ ruled	**B1**	
	$x = –0.5$ to $–0.55$ $x = 0.85$ to 0.9	**B2**	**B1** for –0.5 to –0.55 **B1** for 0.85 to 0.9
19(a)	$3(2m + 5t)(2m – 5t)$ final answer	**3**	**B2** for $(6m + 15t)(2m – 5t)$ or $(2m + 5t)(6m – 15t)$ or **B1** for $3(4m^2 – 25t^2)$ or $(2m + 5t)(2m – 5t)$
19(b)	$(x + 3)(y + 5)$ final answer	**2**	**B1** for $x(y + 5) + 3(y + 5)$ or $y(x + 3) + 5(x + 3)$
20	218.7, 321.3	**3**	**B2** for one correct or **M1** for $\sin x = -\frac{5}{8}$ oe If M1 or 0 scored, **SC1** for two reflex angles with a sum of 540 or two non-reflex angles with a sum of 180

Question	Answer	Marks	Partial Marks
21	33.2 or 33.18…	**4**	**M3** for $\tan = \frac{6.5}{\sqrt{4^2 + 9.1^2}}$ oe or **M2** for $4^2 + 9.1^2$ oe or $4^2 + 9.1^2 + 6.5^2$ oe or **M1** for recognising the angle *ECH*
22	0.225 oe	**4**	**M3** for $\left(1 - \frac{0.25}{0.4}\right) \times (1 - 0.4)$ oe OR **M2** for $\frac{0.25}{0.4}$ or **M1** for $0.4 \times p = 0.25$ oe **M1** for (1 – *their*P(Jen red))×(1 – 0.4) oe

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MATHEMATICS **0580/22**

Paper 2 (Extended) **May/June 2024**

MARK SCHEME

Maximum Mark: 70

Published

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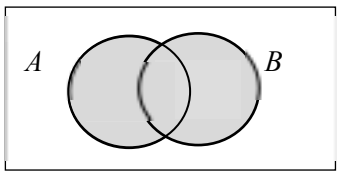
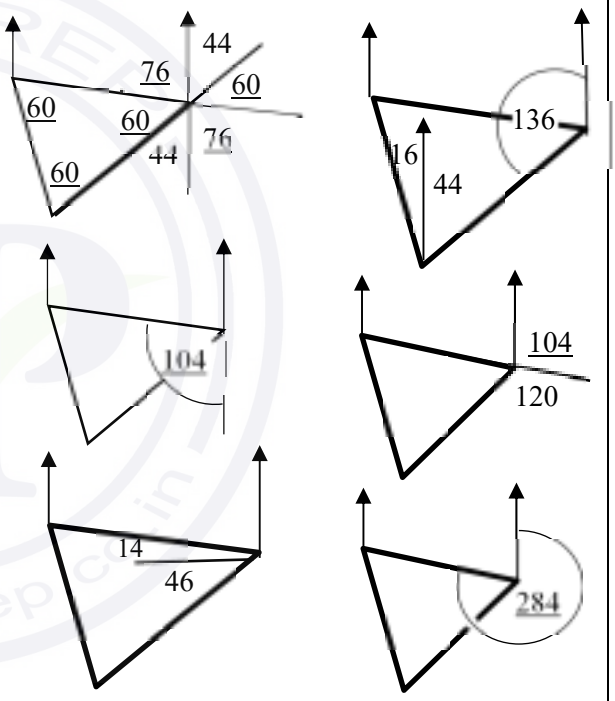
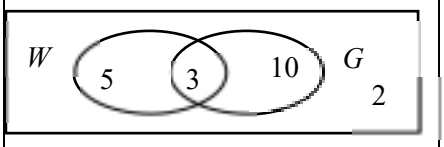
soi seen or implied

Question	Answer	Mark	Partial Marks
1	29	**1**	
2	41.7[0]	**2**	**M1** for $6.55 \times 4 + 15.5$
3(a)	Correct table **2** | **2 8** **3** | **6 9** **4** | **1 4 8 9** **5** | **2 4 7 7**	**2**	**B1** for two rows correct or for fully correct unordered stem-and-leaf diagram
3(b)	46	**1**	
4	$\frac{1}{6}$ or equivalent fraction	**3**	**B2** for $\frac{625}{750}$ oe or **M2** for $750 - \frac{750}{4} - 437.5$ oe or **M1** for $750 - \frac{750}{4}$ oe or $\frac{750}{4} + 437.5$ oe or $\frac{437.5}{750}$ oe
5	13 05 or 1 05pm	**2**	**M1** for 47 [minutes]
6	0.046 cao	**1**	

Question	Answer	Mark	Partial Marks
7		**1**	
8	1.75	**3**	**M2** for $\frac{(5700-5000)[\times 100]}{5000\times 8}$ oe or $\frac{(5700-5000)\times 100}{5000[\times 8]}$ oe or **M1** for [5700 – 5000] $= \frac{5000\times 8\times r}{100}$ oe or **B1** for 87.5 or 0.14 or 1.14 If 0 scored **SC1** for answer 14.25
9(a)	Enlargement [s f] 2 [centre] $(1,-1)$	**3**	**B1** for each
9(b)	image at $(-1,\ 4)(-1,\ 5)(1,\ 4)$	**2**	**B1** for translation by $\begin{pmatrix}-4\\k\end{pmatrix}$ **or** $\begin{pmatrix}k\\3\end{pmatrix}$
10	1.74×10^{5}	**1**	
11	93	**2**	**M1** for $\frac{3}{40}[\times 1240]$ oe or $\frac{1240}{40}[\times 3]$ oe or $\frac{40}{3}=\frac{1240}{x}$ oe
12	52.6 or 52.61 to 52.62	**2**	**M1** for $\cos[\ldots=]\frac{8.5}{14}$ oe
13	$\frac{9}{4}\times\frac{8}{15}$ oe or $\frac{18}{8}\div\frac{15}{8}$ oe with common denominator	**M2**	**B1** for $\frac{9}{4}$ oe or $\frac{15}{8}$ oe or **M1** for $\frac{their\,9}{4}\times\frac{8}{their\,15}$ oe
	$1\frac{1}{5}$ cao	**A1**	dep on M2

Question	Answer	Mark	Partial Marks
14	$y = \frac{1}{2}x + 2$ oe	**2**	**M1** for $\frac{6-2}{8-0}$ oe or for $y = kx + 2$
15	224	**3**	**M2** for a fully correct method e.g. 360 – (180 – 104 + 60) oe or **B2** for 120, 136, 44, 46, 14, or 16 in the correct position or **B1** for 60, 76, 104 or 284 in the correct position or for interior angle of triangle = 60 i.e. these positions for B2 or B1: 
16(a)	0.2 oe	**1**	
16(b)	4240	**3**	**M2** for $\frac{1}{2} \times (210 + 320) \times 16$ oe or **M1** for one area correct
17		**2**	**B1** for 2 sections out of 4 correct
18(a)	tangent ruled at $x = 3$	**1**	

Question	Answer	Mark	Partial Marks
18(b)	4.8 to 5.8	**2**	dep on a close attempt at a tangent **M1** for $\frac{\text{rise}}{\text{run}}$ also dep on close attempt at tangent
19(a)	12	**3**	**M1** for $y = k(x-1)^2$ oe **M1** for $y = \textit{their}\ k(7-1)^2$ oe
19(b)	divided by 3 oe	**1**	
20	3.9	**3**	**M2** for $5.2 \times \sqrt[3]{\frac{33.75}{80}}$ oe or **M1** for $\frac{\sqrt[3]{33.75}}{\sqrt[3]{80}}$ oe or $\frac{\sqrt[3]{80}}{\sqrt[3]{33.75}}$ oe or $\frac{h^3}{5.2^3} = \frac{33.75}{80}$ oe
21	$4x^2 + 3x - 85[= 0]$ or $16y^2 - 113y + 7[= 0]$ oe simplified	**M2**	**M1** for $4(x^2 - 18) + 3x = 13$ or $x^2 - 18 = \frac{13-3x}{4}$ or $y = \left(\frac{13-4y}{3}\right)^2 - 18$ oe or better
	correct method to solve *their* quadratic equation e.g. factors, quadratic formula, completing the square	**M1**	$\frac{-3 \pm \sqrt{3^2 - 4\times4\times-85}}{2\times4}$ oe, $(4x - 17)(x + 5)$ $\frac{-(-113) \pm \sqrt{(-113)^2 - 4\times16\times7}}{2\times16}$ oe, $(16y - 1)(y - 7)$
	$x = -5$ $y = 7$ $x = \frac{17}{4}$ oe $y = \frac{1}{16}$ oe	**B2**	**B1** for one correct pair or two correct x values or two correct y values If B0 scored and at least 2 method marks scored, **SC1** for correct substitution of both of their x values or their y values into $4y + 3x = 13$ or $y = x^2 - 18$
22(a)(i)	cubic	**1**	
22(a)(ii)	reciprocal	**1**	

Question	Answer	Mark	Partial Marks
22(b)(i)	correct sine curve sketch through (0, 0), (180, 0) and (360, 0) 	**2**	**M1** for correct sine curve shape through the origin
22(b)(ii)	203.6 and 336.4	**3**	**B2** for one correct or **M1** for $\sin x = -0.4$ oe If 0 or M1 scored, **SC1** for two reflex angles with a sum of 540 or two non-reflex angles with a sum of 180
23(a)	15	**1**	
23(b)	$\frac{1}{2}$ oe nfww	**2**	**M1** for $\frac{2+3}{2+1+3+4}$ oe or $1-\frac{4+1}{2+1+3+4}$ oe with either the numerator or denominator correct
24(a)	$\frac{1}{2}\mathbf{b}-\frac{2}{3}\mathbf{a}$	**2**	**B**1 for answer $\frac{1}{2}\mathbf{b}+k\mathbf{a}$ or $j\mathbf{b}-\frac{2}{3}\mathbf{a}$ or correct unsimplified in terms of **a** and **b**
24(b)	$\frac{5}{4}\mathbf{b}$	**3**	**M2** for $\overrightarrow{RS}=\frac{1}{4}\mathbf{b}$ oe or $\overrightarrow{MS}=\frac{3}{2}\left(\frac{1}{2}\mathbf{b}-\frac{2}{3}\boldsymbol{a}\right)$ oe or $\overrightarrow{NS}=\frac{1}{2}\left(\frac{1}{2}\mathbf{b}-\frac{2}{3}\boldsymbol{a}\right)$ oe or **M1** for a correct route in terms of vertices and/or **a** and/or **b** or **B**1 for answer $j\mathbf{b}$ where $j > 1$ or $\overrightarrow{RS}=\frac{1}{2}\overrightarrow{MQ}$, $\overrightarrow{RS}=\frac{1}{4}\overrightarrow{OR}$, oe $\overrightarrow{NS}=\frac{1}{2}\overrightarrow{MN}$, $\overrightarrow{MS}=\frac{3}{2}\overrightarrow{MN}$ $\overrightarrow{NS}=\frac{1}{3}\overrightarrow{MS}$

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MATHEMATICS **0580/23**

Paper 2 (Extended) **May/June 2024**

MARK SCHEME

Maximum Mark: 70

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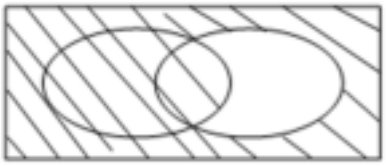
Question	Answer	Marks	Partial Marks
1	2 002 002	**1**	
2	$5 – (4 \times 3 – 9) – 2$	**1**	
3	$6x – 9y$ or $3(2x – 3y)$ final answer	**2**	**B1** for $6x$ or $– 9y$ in final answer or $6x – 9y$ seen then spoilt
4	4	**2**	**M1** for $10 \times 7 \times [...] = 280$ oe or better
5	0.85 oe	**1**	
6	$xy(4x – 5y)$ final answer	**2**	**B1** for $y(4x^2 – 5xy)$ or $x(4xy – 5y^2)$ or $xy(4x – 5y)$ seen then spoilt
7	14.8	**2**	**M1** for 1 cm represents 0.4 km soi or **B1** for figs 148 as answer
8	$\frac{6}{14}$ and $\frac{1}{14}$ oe	**M1**	Allow any correct denominator $14k$
	$\frac{5}{14}$ cao	**A1**	
9	6.39 or 6.389...	**2**	**M1** for $\cos 37 = \frac{AB}{8}$ oe
10	$-\frac{6}{5}$ oe	**2**	**M1** for $\frac{1-7}{3--2}$ oe
11	$[t =] 3$ $[w =] –2$	**2**	**B1** for each
12(a)	$2g^8$ final answer	**2**	**B1** for final answer kg^8 or $2g^k$ or correct answer seen then spoilt
12(b)	$125k^6$ final answer	**2**	**B1** for final answer ck^6 or $125k^c$ or correct answer seen then spoilt

Question	Answer	Marks	Partial Marks
13(a)		**1**	
13(b)	$R \cap (P \cup Q)'$ or $R \cap P' \cap Q'$ oe	**1**	
14(a)	50	**1**	
14(b)	24	**2**	**B1** for angle $PQR = 132$ soi or **M1** for $\frac{180-(180-48)}{2}$
15(a)	11	**2**	**B1** for 16 or 27 seen
15(b)	6	**2**	**M1** for 194 seen
16	$\frac{A-\pi r^2}{\pi d}$ oe final answer	**2**	**M1** for $A-\pi r^2 = \pi dh$ or $\frac{A}{\pi d} = \frac{\pi r^2}{\pi d} + h$ or $\frac{A}{\pi} - r^2 = dh$
17(a)	1.68×10^{203}	**2**	**B1** for 16.8×10^{202}
17(b)	2.31×10^{101}	**2**	**B1** for figs 231
18	25	**3**	**B2** for [y =] 14.4 oe or **M1** for $y + 11.5y = 180$ or for 360 ÷ *their y*
19(a)	Rotation 90° clockwise oe (0, –2)	**3**	**B1** for each
19(b)	Triangle at (–5, –1), (–5, –7), (–7, –7)	**2**	**B1** for enlargement s.f. –2 in wrong position
20(a)	5	**2**	**M1** for $3^x + 2 = 245$
20(b)	2189	**2**	**M1** for $x = f(7)$ or $3^7 + 2$
21	41.11...– 4.11... oe	**M1**	
	$\frac{37}{90}$ cao	**A1**	If **M0** scored **SC1** for answer $\frac{37}{90}$ with insufficient working.

Question	Answer	Marks	Partial Marks
22	120, 300	**3**	**B2** for one correct or **M1** for tan $x = -\sqrt{3}$ oe If 0 or M1 scored **SC1** for answers with difference of 180
23	$\frac{-y-3}{y(y+1)}$ or $\frac{-y-3}{y^2+y}$ or $-\frac{y+3}{y(y+1)}$ or $-\frac{y+3}{y^2+y}$ final answer	**3**	**B1** for $2y-3(y+1)$ oe **B1** for common denominator $y(y+1)$ or y^2+y isw
24	14.2 or 14.19 to 14.20	**4**	**M3** for tan = $\frac{4}{\sqrt{15^2+5^2}}$ oe or **M2** for 15^2+5^2 or $15^2+5^2+4^2$ or **M1** for recognition of angle *VAC*
25	$\frac{1-p}{1+t}$ oe final answer	**4**	**B2** for $(p-1)(t-1)$ oe or **B1** for $p(t-1)-(t-1)$ or $t(p-1)-(p-1)$ **B1** for $(1-t)(1+t)$ oe
26	$\frac{4}{3}\mathbf{p}+\frac{2}{3}\mathbf{q}$ oe	**4**	**B3** for correct unsimplified answer or for $\overrightarrow{OR}=\mathbf{p}+\frac{1}{3}\mathbf{q}-\frac{1}{3}\mathbf{p}$ oe or **M2** for $\overrightarrow{PR}=\frac{1}{3}(-\mathbf{p}+\mathbf{q})$ oe or $\overrightarrow{QR}=\frac{2}{3}(-\mathbf{q}+\mathbf{p})$ oe or **M1** for $\overrightarrow{PQ}=-\mathbf{p}+\mathbf{q}$ oe or $\overrightarrow{QP}=-\mathbf{q}+\mathbf{p}$ oe or a correct route from *O* to *S*.

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MATHEMATICS **0580/22**

Paper 2 (Extended) **February/March 2024**

MARK SCHEME

Maximum Mark: 70

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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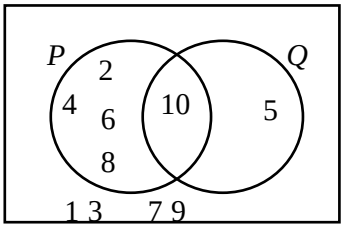
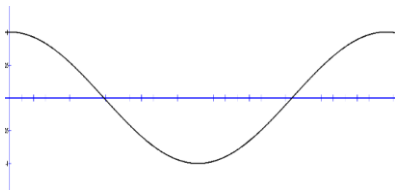
Abbreviations

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	7h 28min	**1**	
2	24.352	**1**	
3	$3m+10k$ final answer	**2**	**B1** for $3m$ or $10k$ in final answer or for $3m+10k$ seen and spoilt
4	$a = 18$ $b = 10$ $c = 4$ $d = 9$	**4**	**B1** for each If 0 scored, **SC1** for b or c = 4, 5 or 10
5(a)	54	**2**	**M1** for $\frac{3}{20}[\times 360]$ oe or $\frac{360}{20}[\times 3]$ oe
5(b)	$\frac{17}{20}$ oe	**1**	
6	$\begin{pmatrix}-10\\3\end{pmatrix}$ final answer	**1**	
7	Positive	**1**	
8(a)	–2 1 6	**2**	**B1** for any 2 correct in correct position If 0 scored **SC1** for $-3-2$ 1
8(b)	3^{n-1}	**2**	**B1** for 3^{an+k} , $a \neq 0$ or 3^c for any integer c>1
9	$(4,3)$	**2**	**B1** for each or **M1** for $3 = 2x - 5$ or better
10	26.6	**2**	**M1** for $\frac{1}{2}\times(5.3+8.7)\times 3.8$ oe

Question	Answer	Marks	Partial Marks
11	$\frac{5}{4}$ or $\frac{1}{4}+\frac{1}{6}$	**B1**	Correct method for dealing with mixed number Allow $\frac{5k}{4k}$
	$\frac{15}{12}$ and $\frac{10}{12}$	**M1**	Correct method to find common denominator e.g. $[1]\frac{3}{12}$ and $\frac{10}{12}$
	$\frac{5}{12}$ cao	**A1**	
12	14	**1**	
13	287	**2**	**M1** for 360 – (180 – 107) oe or indicates correct angle on a diagram
14	146 cao	**3**	**M2** for $\frac{1750+480}{55\times1000}\times60\times60$ oe or **M1** for distance = 1750 + 480 oe or $\frac{55\times1000}{60\times60}$ oe soi or correctly writing *their* whole number of seconds from a more accurate answer seen
15(a)(i)	reflection $x = -2$	**2**	**B1** for each
15(a)(ii)	enlargement [sf] $\frac{1}{2}$ $(-3,-4)$	**3**	**B1** for each
15(b)	Image at $(0,3)$, $(-4,3)$, $(-3,-1)$	**2**	**B1** for correct size and orientation, wrong centre
16		**2**	**B1** for two sections correct out of four

Question	Answer	Marks	Partial Marks
17	138.425	**4**	**M1** for mid-points soi (110, 125, 140, 170) **M1** for use of Σfh with h in correct interval including both boundaries **M1** for (dep on 2nd M1) for Σfh ⩾ 200
18	$14x^3$	**2**	**B1** for $14x^k$ or $7x^3$ or $2x^3$
19	2325	**3**	**M2** for correct method for total area e.g. $\frac{1}{2}\times 15\times(190+120)$ or **M1** for correct method for one area e.g. $\frac{1}{2}\times 20\times 15$, (140 – 20) × 15 or $\frac{1}{2}\times(190-140)\times 15$ oe
20	5.36 or 5.360 to 5.361	**2**	**M1** for $\frac{1}{2}\times 5.6\times 4.9\times \sin 23$ oe
21(a)	$\frac{1}{5}$ oe	**1**	
21(b)	$64x^9$	**2**	**B1** for $64x^k$ or kx^9 as final answer or correct answer spoiled
22	$[y=]\frac{24}{(x+3)^2}$ oe final answer	**2**	**M1** for $y=\frac{k}{(x+3)^2}$
23(a)	 Correct sketch to go through (0, 1), close to (360, 1) and reasonably close to (180, –1)	**2**	**M1** for correct cosine curve shape through (0, 1)
23(b)	72.9 and 287.1	**2**	**B1** for one correct If 0 scored, **SC1** for two angles with a sum of 360

Question	Answer	Marks	Partial Marks
24	[a =] 64 [b =] −8	**2**	**B1** for each or for both $(x-8)^2$ and $x^2-16x+64$
25	$\frac{2}{3}$ oe nfww	**4**	**M3** for $\frac{2}{13}\times\frac{11}{12}+\frac{5}{13}\times\frac{8}{12}+\frac{6}{13}\times\frac{7}{12}$ oe or $1-\left(\frac{2}{13}\times\frac{1}{12}+\frac{5}{13}\times\frac{4}{12}+\frac{6}{13}\times\frac{5}{12}\right)$ oe or **M2** for sum of three or more correct product pairs and no incorrect pairs or for $\frac{2}{13}\times\frac{1}{12}+\frac{5}{13}\times\frac{4}{12}+\frac{6}{13}\times\frac{5}{12}$ and no other pairs or **M1** for $\frac{j}{13}\times\frac{k}{12}$ If 0 scored **SC1** for answer $\frac{104}{169}$ oe
26	$y=\frac{2}{3}x+\frac{4}{3}$ final answer	**5**	**B1** for midpoint $(4,4)$ soi **M1** for [gradient AB =] $\frac{7-1}{2-6}$ oe **M1** for [m =] $\frac{-1}{\textit{their}\text{ gradient of }AB}$ **M1** for substituting *their* midpoint into $y=(\textit{their}\ m)x+c$ dep on at least M1 earned

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MATHEMATICS **0580/21**

Paper 2 (Extended) **October/November 2023**

MARK SCHEME

Maximum Mark: 70

Published

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[Turn over

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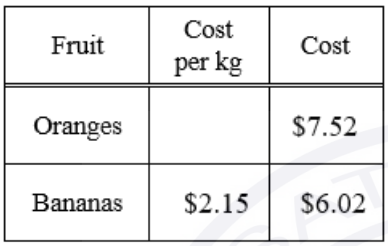
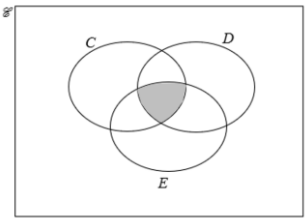
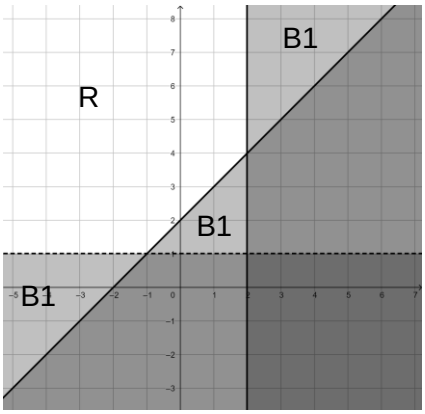
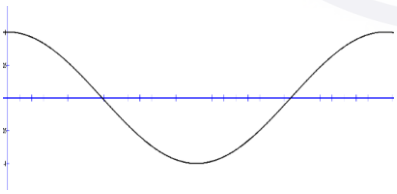
isw – ignore subsequent working
oe – or equivalent
SC – Special Case
nfww – not from wrong working
soi – seen or implied

Question	Answer	Marks	Partial Marks
1	98	**2**	**M1** for $x + 41 + 41 = 180$ oe or better
2(a)	27	**1**	
2(b)	15	**1**	
2(c)	25	**1**	
3(a)	5	**1**	
3(b)	90	**1**	
4		**3**	**B1** for 7.52 **B1** for 6.02 or **B1FT** for 13.54 – *their* 7.52 correctly evaluated provided *their* 7.52 < 13.54 **B1FT** for *their* 6.02 ÷ 2.8 correctly evaluated
5(a)	$7m(6k – 5)$ final answer	**2**	**B1** for $7(6mk – 5m)$ or $m(42k – 35)$ as final answer or $7m(6k – 5)$ seen and then spoiled
5(b)	$(h + 12)(h – 12)$ final answer	**1**	
6(a)	4800	**1**	
6(b)	Point plotted at (54 000, 6100)	**1**	
6(c)	Positive	**1**	
7	260	**1**	
8	24 cao	**1**	
9	14	**2**	**B1** for answer 2 or 7 or **M1** for 2×7 as final answer or [140 =] $2 \times 2 \times 5 \times 7$ and [126 =] $2 \times 3 \times 3 \times 7$ or 2 correct factor trees or tables
10(a)	n^6 final answer	**1**	
10(b)	$4x^4$ final answer	**2**	**B1** for kx^4 or $4x^k$ as final answer or correct answer seen and then spoiled
10(c)	$9y^8$ final answer	**2**	**B1** for ky^8 or $9y^k$ final answer or correct answer seen and spoiled

Fruit	Cost per kg	Cost
Oranges		$7.52
Bananas	$2.15	$6.02

Question	Answer	Marks	Partial Marks
11	$x \geqslant 11$ final answer	**3**	**M1** for $8x - 12 \geqslant 43 + 3x$ or better **M1** for e.g. $8x - 3x \geqslant 43 + 12$ oe OR **M1** for $2x - 3 \geqslant \frac{43}{4} + \frac{3x}{4}$ **M1** for $2x - \frac{3x}{4} \geqslant \frac{43}{4} + 3$
12	42.22… – 4.22… oe	**M1**	**M1** for correct working shown
	$\frac{19}{45}$ cao	**A2**	**A1** for $\frac{38}{90}$ oe seen If **M0** scored **SC1** for $\frac{k}{90}$ or for answer $\frac{19}{45}$ with insufficient working.
13	23 903 cao	**3**	**B2** for answer 23900, 23902, 23902.9… or 23 903 seen then rounded OR **M1** for $27\,000 \times \left(1 - \frac{3}{100}\right)^4$ oe **B1** for *their* more accurate value seen and correctly rounded to the nearest whole number
14(a)	9	**3**	**B2** for $x = 4$ or **B1** for answer 4 (without $x = 4$ in working) OR **M1** for $5x + x + 5 + 12 - x + 15 = 52$ oe or better **B1FT** for identifying the correct region $A \cap B$
14(b)		**1**	

Question	Answer	Marks	Partial Marks
15		**5**	**B1** for $y = 1$ dashed line **B1** for $x = 2$ solid line **B1** for $y = x + 2$ solid line **B2** for region identified satisfying all 3 inequalities or **B1** for region identified satisfying only 2 of these inequalities with $y = 1$, $x = 2$ and $y = x + 2$ all drawn
16	[Lower bound =] 39.9 nfww [Upper bound =] 42.1 nfww	**3**	**B2** for one correct or **M1** for 11 + 0.5 or 9.5 + 0.05 or 11 – 0.5 or 9.5 – 0.05
17	33	**3**	**B2** for $254 + 20 + x + 53 = 360$ oe or better or $53 + 20 + x + 37 + 37 = 180$ oe or better or $OAB = 33$ or $AOB = 114$ or 70 and 37 correctly identified or 53 and 20 correctly identified or **B1** for any correct relevant angle identified
18	29.7 or 29.66[...]	**3**	**M2** for $[\sin y =] \dfrac{8.3\sin 105}{16.2}$ or **M1** for $\dfrac{16.2}{\sin 105} = \dfrac{8.3}{\sin y}$ oe
19(a)	 Correct sketch to go through (0, 1), close to (360, 1) and reasonably close to (180, –1)	**2**	**B1** for correct cosine curve shape through (0,1)
19(b)	282.1 or 282.12…	**2**	**B1** implied by 77.9 or 77.87 to 77.88 or 282.13 or **M1** for 360 – *their* acute angle
20(a)	$\dfrac{10x}{x+5}$ final answer	**3**	**B1** for $10x(x – 6)$ **B1** for $(x – 6)(x + 5)$

Question	Answer	Marks	Partial Marks
20(b)	$\frac{61x+8}{(x+3)(8x-1)}$ final answer	**3**	**B1** for common denominator of $(x + 3)(8x – 1)$ isw **B1** for $7(8x – 1) + 5(x + 3)$ or better isw
21	55.9 or 55.85…	**4**	**M3** for $\tan[\ldots] = \frac{15.1}{\sqrt{4.5^2 + 9.2^2}}$ oe or **M2** for $[AH^2 =] 4.5^2 + 9.2^2$ or $[BH^2 =] 4.5^2 + 9.2^2 + 15.1^2$ or **M1** for recognising angle *BHA* if 0 scored **SC1** for [angle *BHD* =] 59.7[1…] or 59.72
22	110 or 110.3…	**4**	**M3** for $[2 \times] (2(\frac{1}{2} \times 13.6^2 \times \sin 41) – (\frac{41}{360} \times \pi \times 13.6^2))$ oe OR **M1** for $\left[\frac{1}{2}\times\right] 13.6^2 \times \sin 41$ oe **M1** for $[2\times] \frac{41}{360} \times \pi \times 13.6^2$ oe

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Mathematics-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.

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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
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SC – Special Case
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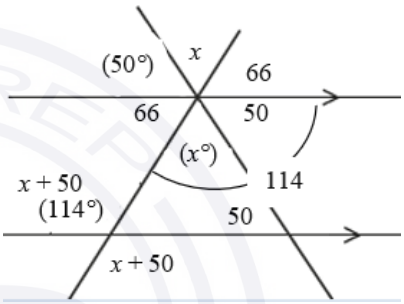
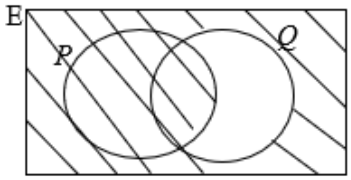
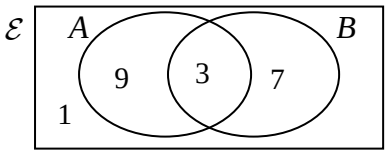
soi – seen or implied

Question	Answer	Marks	Partial Marks
1(a)	24.08 cao	**1**	
1(b)	20 cao	**1**	
2	–14	**1**	
3	16	**2**	**B1** for –14 or **M1** for $30 - 2 \times 7$
4	0.062	**1**	
5	64	**2**	**B1** for any of these angles labelled on the diagram  or **M1** for $x + 50 = 114$ or better
6(a)	Multiple of 3 or multiple of 37	**1**	
6(b)	113	**1**	
7	231	**2**	**B1** for any of these angles in correct place on diagram 51 or 129 or 141 between east line drawn from *P* and *QP* or 39 between west line drawn from *P* and *QP* or indicating the correct bearing of *Q* from *P* on the diagram or **M1** for $180 + (90 - 39)$ oe or $360 - (90 + 39)$ oe
8	$\frac{25}{8}$ or $\frac{7}{4}$ $2\frac{1}{8} - \frac{3}{4}$	**B1**	Correct step for dealing with mixed numbers Allow $\frac{25k}{8k}$ or $\frac{7k}{4k}$
	$\frac{25}{8}$ and $\frac{14}{8}$ $2\frac{1}{8}$ and $\frac{6}{8}$ oe	**M1**	Correct method to find common denominator e.g. $3\frac{1}{8} - 1\frac{6}{8}$, $\frac{100-56}{32}$

Question	Answer	Marks	Partial Marks
	$1\frac{3}{8}$ cao	**A1**	
9	$2 \times 3 \times 3 \times 5$ or $2 \times 3^2 \times 5$	**2**	**B1** for 2, 3, 3, 5 or **M1** for correct factor tree/diagram/list/table.
10	$5w - t$ final answer	**2**	**B1** for $2t + 2w$ or $3w - 3t$ or for $5w - t$ seen then spoiled or for $5w$ or $-t$ in the final answer
11(a)	3.5	**2**	**M1** for $\frac{9}{5} = \frac{6.3}{h}$ oe
11(b)	51.84	**2**	**M1** for $\left(\frac{9}{5}\right)^2$ or $\left(\frac{5}{9}\right)^2$ oe or $\left(\frac{6.3}{their(a)}\right)^2$ or $\left(\frac{their(a)}{6.3}\right)^2$ oe
12(a)	2.5 oe	**1**	
12(b)	140	**2**	**M1** for a correct area e.g. 10×12, $\frac{1}{2} \times 4 \times 10$, $0.5 \times (16 + 12) \times 10$
13(a)	1.2 oe	**2**	**B1** for 3^{2p+3p} or 3^6 soi
13(b)	$2x^2$ final answer	**2**	**B1** for kx^2 or $2x^k$ as final answer or correct answer spoiled
14	$[\pm]\sqrt{\frac{y+x}{2}}$ oe final answer	**3**	**M1** for isolating term in w **M1** for division by 2 **M1** for square root Max 2 marks if answer incorrect
15(a)		**1**	
15(b)		**2**	**B1** for two correct or for n(A) =12 **and** n(B) = 10 **and** n($A \cap B$) ≠ 0
16	$24x^{12}$ final answer	**2**	**B1** for $24x^k$ or kx^{12} in final answer

Question	Answer	Marks	Partial Marks
17(a)	62	**2**	**B1** for angle *AOB* = 124 or **M1** for $\frac{180-28-28}{2}$ oe
17(b)	81	**2**	**B1** for angle *RQP* = 47 or *QPU* = 52 or **M1** for 180 – 52 – 47
18	408 or 408.4 to 408.5	**4**	**M3** for $2\times\pi\times5\times8 + 2\times\pi\times5^2$ oe OR **M1** for $2\times\pi\times5\times8$ **M1** for $[2]\times\pi\times5^2$
19(a)	$14 - 3n$ oe final answer	**2**	**B1** for $14 - kn$ or $c - 3n$ or $14 - 3n$ seen then spoiled
19(b)	5^{n-1} oe	**2**	**B1** for 5^{an+b} where $a > 0$ or 5^k for any integer $k > 1$
20	6.5 nfww	**3**	**M2** for $\frac{55.2+0.05}{8 \text{ to} 9}$ or $\frac{55.2 \text{ to } 55.3}{9-0.5}$ or **M1** for 9 + 0.5 or 9 – 0.5 or 55.2 + 0.05 or 55.2 – 0.05
21	(2, 3) and (–2, –1)	**4**	**B3** for $x = 2$ and $x = -2$ or **B2** for $x^2 - 4[=0]$ or better or for (2, 3) or (–2, –1) or **M1** for $x+1 = x^2 + x - 3$ oe
22	$\frac{12}{\sqrt{w}}$ oe final answer	**2**	**M1** for $x = \frac{k}{\sqrt{w}}$ oe
23	10	**2**	**M1** for $\frac{7.5}{18\div6}$ oe or better or [frequency densities] 3 and 4 or 45 and $4h$ or 45 and 40
24	$\frac{x-2}{a+1}$ final answer	**4**	**B2** for $(x-2)(a-1)$ or **M1** for $a(x-2)-(x-2)$ or $x(a-1)-2(a-1)$ **B1** for $(a-1)(a+1)$

Question	Answer	Marks	Partial Marks
25	$a = 3$ $k = 5$	**2**	**B1** for each or **M1** for $2 \times 7ax^6 + 3kx^{k-1}$ or better
26	$\mathbf{b} + \frac{4}{3}\mathbf{a}$	**3**	**B2** for correct unsimplified answer or $\overrightarrow{QX} = \frac{1}{3}\mathbf{a}$ seen or **B1** for a correct route for $\overrightarrow{OX}$ or answer $\mathbf{b} + k\mathbf{a}$ where $k > 1$ or $\overrightarrow{OK} = \mathbf{a} + \frac{3}{4}\mathbf{b}$ seen or $\overrightarrow{QX} = \frac{1}{3}\overrightarrow{OP}$ or $\overrightarrow{OX} = \frac{4}{3} \times \overrightarrow{OK}$

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MATHEMATICS **0580/23**

Paper 2 (Extended) **October/November 2023**

MARK SCHEME

Maximum Mark: 70

Published

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[Turn over

Generic Marking Principles

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GENERIC MARKING PRINCIPLE 1:

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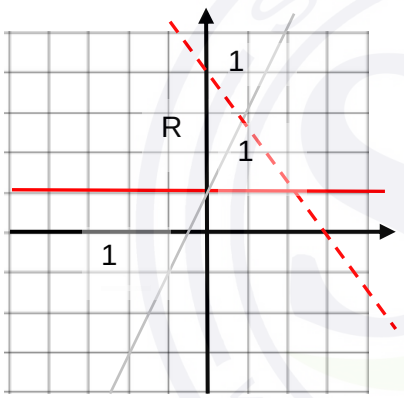
Question	Answer	Marks	Partial Marks
1	1923 or 723 pm	**1**	
2(a)	64	**1**	
2(b)	61	**1**	
3(a)	12.2	**1**	
3(b)	12.1	**2**	**B1** for 157.3 oe or **M1** for *their* total ÷ 13
4	67.5[0]	**2**	**M1** for $\frac{750 \times 1.8[\times 5]}{100}$ oe
5(a)	Parallelogram	**1**	
5(b)	68	**2**	**M1** for 180 – 112 oe or for $180-112-44$
6(a)	0.11 oe	**2**	**M1** for 1 – (0.4 + 0.32 + 0.17) oe
6(b)	576	**1**	
7	$\frac{11}{6}\times\frac{15}{11}$ or $\frac{55k}{30k}\div\frac{22k}{30k}$ oe with common denominator	**M2**	**B1** for $\frac{11}{6}$ oe or **M1** for *their* $\frac{\textit{their}11}{6}\times\frac{15}{11}$
	$2\frac{1}{2}$ cao	**A1**	
8	16	**2**	**B1** for answer 2 or 4 or 8 or **M1** for 2 × 2 × 2 × 2 oe as final answer or [48 =] 2 × 2 × 2 × 2 × 3 and [80 =] 2 × 2 × 2 × 2 × 5 or for 2 correct factor trees or tables
9	4.5, $4\frac{1}{2}$ or $\frac{9}{2}$	**3**	**M2** for $y^2 = \frac{3P}{2w}$ or $y^2 = \frac{3\times108}{2\times8}$ or better or **M1** for $108 = \frac{2\times8\times y^2}{3}$ or better
10(a)	$\begin{pmatrix}21\\-9\end{pmatrix}$	**1**	
10(b)	7.62 or 7.615 to 7.616	**2**	**M1** for $(7)^2 + (-3)^2$ oe If 0 scored **SC1** for 22.8 or 22.84 to 22.85

Question	Answer	Marks	Partial Marks
11	1.573 cao	**4**	**B3** for answer figs 157[0] or 1573… OR **M2** for $\frac{4}{3}\times\pi\times3.6^3\times8.05$ oe or better or **M1** for $\frac{4}{3}\times\pi\times3.6^3$ oe **M1** for division by 1000 of *their* mass in g **and** correct rounding to 3 dp
12	55	**3**	**B2** for 250 or **M2** for (305 ÷ 122) × 22 oe or better or **M1** for $\left(1+\frac{22}{100}\right)m = 305$ oe or better
13	Correct region indicated  	**4**	**B1** for $4x + 3y = 12$ dashed line **B1** for $y = 1$ solid line **B2** for region identified satisfying all 3 inequalities or **B1** for region satisfying only 2 of these inequalities with $4x + 3y = 12$ and $y = 1$ both drawn
14(a)	3.3	**1**	
14(b)	0.55	**1**	
15	$[d =] \frac{T^2+e}{3}$ oe final answer	**3**	**M1** for $T^2 = 3d - e$ **M1** for isolating term in d **M1** for dividing by 3 Max 2 marks if answer incorrect
16	693 or 692.7 to 692.8…	**4**	**M2** for $\frac{105}{2\times12.5}$ oe or **M1** for $2 \times \pi \times r \times 12.5 = 105\pi$ or better **M1** for $\pi \times (\textit{their } r)^2 \times 12.5$
17(a)	$16y^{18}$ final answer	**2**	**B1** for $16y^k$ or ky^{18} as final answer or correct answer spoiled
17(b)	$\frac{1}{x+5}$ final answer	**2**	**B1** for $(x + 5)(x – 5)$

Question	Answer	Marks	Partial Marks
18	19	**3**	**M2** for $\left(1+\frac{40}{100}\right)\left(1-\frac{15}{100}\right)$ [*ma*] oe or **M1** for $F = kma$ or better or $\left(1+\frac{40}{100}\right)$ **and** $\left(1-\frac{15}{100}\right)$ oe seen
19	116.9 or 116.85…	**4**	**M3** for $180 - \sin^{-1}\left(\frac{18\sin 42}{13.5}\right)$ or **B3** for 63.1 or 63.14 to 63.15 or **M2** for [sin *PRQ* =] $\frac{18\sin 42}{13.5}$ or **M1** for $\frac{18}{\sin PRQ} = \frac{13.5}{\sin 42}$ oe
20	[a =] – 3 [b =] 1 [c =] – 15	**3**	**B1** for $a = -3$ **B1FT** for $b = 7 + 2 \times$ *their a* **B1FT** for $c = 6 + 7 \times$ *their a* If B0 scored **B1** for correct expansion of a pair of brackets or of three brackets $\left(x^2+ax+2x+2a\right)\left[2x+3\right]$ or $\left[x+a\right]\left(2x^2+4x+3x+6\right)$ or $2x^3+(2a+7)x^2+(7a+6)x+6a$ oe or for $b = 7+2a$ or for $c = 6+7a$
21(a)	11.7 or 11.74 to 11.75	**3**	**M2** for $\left(\frac{14}{2}\right)^2 + 5^2 + 8^2$ oe or **M1** for $\left(\frac{14}{2}\right)^2 + 5^2$, $5^2 + 8^2$ or $\left(\frac{14}{2}\right)^2 + 8^2$
21(b)	42.9 to 43.14	**3**	**M2** for sin [….] = $\frac{8}{\textit{their}\ \textbf{(a)}}$ oe or **M1** for recognising angle *MBX* where *X* is the midpoint of *DC*
22	$x^2 - 4x + 4$ [= 0]	**M2**	**M1** for $9 - 4x = 5 - x^2$ oe
	$(x - 2)(x - 2)$	**M1**	Accept alt methods e.g. use of formula, complete the square for *their* 3 – term quadratic equation
	(2, 1)	**B2**	**B1** for $x = 2$

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MATHEMATICS **0580/21**

Paper 2 (Extended) **May/June 2023**

MARK SCHEME

Maximum Mark: 70

Published

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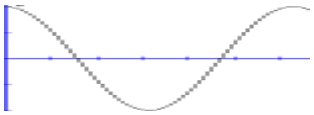
SC Special Case
nfww not from wrong working
soi seen or implied

Question	Answer	Marks	Partial Marks
1	51	**2**	**M1** for 360 – (56 + 104 + 71)
2	06 15 or 6:15 am	**1**	
3	58, vertically opposite	**2**	**B1** for each
	122, interior	**2**	**B1** for each
4	$\frac{7\times 2}{20-6}$	**M1**	
	1 nfww	**A1**	If 0 scored **SC1** for 3 correct roundings or for all correct but with any trailing zeros
5	0.22 oe	**2**	**M1** for 1 – (0.3 + 0.35 + 0.13) oe or B1 for 0.78 oe
6	57.9 or 57.90 to 57.91...	**2**	**M1** for $\frac{4}{3}\times\pi\times\left(\frac{4.8}{2}\right)^3$
7	11.75	**2**	**M1** for $\frac{9.4\times 125000}{100\times 1000}$ oe or **B1** for figs 1175 or 1 cm : 1.25 km
8(a)	9 6 1	**2**	**B1** for 2 correct
8(b)	$3n + 4$ oe final answer	**2**	**B1** for $3n + j$ or $kn + 4$ $k \neq 0$, or $3n + 4$ seen then spoilt
9	6.3	**2**	**M1** for $\frac{5.6}{h} = \frac{7.2}{8.1}$ oe or better
10	$\frac{15}{7}\times\frac{9}{5}$ oe or $\frac{135}{63}\div\frac{35}{63}$ oe with common denominator	**M2**	**B1** for $\frac{15}{7}$ oe or **M1** for $\frac{their 15}{7}\times\frac{9}{5}$ oe

Question	Answer	Marks	Partial Marks
	$3\frac{6}{7}$ cao	**A1**	
11(a)	Enlargement [sf] 2 (0, 7)	**3**	**B1** for each
11(b)	Rotation (3, 1) 90° clockwise oe	**3**	**B1** for each
12(a)	SSS	**1**	
12(b)(i)	42	**1**	
12(b)(ii)	42	**1**	**FT** their part **(i)**
12(b)(iii)	84	**1**	**FT** 2 × their part **(ii)**
13	1.24[0…]	**3**	**M2** $\sqrt[8]{\frac{6000+621.70}{6000}}$ oe or **M1** for $6000+621.70=6000(k)^8$ oe
14	3.2 oe	**3**	**M1** for $y=k(x+3)^2$ oe or better **M1** for substituting *their k* into $y=k(1+3)^2$
15	$\frac{20}{39}$ oe	**3**	**M2** for $\frac{5}{13}\times\frac{8}{12}[\times 2]$ oe or **M1** for $\frac{5}{13}$ or $\frac{8}{12}$ or $\frac{5}{12}$ or $\frac{8}{13}$ If 0 scored **SC1** for answer $\frac{80}{169}$ oe
16(a)	6.4[0] or 6.403...	**2**	**M1** for $(-4)^2+5^2$ oe
16(b)	**2x − y**	**1**	
17	$27x^9$ final answer	**2**	**B1** for answer $27x^n$ or nx^9, or for correct answer seen and spoilt

Question	Answer	Marks	Partial Marks
18	236[.0…]	**4**	**M2** for $\frac{27.3\times \sin 125}{62.4}$ or **M1** for $\frac{27.3}{\sin UWV}=\frac{62.4}{\sin 125}$ **M1** for $180+(125-90)+$ *their* 21 oe or $180+(90-$ *their* $34)$ oe If 0 scored **SC1** for the correct bearing marked at W

Question	Answer	Marks	Partial Marks
19(a)	correct sketch  Correct sketch to go through (0, 1), (360, 1) and (180, –1)	**2**	**B1** for correct cosine curve shape through (0, 1)
19(b)	126.9 or 126.86 to 126.87 233.1 or 233.13 to 233.14	**3**	**B2** for 1 correct angle or **M1** for $\cos x = -\frac{3}{5}$ oe If M1 or 0 scored SC1 for two angles with a sum of 360
20(a)	0.75 and –1.25	**1**	
20(b)	Correct curve	**3**	**B2 FT** for 6 or 5 correct plots or **B1 FT** for 4 or 3 correct plots
20(c)	ruled line $y = 2x + 1$	**B2**	**B1** for correct equation $[y =]2x + 1$ soi or $y = 2x + k$ or $y = kx + 1$ drawn
	−0.35 to −0.45	**B1**	
21(a)	-9	**3**	**B2** for $3x^2 - 12$ isw or **B1** for $3x^2 - k$ or $kx^2 - 12$
21(b)	$(-2, 16)$ $(2, -16)$	**3**	**M1** for *their* $(3x^2 - 12) = 0$ or stating $\frac{dy}{dx} = 0$ **A1** for $x = \pm 2$ or $(-2, 16)$ or $(2, -16)$

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MATHEMATICS **0580/22**

Paper 2 (Extended) **May/June 2023**

MARK SCHEME

Maximum Mark: 70

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 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:

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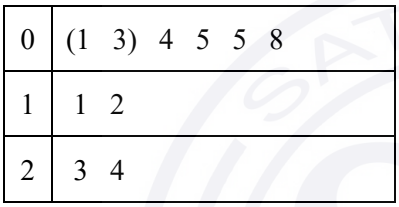
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

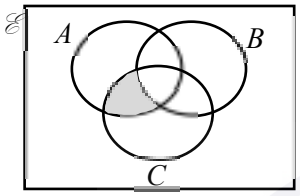
Abbreviations

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	–13	**1**	
2	108	**2**	**B1** for 47 or 61 identified
3(a)		**2**	**B1** for a correct diagram with one error or omission or for a fully correct unordered stem-and-leaf diagram
3(b)	6.5	**1**	
4	8.75	**2**	**M1** for $\frac{3.5\times250000}{100\times1000}$ oe or **B1** for figs 875 or 1 cm : 2.5 km
5	0.4 oe	**2**	**M1** for 1 – (0.2 + 0.05 + 0.35) oe or **B1** for 0.6 oe
6(a)	4 cao	**1**	
6(b)	10, 20	**1**	
6(c)	An odd number or decimal in the range $1 \leqslant x \leqslant 20$	**1**	
7	$\frac{4}{7} \times \frac{21}{26}$ oe or $\frac{12}{21} \div \frac{26}{21}$ oe with common denominator	**M2**	**B1** for $\frac{26}{21}$ or $\frac{21}{26}$ oe or **M1** for $\frac{4}{7} \times \frac{21}{\textit{their}\,26}$ oe
	$\frac{6}{13}$ cao	**A1**	
8(a)	5	**1**	

Question	Answer	Marks	Partial Marks
8(b)	$x \geqslant 3$ final answer	**3**	**M1** for correct first step $11x - 3 \geq 4x + 18$ or $5.5x - 1.5 \geqslant 2x + 9$ or better **M1** for correctly collecting *their x* terms on one side and *their* number terms on the other side e.g. $11x - 4x \geqslant 18 + 3$ or better
9(a)	$\begin{pmatrix} 24 \\ -9 \end{pmatrix}$	**1**	
9(b)	$\begin{pmatrix} -4 \\ 32 \end{pmatrix}$	**1**	
9(c)	(9, –7)	**1**	
9(d)	37	**2**	**M1** for $(-12)^2 + 35^2$ oe
10(a)	Reflection $y = 2$	**2**	**B1** for each
10(b)	Shape at (–2, –2), (–6, –5), (–6, –3), (–4, –2)	**2**	**B1** for correct size and orientation but wrong position or for rotation of 90° anticlockwise about (–1, 2) or for three correct vertices
10(c)	Shape at (0, –2), (0, 2), (–2, 6), (–6, 6)	**2**	**B1** for correct size and orientation but wrong position or for three correct vertices
11	9.1	**3**	**M2** for $\frac{140}{360} \times [\pi] \times (3.2 + 2.6)^2 - \frac{140}{360} \times [\pi] \times 3.2^2$ oe or **M1** for $\frac{140}{360} \times [\pi] \times 3.2^2$ oe or $\frac{140}{360} \times [\pi] \times (3.2 + 2.6)^2$ oe or $[\pi] \times (3.2 + 2.6)^2 - [\pi] \times 3.2^2$
12(a)	53	**2**	**M1** for $a \times 8^2 + b = 181$ oe seen
12(b)	–8	**1**	

Question	Answer	Marks	Partial Marks
13	116	**2**	**B1** for $ABD = 32$, $CAB = 32$, $BDC = 32$ or $CED = 116$ or **M1** for $180 - 32 - 32$
14	$\frac{x-2}{5}$ oe final answer	**2**	**M1** for a correct first step $x = 5y + 2$ or $y - 2 = 5x$ or $\frac{y}{5} = x + \frac{2}{5}$
15(a)	(9, 7)	**2**	**B1** for each
15(b)	2	**2**	**M1** for $\frac{15 - -1}{13 - 5}$ oe
15(c)	$[y =] -\frac{1}{2}x + \frac{23}{2}$ oe final answer	**3**	**M1** for gradient = $-\frac{1}{\textit{their}\ \textbf{(b)}}$ oe **M1** for correct substitution of *their* **(a)** into $y = (\textit{their}\ m)x + c$ oe
16	621.21… – 6.21… oe	**M1**	
	$\frac{41}{66}$ cao	**A2**	**A1** for $\frac{615}{990}$ oe If M0 scored **SC1** for $\frac{k}{990}$ or for answer $\frac{41}{66}$ with insufficient working
17	40.7 or 40.73 to 40.74	**2**	**M1** for $\frac{1}{2} \times 92.5 \times 71 \sin x = 2143$ oe
18	$\frac{5c}{2c-3}$ oe final answer	**4**	**M1** for correctly clearing the denominator **and** expanding bracket or correctly clearing the denominator **and** dividing by c **M1** for correctly collecting terms in x on one side and terms not in x on the other **M1** for correct factorising **M1** for correct division dependent on x appearing only once in a factorised expression Maximum 3 marks for an incorrect answer

Question	Answer	Marks	Partial Marks
19	0.16 oe	**3**	**M1** for $m = \frac{k}{(t+2)^2}$ oe **M1** for substituting *their k* into $m = \frac{their\ k}{(8+2)^2}$ OR **M2** for $0.64 \times (3+2)^2 = m(8+2)^2$ oe
20		**1**	
21	216.9 or 216.86 to 216.87 323.1 or 323.13…	**3**	**B2** for one correct angle or **M1** for $\sin x = -\frac{3}{5}$ or better If M1 or 0 scored **SC1** for two reflex angles with a sum of 540 or two non-reflex angles with a sum of 180
22	$\frac{22x+3}{(3x+2)(2x-1)}$ final answer	**3**	**B1** for a common denominator $(3x+2)(2x-1)$ oe isw **B1** for $5(2x-1)+4(3x+2)$ oe isw
23	$\frac{1}{3}$ oe	**3**	**M1** for $\left(1-\frac{2}{5}\right) \times p = \frac{1}{10}$ oe **M1** for $\frac{2}{5} \times (1 - their\ p)$ where $0 < their\ p < 1$

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MATHEMATICS **0580/23**

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Maths-Specific Marking Principles	
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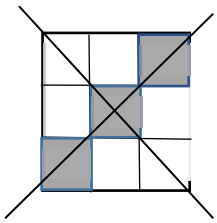
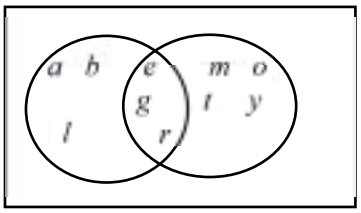
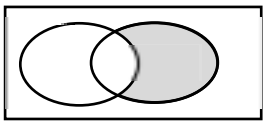
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal 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)	2	**1**	
1(b)		**2**	**B1** for one correct line and no extras or two correct lines and one extra
2	20 15 or [0]8.15pm	**1**	
3	158	**3**	**M2** for $[2](8\times5+8\times3+5\times3)$ or **M1** for 8×5 or 8×3 or 5×3
4	72.6	**2**	**M1** for $4-9.8\times-7$ or better
5	d^6	**1**	
6	52	**2**	**M1** for $12=x\times\frac{3}{13}$ oe or better e.g. $12\div\frac{3}{13}$ oe
7(a)	0.11 oe	**2**	**M1** for 1 – (0.3 + 0.16 + 0.18 + 0.25) oe or **B1** for 0.89 oe
7(b)	0.46 oe	**2**	**M1** for 0.3 + 0.16
8	Rotation (0,0) oe 90° clockwise oe	**3**	**B1** for each
9(a)	32.5	**2**	**M1** for $\frac{65}{\textit{their time}}$ or $\frac{\textit{their distance}}{2}$
9(b)	correct ruled line from (12 00, 65) to (13 18, 0)	**1**	
10	$\frac{k}{12}+\frac{27}{12}$ or $\frac{71}{12}+\frac{c}{12}$ oe	**M1**	[5] $\frac{11}{12}$ and [2] $\frac{3}{12}$ oe Accept with other correct common denominators e.g. 24, 36, 48 such as $\frac{71f}{12f}$ and $\frac{27f}{12f}$
	$8\frac{1}{6}$ cao	**A2**	**A1** for fraction equivalent to $8\frac{1}{6}$ e.g. $\frac{49k}{6k}$ or $8\frac{1k}{6k}$ or $7\frac{7}{6}$

Question	Answer	Marks	Partial Marks
11(a)		**2**	**B1** for 1 region correct
11(b)		**1**	
12	$\sqrt{1^2 + (-5)^2}$	**M2**	**M1** for $\begin{pmatrix} 1 \\ -5 \end{pmatrix}$ or $(5-4)^2 + (3-8)^2$ or $\sqrt{e^2 + f^2}$ from *their* $\overrightarrow{OB} = \begin{pmatrix} e \\ f \end{pmatrix}$ or *their* $B = (e, f)$ or only $\sqrt{1+25}$
	Correct working leading to 5.09[9..]	**A1**	**Dep.** on **M2** or **M1** for only $\sqrt{1+25}$
13	8.03 or 8.032 to 8.033	**1**	
14	581.81... − 5.81...oe	**M1**	
	$\frac{32}{55}$ cao	**A2**	**A1** for $\frac{576}{990}$ oe If **M0** scored **SC1** for $\frac{k}{990}$ or for answer $\frac{32}{55}$ with insufficient working.
15	807	**2**	**M1** for $980 \times \left(1 - \frac{1.75}{100}\right)^{11}$ oe or better
16	7.00 or 6.998 to 7.002	**3**	**M2** for $[r^2] = \frac{1970}{12.8 \times \pi}$ oe or better or **M1** for $1970 = \pi \times r^2 \times 12.8$ or better

Question	Answer	Marks	Partial Marks
17	$m=\frac{2k}{(2-R)}$ or $m=\frac{-2k}{(R-2)}$ final answer	**4**	**M1** for clearing fractions **M1** for expanding brackets (or ÷ 2) **M1** for collecting terms in *m* on one side and terms not in *m* on the other **M1** for dividing by a bracket maximum of **3** if final answer incorrect
18	8	**3**	**M1** for $y=\frac{k}{\sqrt[3]{x+5}}$ oe **M1** for substituting *their k* into $y=\frac{k}{\sqrt[3]{22+5}}$ oe OR **M2** for $12\sqrt[3]{3+5}=y\sqrt[3]{22+5}$ oe
19	$\frac{-5\pm\sqrt{5^2-4\times1\times-7}}{2\times1}$	**B2**	**B1** for $\sqrt{5^2-4\times1\times-7}$ and if in form $\frac{p+\sqrt{q}}{r}$ or $\frac{p-\sqrt{q}}{r}$ **B1** for $p=-5$ and $r=2\times1$
	−6.14 and 1.14 cao	**B2**	**B1** for 1 correct answer for −6.1 and 1.1 or −6.140... and 1.140... or 6.14 and −1.14 or correct answers seen in working
20(a)	$6x+5$ cao final answer	**2**	**M1** for $6(x+2)-7$ oe
20(b)	$\frac{x+7}{6}$ or $\frac{x}{6}+\frac{7}{6}$ final answer	**2**	**M1** for $x=6y-7$ or $y+7=6x$ or $\frac{y}{6}=x-\frac{7}{6}$
20(c)	$\frac{1}{5}$ or 0.2	**2**	**M1** for $x^{-3}=6\times22-7$ or better
21	$\frac{x+4}{2x+3}$ final answer	**4**	**B1** for $(2x-3)(2x+3)$ **B2** for $(2x-3)(x+4)$ or **B1** for $(2x+a)(x+b)$ where $ab=-12$ or $a+2b=5$ or $x(2x-3)+4(2x-3)$ or $2x(x+4)-3(x+4)$

Question	Answer	Marks	Partial Marks
22	[a =] $\frac{-1}{2}$ oe [b =] 3	**5**	**B4** for $\frac{1}{4}n^3 - \frac{1}{2}n^2 + 3n$ seen OR **M2** for any two of $\frac{1}{4} + a + b = 2.75$ $8 \times \frac{1}{4} + 4a + 2b = 6$ $27 \times \frac{1}{4} + 9a + 3b = 11.25$ $64 \times \frac{1}{4} + 16a + 4b = 20$ or **M1** for one correct equation **M1** for correct method to eliminate 1 variable **B1** for 1 correct answer
23	1h 48 min nfww	**4**	**B3** for 1.8 [hrs], $1\frac{4}{5}$ [hrs], $\frac{9}{5}$ [hrs] or 108 [mins] nfww or **M2** for $\frac{220 \text{ to } 221}{125 - 2.5}$ or $\frac{220 + 0.5}{120 \text{ to } 125}$ or **M1** for 220 + 0.5 or 220 – 0.5 or 125 + 2.5 or 125 – 2.5

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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.

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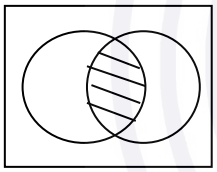
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)	27	**1**	
1(b)	29	**1**	
2(a)	$\begin{pmatrix}-3\\-2\end{pmatrix}$	**1**	
2(b)	$\begin{pmatrix}-2\\6\end{pmatrix}$	**1**	
3	Correct shading 	**1**	
4(a)	–1	**1**	
4(b)	$29 - 6n$ oe final answer	**2**	**B1** for $k - 6n$ or $29 - kn$ or $29 - 6n$ seen then spoiled
5	$2g(4 - g)$ final answer	**2**	**B1** for $2(4g - g^2)$ or for $g(8 - 2g)$ or for $2g(4 - g)$ seen then spoiled
6	$\frac{4}{7} \times \frac{1}{8}$ oe or $\frac{4}{7} \div \frac{56}{7}$ oe	**M1**	
	$\frac{1}{14}$ cao	**A1**	
7(a)	$-\frac{1}{4}$ oe	**2**	**M1** for $15t + t = 4 - 8$ oe
7(b)	9.5 oe	**2**	**M1** for $25 - 2u = 3 \times 2$ oe or for $\frac{25}{3} - 2 = \frac{2u}{3}$

Question	Answer	Marks	Partial Marks
8	9×10^{-2}	**2**	**B1** for 0.09 oe or **M1** for *their* decimal correctly converted to standard form if negative power
9	Correctly eliminating one variable	**M1**	
	[x =] 5	**A1**	
	[y =] –2	**A1**	If **M0** scored **SC1** for 2 values satisfying one of the original equations.
10	9.45	**3**	**M2** for $\frac{2.7\times7.5}{3}+2.7$ oe OR **B2** for 6.75 oe or **M1** for $\frac{3}{7.5}=\frac{2.7}{XC}$ oe If 0 scored **SC1** for answer 7.7
11	$4x^{12}$ final answer	**2**	**B1** for $4x^k$ or kx^{12} or for $4x^{12}$ seen then spoiled
12	24	**3**	**M2** for $180(n-2)=11\times360$ oe OR **M1** for $\frac{180}{11+1}$ [× 11] oe **M1** for $\frac{360}{their\ 15}$ or for $\frac{(n-2)\times180}{n}=(180-their\ 15)$
13	90	**2**	**M1** for a correct area calculation e.g. 8 × 10 or 0.5 × 2 × 10 or better
14	6.12 or 6.116… to 6.118	**3**	**M1** for $\sin=\frac{3}{9}$ oe or $\cos=\frac{9^2+9^2-6^2}{2\times9\times9}$ oe **M1 dep** for $\frac{their\ angle}{360}\times\pi\times2\times9$ dependent on use of trig for *their angle*
15	$5w^{625}$ final answer	**2**	**B1** for kw^{625} or $5w^k$ final answer or for $5w^{625}$ then spoiled

Question	Answer	Marks	Partial Marks
16	4.5 oe	**3**	**M2** for $2^2 \times y = 3^2 \times 2$ OR **M1** for $y = \frac{k}{x^2}$ **M1** for $y = \frac{their k}{2^2}$
17(a)	42	**1**	
17(b)	55	**1**	
17(c)	85	**1**	
17(d)	108	**2**	**M1** for [angle *ACD* =] 53 or [angle *BAC* =] 30
17(e)	53	**1**	
18	99	**3**	**M2** for $44 \times \left(\frac{81}{24}\right)^{\frac{2}{3}}$ oe or **M1** for $\left(\frac{81}{24}\right)^{\frac{1}{3}}$ oe or $\left(\frac{24}{81}\right)^{\frac{1}{3}}$ oe or $\left(\frac{44}{Area}\right)^3 = \left(\frac{24}{81}\right)^2$ oe
19	0 and –3	**3**	**B2** for $x^2 + 3x$ [= 0] or better or **M1** for $10 - 6x = x^2 - 3x + 10$ oe or for correct simplification of *their* quadratic to the form $ax^2 + bx + c$ [= 0] or better or finding $y = 28$ and $y = 10$
20(a)	$(n-1)^3 - 1$ oe	**2**	**M1** for any cubic or third differences = 6
20(b)	$24 \times \left(\frac{1}{2}\right)^{n-1}$ oe	**2**	**M1** for $c \times \left(\frac{1}{2}\right)^{an+b}$ oe where *a*, *b* and *c* are constants and $a > 0$
21	1.08	**3**	**M2** for $\frac{13 \text{ to } 14}{12 + 0.5}$ oe or $\frac{14 - 0.5}{12 \text{ to } 13}$ oe or **M1** for 14 + 0.5 oe or 14 – 0.5 oe or 12 + 0.5 oe or 12 – 0.5 oe

Question	Answer	Marks	Partial Marks
22	24.9 or 24.93 to 24.94	**4**	**M3** for tan = $\frac{4}{\sqrt{5^2+7^2}}$ oe or **M2** for $5^2 + 7^2$ oe or $5^2 + 7^2 + 4^2$ oe or **M1** for recognition of angle *PCA*.
23	$\frac{5x-4}{x+3}$ final answer	**4**	**B2** for $(5x-4)(x-3)$ or **B1** for $(5x+a)(x+b)$ with $ab = 12$ or $a + 5b = -19$ or for $5x(x-3)-4(x-3)$ or $x(5x-4)-3(5x-4)$ **B1** for $(x+3)(x-3)$
24	7	**2**	**B1** for answer 6 or **M1** for $\left(\frac{2}{3}\right)^k\left(\frac{1}{3}\right)$ shown with $k > 1$ or $\left(\frac{2}{3}\right)^{an+b}\left(\frac{1}{3}\right)=\frac{64}{2187}$ oe or for $3^n = 2187$ soi or $2^{n-1} = 64$ or $3^{n-1} = 729$ or better
25	$\sqrt[3]{x-1}$ or $(x-1)^{\frac{1}{3}}$	**2**	**M1** for $x = y^3 + 1$ or for $y - 1 = x^3$ or better

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MATHEMATICS **0580/21**

Paper 2 Extended **October/November 2022**

MARK SCHEME

Maximum Mark: 70

Published

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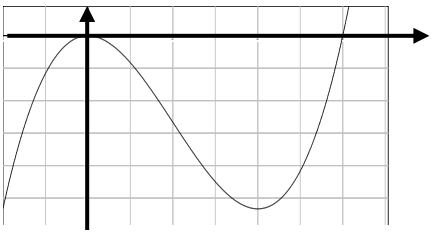
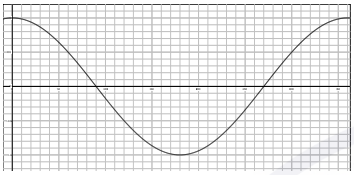
Question	Answer	Marks	Partial Marks
1	Any multiple of 72	**1**	
2	7 h 10 min	**1**	
3	$\frac{4}{25}$ cao	**2**	**M1** for $\frac{32}{200}$ oe
4	140, 60	**2**	**M1** for $\frac{200}{(7+3)} \times k$ where k = 1, 7 or 3
5	54	**2**	**M1** for 180 – 71 – 55 oe or **B1** for 55 or 125 in a relevant correct position on the diagram
6	442	**2**	**M1** for $\frac{100-15}{100} \times 520$ oe or **B1** for 78
7(a)	*a*, *b*, *c*, *d*	**1**	
7(b)	6	**1**	
8(a)	243	**1**	
8(b)	$4n + 9$ oe final answer	**2**	**B1** for $4n + k$ or $jn + 9$, $j \neq 0$ or for correct answer seen then spoilt
9	$\frac{2}{6} + \frac{5}{6}$ oe	**M1**	i.e. correct fractions with common denominator 6*k*
	$1\frac{1}{6}$ cao	**A1**	
10	$2x^9$ final answer	**2**	**B1** for kx^9 or $2x^k$ as final answer or $2x^9$ spoiled
11	[x =] 4 [y =] –1	**2**	**B1** for each
12(a)	6	**1**	
12(b)	8	**2**	**M1** for $\left(\frac{2}{3}\right)^2$ or $\left(\frac{3}{2}\right)^2$ oe seen
13(a)	2.8 oe	**1**	
13(b)	175	**2**	**M1** for a correct relevant area calculation e.g. $(15 – 5) \times 14$ or $\frac{1}{2} \times 5 \times 14$ oe or better

Question	Answer	Marks	Partial Marks
14	Rotation (5, 3) 90° clockwise oe	**3**	**B1** for each
15	71.6 or 71.61 to 71.62	**3**	**M2** for $\frac{\text{angle}}{360} = \frac{26-8-8}{2\pi\times 8}$ or better or **M1** for $\frac{\text{angle}}{360}\times 2\pi\times 8$ oe
16	[u =] 20 [v =] 52 [w =] 108 [x =] 36	**4**	**B1** for each
17	$5x^{625}$ final answer	**2**	**B1** for final answer kx^{625} or $5x^k$ or correct answer spoiled
18	12.7 or 12.68 to 12.69	**4**	**M3** for $\frac{7\sin 115}{\sin(180-115-35)}$ or **B2** for 8.03… seen OR **B1** for [angle C =] 30 **M2** for $\frac{7\sin 115}{\sin(\textit{their}\text{ angle }C)}$ or **M1** for $\frac{\sin 115}{BC} = \frac{\sin(\textit{their}\text{ angle }C)}{7}$ oe
19	$2x^3-5x^2-4x+12$ final answer	**3**	**B2** for correct expansion of the three brackets unsimplified or for simplified four-term expression of correct form with three terms correct or **B1** for correct expansion of two of the three given brackets with at least three terms out of four correct
20(a)	$(1+x)(1-y)$ final answer	**2**	**B1** for $1+x-y(1+x)$ or $1-y+x(1-y)$
20(b)	$2x(x+3y)(x-3y)$ final answer	**3**	**B2** for $2x(x^2-9y^2)$ or correctly factorising into two brackets e.g. $(2x^2+6xy)(x-3y), (x^2-3xy)(2x+6y)$ or **B1** for $2(x^3-9xy^2)$ or $x(2x^2-18y^2)$ or for $(x+3y)(x-3y)$

Question	Answer	Marks	Partial Marks
21	Correct sketch with maximum at origin and minimum in fourth quadrant 	**2**	**B1** for any cubic with exactly 2 distinct turning points
22(a)	Correct sketch  Correct sketch to go through (0, 1), (360, 1) and (180, –1)	**2**	To go through (0, 1) and close to (360, 1) and reasonably close to (180, –1) **B1** for correct cosine curve shape through (0, 1)
22(b)	120, 240	**2**	**B1** for each or for two values with sum of 360
23	$\frac{144}{w}$ oe	**3**	**M2** for $y = \frac{k}{w}$ oe or **M1** for $x = cw^2$ or for $y = \frac{j}{\sqrt{x}}$ oe
24	4 nfww	**2**	**M1** for 39 + 0.5 or 36 – 0.5 or better seen 39 – 0.5 or 36 + 0.5
25(a)(i)	$\frac{3}{4}$ oe	**1**	
25(a)(ii)	45	**1**	**FT** 60 × *their* **(a)(i)** correctly evaluated
25(b)	$\frac{47}{66}$ oe	**4**	**M3** for $1 - \left(\frac{5}{12}\times\frac{4}{11}+\frac{4}{12}\times\frac{3}{11}+\frac{3}{12}\times\frac{2}{11}\right)$ oe or **M2** for $\left(\frac{5}{12}\times\frac{4}{11}+\frac{4}{12}\times\frac{3}{11}+\frac{3}{12}\times\frac{2}{11}\right)$ oe or $\left(\frac{5}{12}\times\frac{4}{11}+\frac{5}{12}\times\frac{3}{11}+\frac{4}{12}\times\frac{3}{11}\right)$ oe or **M1** for $\frac{5}{12}\times\frac{4}{11}$ or $\frac{5}{12}\times\frac{3}{11}$ or $\frac{4}{12}\times\frac{3}{11}$ or $\frac{3}{12}\times\frac{2}{11}$ oe If 0 scored, **SC1** for $\frac{47}{72}$ oe

Question	Answer	Marks	Partial Marks
25(c)	5	**2**	**M1** for correct trial to at least two balls one of which is not green

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MATHEMATICS **0580/22**

Paper 2 Extended **October/November 2022**

MARK SCHEME

Maximum Mark: 70

Published

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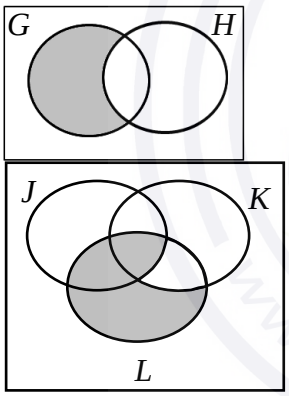
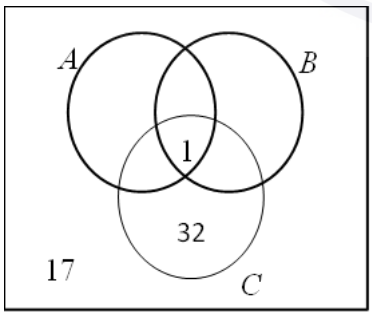
Question	Answer	Marks	Partial Marks
1	112	**2**	**M1** for $180 - 34 \times 2$ oe
2	$-50y$	**1**	
3	0	**1**	
4	$3x + x^3$ final answer	**2**	**B1** for one correct term from two in final answer or for correct answer then spoilt
5	6.55	**3**	**M2** for $(33.48 - 2.4 \times 0.85)$ oe or **M1** for 2.4×0.85
6(a)	2 –9	**2**	**B1** for one correct
6(b)	Sequence A $7n - 4$ oe final answer	**2**	**B1** for $7n + c$ or $kn - 4$ $k \neq 0$ or for correct answer seen then spoilt
	Sequence B $3n^2 - 1$ oe final answer	**2**	**M1** for finding second differences of 6 or has an answer that is a quadratic sequence or for correct answer seen then spoilt
7	$\frac{10}{18}$ and $\frac{3}{18}$	**M1**	Allow any correct common denominator $18k$
	$\frac{7}{18}$ cao	**A1**	
8(a)	3.5	**2**	**M1** for values in correct order 1.5 2 2 3 4 4.5 5 18 or 3 and 4 identified as middle numbers
8(b)	One extreme value oe	**1**	
9(a)	A and C	**1**	
9(b)	ASA	**1**	
10(a)	3456	**1**	
10(b)	0.75 or $\frac{3}{4}$ oe	**1**	
10(c)	0.25 or $\frac{1}{4}$	**1**	
11(a)	5	**2**	**M1** for $(0 - 3)(0 + b)(0 + 2) = -30$ oe or better

Question	Answer	Marks	Partial Marks
11(b)	(3, 0)	**1**	
12	5×199^{57}	**2**	**M1** for [315 =] $3^2 \times 5 \times 7$ oe or $3^2 \times 5^2 \times 7 \div 315 = 5$
13(a)	A correct cumulative frequency diagram	**3**	**B1** for correct horizontal placement for 7 plots **B1** for correct vertical placement for 7 plots **B1FT dep** on at least B1 for reasonable increasing curve or polygon through *their* 7 points If 0 scored **SC1 FT** for 6 out of 7 points correctly plotted
13(b)	33 to 34.5	**1**	**FT** *their* increasing cumulative frequency graph
14	104	**2**	**M1** for 0.5×136 oe or 0.25×144 oe
15	Opposite angles add up to 180 oe	**1**	
16(a)		**2**	**B1** for each
16(b)		**2**	**B1** for 2 correct
17(a)	9	**1**	
17(b)	$2x - 5$ final answer	**2**	**M1** for correct first step e.g. $x = \frac{y+5}{2}$ or $2y = x + 5$ or $y - \frac{5}{2} = \frac{x}{2}$ or better

Question	Answer	Marks	Partial Marks
17(c)	11	**3**	**M1** for $\frac{x^2+5}{2}$ **M1** for $hh^{-1}(63) = 63$ soi
18	$419.\dot{1}\dot{9} - 4.\dot{1}\dot{9}$ oe	**M1**	
	$\frac{83}{198}$ cao	**A2**	**Al** for $\frac{415}{990}$ oe If M0 scored **SC1** for $\frac{k}{990}$ or correct answer with insufficient working
19	$\frac{3}{7}$ oe	**3**	**M1** for clearly identifying the 7 even outcomes 2 6, 3 5, 3 7, 3 9, 5 5, 5 7, 5 9 **M1** for clearly identifying the 3 even outcomes with just one five 3 5, 5 7 and 5 9 If 0 scored **SC1** for answer $\frac{1}{4}$ oe
20(a)	$27x^{12}$ final answer	**2**	**B1** for kx^{12} or $27x^c$ final answer or for $27x^{12}$ then spoilt
20(b)	[±] y	**1**	
21	228 or 228.3 to 228.4	**4**	**M1** for $\frac{1}{3}\times\pi\times\left(\frac{9.2}{2}\right)^2\times 12.5$ oe **M1** for $\frac{9.2}{12.5} = \frac{diameter}{12.5-5.5}$ oe or better **M1** for $\frac{1}{3}\times\pi\times\left(\frac{their 5.152}{2}\right)^2\times(12.5-5.5)$ oe OR **M2** for $\frac{\pi}{3}\times\left(\frac{9.2}{2}\right)^2\times 12.5 - \frac{\pi}{3}\times r^2\times(12.5-5.5)$ oe for any $r < 4.6$ If 0 scored **SC1** for 913 or 913.3 to 913.5

Question	Answer	Marks	Partial Marks
22	45	**3**	**M2** for $\sqrt[3]{\frac{875}{56}} \times 18$ oe or **M1** for $\sqrt[3]{\frac{875}{56}}$ or $\sqrt[3]{\frac{56}{875}}$ oe or $\frac{18^3}{h^3} = \frac{56}{875}$ oe
23	$[0 =] 6x^2 - 19x + 3$	**B5**	**B4** for $8x - 20 + 2x + 2 = 6x^2 + 6x - 15x - 15$ or better OR **M2** for $4(2x - 5) + 2(x + 1) = 3(x + 1)(2x - 5)$ oe or **M1** for $4(2x - 5) + 2(x + 1)$ or better or common denominator $(x + 1)(2x - 5)$ or better **B1** for $2x^2 + 2x - 5x - 5$ or better seen **M1** for correctly simplifying *their* quadratic to the form $[0 =] ax^2 + bx + c$
	Correct method to solve *their* three term quadratic	**M1**	e.g. $(6x - 1)(x - 3)$ $\frac{-(-19) \pm \sqrt{(-19)^2 - 4 \times 6 \times 3}}{2 \times 6}$
	$x = 3$, $x = \frac{1}{6}$ oe	**B1**	

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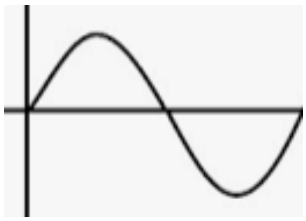
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

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	5[h] 23[min]	**1**	
2(a)	121	**1**	
2(b)	216	**1**	
3	6.05 or 6.054 to 6.055	**1**	
4	93 95 101 101	**3**	**M1** for 4×97.5 implied by 390 or for four numbers which add to 390 **B1** for four numbers with a range of 8 **B1** for four numbers with mode of 101 to a maximum of 2 marks
5	$\frac{15}{21}$ and $\frac{14}{21}$ oe	**M1**	Allow any correct common denominator $21k$
	$\frac{1}{21}$ cao	**A1**	
6(a)	$\frac{7}{20}$ oe or 0.35 or 35%	**2**	**M1** for $1 - \left(\frac{2}{5} + \frac{1}{4}\right)$ oe
6(b)	48	**1**	
7	180	**2**	**M1** for answer $2 \times 2 \times 3 \times 3 \times 5$ or better or for answer $180k$ or two correct factor trees, tables or Venn diagram or better or a list of multiples of both 36 and 60 with at least 3 correct of each
8	(1, 3.5)	**2**	**B1** for each
9	$[x =]$ 9 $[y =]$ 3	**2**	**B1** for each answer
10(a)	9.8[0] or 9.797 to 9.798	**3**	**M2** for $14^2 - 10^2$ oe or better or **M1** for $10^2 + h^2 = 14^2$ oe or better
10(b)	33.8 or 33.79 to 33.80	**1**	**FT** 24 + *their* **(a)**
11	15	**4**	**B2** for $x = 16$ **s**oi or **M1** for $7x + 44 + x + 8 = 180$ or better **M1** for $360 \div (\textit{their}\ x + 8)$ oe
12	320.18	**3**	**B2** for 4320.18 or **M1** for $4000 \times \left(1 + \frac{2.6}{100}\right)^3$ [– 4000] oe

Question	Answer	Marks	Partial Marks
13	$2.\dot{4}-0.2\dot{4}$ oe	**M1**	
	$\frac{11}{45}$ cao	**B1**	If **0** scored **SC1** for $\frac{k}{90}$.
14	49.6	**2**	**M1** for answer figs 496
15(a)	2	**1**	
15(b)	25.125	**4**	**M3** for $\frac{15\times30}{2}+30(k-15)[=\text{figs } 45]$ oe OR **B2** for 44 775 or 44.775 OR **M1** for $\frac{15\times30}{2}$ or $30(k-15)$ oe **B1** for 45 000 or 0.225 or 0.03
16	$[y=]\ -\frac{1}{4}x-\frac{11}{2}$ oe	**3**	**M1** for grad $=-\frac{1}{4}$ oe soi **M1** for correct substitution shown of (–2, –5) into $y = (\textit{their } m)x + c$ oe ($\textit{their } m \neq 4$)
17	8	**3**	
18	16	**3**	**M2** for $12\times\sqrt[3]{\frac{768}{324}}$ oe or **M1** for $\sqrt[3]{\frac{768}{324}}$ or $\sqrt[3]{\frac{324}{768}}$ or $\frac{h^3}{12^3}=\frac{768}{324}$ oe
19(a)	$\frac{2}{x-1}$ final answer	**2**	**M1** for $\frac{10}{5x-3-2}$ or better
19(b)	$\frac{10}{x}+2$ or $\frac{10+2x}{x}$ final answer	**3**	**M2** for $y-2=\frac{10}{x}$ or $x=\frac{10+2y}{y}$ oe or $yx = 10 + 2x$ oe or **M1** for $x=\frac{10}{y-2}$ or $y(x – 2) = 10$ oe or better
19(c)	$x – 1$	**1**	

Question	Answer	Marks	Partial Marks
20(a)	 Correct sketch to go through (0, 0), (180, 0) and (360, 0)	**2**	**B**1 for correct sine curve shape through the origin
20(b)	187.2 and 352.8	**3**	**B2** for one correct value, if more than two answers given award **B2** if any of the correct answers found and may be in the working or **M1** for $\sin x = -\frac{1}{8}$ oe soi If **0** scored, **SC1** for two reflex angles with a sum of 540 or two non-reflex angles with a sum of 180
21	076 or 076.4 to 076.5	**5**	**B3** for [angle ABC =] 144 or 144.4 to 144.5 OR **M2** for [$\sin ABC$ =] $\frac{17.6\sin 25}{12.8}$ oe or **M1** for $\frac{17.6}{\sin B} = \frac{12.8}{\sin 25}$ oe **M1** for 180 – *their* 35.5 AND **M1** for *their* angle ABC – (180 – 112) oe
22(a)	$2x^3 + x^2 - 25x + 12$ 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 brackets with at least 3 terms out of 4 correct
22(b)	$\frac{2}{x}$ final answer	**4**	**M1** for $\left[\frac{4}{2x-3}\right] \times \frac{2x^2+11x-21}{2x^2+14x}$ oe soi **B1** for $(x + 7)(2x – 3)$ oe factorised **B1** for $2x(x + 7)$ oe factorised

Cambridge Assessment International Education

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SUBJECT **0580/21**

Paper 2 (Extended) **May/June 2022**

MARK SCHEME

Maximum Mark: 70

Published

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This document consists of **6** printed pages.

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Question	Answer	Marks	Partial Marks
1	31 or 37	**1**	
2	399	**1**	
3	2h 57 min	**1**	
4	4.286 cao	**2**	**B1** for 4.285[7...] or 4.29 or $\frac{30}{7}$ or $4\frac{2}{7}$ or for correctly rounding their more accurate decimal to 4sf
5	320	**2**	**M1** for 380.8 ÷ 1.19 oe
6	2 × 2 × 3 × 3 × 5 oe	**2**	**B1** for 2, 2, 3, 3, 5 or **M1** for correct factor tree/diagram/table.
7	$\frac{9}{21}$ and $\frac{2}{21}$ oe	**M1**	Allow any correct denominator 21k
	$\frac{1}{3}$ cao and correct working	**A1**	
8(a)	7.2 oe	**1**	
8(b)	[±] $\sqrt{\frac{2s}{a}}$ final answer	**2**	**M1** for $\frac{s}{a}=\frac{1}{2}t^2$ or $2s = at^2$ or better
9	$7y(2x-y)$ final answer	**2**	**B1** for $7(2xy-y^2)$ or $y(14x-7y)$ or $7y(2x-y)$ seen then spoilt
10(a)	–3	**1**	
10(b)	27 – 5n oe final answer	**2**	**B1** for j – 5n or 27 – kn, $k \neq 0$ or for 27 – 5n seen then spoilt
11(a)	4.5 oe	**2**	**M1** for $\frac{8}{6}=\frac{6}{QR}$ oe or better
11(b)	135	**2**	**M1** for $\left(\frac{6}{8}\right)^3$ or $\left(\frac{8}{6}\right)^3$ or $\left(\frac{their 4.5}{6}\right)^3$ oe
12	162	**3**	**M2** for $\left(\frac{(5-2)\times 180}{4+5+5+7+9}\right) \times k$ where k = 1, 4, 5, 7, 9 or **M1** for 180n ÷ (4 + 5 + 5 + 7 + 9) where $n \geqslant 2$ or for (5 – 2) × 180 oe

Question	Answer	Marks	Partial Marks
13	1.98×10^{100}	**2**	**B1** for 200×10^{98} or 0.02×10^{100} or answer with figs 198
14	90	**3**	**B2** for 210 or 0.09 km OR **M1** for speed × time seen **M1** for correct conversion of both km to m and between h and s
15	–3	**1**	
16	Enlargement [sf] $-\frac{1}{2}$ [centre] (4, 4)	**3**	**B1** for each
17	3.37 or 3.367 to 3.368	**3**	**M2** for isolating r^3, e.g. $r^3 = \frac{120}{\pi}$ or **M1** for $\frac{1}{2}\times\frac{4}{3}\times\pi r^3 = 80$ oe If 0 scored **SC1** for answer 2.67 or 2.672 to 2.673...
18	[x =] 38 [y =] 22	**3**	**B1** for [x =] 38 and **B2** for [y =] 22 or **M1** for angle ACB = *their* x or angle BAD = 60 or angle CBA = 120
19	PQX and alternate PXQ and [vertically] opposite oe ASA XB	**4**	**B2** for lines 1 and 2 correct or **B1** for line 1 or 2 correct, or both angles correct **B1** for line 3 correct **B1** for line 4 correct
20(a)	1.5 or $1\frac{1}{2}$	**1**	
20(b)	240	**2**	**M1** for one correct area
21	$(1 – q)(1 – a)$ or $(a – 1)(q – 1)$ final answer	**2**	**B1** for $1 – q – a(1 – q)$ or $1 – a – q(1 – a)$ or better or correct answer seen and spoilt
22	$36y^{144}$ final answer	**2**	**B1** for ky^{144} or $36y^k$ final answer $k \neq 0$ or correct answer seen and spoilt

Question	Answer	Marks	Partial Marks
23(a)	[p =] 4 [q =] –6	**2**	**B1** for one correct or $(x+4)^2-6$ or $x^2+px+px+p^2$ [+ q]
23(b)	–10 and 2	**2**	**M1** for $(x+4)^2=36$ or $(x+their4)^2=30-their(-6)$ or for correct method to solve quadratic e.g. $(x+10)(x-2)$
24	28	**3**	**M2** for $24^2+12^2+8^2$ or **M1** for 24^2+12^2 or 24^2+8^2 or 12^2+8^2
25	$\frac{16}{\sqrt{x}}$ oe final answer	**3**	**M2** for $w=\frac{k}{\sqrt{x}}$ oe OR **M1** for $w=j\sqrt{y}$ **M1** for $y=\frac{c}{x}$
26	$\frac{5}{3}$**a** + $\frac{1}{3}$**b** final answer	**4**	**M1** for $\overrightarrow{AK}=-\frac{1}{3}$**a** + $\frac{1}{3}$**b** or $\overrightarrow{BK}=\frac{2}{3}$**a** $-\frac{2}{3}$**b** **M1** for $\overrightarrow{AL}$ (or $\overrightarrow{OK}$) = **a** + *their* $\overrightarrow{AK}$ oe soi or $\overrightarrow{OK}$ (or $\overrightarrow{AL}$) = **b** + *their* $\overrightarrow{AK}$ oe soi or $\overrightarrow{BL}$ = **a** + *their* $\overrightarrow{AK}$ oe soi **M1** for a correct route e.g. $\overrightarrow{OL}$, **a** + $\overrightarrow{AL}$, **b** + $\overrightarrow{BL}$
27	(–2, –1) and (6, 7)	**4**	**B3** for x = – 2 and 6 OR **M1** for $x^2-3x-11=x+1$ or better **M1** for correct method to solve *their* quadratic e.g. $(x+2)(x-6)$ If 0 scored, **SC1** for one correct pair of coordinates

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MATHEMATICS **0580/22**

Paper 2 (Extended) **May/June 2022**

MARK SCHEME

Maximum Mark: 70

Published

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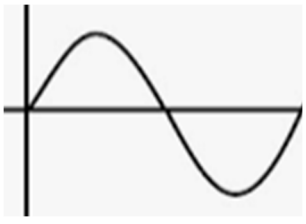
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Question	Answer	Marks	Partial Marks
1	13 or – 13	**1**	
2	54	**2**	**M1** for $\frac{360}{8+5+4+3}[\times 3]$ or $\frac{3}{8+5+4+3}[\times 360]$ oe
3	11 27	**3**	**M1** for 500 ÷ 43 oe **M1** for $500 - \textit{their}11 \times 43$ oe *their* 11 must be an integer from 2 to 11
4	102	**1**	
5	180	**3**	**M2** for $[2\times](8\times 6+8\times 3+3\times 6)$ oe or **M1** for 8×6 or 8×3 or 3×6
6	0.48 oe	**2**	**M1** for $1-(0.2+0.32)$ oe
7	103.32 cao	**2**	**M1** for $126\times\left(1-\frac{18}{100}\right)$ oe or **B1** for 22.68
8	13 16 21	**2**	**B1** for 2 correct terms in correct position or **SC1** for 12, 13, 16
9	239	**2**	**M1** for 180 + 59 or 360 – (180 − 59) oe or indicates correct angle on diagram
10(a)(i)	$\begin{pmatrix}3\\4\end{pmatrix}$	**1**	
10(a)(ii)	$\begin{pmatrix}12\\48\end{pmatrix}$	**1**	
10(b)	5	**2**	**M1** for $(\textit{their}3)^2+(\textit{their}4)^2$ or better
11	24	**1**	
12(a)	correct graph	**3**	**B1** for line from (0, 0) to (1.5, 30) **B1** for horizontal line from (*their* 1.5, *their* 30) for 0.5 hours **B1** for a line from (*their* 2, *their* 30) ending at distance 70 with a gradient of 16 Provided it fits on the grid and *their* 30 is <70

Question	Answer	Marks	Partial Marks
12(b)	15.6 or 15.55 to 15.56 nfww	**3**	**M2** for 70 ÷ (*their* final time in hours) (final time =) $1.5 + 0.5 + \frac{70 - \textit{their}30}{16}$ or 4.5 or *their* final time from graph or **M1** for 70 ÷ any time
13	$\frac{33}{8}$ or $\frac{17}{6}$ $2\frac{1}{8} - \frac{5}{6}$	**B1**	Correct step for dealing with mixed numbers Allow $\frac{33k}{8k}$ or $\frac{17k}{6k}$
	$\frac{99}{24}$ and $\frac{68}{24}$ $[2]\frac{3}{24} - \frac{20}{24}$	**M1**	Correct method to find common denominator e.g. $4\frac{3}{24}$ and $2\frac{20}{24}$
	$1\frac{7}{24}$ cao and correct working	**A1**	
14	2.6[0] or 2.600…	**3**	**M2** for $\sqrt[10]{\frac{1328.54 + 4540}{4540}}$ or **M1** for $4540 \times k^{10} = 1328.54 + 4540$ for any k If 0 scored **SC1** for answer –11.6 or –11.56…
15	$4a^2b$ final answer	**2**	**M1** for two correct parts out of three from 4, a^2 and b in final answer
16(a)	$(M \cup G) \cap P'$	**1**	
16(b)	22	**1**	
16(c)	$\frac{8}{23}$ oe	**2**	**M1** for $\frac{k}{23}$ or $\frac{k}{3+9+5+6}$ or $\frac{8}{c}$ or $\frac{3+5}{c}$ $c \neq 1$ or for 8 and 23 identified
17(a)	 Correct sketch to go through (0, 0), (180, 0) and (360, 0)	**2**	**B1** for correct sine curve shape through the origin

Question	Answer	Marks	Partial Marks
17(b)	199.5 or 199.47… and 340.5 or 340.52 to 340.53…	**3**	**B2** for one correct or **M1** for $\sin x = -\frac{1}{3}$ oe If 0 scored **SC1** for two reflex angles with sum of 540 or two non-reflex angles with sum of 180
18(a)	2.5	**3**	**M1** for $y = k \times \sqrt[3]{x+1}$ **M1** for $y = their k \times \sqrt[3]{124+1}$
18(b)	multiplied by 4 oe	**1**	
19(a)	$\frac{x+8}{7}$ final answer	**2**	**M1** for $x = 7y - 8$ or $y + 8 = 7x$ or $\frac{y}{7} = x - \frac{8}{7}$
19(b)	4	**2**	**M1** for $4 \div \frac{1}{3} + 5$ oe or better
20(a)	$(2m+3p)(1-4k)$ final answer	**2**	**B1** for $2m + 3p - 4k(2m+3p)$ or better or $2m(1-4k) + 3p(1-4k)$ or correct answer seen and spoilt
20(b)	$5(x-2y)(x+2y)$ final answer	**3**	**B2** for $(5x - 10y)(x + 2y)$ or $(x - 2y)(5x + 10y)$ or correct answer seen then spoilt or **B1** for $5(x^2 - 4y^2)$ or for $(x-2y)(x+2y)$
21	[a =] 2 [b =] − 1	**5**	**M2** for correct method to find two simultaneous equations e.g. two from $a \times 1^2 + b \times 1 - 4 = -3$ $a \times 2^2 + b \times 2 - 4 = 2$ $3a + b = 2 - -3$ or **M1** for 1 correct equation **M1** for correctly eliminating one variable for *their* simultaneous equations **A1** for a = 2 **A1** for b = − 1
22	4 : 3 oe	**2**	**M1** for $\overrightarrow{AD} = -\frac{4}{7}x + \frac{4}{7}y$ oe or $\overrightarrow{DB} = -\frac{3}{7}x + \frac{3}{7}y$ oe

Question	Answer	Marks	Partial Marks
23	18.4 or 18.40…	**4**	**M3** for $\frac{600-\frac{1}{2}\times4\times\pi\times6.2^2}{6.2\times\pi}$ oe or **M2** for $\frac{1}{2}\times4\times\pi\times6.2^2+\pi\times6.2\times l=600$ oe or $\frac{600-4\times\pi\times6.2^2}{6.2\times\pi}$ or better or **M1** for $\left[\frac{1}{2}\right]\times4\times\pi\times6.2^2$ or $\pi\times6.2\times l$

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Maths-Specific Marking Principles	
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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.
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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	0.95 oe	**1**	
2	792 or 792.1…	**2**	**M1** for $\frac{4\times7^3}{\sqrt{3}}$ oe or **B1** for 1372
3	97	**2**	**M1** for 360 – (73 + 129 + 75)
4(a)	0 | (3 4) 7 8 1 | 1 1 2 2 7 8 2 | 1 3	**2**	**B1** for two rows correct or for fully correct unordered stem-and-leaf diagram or for a correct diagram with one error or omission
4(b)	1.15	**1**	
5	0, 3, 8	**2**	**B1** for 2 correct terms in correct position or **SC1** for −1, 0, 3
6(a)	y^{-2} or $\frac{1}{y^2}$ final answer	**1**	
6(b)	7	**1**	
7(a)	27 000	**1**	
7(b)	Point plotted at (175, 9)	**1**	
7(c)	Correct single ruled line of best fit	**1**	
7(d)	300 to 350	**1**	**FT** *their* straight line of best fit provided positive gradient
8	$\frac{2}{9}\times\frac{6}{5}$ or $\frac{4}{18}\div\frac{15}{18}$ oe	**M1**	
	$\frac{4}{15}$ cao	**A1**	
9	18	**2**	**M1** for $\frac{300\times60}{1000}$ oe or **B1** for figs 18 in *their* answer
10	40	**1**	
11	*DE*	**1**	

Question	Answer	Marks	Partial Marks
12	0.14 oe nfww	**4**	**M3** for $\frac{14}{50\times 2}$ with at least 2 out of 3 values correct and for the **one** incorrect value: f must be 1, 2 or 7 m must be a multiple of 50 p must be prime OR **B1** for $f = 14$ **B1** for $m = 50$ **B1** for $p = 2$ If **0** scored **SC1** for a correct multiple for m, factor for f or prime for p
13(a)	$9p(2x - 3)$ final answer	**2**	**B1** for $9(2px - 3p)$ or $p(18x - 27)$ or $3p(6x - 9)$ or $9p(2x - 3)$ seen and spoilt
13(b)	$(m + n)(t - 1)$ final answer	**2**	**B1** for $m(t - 1) + n(t - 1)$ or $t(m + n) - [1](m + n)$ or correct answer seen and spoilt
14	$3n^2 + 5$ oe final answer	**2**	**M1** for correctly finding second differences or an answer that is a quadratic sequence
15	$x \geqslant 2$ final answer	**2**	**M1** for $12x - 4x \geq 13 + 3$ oe
16	D B C	**B1**	
	$\frac{1}{3}$ or 0.333…	**B1**	
	150	**B2**	or **M1** for $\frac{1}{2}\times 30\times 10$
17	*ADC* and *ADB* and 90 *AD* RHS	**3**	**B1** for each correct line

Question	Answer	Marks	Partial Marks
18	252	**3**	**M2** for 180 ÷ (7 – 2) oe OR **M1** for $180 - x + y = 360$ oe **M1** for correct use of ratio
19(a)	3	**2**	**M1** for $k(-5k)^2 = 675$ or better
19(b)	$\frac{5}{7x-2}$ final answer	**1**	
19(c)	$\frac{1}{2}$ or 0.5	**4**	**B3** for answer $\frac{7}{14}$ OR **B2** for $\frac{5x+2}{7}$ or **M1** for correct first step for $h^{-1}(x)$ e.g. $x = \frac{7y-2}{5}$ $5y = 7x - 2$ $y + \frac{2}{5} = \frac{7x}{5}$ **M1FT** for $\frac{2(5x+2)}{14} + \frac{3-10x}{14}$ oe with common denominator
20	90.2 or 90.18…	**4**	**B3** for 9.82[%] OR **M3** for $[100\times]\left(k^2 - \frac{45}{360}\times\pi\times\left(\frac{k}{2}\right)^2\right) \div k^2$ oe or **M2** for $[100\times]\frac{45}{360}\times\pi\times\left(\frac{k}{2}\right)^2 \div k^2$ oe or $k^2 - \frac{45}{360}\times\pi\times\left(\frac{k}{2}\right)^2$ or $100\times(k^2 - m\pi k^2) \div k^2$ or **M1** for $\frac{c}{360}\times\pi\times\left(\frac{k}{2}\right)^2$ oe or for $(k^2 - m\pi k^2) \div k^2$ or for $100\times(k^2 - mk^2) \div k^2$

Question	Answer	Marks	Partial Marks
21	13.75 14.85	**3**	**B2** for one correct answer or both correct answers seen in working then rounded to 3sf or both correct but reversed or **M1** for 2 correct seen from 23 + 0.5, 23 – 0.5, 8.7 + 0.05 or 8.7 – 0.05 or better
22	$\frac{x}{5+x}$ final answer nfww	**3**	**B1** for $x(5-x)$ **B1** for $(5-x)(5+x)$ or
23	221.8 or 221.81... and 318.2 or 318.18 to 318.19	**3**	**B2** for one correct or **M1** for $\sin x = -\frac{2}{3}$ oe If **0** scored, **SC1** for two reflex angles with a sum of 540 or two non-reflex angles with a sum of 180
24	2.8	**3**	**M1** for $y = \frac{k}{(x-1)^3}$ **M1** for $y = \frac{their\ k}{(4-1)^3}$ OR **M2** for $y(4-1)^3 = 9.45(3-1)^3$
25	81	**3**	**M2** for $m^{\frac{3}{4}} = 27$ or better or **M1** for $\frac{1}{m^{\frac{1}{4}}} = \frac{27}{m}$ or better or $m^{-\frac{1}{4}---1} = 27$ If **0** scored **SC1** for answer $\frac{1}{81}$

Cambridge Assessment International Education

Cambridge IGCSE™

MATHEMATICS **0580/22**

Paper 2 (Extended) **February/March 2022**

MARK SCHEME

Maximum Mark: 70

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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[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**:

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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:

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.
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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	40°	**1**	
2	80.50 cao	**2**	**B1** for 80.498… or 80.5 or correctly rounding their more accurate decimal to 2 dp
3	7 [h] 18 [min]	**1**	
4	166	**3**	**M2** for [2 ×] (7×4 + 4×5 + 5×7) or **M1** for 7×4 or 4×5 or 5×7
5(a)	5	**1**	
5(b)	(0, 7)	**1**	
6	correct triangle with arcs	**2**	**B1** for correct triangle with incorrect or no arcs or for two correct arcs. or a triangle with arcs but one side not in range
7	$n > -1$ oe	**1**	
8(a)(i)	triangle at (− 1, 1) (− 4, 2) (− 3, 5)	**1**	
8(a)(ii)	triangle at (− 2, −3) (1, − 2) (0, 1)	**2**	**B1** for translation by $\begin{pmatrix}-3\\k\end{pmatrix}$ or by $\begin{pmatrix}k\\-4\end{pmatrix}$
8(b)	enlargement [sf] $\frac{1}{2}$ [centre] (9, − 1)	**3**	**B1** for each
9	$3a\left(4a^2-7\right)$ final answer	**2**	**B1** for $3\left(4a^3-7a\right)$ or $a\left(12a^2-21\right)$ or for $3a\left(4a^2-7\right)$ seen then spoilt
10(a)	8 11 16	**2**	**B1** for two correct
10(b)	23 – 8n oe final answer	**2**	**B1** for $j - 8n$ or $23 - kn$ $k \neq 0$ or 23 – 8n seen then spoilt
11	Positive	**1**	

Question	Answer	Marks	Partial Marks
12(a)	805	**3**	**B2** for 105 or **M2** for $\frac{700\times2.5\times6}{100}+700$ oe or **M1** for $\frac{700\times2.5[\times6]}{100}$ oe
12(b)	2.3[0…]	**3**	**M2** for $\sqrt[17]{\frac{1030.35}{700}}$ oe or **M1** for $1030.35=700(k)^{17}$ oe for any k
13(a)	h^7 final answer	**1**	
13(b)	$\frac{x^3}{343}$ final answer	**1**	
13(c)	6	**1**	
14	29.5 or 29.53…	**2**	**M1** for $2\times\pi\times4.7$ oe
15	$\frac{7}{3}$ oe improper fraction	**M1**	or $\frac{k}{3}\times\frac{11}{14}$ where $k>3$
	$1\frac{5}{6}$ cao	**A2**	**A1** for $\frac{77}{42}$ or $\frac{11}{6}$ or $1\frac{35}{42}$
16(a)	$[y=]-2x-7$ final answer	**2**	**B1** for $-2x+c$ or $kx-7$, $k\neq0$ final answer
16(b)	$y=\frac{1}{2}x[\pm0]$ final answer	**2**	**FT** $-\frac{1}{\textit{their gradient in}\ \textbf{(a)}}$ **B1** for $y=kx[\pm0]$ oe, $k\neq0$ or $y=\textit{their}\frac{1}{2}x+c$ oe for any c or $\textit{their}\frac{1}{2}x$ $[\pm0]$ oe

Question	Answer	Marks	Partial Marks
17	77.8 or 77.77 to 77.80	**5**	**B4** for answer 22.2[%] or 22.20[%] to 22.23[%] OR **M1** for $tan^{-1}\frac{11}{4}$ oe or $tan^{-1}\frac{4}{11}$ oe **M2** for $4\times11-\frac{their\ acute\ angle}{360}\times\pi\times4^2$ oe or **M1** for $\frac{their\ acute\ angle}{360}\pi\times4^2$ oe **M1** for $\frac{their\ shaded\ area}{4\times11}$ [×100] oe or $\frac{their\ sector\ area}{4\times11}$ ×100 oe
18	A correct equation leading to 41	**3**	**M2** for $4x=164$ or **M1** for $x+2(x-24)+x-16=100$ oe or **M1** for correctly simplifying *their* equation to the form $kx = c$ provided at least one part correct from $[2](x-24)$ oe or $x-16$ or **B1** for answer 41 without an equation in x shown
19	$\frac{2}{3}$ oe	**3**	**M1** for $y=\frac{k}{\sqrt{x+4}}$ **M1** for $y=\frac{theirk}{\sqrt{77+4}}$

Question	Answer	Marks	Partial Marks
20	$x^2+6x-40$ [=0] or $y^2-40y-41$ [=0]	**M2**	**M1** for correct method to eliminate one variable e.g. $x^2-2(11-3x)=18$ or $\frac{(11-y)^2}{3^2}-2y=18$
	$(x-4)(x+10)$ [=0] or $(y-41)(y+1)$ [=0]	**M1**	or for correct factors for *their* quadratic equation or for correct use of quadratic formula for *their* quadratic equation or for correctly completing the square for *their* quadratic equation
	$x=4, y=-1$ $x=-10, y=41$	**B2**	**B1** for $x=4$, $x=-10$ or for $y=-1$, $y=41$ or for a correct pair of x and y values If B0 scored and at least 1 method mark scored **SC1** for correct substitution shown of both of *their x* values or *their y* values into $3x+y=11$ or $x^2-2y=18$
21(a)	35.1 or 35.05 to 35.06	**4**	**M3** for $\tan = \frac{14.5}{\sqrt{18.6^2+9^2}}$ oe or **M2** for $[AC^2 =]18.6^2+9^2$ oe or better or $[AG^2 =]18.6^2+9^2+14.5^2$ or **M1** for recognising the angle *GAC*

Question	Answer	Marks	Partial Marks
21(b)	$30-\sqrt{18.6^2+9^2+14.5^2}$ $30-\dfrac{14.5}{\sin(their\,\mathbf{(a)})}$ or $30-\dfrac{\sqrt{18.6^2+9^2}}{\cos(their\,\mathbf{(a)})}$	**M2**	**M1** for $AG^2=18.6^2+9^2+14.5^2$ oe or better or $\sin(their\,\mathbf{(a)})=\dfrac{14.5}{\text{AG}}$ or $\cos(their\,\mathbf{(a)})=\dfrac{\sqrt{18.6^2+9^2}}{\text{AG}}$
	4.75 to 4.78…	**A1**	
22(a)	$\boldsymbol{a}-\dfrac{2}{5}\boldsymbol{b}$ oe simplified	**2**	**M1** for $-\boldsymbol{b}+\boldsymbol{a}+\dfrac{3}{5}\boldsymbol{b}$ or a correct route
22(b)	$\dfrac{5}{2}\boldsymbol{a}$ oe	**2**	**B1** for $k\mathbf{a}$ where $k>1$ or $\dfrac{5}{2}\overrightarrow{\text{OR}}$

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MATHEMATICS **0580/21**

Paper 2 (Extended) **October/November 2021**

MARK SCHEME

Maximum Mark: 70

Published

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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	79	**2**	**B1** for 64 or 81 seen or for answer 61, 62, 67, 71 or 73
2(a)	Sunday 24 [July] 02 15	**3**	**B1** for Sunday 24th [July] as final answer **B2** for 02 15 oe as final answer or **B1** for sight of any of these 12 40 oe, 11 15 oe, 28h 35min, 50 15, 35 15 or 0215 oe spoilt or **M1** for departure time + 13h35min + 15h evaluated as a time with one interval correctly added
2(b)	6320.4[0]	**1**	
3	3.1	**1**	
4(a)	22	**1**	
4(b)	30	**1**	
5	<table><tr><td>lost</td><td>drawn</td></tr><tr><td>0.6 oe</td><td>0.3 oe</td></tr></table>	**3**	**B2** for 0.6 oe or 0.3 oe or **M1** for 1 – 0.1 or 0.9 seen
6(a)	32.8	**2**	**M1** for 8[cm] to 8.4[cm] seen or for *their* measurement [in cm] multiplied by 4
6(b)	065	**1**	
6(c)	*X* correctly placed 7 cm from *P* on a bearing of 140°	**2**	**M1** for *X* on bearing of 140 from *P* or for *X* 7 cm from *P* If 0 scored **SC1** for *X* on bearing of 140 from *Q* **and** 7 cm from *Q*
7	$\frac{25 \text{ or } 55}{30}$ and $\frac{12}{30}$	**M1**	Accept $\frac{25k \text{ or } 55k}{30k}$ and $\frac{12k}{30k}$
	$2\frac{7}{30}$ cao	**A2**	**A1** for $\frac{67k}{30k}$ or $1\frac{37k}{30k}$

Question	Answer	Marks	Partial Marks
8	Correctly eliminates one variable	**M1**	
	[x =] – 3 , [y =] 0.5 oe	**A2**	**A1** for either correct If M0 scored, **SC1** for 2 values satisfying one of the original equations If 0 scored, **SC1** for correct answers from no working
9	54.3 or 54.31…	**2**	**M1** for cos [x] = $\frac{7}{12}$ oe
10	60	**2**	**M1** for 360 ÷ (180 – 174) or for $\frac{180(n-2)}{n}=174$ oe
11	$y=\frac{1}{5}x+6$ oe final answer	**3**	**B2** for $y=\frac{1}{5}x+c$ oe or $\frac{1}{5}x+6$ oe or $y = mx + 6$ oe or **B1** for [gradient =] $\frac{1}{5}$ oe or $mx + 6$
12	[–] 9	**3**	**M2** for [k ×] $\left(1-\frac{35}{100}\right)\times\left(1+\frac{40}{100}\right)$ oe or better or for [k ×] $\left(\frac{35}{100}-\left(1-\frac{35}{100}\right)\times\frac{40}{100}\right)$ or **M1** for [k ×] $\left(1-\frac{35}{100}\right)$ oe or [k ×] $\left(1+\frac{40}{100}\right)$ or better
13	$x\leqslant 1$ final answer	**3**	**M1** for $20 – 15x \geqslant 6 – x$ or $4-3x\geqslant\frac{6}{5}-\frac{x}{5}$ **M1** for correctly isolating terms in x FT *their* first step of dealing with the 5 $20 – 6 \geqslant – x + 15x$ or $-3x+\frac{x}{5}\geqslant\frac{6}{5}-4$

Question	Answer	Marks	Partial Marks
14	38	**3**	**M2** for $12\times\sqrt{4.25-2}=3\times\sqrt{x-2}$ OR **M1** for $y=\frac{k}{\sqrt{x-2}}$ oe **M1** for $3=\frac{their\ k}{\sqrt{x-2}}$ oe
15	3 : 5 nfww	**4**	**M3** for $5^2 - 1$ oe and $8^2 - 5^2 + 1$ oe or **M2** for $5^2 - 1$ oe or $8^2 - 5^2 + 1$ oe or **M1** for 5^2 oe or 8^2 oe seen
16(a)	$n^3 + 7$ oe final answer	**2**	**B1** for any cubic or for 3rd differences of 6
16(b)	$\frac{n+1}{4^{n-1}}$ oe final answer	**3**	**B1** for $n + 1$ **B2** for 4^{n-1} oe or **B1** for 4^{n-k} oe k can be 0 Maximum 2 marks if not correctly combined as a fraction
17	$[x =]\ \frac{y+2}{y+3}$ oe final answer	**4**	**M1** $y\,(1 - x) = 3x - 2$ or better **M1** for correctly isolating x terms on one side FT *their* first step/bracket expansion **M1dep** for correctly removing factor of x FT *their* previous step **M1dep** for correct division to isolate x Max 3 marks for an incorrect answer
18	1150	**3**	**M2** for $\left(\frac{1}{2}\times 800\times 2300\times\sin 30\right)\div 400$ oe or **M1** for $\frac{1}{2}\times 800\times 2300\times\sin 30$ oe
19	$\frac{8-5x-x^2}{7(x+3)}$ or $\frac{8-5x-x^2}{7x+21}$ final answer	**3**	**B1** for $7 \times 2 - (x + 2)(x + 3)$ or better seen **B1** for common denominator $7(x + 3)$ oe isw

Question	Answer	Marks	Partial Marks
20	109.4 to 109.5 and 250.5 to 250.6	**3**	**B2** for one correct angle or **M1** for cos $x = \frac{5}{3} - 2$ or better If 0 scored **SC1** for two angles that sum to 360
21	68.6 or 68.55 to 68.56	**4**	**M3** for tan[..] = $\frac{9}{\frac{1}{2}\sqrt{5^2+5^2}}$ oe or **M2** for $\frac{1}{2}\sqrt{5^2+5^2}$ oe or **M1** for $5^2 + 5^2$ oe or $2.5^2 + 2.5^2$ oe or $x^2 + x^2 = 5^2$ oe or **B1** for indicating required angle
22(a)	x^{-2} or $\frac{1}{x^2}$ final answer	**1**	
22(b)	$\frac{2}{3}$	**1**	
22(c)	1 nfww	**3**	**M1** for $3^{-2(4-3x)}$ oe or better or $9^{\frac{3x}{2}} \times 9^{-(4-3x)} = 9^{\frac{1}{2}}$ oe or better **M1** for $3x + (their - 2) \times (4 - 3x) = 1$ oe or better or $their\frac{3x}{2} - (4-3x) = their\frac{1}{2}$ oe or better

Cambridge Assessment International Education

Cambridge IGCSE™

MATHEMATICS **0580/22**

Paper 2 (Extended) **October/November 2021**

MARK SCHEME

Maximum Mark: 70

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

Generic Marking Principles

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- the specific skills defined in the mark scheme or in the generic level descriptors for the question
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GENERIC MARKING PRINCIPLE 2:

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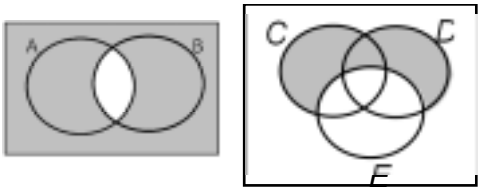
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

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	7.5	**1**	
2	41 43 20	**3**	**B1** for each
3	129	**1**	
4	79 nfww	**3**	**M2** for $x + x + 58 + 58 + 86 = 360$ oe or $86 - (180 - 2 \times 58)$ implied by $CAB = 22$ or **B1** for $DCA = 58$ or $BCA = x$ or $DAC = 64$
5	12	**3**	**M2** for $(95.25 - 15.5) \div 7.25$ oe or $(95.25 - (15.5 - 7.25)) \div 7.25$ oe or **M1** for $95.25 - 15.5$ or **B1** for 79.75
6	$\frac{1}{3} \times \frac{6}{7}$ oe or $\frac{2}{6} \div \frac{7}{6}$ oe	**M1**	
	$\frac{2}{7}$ oe	**A1**	
	their $\frac{2}{7} + \frac{1}{5}$ with a correct method to find fractions with a common denominator	**M1**	e.g. $\frac{10}{35} + \frac{7}{35}$ oe
	$\frac{17}{35}$ cao	**A1**	If order of operations not correct **SC2** for answer $\frac{10}{41}$ with correct working for $\frac{1}{3} \div \left(\frac{7}{6} + \frac{1}{5}\right)$ or **SC1** for $\frac{35}{30} + \frac{6}{30}$ oe
7	$\frac{37}{60}$ oe	**4**	**B3** for $x = 18$ or 37 [yellow] or **SC2** for answer $\frac{5}{12}$ or **M2** for $\frac{1}{12} = \frac{5}{5+x+2x+1}$ oe or **M1** for $5 + x + 2x + 1$ oe or [total number of flowers =] 60

Question	Answer	Marks	Partial Marks
8	2.5 oe	**1**	
9	$\frac{24}{1000} < 2.1 \times 10^{-1} < 22\% < 0.\dot{2} < \sqrt{0.2}$	**2**	**M1** for four values in the correct order or for conversion to consistent comparable form e.g. 0.21, 0.22…, 0.22, 0.4.., 0.024
10	15	**2**	**M1** for 360 ÷ (180 – 156) or $\frac{180(n-2)}{n} = 156$ oe
11	Straight line from (20, 14) to (35, 14) and straight line from (35, 14) to (45, 0)	**3**	**M1** for 210 ÷ 14 soi **M1** for 14 ÷ 1.4 or any line with gradient –1.4 ending at x axis
12	$13 - 5n$ oe final answer $\frac{n+1}{n}$ oe final answer 2^{n-2} oe final answer	**5**	**B2** for $13 - 5n$ oe final answer or **B1** for $-5n + c$ or $13 - kn$ $k \neq 0$ or $13 - 5n$ seen then spoilt **B1** for $\frac{n+1}{n}$ oe final answer **B2** for 2^{n-2} oe final answer or **B1** for 2^{n-k} oe k can be 0
13(a)	3^{6n+5} final answer	**2**	**B1** for 3^5 or $(3^3)^{2n}$ or better or answer $6n + 5$
13(b)	$2^3 \times 3^5 \times p^6$ final answer	**2**	**B1** for two parts correct or $2 \times 3 \times 2 \times 3^2 \times p^3 \times 2 \times 3^2 \times p^3$ or $1944p^6$ or $k^2 = 2^2 \times 3^4 \times p^6$
14(a)	55 Alternate segment theorem	**2**	**B1** for 55
14(b)	Tangents from an external point are equal in length	**1**	
15(a)	[y =] $3x + 7$ final answer	**3**	**M1** for $\frac{31-16}{8-3}$. oe **M1** for correct substitution of (3, 16) or (8, 31) into $y = (\textit{their } m)x + c$
15(b)	–2	**1**	

Question	Answer	Marks	Partial Marks
16(a)	Multiples of 3 Prime numbers + | 3 | **6** | 9 2 | 5 | **8** | 11 3 | 6 | **9** | **12** **5** | **8** | **11** | **14**	**2**	**B1** for at least 4 correct entries
16(b)	$\frac{2}{5}$ oe	**2**	**B2FT** for $\frac{their\,2}{their\,5}$ or **B1FT** for $\frac{their\,2}{k}$ k is any integer in the range $1 \leqslant k \leqslant 7$ or $\frac{c}{their\,5}$ c is 0, 1 or 2
17	$\frac{3}{5}$ oe and $-\frac{7}{2}$ oe	**1**	
18	$x^2 - 11x + 24$ [= 0] or $y^2 - 16y + 39$ [= 0]	**M2**	**M1** for $x^2 - 9x + 21 = 2x - 3$ oe or $y = \left(\frac{y+3}{2}\right)^2 - 9\left(\frac{y+3}{2}\right) + 21$ oe
	$(x - 8)(x - 3)$ [= 0] or $(y - 13)(y - 3)$ [= 0]	**M1**	or for correct factors for *their* quadratic equation or for correct use of quadratic formula for *their* equation
	[x =] 3 [y =] 3 [x =] 8 [y =] 13	**B2**	**B1** for one correct pair or two correct x values or two correct y values. If B0 scored **and** at least 2 method marks scored **SC1** for correct substitution of both of *their* x values or *their* y values into $y = x^2 - 9x + 21$ or $y = 2x - 3$
19		**2**	**B1** for each
20(a)	32	**2**	**M1** for f(6) = 8 or $\text{ff}(x) = 2^{\left(2^{x-3}\right)-3}$ oe

Question	Answer	Marks	Partial Marks
20(b)	$x + 21$	**1**	
20(c)	–1	**2**	**M1** for $\frac{1}{16}$ oe or 2^{-4} oe
21	$2x^3 - 7x^2 - 12x + 45$ final answer	**3**	**B2** for unsimplified expansion of the three brackets with at most one error or for simplified four-term expression of correct form with three terms correct or **B1** for correct expansion of two of the given brackets with at least three terms out of four correct
22	196.6 or 196.60… and 343.4 or 343.39…	**3**	**B2** for one correct angle or **M1** for $\sin x = -\frac{2}{7}$ or better If 0 scored **SC1** for two angles that sum to 540°
23	$\frac{3y-5}{2(x-12)}$ or $\frac{3y-5}{2x-24}$ final answer	**4**	**SC3** for answer $\frac{3y-5}{x-12}$ or **B3** for $(3y – 5)(x + 12)$ **and** $2(x – 12)(x + 12)$ or $(2x – 24)(x + 12)$ or **B2** for $(3y – 5)(x + 12)$ or $2(x – 12)(x + 12)$ or $(2x – 24)(x + 12)$ or $(2x + 24)(x – 12)$ or **B1** for $3y(x + 12) – 5(x + 12)$ or $x(3y – 5) + 12(3y – 5)$ or $2(x^2 – 144)$ or $(x – 12)(x + 12)$

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MATHEMATICS **0580/23**

Paper 2 (Extended) **October/November 2021**

MARK SCHEME

Maximum Mark: 70

Published

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[Turn over

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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	12.5	**1**	
2	48	**2**	**B1** for 132 or 48 in the correct position on the diagram or **M1** for 180 – 132
3	13	**1**	
4(a)	$\neq$ and $>$ indicated	**1**	
4(b)	$7 - (3 - 1) + 2 = 7$ cao	**1**	
5	170	**1**	
6	357	**2**	**M1** for $\left(1-\frac{15}{100}\right)\times 420$ oe or **B1** for 63
7	$8g^{28}$ final answer	**2**	**B1** for kg^{28} or $8g^{k}$ as final answer or correct answer seen and spoilt
8	4.32	**3**	**B1** for $\frac{1}{4}$ oe or $\frac{2}{4.5}$ oe seen **M1 dep** on **B1** for $\frac{1+2}{their\frac{1}{4}+their\frac{2}{4.5}}$ oe
9	$\frac{3}{11}$ oe fraction	**1**	
10(a)	–13	**1**	
10(b)	$-4n + 7$ oe final answer	**2**	**B1** for $-4n + k$ or $jn + 7$ ($j \neq 0$) or for a correct answer spoilt
11(a)	2925	**2**	**M1** for $100(3^2 + 4.5^2)$ or **B1** for 29.25 seen
11(b)	$[\pm]\sqrt{\frac{P}{M}-h^2}$ or $[\pm]\sqrt{\frac{P-Mh^2}{M}}$ final answer	**3**	**M1** for correct division by M **M1** for correct re-arrangement to isolate g or g^2 **M1** for correct square root of two term expression Max **2** marks for an incorrect answer
12	$\frac{11}{12}+\frac{9}{12}$ oe	**M1**	Allow any correct common denominator $12k$
	$1\frac{2}{3}$ cao	**A2**	**A1** for $\frac{20}{12}$ or equivalent improper fraction or mixed number

Question	Answer	Marks	Partial Marks
13	$1[.0] \times 10^{-2}$ cao	**2**	**B1** for 0.01 oe
14(a)	*b, c, d, e, f, g*	**1**	
14(b)	4	**1**	
14(c)	3	**1**	
15	145	**2**	**M1** for $x\left(1+\frac{6}{100}\right) = 153.7$ oe or better
16	31 : 21	**3**	**B2** for equivalents e.g. 15.5 oe and 10.5 oe or for an equivalent ratio e.g. 3.1 : 2.1 or **M1** for e.g. $x + 5 + x = 26$ oe or $x – 5 + x = 26$ oe
17	240	**2**	**M1** for $360 \div (180 – 178.5)$ oe or for $\frac{180(n-2)}{n} = 178.5$ oe
18	[y =] $12x – 26$ final answer	**3**	**M1** for $\frac{10--2}{3-2}$ oe **M1** for correct substitution of (2, –2) or (3, 10) into y = (*their m*)$x + c$ oe
19	33.8 or 33.78 to 33.80	**4**	**M2** for $2 \times 12.6 \times \sin 40$ oe or **M1** for $\sin 40 = \frac{(...)}{12.6}$ oe **M1** for $\frac{80}{360} \times 2 \times \pi \times 12.6$ oe
20	40 000	**3**	**B2** for 1 cm to 0.4 km or 2.5 cm to 1 km or 1 600 000 000 or **M2** for $\sqrt{\frac{3 \times 10^k}{18.75}}$ oe where $k > 5$ or **M1** for 1 cm^2 to 0.16 km^2 or 6.25 cm^2 to 1 km^2 or for 3×10^{10} oe or 1.875×10^{-9} oe or 3×10^6 oe **and** 1.875×10^{-3} oe
21	$27y^6$ final answer	**2**	**B1** for ky^6 or $27y^k$ as final answer or correct answer seen and spoilt

Question	Answer	Marks	Partial Marks
22	$x^2 - 4x - 12$ [= 0] or $y^2 - 2y - 15$ [= 0]	**M2**	**M1** for $x^2 - 3x - 13 = x - 1$ or for $y = (y + 1)^2 - 3(y + 1) - 13$
	$(x - 6)(x + 2)$ [= 0] or $(y - 5)(y + 3)$ [= 0]	**M1**	or for correct factors for *their* quadratic equation or for correct use of quadratic formula or completing the square for *their* equation
	[x =] 6, [y =] 5 [x =] –2, [y =] –3	**B2**	**B1** for one correct pair or two correct x values or two correct y values If **B0** scored **and** at least 2 method marks scored **SC1** for correct substitution of both of *their x* values or *their y* values into $y = x^2 - 3x - 13$ or $y = x - 1$
23(a)	13.6 or 13.60…	**3**	**M2** for $12^2 + 5^2 + 4^2$ or **M1** for $5^2 + 4^2$ or $12^2 + 4^2$ or $12^2 + 5^2$
23(b)	17.1 or 17.08 to 17.10…	**3**	**M2** for sin = $\frac{4}{\textit{their}\ \textbf{(a)}}$ oe or tan = $\frac{4}{\textit{their AP}}$ or cos = $\frac{\textit{their AP}}{\textit{their}\ \textbf{(a)}}$ or **M1** for recognising angle *CAP*.
24	60 and 240	**2**	**B1** for 60 or 240 If 0 scored **SC1** for two answers with a difference of 180°
25	$\frac{3x}{a + 2c}$ final answer	**4**	**B1** for $3x(x - 6)$ **B2** for $(x - 6)(a + 2c)$ or **B1** for $a(x - 6) + 2c(x - 6)$ or $x(a + 2c) - 6(a + 2c)$
26	$\frac{3}{5}\mathbf{r} + \frac{2}{5}\mathbf{t}$ or $\frac{1}{5}(3\mathbf{r} + 2\mathbf{t})$	**3**	**M2** for $\mathbf{r} + \frac{2}{5}(-\mathbf{r} + \mathbf{t})$ oe or $\mathbf{t} + \frac{3}{5}(\mathbf{r} - \mathbf{t})$ oe or **M1** for $\overrightarrow{RT} = -\mathbf{r} + \mathbf{t}$ oe or $\overrightarrow{TR} = \mathbf{r} - \mathbf{t}$ **M1** for $\overrightarrow{OR} + \overrightarrow{RX}$ or $\overrightarrow{OT} + \overrightarrow{TX}$ any other correct route.

Cambridge Assessment International Education

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MATHEMATICS **0580/21**

Paper 2 (Extended) **May/June 2021**

MARK SCHEME

Maximum Mark: 70

Published

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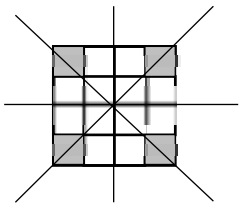
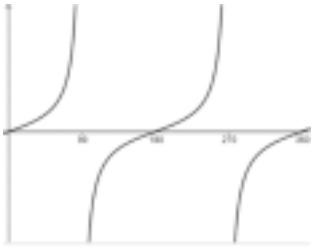
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Question	Answer	Marks	Partial Marks
1(a)	4	**1**	
1(b)		**2**	**B1** for 2 or 3 correct lines drawn or for 4 correct lines and one wrong extra line
2	0.85 oe	**1**	
3(a)	28	**1**	
3(b)	21	**1**	
3(c)	35	**1**	
4	[a =] 59 [b =] 37 [c =] 84	**3**	**B1** for each If 0 scored **SC1** for *their* ($a + b + c$) = 180 if $a, b, c > 0$
5(a)	$\begin{pmatrix}14\\-6\end{pmatrix}$	**1**	
5(b)	$\begin{pmatrix}-12\\21\end{pmatrix}$	**1**	
6(a)	4 10 18	**2**	**B1** for 2 correct
6(b)	$32 - 7n$ oe final answer	**2**	**B1** for $32 - kn$ oe $k \neq 0$ *or* $j - 7n$ oe or $32 - 7n$ seen then spoilt
7	correctly eliminating 1 variable	**M1**	
	$x = 5$	**A1**	
	$y = -7$	**A1**	If M0 scored **SC1** for two values satisfying one of the original equations

Question	Answer	Marks	Partial Marks
8	$\frac{11}{8}$ [$-\frac{5}{6}$] $\frac{3}{8}+\frac{1}{6}$	**B1**	Correct step for dealing with mixed number Allow $\frac{11k}{8k}$
	$\frac{33}{24}$ and $\frac{20}{24}$ $\frac{9}{24}$ and $\frac{4}{24}$	**M1**	Correct method to find common denominator e.g. 1 $\frac{9}{24}$ and $\frac{20}{24}$
	$\frac{13}{24}$ cao	**A1**	
9(a)	(7, − 1)	**2**	**B1** for each
9(b)	8.94 or 8.944…	**3**	**M2** for $\sqrt{(9-5)^2+(3--5)^2}$ oe or **M1** for $(9-5)^2+(3--5)^2$ oe
10(a)(i)	Rotation 90° anticlockwise oe (0, − 1)	**3**	**B1** for each
10(a)(ii)	enlargement [s.f.] $\frac{1}{3}$ (6, 6)	**3**	**B1** for each
10(b)	triangle at (− 4, 7) (− 4, 1) (− 1, 1)	**2**	**B1** for translation by $\begin{pmatrix}k\\10\end{pmatrix}$ or $\begin{pmatrix}2\\k\end{pmatrix}$
11(a)	$256a^4b^{20}$ final answer	**2**	**B1** for two correct elements in final answer
11(b)	27	**1**	
11(c)	6	**2**	**M1** for $3^k \div 3^t = 3^2$ or $3^8 \div 3^t = 3^k$ oe or better or $3^t = 729$ oe
12	9080 or 9080.13	**2**	**M1** for $9500\times\left(1-\frac{0.9}{100}\right)^5$
13	1.8432	**2**	**M1** for $\frac{32\times24000\times24000}{100000\times100000}$ oe If 0 scored, **SC1** for figs 184[32]... as answer

Question	Answer	Marks	Partial Marks
14	24	**3**	**M1** for $y = k\sqrt{x-3}$ oe **M1** for $y = \textit{their}\ k\sqrt{39-3}$ oe
15	$\frac{g}{2m+g}$ final answer	**4**	**M1** for expanding brackets or $\div g$ **M1** for isolating terms in h **M1** for factorising **M1** for dividing by bracket to isolate h Incorrect/unsimplified final answer scores max 3 marks
16(a)	$-\frac{3}{4}$ or -0.75	**2**	**M1** for correct rise over run or **B1** for answer $\frac{3}{4}$ oe
16(b)	$[y =] -\frac{3}{4}x + 2$ oe	**2**	**FT** $[y =]\textit{their}$ **(a)**$x + 2$ oe **B1** for $[y =]\textit{their}$ **(a)**$x + c$ or $[y =]mx + 2$.
16(c)	$[y =] \frac{4}{3}x - 23$ oe	**3**	**M1** for gradient $\frac{-1}{\textit{their}\ \textbf{(a)}}$ **M1** for (12, − 7) substituted into $y = \textit{their}\ mx + c$
17	$\frac{19}{60}$ oe	**3**	**M2** for $\frac{8}{16}\times\frac{7}{15}+\frac{5}{16}\times\frac{4}{15}$ or **M1** for $\frac{8}{16}\times\frac{7}{15}$ or $\frac{5}{16}\times\frac{4}{15}$ If 0 scored **SC1** for $\frac{89}{256}$ oe
18	$\frac{5}{9}$ **a** + $\frac{4}{9}$ **b**	**2**	**M1** for $\frac{4}{9}$ (**b** – **a**) or $\frac{5}{9}$ (**a** – **b**) or a correct route
19(a)	Correct sketch 	**2**	**1** for one correct branch or correct sketch but with branches joined
19(b)	11.3 or 11.30 to 11.31 and 191.3 or 191.30 to 191.31	**2**	**B1** for each If 0 scored **SC1** for two answers with a difference of 180°

Question	Answer	Marks	Partial Marks
20	68 nfww	**3**	**M2** for $\frac{600-5}{8\text{h}40\text{ to}8\text{h}50}$ or $\frac{590\,to\,600}{8\text{h}40+5[\text{m}]}$ oe or **M1** for 600 – 5 oe or 8h 40 + 5[m] oe or 520 + 5 oe[m] seen

Cambridge Assessment International Education

Cambridge IGCSE™

MATHEMATICS **0580/22**

Paper 2 (Extended) **May/June 2021**

MARK SCHEME

Maximum Mark: 70

Published

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- marks are not deducted for omissions
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GENERIC MARKING PRINCIPLE 5:

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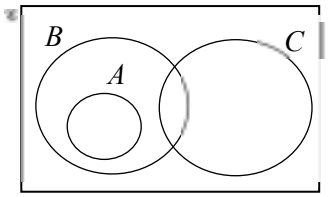
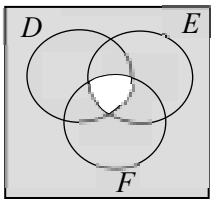
GENERIC MARKING PRINCIPLE 6:

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.

Question	Answer	Marks	Partial Marks
1(a)	$\frac{3}{10}$ oe	**1**	
1(b)	35	**1**	
2	0.4 or $\frac{2}{5}$	**1**	
3	Mode 16 Median 11 Range 17	**3**	**B1** for each
4	$k - 1$	**1**	
5(a)	It is not possible to tell if there is correlation as there are not enough points.	**1**	
5(b)	C	**1**	
6	Accurate construction of rhombus with sides 6.5 cm and correct construction arcs.	**2**	**B1** for accurate diagram with no/wrong arcs or for one triangle (6.5 cm, 6.5 cm, 8 cm) correctly constructed with correct arcs or for four correct arcs
7(a)	5 97	**2**	**B1** for each
7(b)	$\sqrt{7}$	**1**	
8	[±] 7.5 oe	**2**	**M1** for $5.625 = \frac{b^2}{2\times5}$ or better
9	$\frac{2}{3} \times \frac{7}{10}$ or $\frac{14}{21} \div \frac{30}{21}$ oe with common denominator	**M2**	**B1** for $\frac{10}{7}$ oe or **M1** for $\frac{2}{3} \times$ *their* $\frac{7}{10}$
	$\frac{7}{15}$ cao	**A1**	
10(a)	6.54×10^{-3}	**1**	
10(b)	99	**1**	
11	$\frac{4}{99}$ cao	**1**	
12(a)(i)	Even square numbers oe	**1**	

Question	Answer	Marks	Partial Marks
12(a)(ii)		**1**	
12(b)		**1**	
13	68	**3**	**M1** for correctly identifying 90° angle soi or *DAC* / *DCA* = 68 **M1** for [obtuse angle] *AOC* identified as $2x$ soi or x = *their DAC / DCA*
14	456 or 456.4…	**4**	**M2** for $\frac{18.2}{\tan 62}$ oe or **M1** for $\tan 62 = \frac{18.2}{x}$ oe **M1** for $\frac{1}{2}\left(\left(\textit{their trapezium base}\right)+15.4\right)\times 18.2$ oe
15	Congruent SAS Congruent SSS Not congruent None	**3**	**B1** for each correct row
16(a)	8.94 or 8.944…	**3**	**M2** for $\sqrt{(9-5)^2+(-1-7)^2}$ oe or **M1** for $(9-5)^2+(-1-7)^2$ oe
16(b)	$y = -2x + 17$ oe final answer	**3**	**B2** for answer $-2x + 17$ OR **M1** for $\frac{-1-7}{9-5}$ oe **M1** for correct substitution of (5, 7) or (9, –1) into y = *their* $mx + c$ oe
17	$-\frac{3}{4}$ or – 0.75	**2**	**M1** for $y=\frac{4x-5}{3}$ or better or for $\frac{-1}{\textit{their gradient}}$

Question	Answer	Marks	Partial Marks
18	$[x =] -2.1$ oe	**4**	**M3** for $x^2 + 10x = x^2 - 21$ or better OR **M1** for $(x + 1 + 4)^2 - 25$ or better **M1** for $x^2 - 25 + 4$ or better If 0 scored **SC1** for answer $-\frac{11}{6}$ oe
19(a)	77.3 or 77.32 to 77.33…	**3**	**M2** for $\frac{360-60}{360}\times\pi\times12.4\times2$ oe $[\pm n \times 12.4]$ or **M1** for angle 60° or 300° soi or for $\frac{k}{360}\times\pi\times12.4\times2$ oe $[\pm n \times 12.4]$
19(b)	5.17 or 5.172 to 5.173…	**3**	**M2** for $\frac{74.5}{\pi}\times\frac{360}{360-41}=r^2$ oe or better or **M1** for $74.5=\frac{360-41}{360}\times\pi r^2$ oe or for $\sqrt{\frac{74.5}{\pi}\times\frac{360}{k}}$ oe
20	$2x^3 + 7x^2 - 7x - 30$ final answer	**3**	**B2** for unsimplified expansion with at most one error or for simplified four-term expression of correct form with three terms correct or **B1** for correct expansion of two brackets with at least three terms out of four correct
21(a)	$[F =]\frac{108}{d^2}$ final answer	**2**	**M1** for $F = \frac{k}{d^2}$ oe or better
21(b)	$[n =]\frac{1}{4}$ or 0.25	**1**	
22	$\frac{2x+3}{3x}$ final answer	**4**	**B2** for $(x-4)(2x+3)$ or **B1** for $(x + a)(2x + b)$ where $ab = -12$ or $2a + b = -5$ or $x(2x+3)-4(2x+3)$ or $2x(x-4)+3(x-4)$ **B1** for $3x(x-4)$
23	48.6 or 48.59… and 131.4 or 131.4…	**2**	**B1** for each If 0 scored **SC1** for two answers with a sum of 180°

Question	Answer	Marks	Partial Marks
24	$x = 3$, $x = -3$ nfww	**5**	**M2** for $x + 9 + 9(x + 1) = (x + 1)(x + 9)$ oe or better or **M1** for $x + 9 + 9(x + 1)$ or $(x + 1)(x + 9)$ oe or better **B1** for $x^2 + x + 9x + 9$ seen **M1 dep** for $[0 =]x^2 - 9$ oe simplified or better

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MATHEMATICS **0580/23**

Paper 2 (Extended) **May/June 2021**

MARK SCHEME

Maximum Mark: 70

Published

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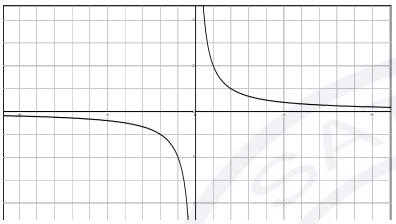
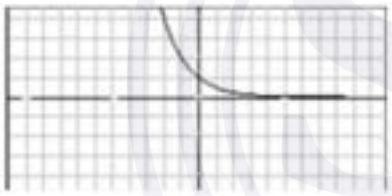
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Question	Answer	Marks	Partial Marks
1	–24.6	**1**	
2(a)	$\frac{18}{25}$ cao	**1**	
2(b)	$\frac{1}{250}$ cao	**1**	
3	Corresponding	**1**	
4	130	**2**	**M1** for 360 – 100 or better
5	63	**2**	**M1** for $600\times\frac{1.5}{100}$ oe or better If **0** scored **SC1** for answer 663
6	$100y - np$	**2**	**B1** for $100y$ seen or for answer $[10^k]\, y - np$
7(a)	125	**1**	
7(b)	29	**1**	
8	162.07 cao	**2**	**M1** for 190 ÷ 1.1723
9	$\frac{5}{3}\times\frac{2}{15}$ oe or $\frac{10}{6}\div\frac{45}{6}$ oe with common denominator	**M2**	**B1** for $\frac{5}{3}$ oe or $\frac{15}{2}$ oe or **M1** for *their* $\frac{5}{3}\times$ *their* $\frac{2}{15}$
	$\frac{2}{9}$ cao	**A1**	
10(a)	Translation $\begin{pmatrix}-1\\-8\end{pmatrix}$	**2**	**B1** for each
10(b)	Image at (–1, –1), (–4, –1), (–1, –2)	**2**	**B1** for image correct scale factor and orientation but wrong position or for enlargement scale factor $\frac{1}{2}$ centre (0, 0)
11	$12x^7$ final answer	**2**	**B1** for $12x^j$ or kx^7 $(j,k \neq 0)$ as final answer
12	–1, 0, 1 final answer	**2**	**B1** for $-1 \leqslant x < 2$ or two correct answers and no extras or three correct answers and one extra/wrong
13	$4t$ final answer	**2**	**B1** for $6t - 6q$ or $-2t + 6q$ or $2t - 6q$ or for $4t$ or $0q$ in the final answer

Question	Answer	Marks	Partial Marks
14	[±] 21	**3**	**M2** for $29^2 - 20^2$ oe or better or **M1** for $20^2 + k^2 = 29^2$ oe
15(a)	Similar	**1**	
15(b)	4	**2**	**M1** for $\frac{12}{6} = \frac{8}{BX}$ oe or better If **0** scored **SC1** for answer 3.5
15(c)(i)	6.7265 or 6.73 or 6.726 to 6.727	**2**	**M1** for scale factor 2^2 or $\left(\frac{1}{2}\right)^2$ oe soi
15(c)(ii)	13.453 or 13.5 or 13.45 to 13.46	**1**	**FT** *their* **(c)(i)** × 2
16	477	**2**	**M1** for 80 – 0.5 oe or better seen
17	72	**2**	**M1** for $\frac{360}{180-175}$ oe or $\frac{180(n-2)}{n} = 175$ oe
18(a)	12	**1**	
18(b)	144	**2**	**FT** 12 × *their V* **M1** for any relevant area **FT** *their V*
19(a)	80	**2**	**B1** for angle $PQT = 50$
19(b)	[w =] 68 [x =] 36	**3**	**B1** for 68 **B2** for 36 or **M1** for $3x + 2x + 68 + 112 = 360$ or better
20	2.31×10^p	**2**	**B1** for $21 \times 10^{p-1}$ or 0.21×10^p or answer with figs 231
21	14.1 or 14.12...	**3**	**M2** for $\sin 65 = \frac{12.8}{BC}$ oe or better or **M1** for recognition that the line from B is perpendicular to AC
22	$\frac{81}{(y-2)^2}$ final answer	**2**	**M1** for $z = \frac{k}{(y-2)^2}$ oe or better

Question	Answer	Marks	Partial Marks
23	70.5 or 70.52 to 70.53	**4**	**B3** for 59(.0) or 58.99… or 50.5 or 50.47 to 50.48 OR **M2** for $\frac{10^2+9^2-11^2}{2\times10\times9}$ oe or equivalent expression for smaller angle or **M1** for $11^2=10^2+9^2-2\times10\times9\cos(...)$ oe or equivalent expression for smaller angle **A1** for $\frac{1}{3}$ oe
24(a)	Correct sketch 	**2**	**B1** for one correct branch or attempt at correct shape
24(b)	Correct sketch 	**2**	**B1** for correct shape but crossing x-axis or for correct shape but just drawn in one quadrant
25	0 and 4 final answer	**4**	**B3** for $5x^3(x-4)$ or better or **B2** for $5x^4-20x^3$ or **B1** for $5x^4$ or $-20x^3$
26	0.845 oe	**3**	**M2** for $0.7\times0.95+(1-0.7)\times0.6$ oe or **M1** for one of these products

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MATHEMATICS **0580/22**

Paper 22 (Extended) **March 2021**

MARK SCHEME

Maximum Mark: 70

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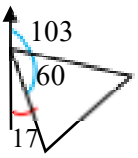
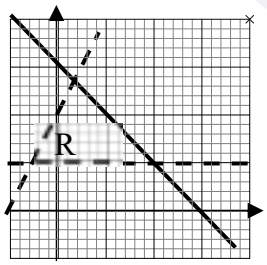
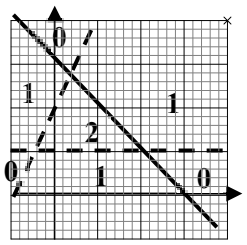
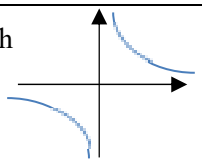
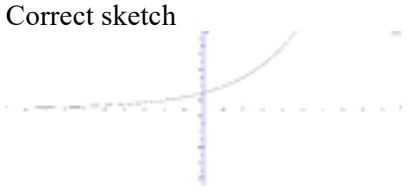
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

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)	2	**1**	
1(b)	2 correct lines	**2**	**B1** for each
2	30 48	**2**	**M1** for $\frac{78}{5+8} \times k$ oe where $k = 1$, 5 or 8
3(a)	1 | 5 7 8 9 9 2 | 2 4 4 5 9 3 | 1 5 6 8	**2**	**B1** for two rows correct or for a fully correct unordered stem-and-leaf diagram or for a correct diagram with one leaf incorrect or omitted
3(b)	24	**1**	
4	3, 80, 30 and 10 seen and answer 12	**2**	**M1** for 3 out of 4 correct elements or for all correct but with any trailing zeros If 0 scored **SC1** for answer 12
5	Negative	**1**	
6	271.2[0]	**2**	**M1** for 56.50 ÷ 5 or 56.50 × 24 oe or better
7	$\frac{9}{4}$ and $\frac{11}{3}$ oe improper fractions	**M1**	
	$\frac{99}{12}$ oe improper fraction	**A1**	
	$8\frac{1}{4}$ cao final answer	**A1**	dep on 1st A1 If M0 scored **SC1** for $\frac{9}{4}$ or $\frac{11}{3}$ oe improper fraction
8	$\frac{37}{99}$ oe fraction	**1**	
9	4.18×10^{7} cao	**1**	

Question	Answer	Marks	Partial Marks
10	343	**2**	**B1** for 103 in correct position **and** 60 or 17 in correct position 
11	12	**2**	**M1** for $2^2 \times 3^2$ and $2^2 \times 3 \times 7$ or for $2 \times 2 \times 3$ final answer or **B1** for 2, 3, 4 or 6 as final answer
12	34.6 or 34.63 to 34.64	**3**	**M2** for $\frac{1}{4} \times \pi \times 5^2 + \frac{1}{2} \times 5 \times 6$ oe or **M1** for $\frac{1}{4} \times \pi \times 5^2$ oe or $\frac{1}{2} \times 5 \times 6$ oe
13	15.8 or 15.76 to 15.77	**2**	**M1** for $125.9 \times \left(1 - \frac{34}{100}\right)^5$ oe
14(a)	1 − 6	**2**	**B1** for each If 0 scored, **SC1** for two terms with a difference of –7
14(b)	$n^2 + 3$ oe	**2**	**M1** for any quadratic or second differences = 2
15	36	**2**	**M1** for angle $EHG = 72$ or for angle $EHF = 47$ **and** $GHF = 25$
16	3 correct ruled lines and *R* clearly indicated 	**5**	**B1** for each line $y = 1$ dashed $y = 2x + 2$ dashed $x + y = 3$ solid **B2** for correct region or **B1** for region satisfying 2 inequalities  or **SC1** for shading of the **wanted** region only

Question	Answer	Marks	Partial Marks
17	13 nfww	**3**	**M2** for $251+7x=7.6(32+x)$ or better or **M1** for $\frac{5\times4+6\times5+7x+8\times11+9\times7+10\times5}{32+x}=7.6$ oe
18	$49x^6$ final answer	**2**	**B1** for $49x^k$ or nx^6 as final answer
19	$x^2+x-156$ [=0] or $y^2+15y-100$ [=0]	**M2**	**M1** for $x^2+x=7+149$ or correct substitution
	$(x-12)(x+13)$ [=0] or $(y-5)(y+20)$ [=0]	**M1**	or for correct factors for *their* quadratic equation or for correct use of quadratic formula or completing the square for *their* equation
	[x =] 12 [y =] 5 [x =] –13 [y =] –20	**B2**	**B1** for $x = 12$, $x = -13$ or for $y = 5$, $y = -20$ or for a correct pair of x and y values If B0 scored and at least 2 method marks scored **SC1** for correct substitution of both of *their* x values or *their* y values into $x - y = 7$ or $x^2 + y = 149$
20(a)	1.84	**2**	**M1** for $\frac{1.61}{x}=\frac{2.8}{3.2}$ oe
20(b)	9.20 or 9.204 to 9.205	**3**	**M2** for $11.5\times\sqrt[3]{\frac{4}{7.8}}$ oe or **M1** for $\sqrt[3]{\frac{4}{7.8}}$ or $\sqrt[3]{\frac{7.8}{4}}$ oe seen or for $\frac{11.5^3}{x^3}=\frac{7.8}{4}$ oe
21(a)	Correct sketch 	**2**	**B1** for one correct branch or attempt at correct shape
21(b)	Correct sketch 	**2**	**B1** for correct shape but crossing x-axis or correct shape but just in one quadrant

Question	Answer	Marks	Partial Marks
22(a)	245	**1**	
22(b)	69 cao nfww	**3**	**M2** for $\frac{200+0.5}{3-0.1}$ oe or **M1** for 200 ± 0.5 oe or 3 ± 0.1 oe seen
23	56.1 or 56.09…	**4**	**M3** for cos[…] = $\frac{\frac{1}{2}\sqrt{10^2+12^2}}{14}$ oe or **M2** for [MC =] $\frac{1}{2}\sqrt{10^2+12^2}$ oe or **M1** for [AC^2 =] 10^2+12^2 oe or **B1** for indicating required angle
24	(0, 5) $\left(\frac{4}{3}, \frac{103}{27}\right)$ oe	**5**	**B2** for $3x^2-4x$ or **B1** for $3x^2$ or $-4x$ **M1** for *their* derivative = 0 oe or $\frac{dy}{dx}=0$ **B1** for [x =] 0 and $\frac{4}{3}$ or for 1 correct coordinate pair

Cambridge Assessment International Education

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MATHEMATICS **0580/21**

Paper 2 (Extended) **October/November 2020**

MARK SCHEME

Maximum Mark: 70

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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Maths-Specific Marking Principles	
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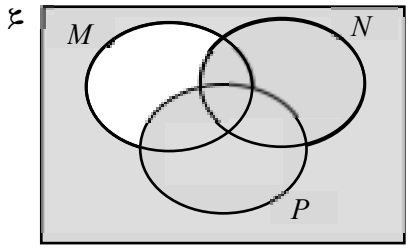
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has 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	$-a + 8b$ final answer	**2**	**B1** for $-a$ or [+]$8b$ in final answer or for $-a + 8b$ spoilt
2	Correct triangle constructed with $AC = 5$ cm and $BC = 6.5$ cm and intersecting arcs	**3**	**B2** for correct triangle with no/incorrect arcs or **SC2** for accurate triangle with arcs but sides interchanged or **B1** for 6.5 [cm] or 5 [cm] soi
3	1.75	**3**	**M2** for $(13.72 - 2.8 \times 2.65) \div 3.6$ oe or **M1** for 2.8×2.65
4(a)	4 points correctly plotted	**2**	**B1** for 2 or 3 points correctly plotted
4(b)	Negative	**1**	
4(c)	Correct ruled line of best fit	**1**	
4(d)	10 to 12	**1**	**FT** *their* straight line of best fit
5	$\frac{50 - 10}{4 \times 2}$	**M1**	Allow **M1** for 3 out of 4 values correctly rounded or for all correct but with any trailing zeros
	5	**A1**	dep on $\frac{50 - 10}{4 \times 2}$
6	$\frac{8}{3}$ and $\frac{11}{4}$ oe improper fractions	**M1**	
	$\frac{88}{12}$ oe improper fraction	**A1**	
	$7\frac{1}{3}$ cao final answer	**A1**	dep on 1st A1 If M0 scored **SC1** for $\frac{8}{3}$ or $\frac{11}{4}$ oe improper fraction
7	$[x =]\frac{2y+7}{5}$ oe or $[x =]\frac{2y}{5} + \frac{7}{5}$ oe final answer	**2**	**M1** for $2y + 7 = 5x$ oe or $\frac{2y}{5} = x - \frac{7}{5}$ oe
8(a)	0	**1**	
8(b)	$2^2 \times 3 \times 7$ or $2 \times 2 \times 3 \times 7$	**2**	**B1** for 2, 2, 3, 7
9(a)	40×4	**1**	
9(b)	$\sqrt{2^2 + (-3)^2}$	**1**	

Question	Answer	Marks	Partial Marks
10	48 700 cao	**3**	**M1** for $45\,000\times\left(1+\frac{1.6}{100}\right)^5$ oe **A1** for 48 710 to 48 720 If A0 scored **B1** for *their* more accurate value correctly rounded to the nearest 100
11	[a =] –1 [b =] 5 [c =] 1 [d =] 4	**2**	**B1** for two or three correct or **SC1** for [a =] $x \geqslant -1$ [b =] $x \leqslant 5$ [c =] $y \geqslant 1$ [d =] $y \leqslant 4$
12	15	**2**	**M1** for $\frac{360}{180-156}$ or $\frac{180(n-2)}{n}=156$ oe
13	17.77… – 1.77… oe	**M1**	**M1** for correct working shown
	$\frac{8}{45}$ cao	**A2**	**B1** for $\frac{16}{90}$ oe seen
14	2	**2**	**M1** for $y=\frac{5-4x}{8}$ oe or better
15(a)	0.3	**1**	
15(b)	360	**3**	**M2** for correct complete area statement e.g. $18\times 60+\frac{1}{2}\times 40\times(18+6)-12\times 100$ or $\frac{1}{2}\times 6\times(60+80)-\frac{1}{2}\times 6\times 20$ or for answer 420 or **M1** for one area calculation
16	$(3x – 4)(2x + 5)$ final answer	**2**	**B1** for $(ax + b)(cx + d)$ where $ac = 6$ and $ad + bc = 7$ or $bd = – 20$
17(a)	[a =] 7	**2**	**M1** for $3(–2)^2 + a = 19$ or better
17(b)(i)	$6x – 9$ or $3(2x – 3)$ final answer	**2**	**M1** for $2(3x – 8) + 7$ or better
17(b)(ii)	$\frac{x-7}{2}$ final answer	**2**	**M1** for a correct first step $x=2y+7$ or $y-7=2x$ or $\frac{y}{2}=x+\frac{7}{2}$

Question	Answer	Marks	Partial Marks
18	990 or 989.58 to 989.73	**4**	**M1** for $4 \times \pi \times 7^2$ [÷2] **M1** for $\pi \times 7^2$ **M1** for $\pi \times 7 \times 2 \times 12$
19		**1**	
20	107	**4**	**B2** for $x = 40$ or **M1** for $2x + x + 60 = 180$ oe **M1** for correctly substituting *their x* into $4x - 87 + y = 180$ oe or $4x - 87 + x + 60 + y + 2x = 360$ oe
21	11.7 or 11.73…	**3**	**M2** for $\sin 43 = \frac{PT}{17.2}$ oe or **M1** for identifying angle *PVT*
22	$\frac{x}{2(x+5)}$ or $\frac{x}{2x+10}$ final answer	**4**	**B1** for $x(x - 5)$ **B2** for $2(x - 5)(x + 5)$ or $(x - 5)(2x + 10)$ or $(2x - 10)(x + 5)$ or **B1** for $2(x^2 - 25)$ or $(x - 5)(x + 5)$
23(a)	$\frac{5}{6}$ **m** $- \frac{1}{3}$ **n**	**3**	**B2** for correct unsimplified answer in terms of **m** and **n** e.g. $\frac{1}{3}$ (**m** – **n**) + $\frac{1}{2}$ **m** or **M1** for a correct route or for $\overrightarrow{FC}$ = **m** – **n** or $\overrightarrow{CF}$ = **n** – **m** or better e.g. $\overrightarrow{AC} = \frac{1}{3}$ (**m** – **n**)
23(b)	$\overrightarrow{GH} = 3\overrightarrow{JK}$ oe or $\overrightarrow{GH}$ has a greater magnitude $\overrightarrow{GH}$ and $\overrightarrow{JK}$ are parallel	**2**	**B1** for each

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MATHEMATICS **0580/22**

Paper 2 (Extended) **October/November 2020**

MARK SCHEME

Maximum Mark: 70

Published

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Generic Marking Principles

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Maths-Specific 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	200 017	**1**	
2	$7 - (5 - 3) + 4$	**1**	
3	1.2 or $1\frac{1}{5}$ or $\frac{6}{5}$	**2**	**M1** for $6 = 2x + 3x$ or better
4	$[x =]$ 60 $[y =]$ 80	**3**	**B1** for $[x =]$ 60 **B2** for $[y =]$ 80 or **B1** for 40 in a correct place on diagram If 0 scored **SC1** for *their* x + *their* $y = 140$
5	48.72	**2**	**M1** for $\frac{16}{100} \times 42$ oe or better
6	$4(1 - 2x)$	**1**	
7	9	**2**	**M1** for $\frac{1}{2} \times 6 \times h = 27$ oe
8	171	**2**	**M1** for $180 - (360 \div 40)$ oe or $\frac{(40-2)\times 180}{40}$ oe
9	$[x =]$ 3 $[y =]$ 1	**2**	**B1** for each
10	$\frac{5}{6} \times \frac{3}{4}$ or $\frac{5}{6} \div \frac{8}{6}$ oe	**M2**	**M1** for $\frac{4}{3}$ seen or for $\frac{5}{6} \times$ *their* $\frac{3}{4}$ or for $\frac{5}{6} \div \frac{\textit{their}8}{6}$
	$\frac{5}{8}$ cao	**A1**	dep on M2
11	$10x^7$ final answer	**2**	**B1** for kx^7 or $10x^k$ final answer or for correct answer then spoilt
12	15	**2**	**M1** for 4 [parts] = 20 soi or a correct equation e.g. $\frac{x+20}{7} = \frac{x}{3}$ oe
13	60	**3**	**M2** for $12 \times \sqrt{13^2 - 12^2}$ or **M1** for $13^2 - 12^2$ or for $12 \times$ *their* 5 from Pythagoras or trig
14	2.03×10^{201}	**2**	**B1** for figs 203 or $[0].03 \times 10^{201}$ or 200×10^{199}

Question	Answer	Marks	Partial Marks
15	29.5 or 29.45 to 29.46	**2**	**M1** for $\frac{60}{360}\times\pi\times7.5^2$ oe
16	25	**2**	**M1** for $x\times\left(1+\frac{6}{100}\right)=26.50$ oe or better
17(a)	0.1 or $\frac{1}{10}$	**1**	
17(b)	90	**3**	**M2** for $\frac{1}{2}\times10\times2+10\times2+\frac{1}{2}(2+4)\times20$ oe or **M1** for one area calculation or indicated on diagram
18	27.15 cao	**3**	**M2** for (9.4 + 0.05) × 2 + 8.2 + 0.05 or better or **M1** for 8.2 + 0.05 or 9.4 + 0.05 or better seen OR **SC2** for answer 25.95 or **SC1** for answer 26.85
19(a)	61.1 or 61.08 to 61.09...	**3**	**M2** for [sin x =] $\frac{8\sin100}{9}$ oe or better or **M1** for $\frac{9}{\sin100}=\frac{8}{\sin x}$ oe
19(b)	11.7 or 11.66 to 11.67	**3**	**M2** for $\frac{1}{2}\times9\times8\times\sin(180-100-$ *their* **(a)**$)$ oe or **M1** for 180 – 100 – *their* **(a)**
20	60	**3**	**M2** for $4\times\sqrt[3]{\frac{40500}{12}}$ oe or **M1** for $\left(\frac{4}{l}\right)^3=\frac{12}{40500}$ oe or $\sqrt[3]{\frac{40500}{12}}$ oe or $\sqrt[3]{\frac{12}{40500}}$ oe
21(a)	4 – 2x	**2**	**B1** for 4 or – 2x
21(b)	(2, 10)	**2**	**B1** for x-coordinate of 2 or **M1** for *their* 4 – 2x = 0
22(a)	**–a** + **b**	**1**	

Question	Answer	Marks	Partial Marks
22(b)	$2\mathbf{a} - \frac{1}{2}\mathbf{b}$	**3**	**B2** for answer $2\mathbf{a} + p\mathbf{b}$ or $q\mathbf{a} - \frac{1}{2}\mathbf{b}$ $q \neq \frac{1}{2}$ or correct unsimplified answer in terms of **a** and **b** or **M1** for $\overrightarrow{AC} = \frac{3}{2}\mathbf{a}$ or $\overrightarrow{OC} = \frac{5}{2}\mathbf{a}$ or correct route If 0 scored **SC1** for answer $\mathbf{a} + \frac{1}{2}\mathbf{b}$
23	$\frac{3}{x+1}$ final answer	**3**	**B1** for $2(x+1)-(2x-1)$ oe **B1** for common denominator $x + 1$
24	(2.4, 1.8) oe	**5**	**M1** for [gradient =] $-1 \div \frac{1}{3}$ oe **M1** for substituting (2, 3) into $y = (\textit{their } m)x + c$ oe **M1** for $\frac{1}{3}x + 1 = \textit{their}\left(mx + c\right)$ with *their* $m \neq \frac{1}{3}$ **M1** for substituting *their* x-coord into either equation to find y or for substituting *their* y-coord into either equation to find x
25	63.4 or 63.43... 243.4 or 243.4...	**2**	**B1** for each If 0 scored **SC1** for two answers with a difference of 180
26	$\frac{x-2}{u+1}$ oe final answer	**4**	**B2** for $(x-2)(u-1)$ or **B1** for $u(x-2)-(x-2)$ or $x(u-1)-2(u-1)$ **B1** for $(u-1)(u+1)$

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MATHEMATICS **0580/23**

Paper 2 (Extended) **October/November 2020**

MARK SCHEME

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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	64	**1**	
2	80	**1**	
3	Accurate triangle with correct construction arcs	**2**	**B1** for accurate triangle with no/incorrect arcs or **SC1** for accurate triangle with arcs with sides interchanged
4	a^{-4} or $\frac{1}{a^4}$ final answer	**1**	
5	396	**1**	
6(a)	Kite	**1**	
6(b)	80	**2**	**M1** for (180 – 82 – 58) or better
7	45.7	**1**	
8	18.25, 18.35	**2**	**B1** for each or **SC1** for both values correct but reversed
9	$\frac{8}{7}$ and $\frac{21}{10}$ oe improper fractions	**M1**	
	$\frac{168}{70}$ oe improper fractions	**A1**	
	$2\frac{2}{5}$ cao final answer	**A1**	**Dep**. on first **A1** If M0 scored **SC1** for $\frac{8}{7}$ or $\frac{21}{10}$ oe improper fractions
10	Correctly eliminates one variable	**M1**	
	[x =] 6 [y =] –0.5 oe	**A2**	**A1** for either correct If M0 scored, **SC1** for 2 values satisfying one of the original equations
11(a)	50	**2**	**M1** for $\frac{5}{7+5+2}$ [× 140] or $\frac{140}{7+5+2}$ [× 5]
11(b)	26	**2**	**M1** for $\frac{5+9}{n} = \frac{2}{7}$ oe or $\frac{5+9}{p+7+5+2+9} = \frac{2}{7}$ oe

Question	Answer	Marks	Partial Marks
12(a)	5	**1**	
12(b)	$(-\frac{12}{5}$ oe, 0)	**2**	**M1** for $5x + 12 = 0$
12(c)	$-\frac{1}{5}$ oe	**1**	**FT** $-\frac{1}{their(a)}$
13	$A' \cap B$	**1**	
14	21	**2**	**B1** for 3×7 soi or $2^4 \times 3^2 \times 7^6$ oe or answer of $21 \times k^2$
15	$[x =] y(m - 2p)^2$ nfww or $[x =] y(m^2 - 4mp + 4p^2)$ final answer	**3**	**M1** for subtract $2p$ or *their* term in p to isolate a term in x **M1** for squaring **M1** for multiplying by *their* term in y Maximum of 2 marks for an incorrect answer
16	205.8	**3**	**M2** for $38.4 \times \left(\frac{7}{4}\right)^3$ oe or **M1** for $\left(\frac{7}{4}\right)^3$ or $\left(\frac{4}{7}\right)^3$ oe or $\frac{7}{4} = \sqrt[3]{\frac{v}{38.4}}$ oe
17	492.2[0]	**3**	**B2** for 32.2[0] OR **M1** for $x \times \left(1 - \frac{7}{100}\right) = 427.8[0]$ oe or better **M1** for *their* $460 \times \left(1 + \frac{7}{100}\right)$ oe or *their* $460 \times \frac{7}{100}$ correctly evaluated

Question	Answer	Marks	Partial Marks
18(a)	$64x^3y^6$ final answer	**2**	**B1** for kx^3y^6 or $64x^ky^6$ or $64x^3y^k$ final answer or correct answer then spoilt
18(b)	$\frac{2}{3}$	**1**	
19(a)	$\frac{5}{12}$ or 0.417 or 0.4166 to 0.4167	**1**	
19(b)	32.5	**4**	**M3** for $\frac{1}{2}(v+v+10)\times 24+\frac{1}{2}\times 16(v+10)=1240$ oe OR **M2** for $\frac{1}{2}(v+v+10)\times 24$ oe and $\frac{1}{2}\times 16(v+10)$ oe or **M1** for one area expression **M1** for correctly solving *their* $(av + b = 1240)$ oe $(a \neq 0, b \neq 0)$
20	$(3x + 8y)(1 – 2a)$	**2**	**M1** for $3x(1 – 2a) + 8y(1 – 2a)$ or $3x + 8y – 2a(3x + 8y)$ or better
21(a)	1.07 or 1.071 to 1.072	**3**	**M2** for [8 −] 8 cos 30 oe or **M1** for $\frac{OP}{8}=\cos 30$ oe
21(b)	2.9[0] or 2.895 to 2.901	**3**	**M1** for $\frac{30}{360}\times\pi\times 8^2$ oe **M1** for $\frac{1}{2}\times 8\times$ *their* $6.93\times\sin 30$ oe or $\frac{1}{2}\times 8\cos 30\times 4$ oe

Question	Answer	Marks	Partial Marks
22(a)	27.625	**4**	**M1** for 5, 12.5, 17.5, 30, 57.5 **M1** for $\sum fx$ where x is in correct interval including boundaries **M1** dep on second **M1** for $\frac{\Sigma fx}{100}$
22(b)	6 and 2.4	**3**	**B2** for either correct or **M1** for [fd =] 1.5 or 0.6 oe or **B1** for [multiplier] 4
23	$y = \frac{10.5}{\sqrt{x}}$ oe final answer	**2**	**M1** for $y = \frac{k}{\sqrt{x}}$
24	$\frac{x+5}{x-12}$ nfww final answer	**4**	**B1** for $(x + 5)(x – 5)$ **B2** for $(x – 12)(x – 5)$ or **B1** for $x(x – 5) – 12(x – 5)$ or $x(x – 12) – 5(x – 12)$ or for $(x + a)(x + b)$ where $ab = –60$ or $a + b = –17$
25	126.9 or 126.86 to 126.87 and 306.9 or 306.86 to 306.87	**3**	**B2** for one correct or **M1** for $\tan x = -\frac{4}{3}$ if 0 scored then **SC1** for two answers with a difference of 180°

Cambridge Assessment International Education

Cambridge IGCSE™

MATHEMATICS **0580/21**

Paper 2 (Extended) **May/June 2020**

MARK SCHEME

Maximum Mark: 70

Published

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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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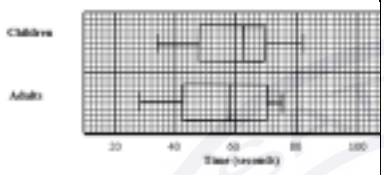
Question	Answer	Marks	Partial Marks
1	86	**2**	**M1** for correct method to find the perimeter e.g. $(8 + 3) \times 2 \times 5 - 3 \times 8$ If 0 scored, **SC1** for answer 98
2	15	**1**	
3(a)	66	**1**	
3(b)	Positive	**1**	
3(c)	Ruled line of best fit	**1**	
3(d)	46 to 50	**1**	**FT** *their* line of best fit if a positive gradient
4(a)	0.22 oe	**2**	**M1** for $0.15 + 0.2 + ? + 0.43 = 1$ or better
4(b)	40	**1**	
5(a)	52	**1**	
5(b)	$7n + 5$ oe final answer	**2**	**B1** for $7n + a$ or $bn + 5$ $b \neq 0$
6	7	**3**	**M2** for $166 + 2x = 180$ or better or **M1** for $97 - 3x + 69 + 5x = 180$ oe
7	$2^5 \times 3^4 \times 13^2$	**1**	
8	$\frac{56}{24} - \frac{21}{24}$	**M2**	**M2** for correct method for common denominator or **B1** for $\frac{7}{3}$
	their $\frac{35}{24} \times \frac{6}{25}$	**M1**	
	$\frac{7}{20}$	**A1**	
9(a)	$7a(3a + 4b)$ final answer	**2**	**B1** for partial factorisation $7(3a^2 + 4ab)$ or $a(21a + 28b)$

Question	Answer	Marks	Partial Marks
9(b)	$5(2x + 3y)(2x – 3y)$ final answer	**3**	**B2** for $(2x + 3y)(2x – 3y)$ or $(10x + 15y)(2x – 3y)$ or $(2x + 3y)(10x – 15y)$ or **B1** for $5(4x^2 – 9y^2)$
10	$[x =]$ 55 $[y =]$ 24	**2**	**B1** for each
11	990	**3**	**M2** for correct complete area statement e.g. $\frac{1}{2} \times 30 \times (6 + 12) + 60 \times 12$ oe or **M1** for one area calculation
12(a)	22	**2**	**B1** for 48 and 70
12(b)		**2**	**M1** for a box with two whiskers and at least two correct from Min 28, LQ 42, Med 58, UQ 70, Max 75
13	16.6 or 16.64…	**5**	**M2** for $21 \times \frac{18}{13.5} = [AC]$ oe or **M1** for scale factor $\frac{13.5}{18}$ or $\frac{18}{13.5}$ oe soi Then Pythagoras method: and **M2** for $\sqrt{28^2 + 18^2}$ $[\div 2]$ or $\sqrt{(theirAC)^2 + 18^2}$ $[\div 2]$ or **M1** for $AD^2 = 28^2 + 18^2$ or $AD^2 = (theirAC)^2 + 18^2$ OR alternative trigonometry method e.g. **M1** for $\tan E = \frac{21}{13.5}$ and **M1** for $AD = \frac{18}{\cos their\, 57.3}$
14(a)	$[p =] -13$	**2**	**M1** for $4(5x – 4) + 3$ or better
14(b)	$\frac{3x+1}{5}$	**3**	**M2** for $x = \frac{3y+1}{5}$, $5y = 3x + 1$ or $y - \frac{1}{5} = \frac{3x}{5}$ **M1** for $x = \frac{5y-1}{3}$, $3y = 5x - 1$ or $y + \frac{1}{3} = \frac{5x}{3}$

Question	Answer	Marks	Partial Marks
15	Complete explanation with geometrical reasons	**3**	**B1** for $RQP = x°$ QR bisects angle PQB **B1** for $RPQ = x°$ alternate segment theorem **B1** for triangle PQR has two equal angles both less than 60 (so can't be equilateral) so must be isosceles
16	1.8 or $1\frac{4}{5}$	**3**	**M2** for $m = \frac{k}{(p-1)^2}$ or **M1** for $m = \frac{theirk}{(6-1)^2}$ OR **M2** for $5(4-1)^2 = m(6-1)^2$ oe
17(a)(i)	$\begin{pmatrix}15\\21\end{pmatrix}$	**1**	
17(a)(ii)	26	**2**	**M1** for $10^2 + (-24)^2$ or better
17(b)	$\mathbf{p} + \frac{3}{4}\mathbf{q}$	**2**	**M1** for a correct route or for $\overrightarrow{AE} = \frac{3}{4}\mathbf{q}$
18	34	**2**	**M1** for 12 + 0.5 or 4 + 0.5 or better seen
19	12.2 or 12.24…	**5**	**M4** for tan = $\frac{4.5}{\sqrt{20^2 + 5.5^2}}$ oe or **M1** for recognising angle GAC **M1** for $\frac{495}{20 \times 5.5}$ **M1** for $\sqrt{20^2 + 5.5^2}$ or $\sqrt{20^2 + 5.5^2 + (their4.5)^2}$ **M1** for tan = $\frac{their4.5}{\sqrt{20^2 + 5.5^2}}$ oe
20	[$y =$] $5x - 4$	**1**	
21	$3x^3 - 7x^2 - 43x + 15$	**3**	**B2** for correct expansion and simplification of two of the brackets or **B1** for correct expansion of two brackets with at least 3 terms correct

Question	Answer	Marks	Partial Marks
22	142 or 142.2 to 142.3	**3**	**M2** for $\frac{1}{2}\times 7.4\times 7.4\times \sin 60\times 6$ or $\tan 60\times \frac{7.4}{2}\times \frac{7.4}{2}\times 6$ or **M1** for $\frac{1}{2}\times 7.4\times 7.4\times \sin 60$ or $\tan 60\times \frac{7.4}{2}$

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MATHEMATICS **0580/22**

Paper 2 (Extended) **May/June 2020**

MARK SCHEME

Maximum Mark: 70

Published

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FT follow through after error
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soi seen or implied

Question	Answer		Marks	Partial Marks
1	2		**1**	
2	–5		**1**	
3	25		**2**	**B1** for 130 seen or **M1** for 50 ÷ 2
4(a)	Any square number greater than 10		**1**	
4(b)	Any irrational number		**1**	
5	–2		**2**	**M1** for (–3)(–2) + (–8)
6	45		**2**	**M1** for $\frac{11+7}{2}\times 5$ oe
7	Intersection shaded		**1**	
8	0.0625		**1**	
9	285		**2**	**M1** for 180 + 105 or 75 or 105 seen in correct position at *B*
10	$\frac{2p^2}{t}$		**2**	**B1** for correct unsimplified answer
11	$\frac{7}{4}$	$\frac{9}{12}$	**B1**	
	$\frac{21}{12}$	$1-\frac{2}{12}$	**M1**	
	$\frac{5}{6}$	$\frac{5}{6}$	**A1**	
12	8		**2**	**M1** for $\frac{5-4.60}{5}[\times 100]$ or $\frac{4.60}{5}\times 100$
13	$2t^4$		**2**	**B1** for $2t^n$ or kt^4 $(n,k\neq 0)$

Question	Answer	Marks	Partial Marks
14	–14	**2**	**M1** for $1 - x = 3 \times 5$ or better or $\frac{x}{3} = 5 - \frac{1}{3}$ or better
15	177.5	**1**	
16	2.7×10^{-8}	**1**	
17	108	**3**	**M1** for $(105 + 225) \div 11$ **M1** for *their* speed $\times \frac{60 \times 60}{1000}$
18	Enlargement [scale factor] $-\frac{1}{2}$ [centre] (3, 4)	**3**	**B1** for each
19	$[\pm]\sqrt{\frac{h^2 - x^2}{2}}$	**3**	**M1** for correct rearrangement for y or y^2 term **M1** for correct square root **M1** for correct division by 2 or $\sqrt{2}$
20(a)	49	**1**	
20(b)	98	**1**	**FT** $2 \times$ *their* **(a)**
20(c)	20	**1**	
20(d)	70	**1**	**FT** 90 – *their* **(c)**
21(a)	$125x^{12}$	**2**	**B1** for $125x^k$ or kx^{12}
21(b)	$8x^{96}$	**2**	**B1** for $8x^k$ or kx^{96}
22	16	**3**	**M1** for $p = k(q + 2)^2$ **M1** for $p = (\textit{their } k)(10 + 2)^2$ OR **M2** for $\frac{p}{(10+2)^2} = \frac{1}{(1+2)^2}$ oe
23(a)	Correct lines and correct region clear 	**5**	**B2** for $2x + y = 8$ correctly ruled or **B1** for ruled line with negative gradient **B1** for $y = x$ correctly ruled **B1** for $x = 2$ correctly ruled
23(b)	6	**1**	

Question	Answer	Marks	Partial Marks
24	25.6 or 25.59 to 25.60…	**4**	**M3** for $\frac{6.4}{2\times\pi\times8}\times\pi\times8^2$ or **M2** for $\frac{x}{360}=\frac{6.4}{2\times\pi\times8}$ oe or **M1** for $\frac{x}{360}\times2\times\pi\times8=6.4$ oe
25	$\frac{2x-5}{a-2b}$ final answer	**5**	**B2** for $(2x-5)(x+3)$ or **B1** for $(2x+p)(x+q)$ where $pq=-15$ or $p+2q=1$ **B2** for $(x+3)(a-2b)$ or **B1** for $x(a-2b)+3(a-2b)$ or $a(x+3)-2b(x+3)$
26	4	**2**	**M1** for $y^{\frac{2}{3}}=x^{\frac{1}{6}}$ or $y^2=\sqrt{x}$ or $y^4=x$
27	64.9 or 64.89 to 64.90	**6**	**B5** for [cos =] $\frac{100+72-100}{2\times10\times\sqrt{72}}$ OR **M1** for 8^2+6^2 **M1** for 6^2+6^2 **M2** for $\frac{(theirAF)^2+(theirAH)^2-(theirHF)^2}{2\times(theirAF)\times(theirAH)}$ or **M1** for $(theirHF)^2=(theirAF)^2+(their\ AH)^2-2\times(theirAF)\times(their\ AH)\cos(HAF)$ *AF*, *AH* etc from correct method

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MATHEMATICS **0580/23**

Paper 2 (Extended) **May/June 2020**

MARK SCHEME

Maximum Mark: 70

Published

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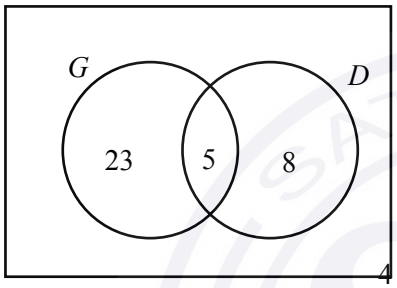
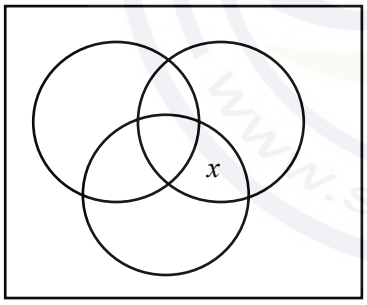
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in 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)	32	**1**	
1(b)	36	**1**	
1(c)	37	**1**	
2	208	**1**	
3	116	**2**	**M1** for angle $ACB = 32$ soi
4(a)	15 09	**1**	Accept 3 09 pm
4(b)	472	**2**	**M1** for $80 \times$ *their* time oe or **B1** for time = 5.9
5	42	**2**	**M1** for $\frac{7}{15}$ [$\times 90$]
6(a)	p^6	**1**	
6(b)	m^{10}	**1**	
6(c)	k^{15}	**1**	
7	Correct common denominator	**M1**	
	Correct method	**M1**	e.g. $1\frac{3-8}{12}$ or $\frac{12+3-8}{12}$ or $\frac{((3\times4)+1)\times3-((2\times3)+2)\times4}{12}$ or $\frac{39-32}{12}$
	$\frac{7}{12}$ cao	**A1**	
8	[0]94	**2**	**M1** for 86 or 274 – 180 or for sketch with 274 marked correctly

Question	Answer	Marks	Partial Marks
9	15.5 or 15.48 to 15.49	**3**	**B2** for 1550 or 1548 to 1549 or **M2** for $\frac{42}{360}\times\pi\times6.5^2$ or **M1** for $\frac{42}{360}\times\pi\times65^2$
10	141 or 141.3 to 141.4	**4**	**M1** for[2 ×] $\pi\times3^2$ **M2** for $2\times\pi\times3\times4.5$ or **M1** for $2\times\pi\times3$ [× 4.5]
11	[y =] 1	**3**	**M1** for $y=k\times\sqrt[3]{x+3}$ **M1** for $y=$ *their* $k\times\sqrt[3]{24+3}$ OR **M2** for $\frac{y}{\sqrt[3]{24+3}}=\frac{2}{3}\times\frac{1}{\sqrt[3]{5+3}}$ oe
12	3.7[0] or 3.689 to 3.699…	**3**	**M2** for $\frac{19.02}{2+\pi}$ or **M1** for $2r+\pi r$ [=19.02] oe
13	$x+y<4$ $y\geqslant1.5$ $y\leqslant2x+1$	**4**	**B3** for any two correct or **B1** for $y\geqslant1.5$ **B2** for $x+y<4$ or $y\leqslant2x+1$ or $x+y=4$ and $y=2x+1$ or with incorrect inequality signs or **B1** for $x+y=4$ or $y=2x+1$ or **SC3** for > instead of $\geqslant$ etc.
14(a)	0.3 oe	**1**	
14(b)	3060	**3**	**M2** for $\frac{1}{2}(300+210)\times12$ oe or **M1** for one correct part area
15	28.33 or 28.3 or 28.33…	**4**	**M1** for midpoints soi **M1** for use of $\sum fx$ **M1 dep** for $\sum fx\div60$
16	1.22 or 1.219 to 1.22	**5**	**M1** for SI = $\frac{2000\times5\times1.25}{100}$ **M3** for $\sqrt[5]{\frac{2000+\textit{their}125}{2000}}$ or **M2** for $2000k^5=2000+$ *their* SI or **M1** for CI = $2000k^5$

Question	Answer	Marks	Partial Marks
17	5	**3**	**M2** for $8 \times \sqrt{\frac{52.5}{134.4}}$ oe or **M1** for $\sqrt{\frac{52.5}{134.4}}$ or $\sqrt{\frac{134.4}{52.5}}$ oe
18(a)	$(x-9)^2-108$	**2**	**B1** for $(x+h)^2-108$ or $(x-9)^2+h$ or $k=-9$
18(b)	19.4 or 19.39… -1.39 or -1.392…	**2**	**M1FT** $x - their 9 = \pm\sqrt{their 108}$ **A1** for $9 \pm \sqrt{108}$ or $9 \pm 6\sqrt{3}$
19(a)(i)		**2**	**B1** for two correct
19(a)(ii)	$G \cup D'$ oe	**1**	
19(b)	15	**1**	
19(c)		**1**	Shade whole rectangle except for region containing x
20	65.3 or 65.28..	**4**	**M3** for $\cos = \frac{\frac{1}{2}\sqrt{11^2+11^2}}{18.6}$ or better or **M2** for $AM = \frac{1}{2}\sqrt{11^2+11^2}$ oe or **M1** for $AC^2 = 11^2 + 11^2$ If 0 scored, **SC1** for identifying angle VAM

Question	Answer	Marks	Partial Marks
21(a)(i)	$\mathbf{a} - \mathbf{b}$ or $-\mathbf{b} + \mathbf{a}$	**2**	**B1** for a correct route or identifying $\overrightarrow{OT}$
21(a)(ii)	$\frac{1}{2}\mathbf{a} - \mathbf{b}$ or $-\mathbf{b} + \frac{1}{2}\mathbf{a}$	**1**	
21(b)	$\overrightarrow{PT} = \mathbf{a} - 2\mathbf{b}$ oe	**M1**	
	$\overrightarrow{PT} = 2\overrightarrow{RV}$ oe	**A1**	Dep on correct vector RV Accept in words

Cambridge Assessment International Education

Cambridge IGCSE™

MATHEMATICS **0580/22**

Paper 2 (Extended) **March 2020**

MARK SCHEME

Maximum Mark: 70

Published

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[Turn over

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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.
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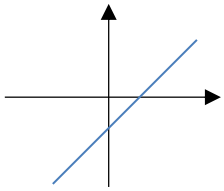
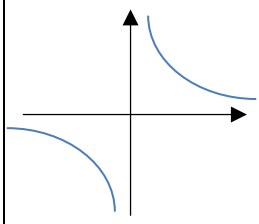
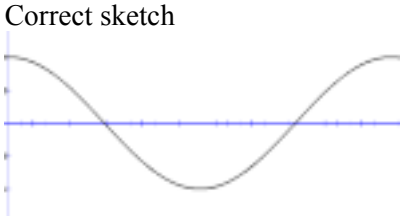
Question	Answer	Marks	Partial Marks
1(a)	12	**1**	
1(b)	8	**1**	
1(c)	5	**1**	
1(d)	$\sqrt{7}$	**1**	
2(a)	1 | 3 5 8 2 | 1 4 6 8 3 | 6 8 8 4 | 5 8	**2**	**M1** for correct but not ordered or for two correct rows ordered
2(b)	27	**1**	
3	$\begin{pmatrix}-4\\3\end{pmatrix}$	**1**	
4	165	**2**	**M1** for $\frac{(24-2)\times180}{24}$ or $180-\frac{360}{24}$
5	$\frac{15}{28}\times\frac{7}{4}$ or $\frac{15}{28}\div\frac{16}{28}$ oe	**M1**	
	$\frac{15}{16}$ cao	**A2**	**A1** for $\frac{105}{112}$ oe
6	7.2	**3**	**M1** for $5\times8+6\times5+7\times11+8\times7+9\times5+10\times4$ **M1dep** for ÷ 40
7(a)	45.9	**2**	**M1** for $0.5\times8.5\times10.8$ oe
7(b)	33[.0] or 33.04…	**3**	**M2** for $8.5+10.8+\sqrt{8.5^2+10.8^2}$ oe or **M1** for $8.5^2+10.8^2$ oe
8	2.98×10^{-3}	**1**	
9(a)	$3x(x-4y)$ final answer	**2**	**B1** for $3(x^2-4xy)$ or $x(3x-12y)$

Question	Answer	Marks	Partial Marks
9(b)	$m^2 - m - 6$ final answer	**2**	**M1** for 3 terms from $m^2, -3m, +2m, -6$
10(a)	Correct sketch 	**1**	Line with positive gradient and negative y intercept
10(b)	Correct sketch 	**2**	**B1** for only one branch or attempt at correct shape
11(a)	Rotation 90° clockwise oe (0, 2)	**3**	**B1** for each
11(b)	Reflection $y = x$	**2**	**B1** for each
11(c)	Enlargement [sf] $\frac{1}{2}$ (4, 6)	**3**	**B1** for each
12	229 500 cao	**3**	**B2** for 229 460… OR **M1** for $250\,000 \times \left(1 - \frac{1.7}{100}\right)^5$ oe **B1** for *their* more accurate answer correctly rounded to the nearest 100
13	$2.\dot{6} - 0.2\dot{6}$ oe	**M1**	
	$\frac{4}{15}$ oe fraction nfww	**A1**	If **M0** scored **SC1** for $\frac{k}{90}$
14(a)	11.5	**1**	
14(b)(i)	12	**1**	
14(b)(ii)	8.5	**1**	

Question	Answer	Marks	Partial Marks
15	116°	**B1**	
	alternate segment theorem	**B1**	
	angles in opposite segments are supplementary or cyclic quadrilateral or angles at a point on a straight line	**B1**	
16	$8y^2 - 42y + 10[= 0]$ or $8x^2 + 14x - 400[= 0]$	**M3**	**M1** for $(7 - 3y)^2 - y^2 = 39$ oe or $x^2 - \left(\frac{7-x}{3}\right)^2 = 39$ oe **M1** for $49 - 21y - 21y + 9y^2$ or better or $49 - 7x - 7x + x^2$ or better or for correct expansion of their quadratic binomial
	$(8y - 2)(y - 5)[= 0]$ oe $(8x - 50)(x + 8)[= 0]$ oe	**M1**	**M1** for correct method to solve *their* quadratic equation e.g. factors, quadratic formula, completing the square
	$x = 6.25$ oe $y = 0.25$ oe $x = -8$ $y = 5$	**B2**	**B1** for $x = 6.25$, $x = -8$ or for $y = 0.25$, $y = 5$ or for a correct pair of x and y values
17	$[y =] -\frac{1}{6}x + \frac{11}{2}$ oe	**4**	**M1** for [gradient of AB =] $\frac{5 - -7}{3 - 1}$ oe **M1** for [gradient of perpendicular =] $-\frac{1}{\textit{their}\ \text{grad}\ AB}$ **M1** for substituting (3, 5) in *their* linear equation
18	22.5 nfww	**3**	**M2** for $\frac{146.2 + 0.05}{7 - 0.5}$ or **M1** for 146.2 + 0.05 or 7 – 0.5 or better seen
19(a)	Correct sketch 	**2**	Needs all three features for 2 marks: • Correct curve shape • Maximum at (0, 1) and at (360, 1) and minimum at (180, – 1) • Passing through (90, 0) and (270, 0) only **B1** for two correct features

Question	Answer	Marks	Partial Marks
19(b)	75.5 or 75.52… and 284.4 to 284.5	**3**	**B2** for one correct or **M1** for $\cos x = \frac{1}{4}$ oe If 0 scored, **SC1** for two answers with a sum of 360
20	[a =] 36 [b =] − 6	**2**	**B1** for each or **SC1** for correct answers reversed
21	X, Y and Z are collinear oe	**1**	Allow in a straight line
	X is the midpoint of ZY oe	**1**	Allow e.g. $ZY = 2XY$, $ZX = XY$ oe

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

MATHEMATICS **0580/21**

Paper 2 (Extended) **October/November 2019**

MARK SCHEME

Maximum Mark: 70

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	1.25	**1**	
2	$p(5+t)$ final answer	**1**	
3	4.6 cao nfww	**2**	**B1** for 4.57 or 4.58 or 4.579 to 4.580 If 0 scored, **SC1** for their calculation rounded to 2 sf if more than 2sf seen
4(a)	Fifteen thousand [and] sixty	**1**	
4(b)	$1.506[0] \times 10^4$	**1**	
5	$3c - 4d$ final answer	**2**	**B1** for $3c + kd$ or $kc - 4d$
6	11	**2**	**M1** for $x - 2 = 3 \times 3$ oe or $\frac{x}{3} = 3 + \frac{2}{3}$ oe or better
7	$6x^5$ final answer	**2**	**B1** for kx^5 or $6x^k$
8	$\frac{5}{16} \times \frac{8}{7}$	**M1**	
	$\frac{5}{14}$ cao	**A1**	
9	1.5	**2**	**M1** for $\frac{600 \times r \times 10}{100} = 90$ oe or better
10	$\frac{16}{x^4}$ or $16x^{-4}$	**2**	**M1** for $\left(\frac{x}{2}\right)^{-4}$ or $\left(\frac{8}{x^3}\right)^{\frac{4}{3}}$ or $\left(\frac{x^{12}}{4096}\right)^{-\frac{1}{3}}$ or better or **B1** for $\frac{16}{x^k}$ or $16x^k$ or $\frac{k}{x^4}$ or kx^{-4} final answer
11	$\frac{P}{2+\pi}$	**2**	**M1** for $P = r(2+\pi)$
12	229.5225 final answer cao	**2**	**M1** for $(15.1 + 0.05)^2$ or **B1** for 15.15 seen

Question	Answer	Marks	Partial Marks
13	45[.0] or 44.99 to 45.00	**2**	**M1** for $\frac{1}{2}\times 13\times 11\times \sin 39$ oe
14	49 000	**3**	**M1** for $4.9\times(10\,000\,000)^2$ **M1** for $\div(100\,000)^2$ OR **M1** for 1 cm : 100 km **M1** for $4.9\times(\textit{their}\ 100)^2$ OR **M2** for $(\sqrt{4.9}\times 10\,000\,000\div 100\,000)^2$ or **M1** for $\sqrt{4.9}\times 10\,000\,000\div 100\,000$
15	128	**3**	**M1** for $y=\frac{k}{x^2}$ **M1** for $y=\frac{\textit{their}\ k}{\left(\frac{1}{2}\right)^2}$ OR **M2** for $\frac{2\times 4^2}{\left(\frac{1}{2}\right)^2}$ or **M1** for $2\times 4^2=y\times\left(\frac{1}{2}\right)^2$
16	109.3 or 109.26 to 109.27	**3**	**M2** for $\frac{12\sin 39}{8}$ or **M1** for $\frac{8}{\sin 39}=\frac{12}{\sin(...)}$ oe
17	6.28 or 6.283 to 6.284	**3**	**M2** for $\frac{45}{360}\times\pi\times 5^2$ oe **and** $\frac{45}{360}\times\pi\times 3^2$ oe or **M1** for $\frac{45}{360}\times\pi\times 5^2$ oe or $\frac{45}{360}\times\pi\times 3^2$ oe or $\pi\times 5^2-\pi\times 3^2$ oe
18	$\frac{x^2-3x-8}{2(x+1)}$ or $\frac{x^2-3x-8}{2x+2}$ final answer	**3**	**B1** for common denominator $2(x+1)$ or $2x+2$ **M1** for $x(x+1)-2(2x+4)$ or better
19(a)	$\begin{pmatrix}19 & 22\\ 43 & 50\end{pmatrix}$	**2**	**B1** for 2 or 3 elements correct

Question	Answer	Marks	Partial Marks
19(b)	–2 final answer	**1**	
20	$\frac{147}{160}$ oe	**3**	**M2** for $\frac{1}{10}\times\frac{3}{4}+\frac{9}{10}\times\frac{15}{16}$ or **M1** for $\frac{1}{10}\times\frac{3}{4}$ or $\frac{9}{10}\times\frac{15}{16}$
21(a)	Translation $\begin{pmatrix}-1\\-5\end{pmatrix}$	**2**	**B1** for each
21(b)	Correct reflection at (6, 2), (6, 6), (7, 6), (7, 3)	**2**	**B1** for three correct vertices
22	2592	**4**	**M3** for $1.2\times100\times60\times60\times6\div1000$ oe or **M2** for $1.2\times60\times60\times6$ oe or **M1** for figs $12\times$ figs 6 or 60×60 or correct conversion e.g. their value in $cm^3\div1000$ their value in $m^3\times1000$ 1.2×100 $6\div10\,000$
23	2, 5 3 *A.....B′* $\subset$	**4**	**B1** for each
24(a)	19	**2**	**M1** for $3(2^x)-5$ soi or for f(8)
24(b)	$\frac{x+5}{3}$ oe final answer	**2**	**M1** for correct first step $y+5=3x$ or $\frac{y}{3}=x-\frac{5}{3}$ or $x=3y-5$
25(a)	$-\frac{1}{3}\mathbf{q}+\frac{1}{2}\mathbf{p}$ oe	**2**	**M1** for correct unsimplified answer or correct route
25(b)	$\frac{1}{2}\mathbf{p}+\frac{1}{2}\mathbf{q}$ oe	**2**	**M1** for correct unsimplified answer or correct route

Question	Answer	Marks	Partial Marks
26	380	**5**	**B2** for time = 8, implied by 23 on t-axis or **M1** for $\frac{20}{t} = 2.5$ or $\frac{20}{t-15} = 2.5$ or $\frac{0-20}{t-15} = -2.5$ oe **M2** for $\frac{1}{2}$(*their* 23 + 15) × 20 or $20 \times 15 + \frac{1}{2} \times$ *their* 8×20 oe or **M1** for any relevant area found

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MATHEMATICS **0580/22**

Paper 2 (Extended) **October/November 2019**

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Abbreviations

cao correct answer only
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FT follow through after error
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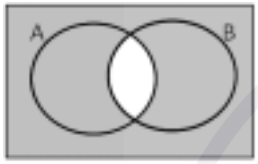
soi seen or implied

Question	Answer	Marks	Partial Marks
1	6.8	**1**	
2	7.6[0] or 7.604 to 7.605	**1**	
3	$a^4 + 3a$ final answer	**1**	
4		**1**	
5(a)	23	**1**	
5(b)	One extreme value oe	**1**	
6	135	**2**	**M1** for $\frac{12}{12+7+9+4}[\times 360]$ or $\frac{360}{12+7+9+4}[\times 12]$ oe
7	440 or 440.2 to 440.3	**2**	**M1** for $30\,000 \div 68.14$
8	282	**2**	**M1** for 180 + 102 or 360 – (180 – 102)
9	$x < -10$ final answer	**2**	**M1** for $-12 - 13 > 3x - \frac{x}{2}$ oe
10	$67.\dot{7} - 6.\dot{7}$ oe	**M1**	
	$\frac{61}{90}$	**A1**	If 0 scored, **SC1** for $\frac{k}{90}$

Question	Answer		Marks	Partial Marks
11	$\frac{29}{8}$ or $\frac{5}{3}$	$2\frac{5}{8}-\frac{2}{3}$	**M1**	Allow $\frac{29k}{8k}$ or $\frac{5k}{3k}$ Correct step for dealing with mixed numbers
	$\frac{87}{24}$ and $\frac{40}{24}$	$[2]\frac{15}{24}$ and $\frac{16}{24}$	**M1**	Correct method to find common denominator e.g. $3\frac{15}{24}$ and $1\frac{16}{24}$
	$1\frac{23}{24}$ cao		**A1**	
12	90		**3**	**M2** for $360 \div (180 - 176)$ oe or **M1** for $180(n - 2) = 176n$ oe or $180 - 176$
13	352		**3**	**B2** for figs 352 or **M1** for $\left(\frac{75}{30}\right)^3$ oe or $\left(\frac{30}{75}\right)^3$ oe OR **M2** for $5.5\times\left(\frac{30}{75}\right)^3\times 1000$
14	Gradient = $\frac{5}{4}$ oe		**M1**	**M** marks can be in any order
	$y = k-\frac{4}{5}x$ oe and gradient = $-\frac{4}{5}$ oe		**M1**	
	Use of product of gradients is −1 oe		**M1**	
15(a)	$2.45x + 3.15y$ final answer		**2**	**B1** for one correct term in final answer If 0 scored, **SC1** for $245x + 315y$
15(b)	13		**2**	**M1** for $60.55 - 2.45 \times 8$ oe
16	$y = 5$ ruled $y = x + 1$ ruled Correct region indicated		**4**	**B2** for two correct lines or **B1** for one correct line **B2** for indication of correct region or **B1** for shading that satisfies two of the inequalities

Question	Answer	Marks	Partial Marks
17	Bisector of angle Q accurate with two pairs of correct arcs and Arc centre R, radius 6.5 cm With bird table correctly indicated or implied by correct intersecting constructions	**4**	**M2** for bisector of angle Q accurate with two pairs of correct arcs or **M1** for accurate bisector with no/wrong arcs **M2** for arc centre R, radius 6.5 cm or **M1** for arc centre R Maximum 3 marks if incorrect position/region is labelled, or there is no label and a region is shaded, or *their* constructions do not intersect
18(a)	0.3 oe	**2**	**M1** for 0.4×0.75
18(b)	0.975 oe	**2**	**M1** for $1 - 0.4 \times 0.25 \times 0.25$ oe or $0.6 + 0.4 \times 0.75 + 0.4 \times 0.25 \times 0.75$ or 0.6 + *their* **(a)** $+ 0.4 \times 0.25 \times 0.75$
19(a)	$180 - 4x$	**1**	
19(b)	$90 - 2x$	**1**	**FT** *their* **(a)** ÷ 2 in its simplest form dep on expression in x in **(a)**
19(c)	$90 + x$	**2**	**FT** $180 -$ *their* **(b)** $- x$ oe dep on expression in x in **(b)** then fully simplified **M1** for $180 - (90 - 2x + x)$ oe or $180 -$ *their* **(b)** $- x$ oe dep on expression in x in **(b)**
20(a)	$(3y + 2x)(6 - a)$ oe final answer	**2**	**M1** for $3y(6 - a) + 2x(6 - a)$ oe or $6(2x + 3y) - a(2x + 3y)$ oe
20(b)	$3(x + 4y)(x - 4y)$ final answer	**3**	**M2** for $(3x + 12y)(x - 4y)$ or $(3x - 12y)(x + 4y)$ or **M1** for $3(x^2 - 16y^2)$ or for $(x + 4y)(x - 4y)$
21(a)	6	**2**	**B1** for 3^4 or 3^{x-2} or **M1** for $3^x = 81 \times 3^2$ or better
21(b)	8	**3**	**M2** for $x^{\frac{5}{3}} = 32$ or better or **M1** for $\frac{1}{x^{\frac{1}{3}}} = \frac{32}{x^2}$ or better or $x^{-\frac{1}{3}--2} = 32$ or better
22(a)	$\begin{pmatrix} 2 & 17 \\ 10 & -25 \end{pmatrix}$	**2**	**B1** for 2 correct elements

Question	Answer	Marks	Partial Marks
22(b)	2	**2**	**M1** for $-3 - 5k = -13$ oe
22(c)	$\frac{1}{10}\begin{pmatrix} 0 & -2 \\ 5 & 3 \end{pmatrix}$ oe isw	**2**	**M1** for $k\begin{pmatrix} 0 & -2 \\ 5 & 3 \end{pmatrix}$ or for det = 10 or soi
23(a)	Tangent ruled at $t = 24$	**B1**	
	-0.7 to -0.3	**B2**	**B2** dep on correct tangent or close attempt at tangent **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.
23(b)	acceleration or deceleration oe	**1**	
23(c)	68	**2**	**M1** for $(22 - 5) \times 4$

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

MATHEMATICS **0580/23**

Paper 2 (Extended) **October/November 2019**

MARK SCHEME

Maximum Mark: 70

Published

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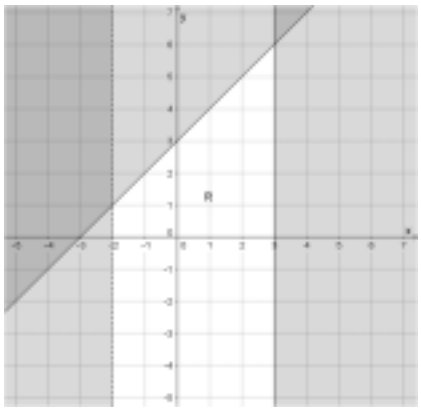
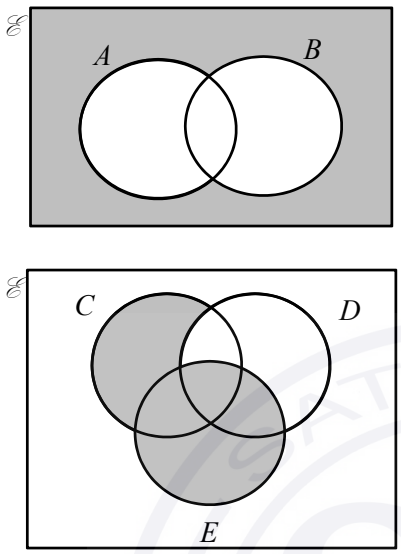
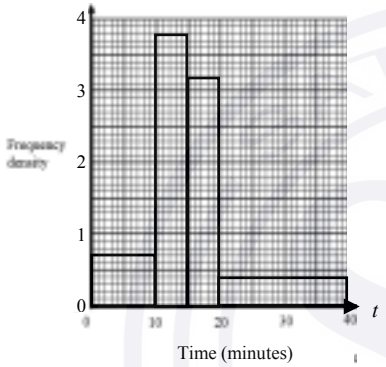
Question	Answer	Marks	Partial Marks
1	–10	**1**	
2	6	**1**	
3(a)	27	**1**	
3(b)	47	**1**	
4	21	**2**	**M1** for [84 =] 2 × 2 × 3 × 7 or [105 =] 3 × 5 × 7 or 3 × 7 as final answer or **B1** for 3 or 7 as final answer
5(a)	7.2×10^4	**1**	
5(b)	1.8×10^{-3}	**1**	
6	$x^2 + 8x + 15$ final answer	**2**	**M1** for three terms correct from $x^2 + 3x + 5x + 15$
7	$-\frac{2}{5}$ or – 0.4	**2**	**M1** for gradient = $\frac{5}{2}$ oe soi
8(a)	21.1 or 21.10…	**1**	
8(b)	158.9 or 158.8 to 158.9	**1**	**FT** 180 – *their* **(a)** providing answer is an obtuse angle
9	298	**3**	**M2** for [2 ×] (5 × 7 + 5 × 9.5 + 7 × 9.5) oe or **M1** for one correct area, 5 × 7 or 5 × 9.5 or 7 × 9.5
10	30	**3**	**M1** for $\frac{391+n+n-1}{3} = 5n$ oe **M1** for correct first step for solving *their* equation e.g. $391+n+n-1 = 3\times 5n$, $\frac{390+2n}{3} = 5n$
11(a)	$3(4x + 5)$ final answer	**1**	
11(b)	$(x + 3)(y – 2)$ final answer	**2**	**B1** for $y(x + 3) – 2(x + 3)$ or $x(y – 2) + 3(y – 2)$ or correct answer seen then spoilt

Question	Answer	Marks	Partial Marks
12	7.62 or 7.615 to 7.616	**3**	**M2** for $\sqrt{(9-2)^2+(4-1)^2}$ oe or **M1** for $(9-2)^2+(4-1)^2$ oe or 58
13	2.75 oe	**3**	**M2** for $6--5=2(3k-k)$ oe or better or **M1** for $\frac{6--5}{3k-k}$ oe If 0 scored, **SC1** for -2.75 oe as answer
14(a)	$\frac{1}{2n}$ oe final answer	**1**	
14(b)	5^{n-1} oe final answer	**2**	**M1** for recognition of terms being powers of 5
15	$\frac{2}{12}$ oe or $\frac{1}{2}\times\frac{1}{3}$ $\frac{2}{3}\left(1+\frac{1}{4}\right)$	**M1**	**M1** for correct first step to deal with multiplication
	$\frac{8}{12}[+]\frac{2}{12}$ oe $\frac{2}{3}\times\frac{5}{4}$	**M1**	**M1** for correct working for common denominator with *their* $\frac{2}{12}$ oe or correct evaluation of bracket
	$\frac{5}{6}$ cao	**A2**	**A1** for $\frac{10}{12}$ oe
16(a)	12.88	**1**	
16(b)	two correct points plotted	**1**	
16(c)	ruled line of best fit	**1**	
16(d)	negative	**1**	
17		**4**	**B1** for $x = -2$ dashed ruled line and $x = 3$ solid ruled line **B1** for $y = x + 3$ solid ruled line **B2** for indication of correct region or **B1** for shading that satisfies two of the inequalities, e.g. two of $x > -2$, $x \leqslant 3$ and $y \leqslant x + 3$

Question	Answer	Marks	Partial Marks
18(a)(i)	4	**1**	
18(a)(ii)	At least one and fewer than four numbers from {2, 3, 4, 5}	**1**	
18(b)		**2**	**B1** for each
19(a)	0.3 or $\frac{3}{10}$	**1**	
19(b)	760	**3**	**M2** for correct complete area statement e.g. $70 \times 10 + \frac{1}{2} \times 20 \times 6$ oe or **M1** for one of these area calculations 70×10, $\frac{1}{2} \times 20 \times 6$, 50×10 or $\frac{1}{2} \times (16 + 10) \times 20$
20(a)	$\frac{45}{(x+1)^2}$ final answer	**2**	**M1** for $t = \frac{k}{(x+1)^2}$
20(b)	4	**2**	**M1** for $1.8 \times (x + 1)^2 =$ *their* 45 or better
21(a)	$\frac{1}{5}\begin{pmatrix} -5 & -10 \\ -1 & -3 \end{pmatrix}$ oe isw	**2**	**M1** for $k\begin{pmatrix} -5 & -10 \\ -1 & -3 \end{pmatrix}$ or det = 5 soi
21(b)	[x =] 6 [y =] 7	**3**	**B1** for $x = 6$ **B2** for $y = 7$ or **M1** for $2 \times 1 + 9y = 65$ or $2 \times -4 + 2y = 6$

Question	Answer	Marks	Partial Marks
22	15.2	**5**	**M4** for $\left(\pi\times5^2\times12-\frac{1}{3}\times\pi\times5^2\times4.8\right)\div\left(\pi\times5^2\right)$ or **M3** for $\pi\times5^2\times12-\frac{1}{3}\times\pi\times5^2\times4.8$ or **M1** for $\pi\times5^2\times12$ **M1** for $\frac{1}{3}\times\pi\times5^2\times4.8$
23(a)	10 [< $t \leqslant$] 15	**1**	
23(b)	Correct histogram  	**3**	**B1** for each correct block If 0 scored, **SC1** for correct frequency densities 3.8, 3.2, 0.4 soi by correct heights

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

MATHEMATICS **0580/21**

Paper 2 (Extended) **May/June 2019**

MARK SCHEME

Maximum Mark: 70

Published

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Question	Answer	Marks	Partial Marks
1	7.5 oe	**1**	
2	$y(5-6p)$ final answer	**1**	
3	4.01 or 4.007 to 4.008	**1**	
4	46.5	**1**	
5	5	**2**	**M1** for $180 \div 6^2$ oe
6(a)	t^{14} final answer	**1**	
6(b)	u^{25} final answer	**1**	
7	6.88 or 6.882 to 6.883	**2**	**M1** for $\sin 35$ [=] $\frac{x}{12}$ oe or better
8	100	**2**	**M1** for reflex angle = 2 × 130 or opposite angle of a cyclic quadrilateral shown = 50
9	47.77…– 4.77… oe	**M1**	
	$\frac{43}{90}$	**A1**	Allow equivalent fractions If **M0** then **SC1** for $\frac{43}{90}$ or equivalent fraction with no/insufficient working
10	$5 - 2x$ final answer	**2**	**M1** for $2(1-x) + 3$ oe
11	$\frac{2}{20}$ oe	**2**	**M1** for $\frac{2}{5} \times \frac{1}{4}$ oe
12(a)	28	**1**	
12(b)	27	**1**	
12(c)	29 or 31	**1**	

Question	Answer	Marks	Partial Marks
13	[a =] 2 [b =] – 13	**3**	**B2** for either correct or $(x + 2)^2 – 13$ OR **M1** for $2a = 4$ soi **M1** for $a^2 + b = – 9$ soi OR **M1** for $x^2 + ax + ax + a^2$ [$+b$] or better
14	$\frac{5}{6} + \frac{4}{6}$ oe	**M1**	2 correct fractions with a suitable common denominator $6k$
	$1\frac{1}{2}$ cao	**A2**	**A1** for $\frac{9}{6}$ oe
15	$3x^2 - 3x + 2$ final answer	**3**	**B2** for $x^2 + 2x + x + 2 + 2x^2 - 6x$ oe or **B1** for 3 correct terms of $x^2 + 2x + x + 2$ oe
16	[$\pm$] 0.6 oe	**3**	**M1** for $y = \frac{k}{\sqrt{x+1}}$ **M1** for $y = \frac{theirk}{\sqrt{99+1}}$ OR **M2** for $\frac{2\sqrt{8+1}}{\sqrt{99+1}}$ or **M1** for $2\sqrt{8+1} = y\sqrt{99+1}$
17(a)	$(p - q)(p + q)$ final answer	**1**	
17(b)	$\frac{7}{2}$ oe	**2**	**M1** for $2 \times (p + q) = 7$ or for $(2+q)^2 - q^2 = 7$ or $p^2 - (p-2)^2 = 7$
18(a)	$27y^{12}$ final answer	**2**	**B1** for ky^{12} or $27y^k$ in final answer
18(b)	$\frac{3}{2}$ oe	**1**	
19	1500	**3**	**M2** for $12 \div \left(\frac{20}{100}\right)^3$ oe or **M1** for $\left(\frac{20}{100}\right)^3$ or $\left(\frac{100}{20}\right)^3$ oe OR **M1** for $\div 20^3$ oe **M1** for $\times 100^3$ oe

Question	Answer	Marks	Partial Marks
20	$\frac{x-5}{(x+2)(3x-1)}$ final answer	**3**	**B1** for common denominator isw expansion **M1** for $3x-1-2(x+2)$ or better
21	60.5 or 60.50…	**4**	**M3** for tan = $\frac{10}{\frac{1}{2}\sqrt{8^2+8^2}}$ oe or **M2** for $[\frac{1}{2}\times]\ \sqrt{8^2+8^2}$ or **M1** for 8^2+8^2 or 4^2+4^2 or **B1** for recognising the angle required
22(a)(i)	17	**1**	
22(a)(ii)	$3n + 2$ oe final answer	**2**	**B1** for $3n + k$ or $cn + 2$, $c \neq 0$
22(b)	$\frac{31}{12}$ oe	**1**	
23(a)	$\begin{pmatrix}11 & 7\\14 & 18\end{pmatrix}$	**2**	**B1** for 2 or 3 correct elements
23(b)	$\frac{1}{10}\begin{pmatrix}4 & -1\\-2 & 3\end{pmatrix}$ oe isw	**2**	**B1** for $k\begin{pmatrix}4 & -1\\-2 & 3\end{pmatrix}$ or for det = 10 soi
24(a)	2	**1**	
24(b)	1300	**3**	**M2** for $\frac{20}{2}\times(60+70)$ oe or **M1** for any relevant area
25(a)	$\frac{1}{3}\mathbf{p} - \frac{1}{2}\mathbf{q}$ oe simplified	**2**	**M1** for a correct unsimplified answer or a correct route
25(b)	$\frac{5}{6}\mathbf{p} + \frac{3}{4}\mathbf{q}$ oe simplified	**2**	**M1** for a correct unsimplified answer or a correct route

Question	Answer	Marks	Partial Marks
26(a)	$y = 2x - 3$ oe	**3**	**B2** for $2x - 3$ or $y = theirm\ x - 3$ or $y = 2x + c$ or **M1** for $\frac{9-(-3)}{6-0}$ oe or $9 = 6m - 3$ oe or **B1** for $2x$ seen or $[y =]mx - 3$ $m \neq 0$
26(b)	$y = -\frac{1}{2}x + 2$ oe	**2**	**FT** *their* **(a)** $y = -\frac{1}{their\ m}x + 2$ **B1** for gradient $-\frac{1}{2}$, gradient **FT** *their* **(a)** or for $y = mx + 2$ $m \neq 0$

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MATHEMATICS **0580/22**

Paper 2 (Extended) **May/June 2019**

MARK SCHEME

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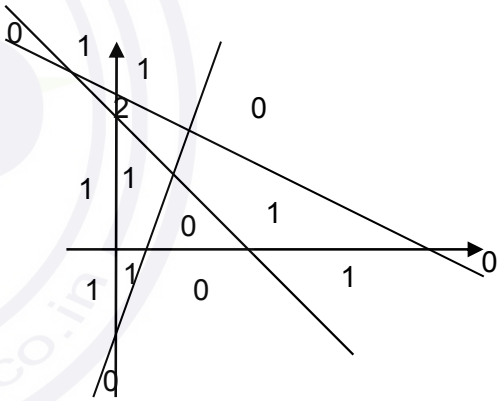
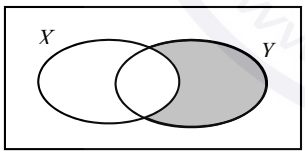
Question	Answer	Marks	Partial Marks
1	53 or 59	**1**	
2	0.839 or 0.8386 to 0.8387	**1**	
3	$\frac{7}{9}$	**1**	
4(a)	Trapezium	**1**	
4(b)	Obtuse	**1**	
5	56.4 or 56.44…	**2**	**M1** for $\frac{254}{their\,4.5}$ or $\frac{254}{their\,270}[\times 60]$
6	2	**2**	**M1** for $9f - 3f$ oe or $23 - 11$ oe
7	14.7	**2**	**M1** for $\frac{1}{2}\times 8.4\times 3.5$ oe
8(a)	0.048 cao	**1**	
8(b)	5.27×10^{-3}	**1**	
9	6	**2**	**M1** for $2 \times 3^2 \times 5$ or $2^4 \times 3$ or for 2×3 as final answer or **B1** for 2 or 3 as final answer
10	2.1	**2**	**M1** for $\frac{33.6\times 25000^2}{100000^2}$ oe or answer figs 21
11	$\begin{pmatrix}3 & 0\\0 & 3\end{pmatrix}$	**2**	**B1** for one row or one column correct in a 2 by 2 matrix in the final answer or **SC1** for $\begin{pmatrix}0 & 3\\3 & 0\end{pmatrix}$
12(a)	$10m^5$ final answer	**2**	**B1** for $10m^k$ or km^5 as final answer
12(b)	x^{24} final answer	**1**	

Question	Answer	Marks	Partial Marks
13	$\frac{9}{4}\times\frac{7}{3}$ or $\frac{63}{28}\div\frac{12}{28}$ oe with common denominator	**M2**	**B1** for $\frac{9}{4}$ oe seen or **M1** for *their* $\frac{9}{4}\times\frac{7}{3}$
	$5\frac{1}{4}$ cao	**A1**	
14	Correctly eliminating one variable	**M1**	
	$[x =] -4$ $[y =] 3$	**A2**	**A1** for one correct If **M0** scored, **SC1** for 2 values satisfying one of the original equations
15	495	**3**	**M2** for $435.6 \div \frac{100-12}{100}$ oe or **B1** for recognising 435.6 as 88[%]
16(a)	*R* identified correctly	**2**	**B** marks 
16(b)	7	**1**	
17	$\frac{3x^2-4x+9}{(x+3)(x-5)}$ final answer	**3**	**B1** for common denominator $(x+3)(x-5)$ oe isw **M1** for $2x(x-5)+(x+3)(x+3)$ or better
18	12.8 4.4 0.8	**3**	**B2** for 2 correct heights or 3 correct freq densities or **B1** for 1 correct height or 2 correct freq densities

Question	Answer	Marks	Partial Marks
19	$m = \frac{k}{P-1}$ final answer	**4**	**B3** for final answer $\frac{k}{P-1}$ OR **M1** for multiplying or dividing by m correctly **M1** for term(s) in m on one side correctly and terms not in m on the other side correctly **M1** for correctly factorising m with a 2-term bracket oe **M1** for correct division by *their* 2-term bracket with m as the subject To a maximum of **M3** for an incorrect answer
20	$\frac{-(-2) \pm \sqrt{(-2)^2 - 4(3)(-10)}}{2 \times 3}$	**B2**	**B1** for $\sqrt{(-2)^2 - 4(3)(-10)}$ or better and if in form $\frac{p+\sqrt{q}}{r}$ or $\frac{p-\sqrt{q}}{r}$ then **B1** for $p = -(-2)$ and $r = 2(3)$
	−1.52 and 2.19 final ans cao	**B1B1**	If B0B0, **SC1** for −1.5 and 2.2 or −1.523 to −1.522... and 2.189.... or 1.52 and −2.19 or −1.52 and 2.19 seen in working
21(a)		**1**	
21(b)(i)	$\frac{9}{16}$ oe	**2**	**B1** for $\frac{9}{k}$ or $\frac{k}{16}$ provided fraction is less than 1
21(b)(ii)	46	**1**	
22(a)	$\begin{pmatrix} 6 & 15 \\ 3 & 7 \end{pmatrix}$	**2**	**B1** for 2 correct elements
22(b)	$\begin{pmatrix} -3 & 7 \\ 1 & -2 \end{pmatrix}$ oe isw	**2**	**B1** for $k\begin{pmatrix} 3 & -7 \\ -1 & 2 \end{pmatrix}$ soi or det = – 1 soi

Question	Answer	Marks	Partial Marks
23(a)	$\frac{5}{3}\mathbf{p}-2\mathbf{q}$ oe simplified	**2**	**M1** for correct unsimplified answer or $c\mathbf{p}-2\mathbf{q}$ or $\frac{5}{3}\mathbf{p}+c\mathbf{q}$ $c \neq 0$ or for a correct route
23(b)	$\frac{5}{6}$	**2**	**B2FT** for $\frac{\textit{their } c}{2}$ if *their* **(a)** is $c\mathbf{p}-2\mathbf{q}$ oe **M1** for $\overrightarrow{MX} = \frac{5}{6}\mathbf{p}-\mathbf{q}$ or $\overrightarrow{MX} = \frac{1}{2}$ *their* **(a)** or $\overrightarrow{BX} = \frac{1}{2}\overrightarrow{AN}$ or $\mathbf{q} + \frac{1}{2}$ *their* **(a)** or $\mathbf{q} + \overrightarrow{MX} - k\mathbf{p} = 0$ oe
24	31.9 or 31.85...	**4**	**M3** for $\tan = \frac{12}{\sqrt{18^2+7^2}}$ oe or **M2** for $\sqrt{18^2+7^2}$ or **M1** for 18^2+7^2 or **B1** for identifying correct angle *CAG*
25(a)	Rotation 90° clockwise oe (1, 0)	**3**	**B1** for each
25(b)	Enlargement – 2 (0, 2)	**3**	**B1** for each

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

MATHEMATICS **0580/23**

Paper 2 (Extended) **May/June 2019**

MARK SCHEME

Maximum Mark: 70

Published

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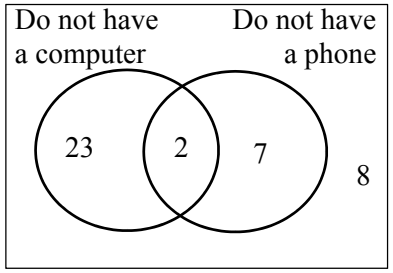
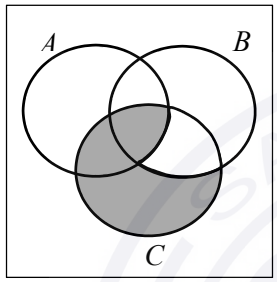
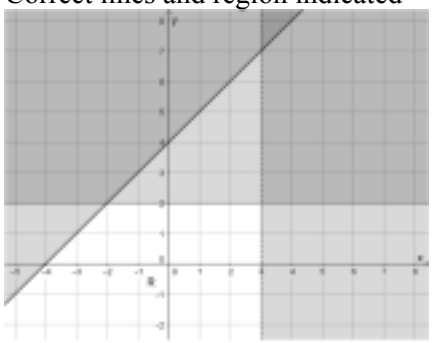
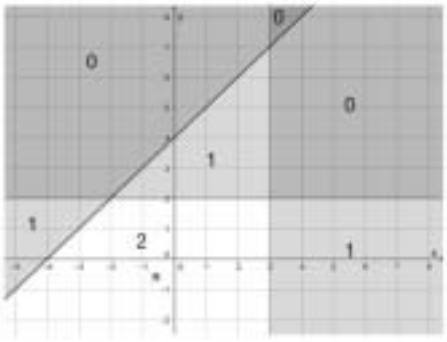
Abbreviations
cao correct answer only
dep dependent
FT follow through after error
isw ignore subsequent working
oe or equivalent
SC Special Case
nfww not from wrong working
soi seen or implied

Question	Answer	Marks	Partial Marks
1	1.90 cao	**1**	
2	$x(2x - 1)$	**1**	
3	$\frac{5}{24}$ or 0.208 or 0.2083…	**1**	
4	Mode	**1**	
5(a)	(0, –8)	**1**	
5(b)	3	**1**	
6(a)	6	**1**	
6(b)	2.15 or 2.154…	**1**	
7(a)	31 or $\sqrt{121}$	**1**	
7(b)	$\sqrt{13}$	**1**	
8(a)	32	**1**	
8(b)	Positive	**1**	
9	$\frac{84}{315}$ or $\frac{4}{35}\times\frac{7}{3}$ or $\frac{12}{5}\times\frac{1}{9}$ or $\frac{4}{5}\times\frac{1}{3}$	**M1**	Accept any correct cancelling
	$\frac{4}{15}$ cao	**A1**	
10	$[w =] \frac{P}{2} - h$ or $\frac{P-2h}{2}$ final answer	**2**	**M1** for $w + h = \frac{P}{2}$ or $2w + 2h = P$
11	$2m + 1$	**2**	**B1** for $2m + c$ or $km + 1$ ($k \neq 0$)
12	72.8 or 72.79 to 72.80…	**2**	**M1** for $\frac{217}{360}\times\pi\times6.2^2$

Question	Answer	Marks	Partial Marks
13(a)	4	**1**	
13(b)	Accurate drawing with correct construction arcs	**2**	**B1** for accurate drawing without the correct arcs
14(a)	3	**2**	**M1** for $a \times 7^2 + a = 150$ oe
14(b)	–7	**1**	
15	13.9 or 13.92 to 13.93	**3**	**M2** for $\sqrt{(7-2)^2+(12--1)^2}$ oe or **M1** for $(7-2)^2+(12--1)^2$ oe
16	6 nfww	**3**	**B1** for 10 + 0.5 or 4 – 0.5 soi **M1** for [b =] $\frac{2A}{h}$ soi
17	$\frac{x^2}{x-5}$ final answer	**3**	**B1** for $x^2(x + 5)$ **B1** for $(x – 5)(x + 5)$
18	0.14 oe	**3**	**M1** for $y = \frac{k}{(x+1)^2}$ **M1** for $y = \frac{their\ k}{(4+1)^2}$ OR **M2** for $\frac{0.875(1+1)^2}{(4+1)^2}$ or **M1** for $y(4 + 1)^2 = 0.875(1 + 1)^2$
19	36	**4**	**B1** for angle *KNL* or *MNJ* = 76 **B2** for angle *LJM* or *LKM* = 68 or **B1** for angle *LMJ* = 90 or *LKJ* = 90 or *LCM* = 136 (*C* = centre) OR **B1** for *MKJ* = 22 **B2** for *LJM* or *LKM* = 68 or **B1** for *LKJ* = 90 or *KJL* = 54 OR **B1** for *MNL* = 104 **B1** for *LMN* = 54 **B1** for *LMJ* = 90

Question	Answer	Marks	Partial Marks
20(a)(i)	$\frac{8}{15}$ oe	**1**	
20(a)(ii)		**2**	**B1** for 2 or 3 correct out of 4 regions
20(b)		**1**	
21(a)	$\begin{pmatrix} 15 & 20 \\ 25 & 0 \end{pmatrix}$	**1**	
21(b)	$\begin{pmatrix} 4 & 8 \\ 2 & 2 \end{pmatrix}$	**1**	
21(c)	$\begin{pmatrix} -9 & 20 \\ 5 & 20 \end{pmatrix}$	**2**	**B1** for two correct elements
22(a)	$-\mathbf{s}+\mathbf{t}$	**1**	
22(b)	$-\frac{4}{5}\mathbf{s}-\frac{1}{5}\mathbf{t}$ oe simplified	**3**	**M2** for correct unsimplified e.g. $-\mathbf{t}+\frac{4}{5}(-\mathbf{s}+\mathbf{t})$ or $-\mathbf{s}-\frac{1}{5}(-\mathbf{s}+\mathbf{t})$ or **M1** for a correct route e.g. $\overrightarrow{CB}$ + $\overrightarrow{BN}$ or [$\overrightarrow{BN}$ =] $\frac{4}{5}(-\mathbf{s}+\mathbf{t})$ or [$\overrightarrow{DN}$ =] $-\frac{1}{5}(-\mathbf{s}+\mathbf{t})$
23(a)(i)	5	**1**	
23(a)(ii)	2.4 to 2.6	**2**	**B1** for [LQ=] 3.4 to 3.6 or [UQ=] 6
23(b)	26, 74	**2**	**B1** for each

Question	Answer	Marks	Partial Marks
24	Correct lines and region indicated 	**5**	**B1** for $y = 2$ solid line **B1** for $x = 3$ dashed line **B1** for $y = x + 4$ solid line **B2, B1 or B0** for region 
25(a)	126	**4**	**M3** for $\frac{360-\left[180-\left(360\div5\right)\right]}{2}$ or $\frac{360-180\times\left(5-2\right)\div5}{2}$ or **M2** for $\frac{180\times\left(5-2\right)}{5}$ or $180-\frac{360}{5}$ or **M1** for $180\times(5-2)$ or $\frac{360}{5}$
25(b)	7 : 2	**2**	**M1** for $\sqrt{\frac{73.5}{6}}$ or $\sqrt{\frac{6}{73.5}}$

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

MATHEMATICS **0580/22**

Paper 2 (Extended) **March 2019**

MARK SCHEME

Maximum Mark: 70

Published

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cao correct answer only
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FT follow through after error
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soi seen or implied

Question	Answer	Marks	Partial Marks
1	–14	**1**	
2	330	**1**	
3	$\frac{23}{99}$	**1**	
4(a)	0.047	**1**	
4(b)	2.76×10^6	**1**	
5	467.42 or 467	**2**	**M1** for $500 \div 1.0697$
6	70	**2**	**M1** for $25\,000 \times 0.0028$ oe
7	308	**2**	**M1** for 180 + 128 oe or 52 seen
8	**x** + 7**y**	**2**	**M1** for a correct route
9	$[y =]\ \frac{1}{4}(x-4)$ oe final answer	**2**	**M1** for $y = k(x-4)$
10	375	**3**	**M2** for $2(12\times5+12\times7.5+5\times7.5)$ oe or **M1** for 12×5 or 12×7.5 or 5×7.5
11	$22\frac{2}{9}$ or 22.2 or 22.22...	**3**	**M2** for $\frac{77-63}{63}[\times100]$ oe or $\frac{77}{63}\times100\,[-100]$ oe or **M1** for $\frac{77}{63}$ oe
12	4.21 or 4.212....	**3**	**M2** for $\sqrt{\frac{275\times3}{14.8\times\pi}}$ oe or **M1** for $275 = \frac{1}{3}\times\pi\times r^2\times14.8$ oe

Question	Answer	Marks	Partial Marks
13(a)	$k(7k-15)$ final answer	**1**	
13(b)	$4(m+p)(3+2m+2p)$ final answer	**2**	**B1** for $(m+p)(12+8(m+p))$ or $(m+p)(12+8m+8p)$ or $(4m+4p)(3+2m+2p)$ or $(2m+2p)(6+4m+4p)$ or $2(2m+2p)(3+2m+2p)$ or $2(m+p)(6+4m+4p)$
14	6290[.0…]	**3**	**M2** for $\frac{6999.31}{\left(1+\frac{2.16}{100}\right)^5}$ or **M1** for $[A]\left(1+\frac{2.16}{100}\right)^5$
15	73	**3**	**B1** for angle $PBC = 52$ **B1** for APO or $BPC = 55$ or APC or $OPB = 125$
16	tangent ruled at $x = 2$	**B1**	
	–0.7 to –0.3	**B2**	**dep on B1** or a close attempt at tangent at $x = 2$ or **M1** for rise/run for their tangent at $x = 2$ must see correct or implied calculation from a drawn tangent
17(a)	– 3	**1**	
17(b)	$\frac{m}{4}$ or $0.25m$ final answer	**2**	**B1** for $\frac{1}{4}$ or 0.25 or 4^{-1} or m correct in final answer
18	917 or 918 or 917.4 to 917.6	**3**	**M2** for $\pi \times 2.6^2 \times 12 \times 60 \times 60 \div 1000$ or **M1** for $\pi \times 2.6^2$ isw or $12 \times 60 \times 60 \div 1000$ isw If 0 scored **SC1** for figs 917 to 918
19	$\frac{b}{a+b}$ final answer	**3**	**B1** for $b(a-b)$ **B1** for $(a+b)(a-b)$
20(a)	$\begin{pmatrix} 7 & 8 \\ -11 & 36 \end{pmatrix}$	**2**	**B1** for 2 correct elements
20(b)	4	**2**	**M1** for $3x-(-1)\times(-7)=5$ or better

Question	Answer	Marks	Partial Marks
21	$\frac{25}{8}$	**B1**	or $\frac{75}{24}$
	their $\frac{25}{8}\times\frac{12}{5}$ or *their* $\frac{75}{24}\div\frac{10}{24}$ oe	**M1**	$\frac{75}{24}\times\frac{24}{10}$
	their $\frac{300}{40}$ oe	**M1**	oe e.g. $\frac{1800}{240}$, $\frac{75}{10}$, $\frac{60}{8}$, $\frac{30}{4}$, $\frac{15}{2}$
	$7\frac{1}{2}$ cao	**A1**	
22(a)	$1\frac{2}{3}$ or 1.67 or 1.666 to 1.667	**1**	
22(b)	1062.5	**3**	**M2** for $\frac{25}{2}(50+35)$ oe or **M1** for one area
23(a)	(4.5, – 1)	**2**	**B1** for each
23(b)	$[y=]\frac{5}{8}x+\frac{7}{4}$	**4**	**M1** for $\frac{-5-3}{7-2}$ oe **M1** for –1/ *their* $-\frac{8}{5}$ **M1** for 3 = 2 × *their* gradient + *c* oe
24(a)	5.95 or 5.954...	**3**	**M2** for $\frac{7.4}{\sin 97}\times\sin 53$ or **M1** for $\frac{\sin 97}{7.4}=\frac{\sin 53}{SR}$ oe
24(b)	3.73 or 3.733 to 3.734	**4**	**M2** for $8.5^2+7.4^2-2\times8.5\times7.4\times\cos 26$ or **M1** for implicit form **A1** for 13.9[4...]

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

MATHEMATICS **0580/21**

Paper 2 (Extended) **October/November 2018**

MARK SCHEME

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Question	Answer	Marks	Partial Marks
1	8[h] 55[min]	**1**	
2	Congruent	**1**	
3	Negative	**1**	
4	7.36×10^7	**2**	**B1** for figs 736
5	$6x^2 + 13x - 63$ final answer	**2**	**M1** for 3 correct terms of $6x^2 - 14x + 27x - 63$
6	[0]47	**2**	**B1** for 133 or 47 seen or **M1** for 227 – 180 oe
7	$\frac{4}{x^3}$ oe final answer	**2**	**M1** for $y = \frac{k}{x^3}$ oe
8	121 nfww	**2**	**M1** for $(6000 + 50) \div 50$ or **B1** for 6050 seen
9	896	**3**	**M2** for $800 + \frac{800 \times 4 \times 3}{100}$ oe or **M1** for $\frac{800 \times 4 \times 3}{100}$ oe
10	900	**3**	**M2** for $\frac{150 \times 100 \times 60}{1000}$ oe or **M1** for $150 \times 100 \times 60$ or $1.5[\times 1] \times 0.6$ or **B1** for figs 9
11(a)	23	**1**	
11(b)	$3n + 5$ oe	**2**	**B1** for $3n + j$ or $kn + 5$, $k \neq 0$
12	4, 5, 6	**3**	**B2** for 1 error or 1 omission or **M2** for $3.75 \leqslant n < 7$ oe or **M1** for $3.75 \leqslant n$ or $n < 7$ or better

Question	Answer	Marks	Partial Marks
13(a)	Correct angle bisector at B with two pairs of correct arcs reaching AC	**2**	**B1** for accurate with no/wrong arcs or for two pairs of correct arcs with no or wrong line or short line
13(b)	Correct region shaded	**1**	
14	$\frac{3}{8}\times\frac{4}{9}$ oe **or** $\frac{3}{8}\div\frac{18}{8}$ oe with common denominator	**M2**	**B1** for $\frac{9}{4}$ oe seen or **M1** for $\frac{3}{8}\times \textit{their}\,\frac{4}{9}$
	$\frac{1}{6}$ cao	**A1**	
15	$\frac{x^2-3x+8}{3(x+2)}$ or $\frac{x^2-3x+8}{3x+6}$ final answer	**3**	**B1** for common denominator $3(x + 2)$ **M1** for $(x-5)(x+2)+3\times6$
16	[x =] 62	**2**	**B1** for 56 identified as angle A or **M1** for $\frac{(180-56)}{2}$
	[y =] 118	**2**	**FT** for 2 marks *their* acute x + *their* y =180 or 56 + *their* acute x = *their* y or **B1** for any of ACB, BCM or LCN = 62 or *their* acute x or **M1** for 180 – 62 or 180 – *their* acute x or 56 + 62 or 56 + *their* acute x
17(a)	8	**1**	
17(b)(i)	$\frac{x^2}{16}$ final answer	**1**	
17(b)(ii)	$a^{-3}b^5$ or $\frac{b^5}{a^3}$ final answer	**2**	**B1** for $a^{-3}b^k$ or a^kb^5
18	for correctly equating one set of coefficients	**M1**	
	for correct method to eliminate one variable	**M1**	
	[x =] 6 [y =] −8	**A2**	**A1** for each If **M0** scored, **SC1** for 2 values satisfying one of the original equations **or** if no working shown, but 2 correct answers given

Question	Answer	Marks	Partial Marks
19	$\frac{-7 \pm \sqrt{(7)^2 - 4(3)(-11)}}{2 \times 3}$	**B2**	**B1** for $\sqrt{(7)^2 - 4(3(-11))}$ or better and **B1** for $\frac{-7+\sqrt{q}}{2(3)}$ or $\frac{-7-\sqrt{q}}{2(3)}$
	–3.41 and 1.08 cao	**B2**	**B1** for each If **B0**, **SC1** for –3.4 and 1.1 or –3.409 and 1.076 or –3.4089... and 1.0756.... or 3.41 and –1.08 or –3.41 and 1.08 seen in working
20(a)	$\begin{pmatrix} 26 & 2 \\ 19 & 8 \end{pmatrix}$	**2**	**B1** for 2 or 3 correct elements
20(b)	$\frac{1}{10}\begin{pmatrix} 3 & -2 \\ -7 & 8 \end{pmatrix}$ oe isw	**2**	**B1** for $k\begin{pmatrix} 3 & -2 \\ -7 & 8 \end{pmatrix}$ soi or det = 10 soi
21(a)(i)	20	**1**	
21(a)(ii)	14	**1**	**FT** part **(i)** providing 20 < part **(i)** ⩽ 40
21(a)(iii)	280	**1**	
21(b)	$2[\times 20] = [20]\left(1+\frac{r}{100}\right)^{14}$ oe isw	**2**	**FT** 2 marks for $2[$*their* **(a)(i)**$]=[$*their* **(a)(i)**$]\left(1+\frac{r}{100}\right)^{\textit{their}\textbf{(a)(ii)}}$ **M1** for $n(x)^{14}$ or $n(x)^{\textit{their}\textbf{(a)(ii)}}$ oe seen isw
22(a)	$\frac{94}{200}$ oe	**2**	**M1** for $\frac{46}{200}+\frac{48}{200}$ oe
22(b)	14.1 or 14.07…	**3**	**M2** for $2\left(\frac{50}{200}\times\frac{56}{199}\right)$ oe or **M1** for $\frac{50}{200}\times\frac{56}{199}$ oe
23(a)	27	**2**	**M1** for 3^{3x} seen
23(b)	3	**2**	**M1** for $7 + 3x = 2^4$
23(c)	$\frac{x-7}{3}$ oe final answer	**2**	**M1** for $x = 7 + 3y$ or $y - 7 = 3x$ or $-3x = 7 - y$ or $\frac{y}{3} = \frac{7}{3} + x$

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

MATHEMATICS **0580/22**

Paper 2 (Extended) **October/November 2018**

MARK SCHEME

Maximum Mark: 70

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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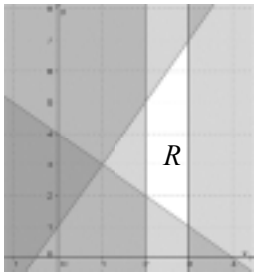
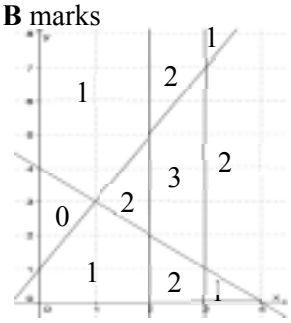
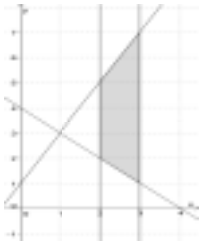
Abbreviations

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	2.3×10^4	**1**	
2	5	**1**	
3	4	**1**	
4	$6x - 2x^3$ final answer	**2**	**B1** for $6x$ or $-2x^3$
5	$\left[\frac{1}{15}+\right]\frac{2\times3}{5\times3}$	**M1**	or better e.g. $\left[\frac{1}{15}+\right]\frac{6}{15}$ Allow any correct common denominator $15k$
	$\frac{7}{15}$ cao	**A1**	
6	$m \geqslant 3$ final answer	**2**	**M1** for correct first step e.g. $7m \geqslant 19 + 2$
7(a)	$C \cap D = \{10\}$	**1**	
7(b)	7	**1**	
8	$(x + 5)(y + 2)$ final answer	**2**	**B1** for $y(x + 5) + 2(x + 5)$ or $x(y + 2) + 5(y + 2)$
9	26 600 cao	**2**	**M1** for $30000 \times \left(1 - \frac{2}{100}\right)^6$ oe
10	$\left(2w, \frac{r+t}{2}\right)$ final answer	**2**	**B1** for $2w$ oe nfww or $\frac{r+t}{2}$ oe
11	34.5 and 37.5 final answers	**2**	**B1** for 11.5 or 12.5 seen or **M1** for $(12 - 0.5) \times 3$ or $(12 + 0.5) \times 3$
12	154.5 or 154.5…	**2**	**B1** for 25.5 or 25.46 to 25.47 or **M1** for $180 - \sin^{-1}(0.43)$ oe
13	$6n - 10$ oe	**2**	**B1** for $6n + c$ or $kn - 10$ $(k \neq 0)$

Question	Answer	Marks	Partial Marks
14	Correct region identified 	**3**	**B** marks  or **SC1** for 
15(a)	$\begin{pmatrix} 15 & -9 \\ -3 & 6 \end{pmatrix}$	**1**	
15(b)	$\frac{1}{7}\begin{pmatrix} 2 & 3 \\ 1 & 5 \end{pmatrix}$ oe isw	**2**	**B1** for $k\begin{pmatrix} 2 & 3 \\ 1 & 5 \end{pmatrix}$ soi or det = 7 soi
16	(a =) 36 (b =) –6	**3**	**B2** for $a = 36$ or **M1** for $b = -6$ or $x^2 + bx + bx + b^2$ or better or $b^2 = a$
17	$-2x + 5$	**4**	**M1** for $\frac{7-2}{9--1}$ oe **M1** for gradient of perpendicular = $\frac{-1}{their\ 0.5}$ **M1** for (1, 3) correctly substituted into *their* $y = -2x + c$
18	Correct pie chart e.g. 	**4**	**B3** for correct chart no labels or for 2 correct sectors with or without labels or **B2** for 3 correct angles seen (171°, 135° and 54°) or 3 correct percentages **(**47.5%, 37.5% and 15%) or **M1** for method e.g. $\frac{57}{120} \times 360$, 57×3 or $\frac{57}{120} \times 100$ oe or one correct sector on the pie chart
19(a)	Correct ruled bisector with two pairs of arcs	**2**	**B1** for correct ruled bisector with no/wrong arcs
19(b)	Correct arc centre E radius 3 cm inside pentagon	**1**	
19(c)	Correct region shaded	**1**	Dependent on at least **B1** in part **(a)** and 1 mark in part **(b)** and a closed region

Question	Answer	Marks	Partial Marks
20	$\frac{2x}{3+x}$ oe final answer	**4**	**M1** for correctly clearing the denominator and expanding bracket **M1** for correctly collecting terms in m on one side and terms not in m on the other **M1** for correct factorising **M1** for correct division dependent on m appearing only once in a factorised expression
21	30.2 or 30.20 to 30.21…	**4**	**M3** for $\frac{1}{2}\times 10\times 10\times \sin 60 - \frac{60}{360}\times \pi \times \left(\frac{10}{2}\right)^2$ or **M1** for $\frac{k}{360}\times \pi \times \left(\frac{10}{2}\right)^2$ oe and **M1** for $\frac{1}{2}\times 10\times 10\times \sin c$ oe
22	25.1 or 25.06…	**4**	**M3** for tan = $\frac{8}{\sqrt{16.2^2+5.5^2}}$ oe or **M2** for $\sqrt{16.2^2+5.5^2}$ or **M1** for $16.2^2+5.5^2$ or **B1** for identifying correct angle
23(a)	$2^3 \times 7$ or $2 \times 2 \times 2 \times 7$	**2**	**B1** for identifying 2 and 7 as the only prime factors
23(b)	168	**2**	**B1** for 168k or $2 \times 2 \times 2 \times 3 \times 7$ oe or for listing multiples of each up to 168
24(a)	25	**1**	
24(b)	12	**2**	**B1** for 16 or 28
24(c)	5	**2**	**B1** for 75
25(a)(i)	$5x^3 + 2$ final answer	**1**	
25(a)(ii)	$\frac{x-2}{5}$ final answer	**2**	**M1** for correct first step e.g. $y - 2 = 5x$, $x = 5y + 2$, $\frac{y}{5} = x + \frac{2}{5}$
25(b)	5	**2**	**M1** for $a \times (-2)^2 + 1 = 21$

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

MATHEMATICS **0580/23**

Paper 2 Extended **October/November 2018**

MARK SCHEME

Maximum Mark: 70

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	126	**1**	
2	$y(1-2y)$ final answer	**1**	
3	2	**1**	
4	6.59 or 6.594 to 6.595	**1**	
5	$\frac{9}{25}$ oe	**1**	
6(a)	5 000 207	**1**	
6(b)	8.13×10^{-3}	**1**	
7	$-3p-4q$ final answer	**2**	**B1** for $-3p$ or $-4q$
8(a)	0.076 cao	**1**	
8(b)	10 000 cao	**1**	
9	$\frac{1}{4}\times\frac{3}{2}$ or $\frac{3}{12}\div\frac{8}{12}$ oe	**M1**	
	$\frac{3}{8}$ oe	**A1**	Accept equivalent fractions
10	13	**2**	**M1** for $3w=32+7$ or $w-\frac{7}{3}=\frac{32}{3}$ or better
11	$\frac{A-\pi r^2}{\pi r}$ or $\frac{A}{\pi r}-r$ oe final answer	**2**	**M1** for $A-\pi r^2=\pi rl$ or $\pi r^2-A=-\pi rl$ or $\frac{A}{\pi r}=l+r$
12	6.5[0] nfww final answer	**2**	**M1** for 42.5 – 0.25 implied by 42.25
13	1.88… – 0.188.. oe	**M1**	e.g. 18.88… – 1.88… or 18.88… – 0.188…
	$\frac{17}{90}$ or equivalent fraction	**B1**	

Question	Answer	Marks	Partial Marks
14	Reflection $y = x$	**2**	**B1** for each
15	600	**3**	**M2** for $\frac{108 \times 1000 \times 20}{60 \times 60}$ oe or **M1** for $\frac{108 \times 1000}{60 \times 60}$ oe or for figs108 × time oe
16(a)	$\frac{1}{w}$ or w^{-1}	**1**	
16(b)	$27w^9$ final answer	**2**	**B1** for kw^9 or $27w^k$
17	10	**3**	**M1** for $y = k\sqrt{x}$ **M1** for $y =$ *their* $k \times \sqrt{25}$ OR **M2** for $\frac{y}{6} = \sqrt{\frac{25}{9}}$
18	$\frac{1}{x(x+1)}$ oe final answer nfww	**3**	**B1** for common denominator $x(x+1)$ oe **M1** for $x + 1 - x$
19	$[p =]$ 12 $[q =] \frac{12}{5}$ oe	**3**	**B1** for $[p =]$ 12 and **B2** for $[q =] \frac{12}{5}$ or **M1** for $\frac{72}{360}[\times\pi] \times 2 \times 6$ oe
20	$\frac{-(-2) \pm \sqrt{(-2)^2 - 4(3)(-2)}}{2(3)}$ oe	**B2**	**B1** for $\sqrt{(-2)^2 - 4(3)(-2)}$ or better or **B1** for $\frac{-(-2) + \sqrt{q}}{2(3)}$ or $\frac{-(-2) - \sqrt{q}}{2(3)}$
	–0.55, 1.22	**B2**	**B1** for each If zero scored, **SC1** for – 0.6 and 1.2 or –0.549 or –0.548… and 1.215… or 0.55 and −1.22 or –0.55 and 1.22 seen in working

Question	Answer	Marks	Partial Marks
21(a)	1.2	**1**	
21(b)	45	**3**	**M2** for $\frac{1}{2}\times10\times12+12(T-10)[=480]$ oe or **M1** for one relevant area OR **M1** for $480-\frac{1}{2}\times10\times12$ implied by 420 **M1** for $\frac{420}{12}$ [+ 10]
22	$\frac{x-1}{x}$ or $1-\frac{1}{x}$ nfww final answer	**4**	**B1** for $x(2x+1)$ **B2** for $(2x+1)(x-1)$ or **B1** for $2x(x-1)+[1](x-1)$ or $x(2x+1)-[1](2x+1)$ or $(2x+a)(x+b)$ where $ab=-1$ or $a+2b=-1$
23	16.6 or 16.60…	**4**	**M3** for $\tan=\frac{4}{\sqrt{12^2+6^2}}$ oe or **M2** for $\sqrt{12^2+6^2}$ or **M1** for 12^2+6^2 oe or **B1** for recognising angle PAC is required
24(a)	$\begin{pmatrix}9 & 3\\ 6 & 9\end{pmatrix}$	**1**	
24(b)	$\begin{pmatrix}2 & 10\\ -1 & 16\end{pmatrix}$	**2**	**B1** for 2 or 3 correct elements
24(c)	$\frac{1}{6}\begin{pmatrix}4 & -2\\ 1 & 1\end{pmatrix}$ oe isw	**2**	**B1** for $k\begin{pmatrix}4 & -2\\ 1 & 1\end{pmatrix}$ soi or det = 6 soi
25(a)	$(x+y)(p-1)$ final answer	**2**	**M1** for $p(x+y)-(x+y)$ or $x(p-1)+y(p-1)$
25(b)	$2(t+7m)(t-7m)$ final answer	**3**	**M2** for $(2t+14m)(t-7m)$ or $(t+7m)(2t-14m)$ or correct answer seen or **M1** for $2(t^2-49m^2)$ or $(t+7m)(t-7m)$ or $2(t+7)(t-7)$

Question	Answer	Marks	Partial Marks
26(a)	$\mathbf{c} + \frac{2}{3}\mathbf{a}$	**2**	**M1** for correct unsimplified form or correct route e.g. $\overrightarrow{OC} + \overrightarrow{CP}$
26(b)(i)	$\frac{2}{5}\mathbf{a} + \frac{3}{5}\mathbf{c}$	**2**	**M1** for correct unsimplified form or correct route e.g. $\overrightarrow{OC} + \overrightarrow{CX}$
26(b)(ii)	3 : 2 oe	**2**	**B1** for $\overrightarrow{OX} = \frac{3}{5}\overrightarrow{OP}$ oe or $\overrightarrow{XP} = \frac{2}{5}\mathbf{c} + \frac{4}{15}\mathbf{a}$

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

MATHEMATICS **0580/21**

Paper 2 (Extended) **May/June 2018**

MARK SCHEME

Maximum Mark: 70

Published

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SC Special Case
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soi seen or implied

Question	Answer	Marks	Partial Marks
1	23 or 29	**1**	
2	3.87×10^{-5}	**1**	
3	$\frac{7}{11}$ oe	**1**	
4	66	**2**	**B1** for 84 or −18 seen
5	94	**2**	**B1** for ACB or PAB or $ABC = 43$ or **M1** for $180-2\times43$ or $\frac{1}{2}x = 90-43$
6	81.7 or 81.71 to 81.72…	**2**	**M1** for $\pi\times5.1^2$
7	4.8[0] or 4.802…	**2**	**M1** for $[AC^2 =]\ 2.5^2+4.1^2$
8	$7y-23$ final answer	**2**	**M1** for $12y-18$ or $-5y-5$ or **B1** for answer $7y-k$ or $cy-23\quad c\neq0$
9	−7	**2**	**B1** for 3^{-3} or 3^4 or 3^7 or 3^{-7} seen or **SC1** for final answer 7
10(a)	6.58331…	**1**	
10(b)	6.5833	**1**	**FT** *their* **(a)** correctly rounded to 4 dp
11	$\frac{4}{7}$ oe exact answer	**2**	**B1** for 4 or $\frac{1}{7}$
12	$n<-4.4$ or $n<-4\frac{2}{5}$ final answer	**2**	**M1** for $8n-3n<-5-17$ or better or $3n-8n>17+5$ or better

Question	Answer	Marks	Partial Marks
13	$\frac{7}{4}$	**M1**	or $\frac{k}{4} \times \frac{6}{35}$ where $k > 4$
	$\frac{3}{10}$ cao	**A2**	**A1** for $\frac{42}{140}$ or $\frac{21}{70}$ or $\frac{6}{20}$
14	19.3 or 19.26 to 19.27 nfww	**3**	**M2** for $[\sin =]5.9 \times \frac{\sin 84.6}{17.8}$ or **M1** for $\frac{5.9}{\sin B} = \frac{17.8}{\sin 84.6}$ oe
15	9	**3**	**M1** for $y = k(x-1)^2$ **M1** for $[y =]$*their* $k(7-1)^2$ OR **M2** for $\frac{4}{(5-1)^2} = \frac{y}{(7-1)^2}$ oe
16	Shape with vertices at (1, 1), (1, 4), (−1, 2), (−1, 4)	**3**	**M2** for 3 correct vertices on grid or in working or **M1** for correct set-up $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}\begin{pmatrix} 2 & 1 & 4 & 4 \\ 1 & -1 & -1 & 1 \end{pmatrix}$ or for rotation, 90° [anti-clockwise], centre *O*
17(a)	2200	**3**	**M2** for $\frac{1}{2}(90+130) \times 20$ or $\frac{1}{2}(10 \times 20) + (90 \times 20) + \frac{1}{2}(30 \times 20)$ or **M1** for one area
17(b)	16.9 or 16.92…	**1**	**FT** *their* **(a)** ÷ 130
18(a)	10 nfww	**2**	**B1** for UQ = 30 or LQ = 20 clearly identified
18(b)	4	**2**	**B1** for 116 indicated
19	46.2 or 46.17 to 46.18	**4**	**M2** for $[\cos =]\frac{16^2 + 19^2 - 14^2}{2 \times 16 \times 19}$ or **M1** for $14^2 = 19^2 + 16^2 - 2 \times 19 \times 16\cos M$ **A1** for 0.692… or $\frac{421}{608}$

Question	Answer	Marks	Partial Marks
20(a)	$\frac{8}{15}$ oe	**1**	
20(b)	$\frac{168}{210}$ oe	**3**	**M2** for $1-\frac{7}{15}\times\frac{6}{14}$ oe or $3(\frac{7\times8}{15\times14})$ oe or **M1** for $\frac{7}{15}\times\frac{6}{14}$ or $\frac{7}{15}\times\frac{8}{14}$ or $\frac{8}{15}\times\frac{7}{14}$ oe
21	$y \geqslant 1.5$ oe $y \geqslant \frac{3}{4}x$ oe $y < -\frac{1}{2}x + 3$ oe	**4**	**SC3** for $y > 1.5$ oe and $y > \frac{3}{4}x$ oe and $y \leqslant -\frac{1}{2}x + 3$ oe or **B3** for any two correct inequalities or **B1** for $y \geqslant 1.5$ oe and **B2** for $y \geqslant \frac{3}{4}x$ oe **or** $y < -\frac{1}{2}x + 3$ oe or $y = \frac{3}{4}x$ oe **and** $y = -\frac{1}{2}x + 3$ oe or with incorrect inequality signs or **B1** for $y = \frac{3}{4}x$ oe OR $y = -\frac{1}{2}x + 3$ oe or with incorrect inequality signs
22(a)	-17	**2**	**M1** for $f(11)$ seen or $5 - 2(5 - 2x)$ or better
22(b)(i)	$4x^2 + 8$ oe	**1**	
22(b)(ii)	$\frac{5-x}{2}$ oe final answer	**2**	**M1** for $x = 5 - 2y$ or $2x = 5 - y$ or $y - 5 = -2x$ or $\frac{y}{2} = \frac{5}{2} - x$

Question	Answer	Marks	Partial Marks
23(a)(i)	4	**1**	
23(a)(ii)	3.2	**3**	**M1** for Σfx, allow one error or omission and **M1dep** for $\frac{their\ 128}{40}$
23(b)	27	**2**	**M1** for $\frac{3}{40}$ or $\frac{360}{40}$
24(a)	78.7 or 78.69…	**3**	**M2** for tan = $\frac{5}{2-1}$ oe or **M1** for use of tangent oe
24(b)	$[y =] -\frac{1}{3}x + 12$ final answer	**3**	**M1** for gradient = $-\frac{1}{3}$ **M1** for substituting (6, 10) into *y = their mx + c*

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

MATHEMATICS **0580/22**

Paper 2 (Extended) **May/June 2018**

MARK SCHEME

Maximum Mark: 70

Published

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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	2 [h] 55 [min]	**1**	
2	$7x - 56$ final answer	**1**	
3	[a =] 15 [b =] –27	**2**	**B1** for each or **SC1** for reversed answers
4(a)	[w =] 7	**1**	
4(b)	[$12x$ =] 36	**1**	
5	24	**2**	**B1** for 17 or 41 identified
6	$\frac{8}{12}$ and $\frac{1}{12}$ oe	**M1**	For correct fractions with a common denominator $12k$
	$\frac{7}{12}$ cao	**A1**	
7	320	**2**	**M1** for 180 + 140 oe
8(a)	1.36×10^6 oe	**1**	
8(b)	5.21×10^{-3} oe	**1**	
9	Correct perpendicular bisector of AB with 2 pairs of correct arcs	**2**	**B1** for correct perpendicular bisector of AB with no or wrong arcs or for 2 pairs of correct arcs
10	$(x + 2)(y + 3)$ final answer	**2**	**B1** for $y(x + 2) + 3(x + 2)$ or $x(y + 3) + 2(y + 3)$
11	80	**2**	**M1** for $\left(\frac{12}{3}\right)^2$ or $\left(\frac{3}{12}\right)^2$ oe or $\frac{3^2}{5} = \frac{12^2}{A}$ oe
12	7 cao nfww	**2**	**B1** for 31 + 0.5 or 5 – 0.5 or 31.5 or 4.5 seen
13	15 and 22	**2**	**M1** for 1.5×10 or 1.1×20
14	62	**3**	**M1** for [height =] $21 \div 7$ **M1** for $2(1 \times \textit{their}3 + \textit{their}3 \times 7 + 1 \times 7)$ oe

Question	Answer	Marks	Partial Marks
15	628 or 628.3 to 628.4 cm^3	**3**	**B2** for 628 or 628.3 to 628.4 or **M1** for $5^2 \times 8 \times \pi$ **B1** for cm^3
16	7.5 nfww	**3**	**M2** for $[OB^2 =] \left(\frac{12}{2}\right)^2 + 4.5^2$ oe or **B1** for recognition of right angle
17	30	**3**	**M2** for ½ (8 + 2) × v [= 150] oe or **M1** for ½ × 6 × v or 2 × v oe
18(a)	$d = 4.9t^2$	**2**	**M1** for $d = kt^2$
18(b)	19.6	**1**	**FT** *their* 4.9 × 4
19	$y > 2$ oe final answer $y \geqslant 3 - x$ oe final answer	**3**	**B1** for $y > 2$ oe final answer **B2** for $y \geqslant 3 - x$ oe final answer or **B1** for $y = 3 - x$ oe soi or **SC2** for $y \geqslant 2$ oe **and** $y > 3 - x$ oe final answer
20(a)	$\mathbf{C}^2$	**2**	**B1** for any correct matrix calculation evaluated
20(b)	–9	**1**	
20(c)	The determinant is 0 oe	**1**	e.g. it is singular.
21(a)	140 000	**1**	
21(b)	Points correctly plotted at (40, 80) and (80, 150)	**1**	
21(c)	Correct ruled line of best fit	**1**	
21(d)	80 000 to 110 000	**1**	**FT** their straight line provided it has positive gradient
22(a)	6**a** – 2**b** or 2(3**a** – **b**)	**2**	**M1** for 4**a** + **b** – (–2**a** + 3**b**) or better
22(b)	5**a** – **b**	**2**	**M1** for a correct route e.g. $\overrightarrow{OD} + \overrightarrow{DE}$, 4**a** + **b** + **a** – 2**b**, $\overrightarrow{OE}$
23(a)	5	**3**	**M2** for $20 - x + x + 8 - x = 23$ or better or **B1** for identifying the correct region $A \cup B$
23(b)	$\frac{7}{30}$ oe	**2**	**B1** for $\frac{7}{c}$ or $\frac{k}{30}$

Question	Answer	Marks	Partial Marks
24(a)	$\frac{4}{5}$ oe	**2**	**M1** for $\frac{2}{3} \times p = \frac{8}{15}$ or better
24(b)	$\frac{1}{15}$ oe	**3**	**3FT** $(1 - \textit{their}\ \frac{4}{5}) \times \frac{1}{3}$ correctly evaluated **M2** for $(1 - \textit{their}\ \frac{4}{5}) \times (1 - \frac{2}{3})$ oe or **M1** for $1 - \textit{their}\ \frac{4}{5}$ or $1 - \frac{2}{3}$
25(a)	$[y =] -\frac{2}{5}x + 3$ or $[y =] -0.4x + 3$ final answer	**4**	**B2** for [gradient of perpendicular =] $-\frac{2}{5}$ oe or **M1** for [gradient =] $\frac{24-9}{22-16}$ or $-\frac{22-16}{24-9}$ **M1** for substituting (5, 1) into $y = \textit{their}\ mx + c$
25(b)	(20, 19)	**2**	**M1** for $\frac{2}{3}(22-16)+16$ or $\frac{2}{3}(24-9)+9$ oe or **SC1** for answer (18, 14)

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

MATHEMATICS **0580/23**

Paper 2 (Extended) **May/June 2018**

MARK SCHEME

Maximum Mark: 70

Published

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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	-5	**1**	
2	$w(1+w^2)$ final answer	**1**	
3	6.15 or 6.153 to 6.154 or $6\frac{2}{13}$	**1**	
4	3, 4, 6, 9, 12, 18	**2**	**B1** for list with one or two errors or omissions or for a complete list of products
5	25.3[0]	**2**	**M1** for $22 \times \frac{15}{100}$ oe or better
6(a)	210 000 cao	**1**	
6(b)	4120 cao	**1**	
7	162	**2**	**M1** for 225×0.72 oe
8(a)	[0].004 82 cao	**1**	
8(b)	5.2×10^7	**1**	
9	-11	**2**	**M1** for $1-p=3\times4$ or better or $-\frac{p}{3}=4-\frac{1}{3}$ or better
10	$(a+2b)(2-x)$ final answer	**2**	**M1** for $2(a+2b)-x(a+2b)$ or $a(2-x)+2b(2-x)$ or $-a(x-2)-2b(x-2)$
11	$[\pm]\sqrt{\frac{A}{2\pi+y}}$ final answer	**2**	**M1** for $\frac{A}{2\pi+y}=x^2$ **M1** for correctly square rooting their expression in x^2 If zero scored **SC1** for $\frac{[\pm\ ]\sqrt{A}}{2\pi+y}$
12	8	**2**	**M1** for Venn diagram with 1 correct region or for a correct method e.g. $5+13-x+x+10-x=20$ oe or better

Question	Answer	Marks	Partial Marks
13	$\frac{1}{3-x}$ nfww final answer	**2**	**B1** for $(3-x)(3+x)$ or $-(x-3)(x+3)$
14	$\frac{2}{3}\mathbf{p}+\frac{1}{3}\mathbf{q}$	**2**	**M1** for correct route e.g. $\overrightarrow{OT}$ or $\overrightarrow{OQ}+\overrightarrow{QT}$ or for $\overrightarrow{QT}=\frac{2}{3}(-\mathbf{q}+\mathbf{p})$ oe or for $\overrightarrow{PT}=\frac{1}{3}(-\mathbf{p}+\mathbf{q})$ oe
15	$\frac{6}{5}$	**B1**	accept equivalent fractions e.g. $\frac{18}{15}$
	$\frac{2}{3}\times \textit{their}\ \frac{5}{6}$	**M1**	or $\frac{10}{15}\div\frac{18}{15}$ oe
	$\frac{5}{9}$ cao	**A1**	
16(a)	50 cao nfww	**2**	**B1** 12.5 seen or **M1** for 12 + 0.5 or better
16(b)	12.3	**1**	
17(a)	27	**1**	
17(b)	$3t^9$ final answer	**2**	**B1** for kt^9 or for $3t^k$ $(k\neq 0)$
18	$6p^2+5p-6$ final answer	**3**	**B2** for $6p^2+9p-4p-6$ or **B1** for three correct terms
19	150	**3**	**M1** for $y=k(x-1)^2$ **M1** for $[y=]$ $\textit{their}\,k\times(6-1)^2$ oe OR **M2** for $\frac{y}{24}=\frac{(6-1)^2}{(3-1)^2}$
20	$[w=]$ 95 $[x=]$ 85 $[y=]$ 48	**3**	**B1** for each If **B0** scored for x and for y, **SC1** for *their* x + *their* y = 133
21	$\frac{1}{y(y-1)}$ or $\frac{1}{y^2-y}$ final answer	**3**	**B1** for common denominator of $y(y-1)$ or y^2-y **B1** for $y-(y-1)$ or $y-y+1$
22(a)	$15-4n$ final answer	**2**	**B1** for $15-kn$ or $p-4n$ $(k\neq 0)$
22(b)	$3\times 2^{n-1}$ oe final answer	**2**	**B1** for recognition of powers of 2 such as 2^k

Question	Answer	Marks	Partial Marks
23	102.1 or 102.06 to 102.07	**4**	**M2** for $[\cos x =] \frac{11^2 + 5^2 - 13^2}{2 \times 11 \times 5}$ or **M1** for $13^2 = 11^2 + 5^2 - 2 \times 11 \times 5 \cos x$ **A1** for – 0.209…. or $-\frac{23}{110}$
24(a)	25	**2**	**M1** for $\frac{90 \times 1000}{60 \times 60}$ oe
24(b)	1.25	**1**	**FT** $\frac{\textit{their}\textbf{(a)}}{20}$ correctly evaluated
24(c)	1250	**2**	**2FT** for *their* **(a)** × 50 correctly evaluated or **M1** for one area e.g. ½(40 + 60) × 25, 25 × 40, ½ × 25 × 20 ½(40 + 60) × 90, 90 × 40, ½ × 90 × 20 ½(40 + 60) × *their* 25, *their* 25 × 40, ½ × *their* 25 × 20
25(a)	1.8	**2**	**M1** for $\frac{10}{8} = \frac{9}{AP}$ oe
25(b)	10.3 or 10.31 to 10.32	**3**	**M2** for $13 \times \sqrt[3]{\frac{0.25}{0.5}}$ oe or **M1** for $\sqrt[3]{\frac{0.5}{0.25}}$ oe or $\sqrt[3]{\frac{0.25}{0.5}}$ oe or $\frac{0.5}{0.25} = \left(\frac{13}{h}\right)^3$ oe
26(a)	Enlargement [scale factor] 2 [centre] (7, 0)	**3**	**B1** for each
26(b)	Image at (6, 4), (7, 4), (6, 8)	**3**	**B2** for rotation through 90° clockwise but about other point or **B1** for rotation through 90° anticlockwise about any point or for triangle at (6, 4), (7, 4), (6, *k*)

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MATHEMATICS **0580/22**

Paper 22 (Extended) **March 2018**

MARK SCHEME

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Question	Answer	Marks	Partial Marks
1	Positive	**1**	
2	5.23×10^{-5}	**1**	
3	2.29 or 2.292…	**1**	
4	$\frac{8}{9}$ oe, must be fraction	**1**	
5(a)	5	**1**	
5(b)	1	**1**	
6	$5m\left(3k^2 - 4m^3\right)$ final answer	**2**	**B1** for $5\left(3k^2m - 4m^4\right)$ or $m\left(15k^2 - 20m^3\right)$ or for $5m\left(3k^2 - 4m^3\right)$ with one error in a number
7	**2q + p**	**2**	**B1** for $CF = 2(\mathbf{q} + \mathbf{p})$ or $BA = \mathbf{q} + \mathbf{p}$ or $DE = \mathbf{q} + \mathbf{p}$ or $DA = 2\mathbf{q}$ or for correct route
8	21400 or 21430 or 21434.[…]	**2**	**M1** for $23000 \times \left(1 - \frac{1.4}{100}\right)^5$ oe
9	–12	**2**	**B1** for 2^3, 2^{-3}, 2^{12} or 2^{-12}
10	12	**3**	**M2** for $9 \times 8 = 6y$ oe OR **M1** for $y = \frac{k}{x}$ oe **M1** for $[y =]$ *their* $\frac{k}{6}$
11	92	**3**	**M2** for $[600-](0.18 \times 600 + \frac{2}{3} \times 600)$ or **M1** for 108 or 400 seen

Question	Answer	Marks	Partial Marks
12	common denominator 24	**B1**	accept $24k$
	$\frac{21}{24}$ and $\frac{4}{24}$ oe	**M1**	
	$1\frac{1}{24}$	**A1**	
13	correctly eliminating one variable	**M1**	
	[x =] 7 [y =] – 2	**A2**	**A1** for each If **M0** scored **SC1** for 2 values satisfying one of the original equations or **SC1** if no working shown, but 2 correct answers given
14(a)	similar	**1**	
14(b)	11.61	**3**	**M2** for $8.6 \times \sqrt{\frac{65.61}{36}}$ or **M1** for $\sqrt{\frac{65.61}{36}}$ or $\sqrt{\frac{36}{65.61}}$ or $\left(\frac{8.6}{BX}\right)^2 = \frac{36}{65.61}$ oe
15	63 corresponding [angles] 59 angles [in a] triangle [add up to] 180 oe	**4**	**B1** for [a =] 63 **B1** for corresponding angles **B1FT** for [b =] 59 or *their a* + *their b* = 122 **B1** for angles [in a] triangle [add up to] 180 oe
16(a)	2.24	**2**	**M1** for $0.5 \times 1.6 \times 2.8$
16(b)	3.22 or 3.224 to 3.225	**2**	**M1** for $[AC^2 =] 1.6^2 + 2.8^2$

Question	Answer	Marks	Partial Marks
17	$\frac{-7 \pm \sqrt{(7)^2 - 4(2)(-3)}}{2 \times 2}$	**B2**	**B1** for $\sqrt{(7)^2 - 4(2)(-3)}$ or better **B1** for $p = -7$ and $r = 2 \times 2$ if in form $\frac{p + \sqrt{q}}{r}$ or $\frac{p - \sqrt{q}}{r}$ Completing the square method: **B1** for $(x + 1.75)^2$ oe **B1** for $-1.75 \pm \sqrt{1.5 + 1.75^2}$ oe
	0.39 and – 3.89 final ans cao	**B2**	**B1** for each If **B0**, **SC1** for 0.4 and – 3.9 or 0.386...and – 3.886... or 0.39 and – 3.89 seen in working or – 0.39 and 3.89
18(a)	Correct ruled perpendicular bisector of *AB* with correct pairs of arcs	**2**	**B1** for correct perpendicular bisector without correct arcs or for correct arcs, with no/wrong line
18(b)	Correct ruled bisector of angle *ABC* with 2 correct pairs of arcs	**2**	**B1** for correct angle bisector without correct arcs or for correct arcs, with no/wrong line
19(a)(i)	$\in$	**1**	
19(a)(ii)	$X \cap Y$ oe	**1**	
19(a)(iii)	$\varnothing$	**1**	
19(b)	*u, v, w*	**1**	
19(c)	5	**1**	
20(a)	Rotation [centre] origin oe 90°[anti-clockwise] oe	**3**	**B1** for each
20(b)	Enlargement [centre] (0, 3) [sf] – 2	**3**	**B1** for each
21(a)	2	**2**	**M1** for f(5) or 7– (7 – *x*) or better
21(b)	$30 - 4x$ final answer	**2**	**M1** for $4(7 - x) + 2$ or better or for correct answer then spoilt
21(c)	$15 - 4x^2$ final answer	**2**	**M1** for $15 - (2x)^2$ or better or for correct answer then spoilt

Question	Answer	Marks	Partial Marks
22(a)	$\frac{9}{20}$ oe	**1**	
22(b)(i)	$\frac{6}{20}\times\frac{5}{19}$	**M1**	
	$\frac{30}{380}$ oe	**A1**	
22(b)(ii)	$\frac{258}{380}$ oe	**4**	**M3** for $1-\frac{3}{38}-\frac{5}{20}\times\frac{4}{19}-\frac{9}{20}\times\frac{8}{19}$ oe or **M2** for $\frac{3}{38}+\frac{5}{20}\times\frac{4}{19}+\frac{9}{20}\times\frac{8}{19}$ oe or $\frac{5}{20}\times\frac{9}{19}+\frac{6}{20}\times\frac{9}{19}+\frac{6}{20}\times\frac{5}{19}$ oe or **M1** for one correct product other than $\frac{6}{20}\times\frac{5}{19}$

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

MATHEMATICS **0580/21**

Paper 2 (Extended) **October/November 2017**

MARK SCHEME

Maximum Mark: 70

Published

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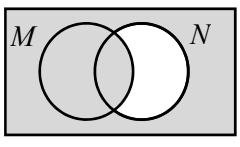
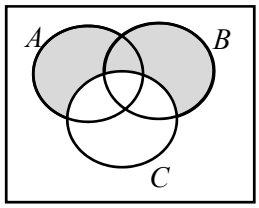
Abbreviations

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	Mark	Partial marks
1	101	**1**	
2	2	**1**	
3(a)	1.49220….	**1**	
3(b)	1.5	**1FT**	**FT** *their* answer to **(a)** rounded correctly to 2 significant figures
4	88	**2**	**M1** for $\frac{68+81+74+89+x}{5} = 80$ oe or **B1** for 400
5	$3x(4x + 5y - 3)$ final answer	**2**	**B1** for $3(4x^2 + 5xy - 3x)$ or $x(12x + 15y - 9)$ allow in working or correct answer spoiled If zero scored, **SC1** for $3x(4x + 5y - 3)$ with only 2 correct elements in the brackets, allow in working
6(a)	(−2, 3)	**1**	
6(b)	Correct rhombus with 4th point at (2,2)	**1**	
7	Diagonal line from (0, 0) to (30, 12)	**1**	
	and Horizontal line from (30, 12) to (70, 12)	**1FT**	**FT** for horizontal line from (30, *k*) to (70, *k*) where *k* is *their* 12
8	19.65 cao	**2**	**B1** for 6.55 seen (must be evaluated, not 6.5 + 0.05) or **M1** for 3 × (6.5 + 0.05)
9	7615.15	**2**	**M1** for $12\,400 \times \left(1 - \frac{15}{100}\right)^3$ oe

Question	Answer		Mark	Partial marks
10	$\frac{5}{3}$	$\frac{2}{3}+\frac{4}{15}$	**B1**	Allow $\frac{5k}{3k}$
	$\frac{25}{15}$ [and $\frac{11}{15}$]	$\frac{10}{15}$ [and $\frac{4}{15}$]	**M1**	Correct method to find common denominator e.g. $\frac{75}{45}$ and $\frac{33}{45}$ Follow through *their* $\frac{5}{3}$ for the **M1** mark
	$\frac{14}{15}$ cao	$\frac{14}{15}$ cao	**A1**	
11	54		**3**	**M2** for $\frac{180\times(5-2)}{5}$ or $180-\frac{360}{5}$ or **M1** for $180\times(5-2)$ or $\frac{360}{5}$
12(a)	343		**1**	
12(b)	−11		**1**	
12(c)	343		**1**	
13(a)	m^{10} final answer		**1**	
13(b)	$20x^5y^2$ final answer		**2**	**B1** for 2 out of 3 elements correct in final answer or correct answer spoiled
14(a)	(9, −4)		**1**	
14(b)	−5		**2**	**M1** for $t^2 + 12^2 = 13^2$ oe or **SC1** for answer 5 or ± 5
15(a)	Fewer than 6 elements from {1, 2, 3, 4, 5, 6} or ∅		**1**	
15(b)			**1**	
			**1**	

Question	Answer	Mark	Partial marks
16	Enlargement	**1**	
	$\frac{1}{3}$	**1**	
	(2, 1)	**1**	
17(a)	$(y =) \frac{72}{(x+1)^2}$ oe	**2**	**M1** for $y = \frac{k}{(x+1)^2}$
17(b)	32	**1FT**	**FT** correct evaluation from *their* equation in **(a)** using 0.5
18	Correct position of *S* with 2 pairs of correct construction arcs for line	**4**	**B3** for correct position of *S* with missing/incorrect construction arcs but correct line or **B2** for correct ruled line equidistant from the two trees with correct arcs or **B1** for correct line with no/wrong arcs or correct arcs with no line and **B1** for arc centre bird bath, radius 5 cm or *S* in correct position with no/incorrect working
19	$\frac{x^2+20x+31}{2(x-3)(x+7)}$ final answer	**4**	**B1** for a common denominator of [2]$(x – 3)(x + 7)$ seen isw **M1** for $2×5×(x + 7) + 2×3×(x – 3) + (x – 3)(x + 7)$ oe **and** must have attempted to expand all the brackets in the numerator **M1** for $10x + 70 + 6x – 18$ **or** $x^2 – 3x + 7x – 21$ **or** [2]$(5x + 35 + 3x – 9)$ or better
20(a)	1480	**1**	
20(b)	30	**3**	**M2** for $10 \times \sqrt{\frac{3960}{440}}$ or $10 \div \sqrt{\frac{440}{3960}}$ or **M1** for $\sqrt{\frac{3960}{440}}$ or $\sqrt{\frac{440}{3960}}$ or $\left(\frac{h}{10}\right)^2 = \frac{3960}{440}$ oe

Question	Answer	Mark	Partial marks
21	46.7 or 46.68 to 46.69	**4**	**M3** for tan […=] $\frac{9}{\frac{1}{2}\sqrt{12^2+12^2}}$ oe or **M1** for $\left[\frac{1}{2}\times\right]\sqrt{12^2+12^2}$ oe e.g. $\sqrt{\frac{12^2}{2}}$ and **M1** for identifying angle *MCE*
22(a)	80 to 84	**2**	**M1** for 116 to 120
22(b)	Correct curve or ruled lines	**3**	**B2** for 7 or 8 correct points **B1** for 5 or 6 correct points
22(c)	26	**2**	**B1** for 156 or 130 or for *their* 130 from *their* **increasing** curve (or lines)
23(a)	$x + y \leqslant 16$ oe $x \geqslant 4$ oe	**2**	**B1** for each mark final answers If zero scored, **SC1** for $x + y < 16$ **and** $x > 4$
23(b)	Correct shading	**3**	**M2** for lines at $x = 4$ **and** $x + y = 16$ or for correct shading of $x < 4$ or $x + y > 16$ or **M1** for line at $x = 4$ or *their* $x = 4$ or for line at $x + y = 16$ or *their* $x + y = 16$
23(c)	144	**2**	**M1** for (8, 8) selected or for $10 \times x + 8 \times y$ for any numerical point which is inside or on the boundary of *their* unshaded region

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FT follow through after error
isw ignore subsequent working
oe or equivalent
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nfww not from wrong working
soi seen or implied

Question	Answer	Marks	Partial marks
1	– 3	**1**	
2	[0].00517	**1**	
3	BC AB oe	**1**	
4(a)	2, 3, 4, 6	**1**	
4(b)	27, 36 cao	**1**	
5	[x =] 60 [y =] 40	**2**	**B1** for each or for two numbers that add to 100
6	2.5	**2**	**B1** for 2200 or 0.055 seen or **SC1** for answer figs 25
7	32	**2**	**M1** for $\frac{1}{2} \times 33 \times h = 528$ oe
8	16.5	**2**	**M1** for $\frac{55}{60}$ or speed × time (numerical)
9	1.32×10^{41}	**2**	**M1** for 0.12×10^{41} or 12×10^{40} or **SC1** for figs 132
10	20.75 final answer cao	**2**	**B1** for one of 5.15, 6.25 or 9.35 seen or **M1** for (5.2 – 0.05) + (6.3 – 0.05) + (9.4 – 0.05)
11	$48.\dot{4}\dot{8} \quad -0.\dot{4}\dot{8}$ oe	**M1**	**SC1** for $\frac{48}{99}$ or $\frac{16}{33}$ or equivalent fraction with no/insufficient working
	$\frac{48}{99}$ or $\frac{16}{33}$ or equivalent fraction	**A1**	
12	$15 + 2n - n^2$ final answer	**2**	**M1** for three terms of $15 + 5n - 3n - n^2$ correct

Question	Answer	Marks	Partial marks
13(a)	$3\frac{2}{3}$ cao	**1**	
13(b)	$\frac{3}{12}$[and $\frac{5}{12}$] oe	**M1**	For correct method to find common denominator e.g. $\frac{12}{48}$ and $\frac{20}{48}$
	$\frac{2}{3}$ cao	**A1**	
14	–1, 0, 1, 2, 3	**3**	**B2** for $-2 < n \leqslant 3$ or list with one error or omission or **M1** for $-5 + 1 < 2n$ or $2n \leqslant 5 + 1$ or a list with 3 correct and no more than 1 incorrect or if zero scored, **SC1** for 5, 3, 1, –1, –3
15	$\frac{y+x}{xy}$ final answer	**3**	**B1** for $y(x+1) - x(y-1)$ **B1** for common denominator xy or **SC2** for $\frac{y-x}{xy}$ final answer
16(a)	–1	**1**	
16(b)	$-6n + 29$ oe	**2**	**M1** for $-6n + k$ (any k) or $-kn + 29$ $(k \neq 0)$
17	60	**3**	**B2** for $x = 6$ or **M1** for $29x + x = 180$ oe and **M1** for $360 \div 6$ or $360 \div$ *their* x or $180(n - 2) =$ *their* $x \times 29n$
18	Correctly eliminating one variable	**M1**	
	[x =] $\frac{2}{3}$ or 0.667 or 0.6666…	**A1**	
	[y =] $\frac{1}{3}$ or 0.333 or 0.333…	**A1**	If zero scored, **SC1** for 2 values satisfying one of the original equations or if no working shown but 2 correct answers given
19	[±] $\sqrt{y^2 - 1}$ final answer	**3**	**M1** for correct squaring **M1** for correct rearranging for x or x^2 term **M1** for correct square root
20	132	**3**	**M2** for $\frac{1}{2}(7 + 15) \times 12$ or **M1** for any correct area

Question	Answer	Marks	Partial marks
21	$\frac{1}{3}\mathbf{a} + \frac{2}{3}\mathbf{b}$ oe simplified	**3**	**B2** for correct unsimplified vector for $\overrightarrow{OK}$ in terms of **a** and **b** or **M1** for a correct route for $\overrightarrow{OK}$ or $\overrightarrow{AB} = -\mathbf{a} + \mathbf{b}$ or $\overrightarrow{BA} = -\mathbf{b} + \mathbf{a}$ or recognition of $\overrightarrow{OK}$ as a position vector
22	[w =] 54 [x =] 126 [y =] 60	**3**	**B1** for [w =] 54 **B1** for [x =] 126 If **B0 B0** for first two B marks then **B1** for *their* w + *their* x = 180 **B1** for [y =] 60 or for *their* w + *their* x + *their* y = 240
23	[k =] 3 [c =] 9	**3**	**M1** for $\frac{30}{360} \times \pi \times 6^2$ **M1** for $\frac{1}{2} \times 6 \times 6 \times \sin 30$
24(a)	$\frac{5}{14}$ or 0.357 or 0.357…	**2**	**M1** for $7 - 2 = 11n + 3n$ oe or better
24(b)	18	**2**	**M1** for $p - 3 = 3 \times 5$ or $\frac{p}{5} = 3 + \frac{3}{5}$
25(a)	$(x-12)(x+11)$ final answer	**2**	**B1** for $(x+a)(x+b)$ where $ab = -132$ or $a + b = -1$
25(b)	$x(x+2)(x-2)$ final answer	**2**	**B1** for $x(x^2 - 4)$ or $(x+2)(x^2 - 2x)$ or $(x-2)(x^2 + 2x)$
26	21.8 or 21.80…	**4**	**M3** for $\tan = \frac{2}{\sqrt{3^2 + 4^2}}$ oe or **M1** for $\sqrt{3^2 + 4^2}$ or $\sqrt{3^2 + 4^2 + 2^2}$ and **M1** for recognising angle QAC

Question	Answer	Marks	Partial marks
27(a)	27	**1**	
27(b)	x^2 final answer	**1**	
27(c)	$\frac{y^2}{2}$ or $0.5y^2$ final answer	**2**	**M1** for $\left(\frac{y^6}{8}\right)^{\frac{1}{3}}$ or $\left(\frac{2}{y^2}\right)^{-1}$ or better or **SC1** for answer $\frac{y^2}{c}$ or $\frac{y^k}{2}$ or $\frac{2}{y^2}$

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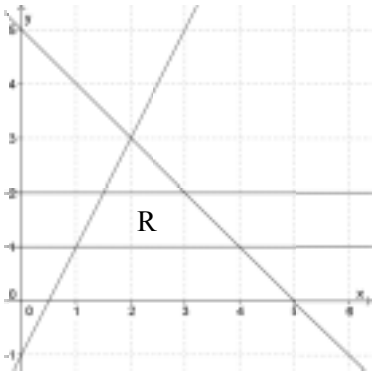
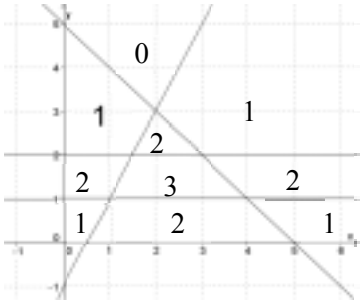
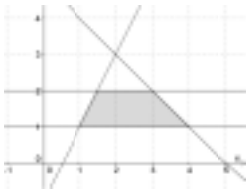
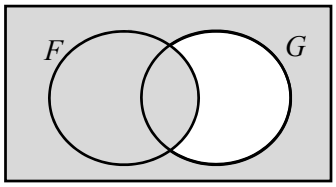
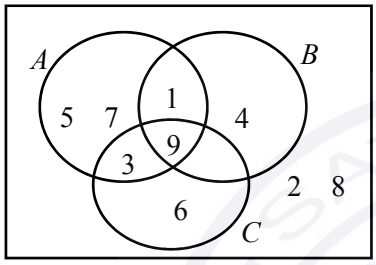
nfww	not from wrong working
soi	seen or implied

Question	Answer	Mark	Part marks
1	x^{10}	**1**	
2	2	**1**	
3(a)	23.46 cao	**1**	
3(b)	20 cao	**1**	
4(a)	Chicago	**1**	
4(b)	-3	**1**	
5	$4n(3n - m)$ final answer	**2**	**B1** for $4(3n^2 - mn)$ or $n(12n - 4m)$ or $2n(6n - 2m)$ or $2(6n^2 - 2mn)$
6(a)	-4	**1**	
6(b)	$\frac{1}{5}$ or 0.2	**1**	
7	$\frac{14(\text{or}35)}{21} + \frac{15}{21}$	**M1**	accept $\frac{14k(\text{or}35k)}{21k} + \frac{15k}{21k}$
	$2\frac{8}{21}$ cao	**A2**	or **A1** for $\frac{50}{21}$ or $1\frac{8}{21}$ or $\frac{29}{21}$ or $1\frac{29}{21}$
8	rt $(1 - t)\, r$ $(1 - r)t$ oe $(1 - r)(1 - t)$ oe	**3**	**B1** for each
9	7.65	**3**	**M1** for $h = k\sqrt{p}$ oe **M1** for $h =$ *their* $k\sqrt{p}$ or **M2** for $\frac{5.4}{\sqrt{1.44}} = \frac{h}{\sqrt{2.89}}$ oe

Question	Answer	Mark	Part marks
10	Correct region identified 	**3**	 **SC1** for 
11	76.9 or 76.94 to 76.95	**3**	**M2** for $90 \div \sqrt[3]{\frac{160}{100}}$ or $90 \times \sqrt[3]{\frac{100}{160}}$ or **M1** for $\sqrt[3]{\frac{160}{100}}$ soi or $\sqrt[3]{\frac{100}{160}}$ soi or $\left(\frac{h}{90}\right)^3 = \frac{100}{160}$ oe
12	$k-3$ or $-3+k$	**3**	**M1** for $5 = \frac{23-8}{k-x}$ oe **M1** for $5(k-x) = 23-8$ or better e.g. $[x =]\ k - \frac{23-8}{5}$
13	22.6 or 22.61 to 22.62	**3**	**M2** for sin [=] $\frac{5}{13}$ oe or **M1** for identifying angle *AGE*
14	165	**3**	**M2** for $\frac{360}{8} + \frac{360}{3}$ oe or **M1** for **[**exterior angle of octagon =] $\frac{360}{8}$ or [exterior angle of triangle =] $\frac{360}{3}$ oe
15(a)	0.8 or $\frac{4}{5}$	**1**	
15(b)	1180	**3**	**M2** for **(**0.5 × 16 × 20) + **(**0.5 × 4 × 30) + (80 × 12) oe or **M1** for part area
16(a)	Points plotted at (4.5, 33) and (6.5, 35)	**1**	

Question	Answer	Mark	Part marks
16(b)	Positive	**1**	
16(c)	Correct ruled line	**1**	
16(d)	33.5 to 37.5	**1FT**	**FT** from *their* line providing positive gradient
17(a)		**1**	
17(b)(i)		**2**	**B1** for four out of the eight regions correct
17(b)(ii)	Any even square number that is also a multiple of 3	**1**	
18(a)	**2a** + **b**	**1**	
18(b)	*D*	**1**	
18(c)	$\overrightarrow{CF}$ and $\overrightarrow{BG}$	**2**	**B1** for each
19	5.53 or 5.54 or 5.534 to 5.543…	**4**	**M3** for $2 \times \{(\frac{40}{360} \times \pi \times 10^2) - (\frac{1}{2} \times 10^2 \times \sin 40)\}$ or **M2** for $\left[\frac{1}{2}\times\right] 10^2 \times \sin 40$ and $[2\times]\frac{40}{360} \times \pi \times 10^2$ or **M1** for $\left[\frac{1}{2}\times\right] 10^2 \times \sin 40$ or $[2\times]\ \frac{40}{360} \times \pi \times 10^2$
20(a)	5 7 7 8 10 7 9 9 10 12	**1**	
20(b)	7	**1**	

Question	Answer	Mark	Part marks
20(c)(i)	$\frac{7}{25}$ or 0.28 or 28%	**2FT**	**FT** $\frac{their\ 7}{25}$ **B1** for $\frac{k}{25}$ If zero scored, then **SC1** for $\frac{2}{5}$ or $\frac{6}{15}$ if no values in the bottom two rows of the table.
20(c)(ii)	0	**1FT**	**FT** $\frac{their\ 0}{25}$
21(a)	[u =] 35	**1**	
	[v =] 110	**2**	**B1** for ACB or ADB = 35
21(b)	75	**2**	**B1** for 150 or **M1** for $\frac{360-210}{2}$
22(a)	$\frac{x}{x+3}$ final answer	**3**	**B1** for $x(x-3)$ **B1** for $(x-3)(x+3)$
22(b)	$\frac{8x+7}{(x-4)(2x+5)}$ final answer	**3**	**B1** for common denominator of $(x-4)(2x+5)$ oe **M1** for $3(2x+5)+2(x-4)$ oe with an attempt to expand the brackets

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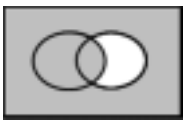
Question	Answer	Marks	Part Marks
1	[0].072	**1**	
2	[0].15 oe	**1**	
3	[0].62	**1**	
4	[0].394 or [0].3944 to [0].3945	**1**	
5	41.9 or 41.87	**1**	
6	$7(2x - 3y)$ final answer	**1**	
7	41	**2**	**M1** for $5(7) - 3(-2)$
8	110	**1**	
	70	**1**	
9	$\frac{5}{6} - \frac{3}{6}$ oe	**M1**	oe for $\frac{5k}{6k} - \frac{3k}{6k}$
	$\frac{1}{3}$ cao final answer	**A1**	
10	$\frac{1}{6}$ oe	**2**	**M1** for $2 - 1 = 5x + x$ oe
11(a)	6.05×10^{-2}	**1**	
11(b)	5.1×10^{3}	**1**	
12	34.8 or 34.84 to 34.85	**2**	**M1** for sin [=] $\frac{4}{7}$
13	$n < 3.5$ oe final answer	**2**	**M1** for $18 - 11 > 5n - 3n$ oe
14(a)	25	**1**	
14(b)	9	**1**	

Question	Answer	Marks	Part Marks
15	$[\pm]\sqrt{\frac{p}{2}}$ oe	**2**	**M1** for $\frac{p}{2} = q^2$ or $\sqrt{p} = \sqrt{2}\,q$ or $[q =] \sqrt{their\ \frac{p}{2}}$ or $[q =] \frac{\sqrt{p}}{their\sqrt{2}}$
16(a)	Correct bisector with correct arcs	**2**	**B1** for correct bisector but no arcs or correct arcs but no line
16(b)	Correct region shaded	**1**	
17	4.34 or 4.336 to 4.337	**3**	**M2** for $\frac{8.15\sin 30}{\sin 110}$ or **M1** for $\frac{\sin 110}{8.15} = \frac{\sin 30}{AC}$ oe
18	2859.75 2968.75 cao final answer	**3**	**B2** for one correct seen or **B1** for 62.5 or 61.5 or 46.5 or 47.5 seen or **M1** for (62 + 0.5) × (47 + 0.5) or (62 – 0.5) × (47 – 0.5)
19	37.4 or 37.38… and 142.6 or 142.6…	**3**	**B2** for one correct or **M1** for 0.5 × 8 × 7 sin = 17 oe If zero or **M1** only scored, **SC1** for two answers with a sum of 180
20	$\frac{2x^2+x-7}{3(x+1)}$ or $\frac{2x^2+x-7}{3x+3}$ final answer	**3**	**M1** for $(2x – 1)(x + 1) – 2 \times 3$ oe with an attempt to expand the brackets **B1** for $3(x + 1)$ or $3x + 3$ for denominator
21	1.5 or $\frac{3}{2}$ or $1\frac{1}{2}$	**3**	**M1** for $\frac{k}{\sqrt{1+x}}$ **M1** for $y = \frac{their\ k}{\sqrt{1+15}}$ or **M2** for $\frac{2}{\sqrt{1+15}} = \frac{y}{\sqrt{1+8}}$
22(a)	$(3t+u)(3t-u)$ final answer	**2**	**B1** for $(at + bu)(ct + du)$ final answer where $ac = 9$ or $ad + bc = 0$ or $bd = -1$
22(b)	$(c-2d)(2-p)$ or $(p-2)(2d-c)$ final answer	**2**	**M1** for $2(c-2d) - p(c-2d)$ or $c(2-p) - 2d(2-p)$ or $p(2d-c) - 2(2d-c)$ or $2d(p-2) - c(p-2)$
23(a)(i)	24	**1**	
23(a)(ii)	5	**1**	

Question	Answer	Marks	Part Marks
23(a)(iii)	$\frac{7}{12}$	**1**	
23(b)		**1**	
24(a)	Similar	**1**	
24(b)	5.6	**2**	**M1** for $\frac{4}{8}=\frac{2.8}{AX}$ oe
24(c)	$\frac{y}{4}$ oe	**1**	
25(a)	$8x^{12}$ final answer	**2**	**B1** for $8x^k$ or kx^{12} in final answer $k \neq 0$
25(b)	9	**2**	**M1** for $27^{\frac{2}{3}}$ or 3^k or $p^{\frac{1}{2}} = 3$ or $p^3 = 729$
26	[w =] 40	**1**	
	[x =] 95	**2**	**B1** for angle ABC = 85 or *their* w + *their* CBD = 85
	[y =] 45	**2**	**B1** for angle CBD = 45 or angle ACD = 40 or angle ACD = *their* w or y = *their* CBD
27(a)	$y = 2x + 4$	**3**	**B2** for $2x + 4$ or $y = 2x + c$ or $y = mx + 4$ or **B1** for $2x + c$ or for $kx + 4$ or **M1** for rise/run
27(b)	$y = -\frac{1}{2}x + \frac{3}{2}$ oe	**4**	**B1** for (–1, 2) **M1** for the gradient $-\frac{1}{2}$ oe or $\frac{-1}{\textit{their } 2}$ oe **M1** for substituting *their* (–1, 2) into *their* $y = mx + c$ oe

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

MATHEMATICS **0580/23**

Paper 2 (Extended) **May/June 2017**

MARK SCHEME

Maximum Mark: 70

Published

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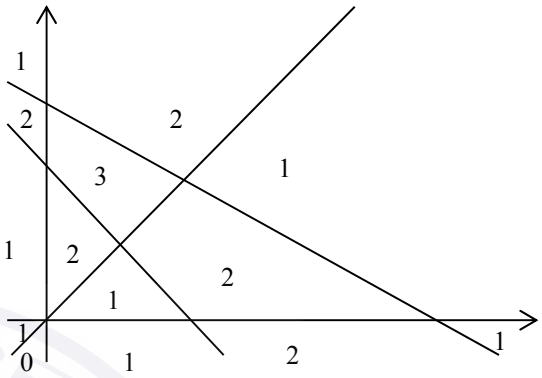
Abbreviations

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	Part Marks
1	0.407 or 0.4067...	**1**	
2	$4x(x-2y)$ final answer	**2**	**M1** for $4\left(x^2-2xy\right)$ or $x\left(4x-8y\right)$ or $2\left(2x^2-4xy\right)$ or $2x\ (2x-4y)$
3	120	**2**	**M1** for finding a correct product of prime factors or correctly listing a minimum of 3 multiples of 20 **and** 24 or for answer $2^3 \times 3 \times 5$ oe or $120k$ where k is an integer > 1
4	$(x-y)^2$ oe final answer	**2**	**M1** for $x-y=\sqrt{a}$ or *their* $(x-y)$ squared
5	68.6 or 68.62 to 68.64	**2**	**M1** for $\frac{1}{2}\times\frac{4}{3}\pi\times3.2^3$ If zero scored, **SC1** for final answer 137 or 137.2 to 137.3
6	$\frac{4}{25}$ oe	**2**	**M1** for $\frac{2}{5}\times\frac{2}{5}$ oe or denominator 5^2 oe
7	$\frac{32}{x^2}$ or $32x^{-2}$ final answer	**2**	**M1** for $y=\frac{k}{x^2}$ oe or [k =] 32
8	$\frac{2}{a^4}$ or $2a^{-4}$ final answer	**2**	**B1** for $\frac{2}{a^k}$ oe or $\frac{k}{a^4}$ oe ($k \neq 0$) final answer
9(a)(i)	$\begin{pmatrix}30\\-20\end{pmatrix}$	**1**	
9(a)(ii)	$\begin{pmatrix}-6\\4\end{pmatrix}$	**1**	
9(b)	–4	**1**	

Question	Answer	Marks	Part Marks
10(a)	10	**2**	**M1** for $5x + 6x + 7x = 180$ oe or $\frac{180}{5+6+7}$ or **B1** for angles 50, 60 and 70
10(b)	70	**1FT**	**FT** 7 × *their* (***a***) provided 0 < *their answer* < 180
11	Correct region	**3**	 **SC1** for *R* not marked and reverse shading
12(a)	$3 + 12x$ final answer	**1**	
12(b)	$24x + 31$ final answer	**2**	**M1** for $3 + 4(6x + 7)$
13	150	**3**	**M2** for $\left(\frac{1}{0.512}\right)^{\frac{2}{3}}$ oe or $\left(\frac{0.512}{1}\right)^{\frac{2}{3}}$ oe or **M1** for scale factor $\left(\frac{1}{0.512}\right)^{\frac{1}{3}}$ oe or $\left(\frac{0.512}{[1]}\right)^{\frac{1}{3}}$ oe
14	$10^{k+2} \times [0].\dot{6}\dot{3} - 10^{k} \times [0].\dot{6}\dot{3}$ oe where $k > 1$	**M1**	
	$\frac{63}{99}$ or equivalent fraction	**A1**	e.g. $\frac{6300}{9900}$ but not $\frac{7}{11}$
	$\frac{7}{11}$	**B1**	
15	35.8 or 35.77….	**3**	**M2** for [sin =] $\frac{24 \times \sin 71.8}{39}$ or **M1** for $\frac{39}{\sin 71.8} = \frac{24}{\sin x}$ oe
16(a)	$x \leqslant 3$ final answer	**2**	**M1** for $13 - 7 \geqslant 3x - x$ oe
16(b)	1, 2, 3	**1FT**	correct answer or **FT** their answer to **(a)**

Question	Answer	Marks	Part Marks
17	$\frac{2}{7}\mathbf{p} + \frac{5}{7}\mathbf{q}$	**3**	**M1** for $PZ = \frac{5}{7}(\mathbf{q} - \mathbf{p})$ oe or $QZ = \frac{2}{7}(\mathbf{p} - \mathbf{q})$ oe **M1** for correct route from O to Z or identifying OZ
18	3000	**3**	**M2** for $12.5 \times \frac{1}{2}(200 + 280)$ oe or **M1** for part area
19	common denominator 12	**B1**	accept $k \times 12$ throughout
	one correct from $\frac{9}{12}$ or $\frac{8}{12}$ oe	**M1**	accept $\frac{9k}{12k}$ or $\frac{8k}{12k}$
	$\frac{5}{6}$ cao	**A2**	**A1** for $\frac{10}{12}$ or $\frac{10k}{12k}$
20(a)	6	**1**	
20(b)	$2x^3$ final answer	**1**	
20(c)	$15y^4$ final answer	**2**	**B1** for $15y^k$ or ky^4 as final answer ($k \neq 0$)
21	$\sqrt{10^2 - 4 \times 5 \times 2}$ oe or better	**B1**	If completing the square: **B1** for $(x+1)^2$ oe **B1** for $-1 + \sqrt{1 - \frac{2}{5}}$ or $-1 - \sqrt{1 - \frac{2}{5}}$ oe
	$\frac{-10 + \sqrt{q}}{2(5)}$ or $\frac{-10 - \sqrt{q}}{2(5)}$ oe	**B1**	
	– 0.23, –1.77 final ans cao	**B1B1**	**SC1** for – 0.2 or – 0.225... **and** –1.8 or –1.774... or –1.775 or 0.23 and 1.77 as answer or – 0.23 and –1.77 seen in working Maximum score without working is 2
22	35.3 or 35.26…	**4**	**M3** for [tan =] $\frac{26}{\sqrt{26^2 + 26^2}}$ oe or **M1** for [AC^2 =] $26^2 + 26^2$ oe and **M1** for [tan =] 26 ÷ *their AC* oe or for angle CAG indicated

Question	Answer	Marks	Part Marks
23(a)	$4(x-6)$ or $4x-24$ as final answer	**1**	
23(b)	$x^2+23x+26$ final answer	**3**	**B2** for $x^2+4x+4x+16$ or better or **B1** for $15x+10$
24	1.96 cao	**5**	**M4** for $\left(\left(\left(\sqrt[3]{\frac{2500\times1.6\times3}{100}+2000}{2000}\right)-1\right)-1\right)$ [× 100] oe or 1.96…or [0].0196... or 101.96… or 1.0196… or **M3** for $\sqrt[3]{\frac{\frac{2500\times1.6\times3}{100}+2000}{2000}}$ or **B2** for [SI =] 120 or [CI total=] 2120 or **M1** for $\frac{2500\times3\times1.6}{100}$ and **M1** for $2000\times(k)^3$

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

MATHEMATICS **0580/22**

Paper 22 (Extended) **March 2017**

MARK SCHEME

Maximum Mark: 70

Published

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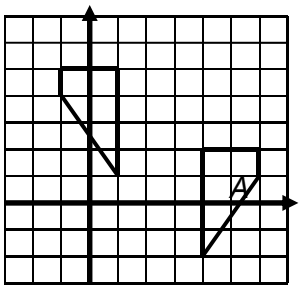
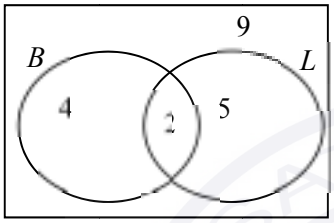
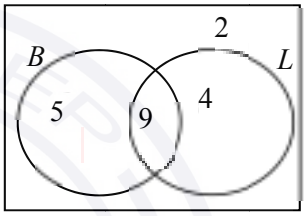
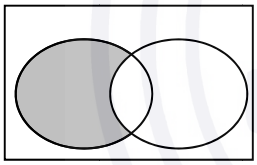
Abbreviations

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	Part Marks
1	$18w+14$ final answer	**2**	**M1** for $20w+12$ or $-2w+2$ or answer $18w+k$ or $kw+14$
2	Equilateral triangle with correct arcs	**2**	**M1** for clear evidence of constructed 60° angles or arcs crossing equal in length to AB or an accurate diagram with no/incorrect arcs
3	$\frac{10\times 20}{90-40}$ 4 nfww	**M1** **A1**	
4	4 nfww	**2**	**M1** for [7.31 =] 7 $\left(1+\frac{1.1}{100}\right)^k$ oe
5	150	**2**	**M1** for $2\times 3+16\times 3^2$
6	$10^k\times 0.1\dot{7}-[10]\times 0.1\dot{7}$ $k\geqslant 1$ oe $\frac{16}{90}$ or $\frac{8}{45}$ oe nfww	**M1** **A1**	
7	70.7625 cao and 72.4625 cao	**3**	**B2** for 70.7625 or 72.4625 or **M2** for 9.25 × 7.65 **and** 9.35 × 7.75 or **B1** for two of 9.25, 9.35, 7.65, 7.75 seen
8	$\frac{10}{3}$ or $\frac{5}{2}$ *their* $\frac{10}{3}\times$ *their* $\frac{2}{5}$ $1\frac{1}{3}$ cao	**B1** **M1** **A1**	oe improper fractions accept $\frac{20}{6}\div\frac{15}{6}$
9	18.1 or 18.10….	**3**	**M2** for $\sqrt{20^2-\left(\frac{1}{2}(17)\right)^2}$ oe or **M1** for $h^2+\left(\frac{1}{2}(17)\right)^2=20^2$

Question	Answer	Marks	Part Marks
10	1050	**3**	**M2** for $924 \div \frac{(100-12)}{100}$ oe or **M1** for 88[%] associated with 924 oe
11		**3**	**B2** for correct translation of A seen or **B1** for translation of A by $\begin{pmatrix}-1\\k\end{pmatrix}$ or $\begin{pmatrix}k\\3\end{pmatrix}$ seen and **B1** for correct reflection of their translation in $x = 2$ seen If 0 scored **SC2** for correct TM(A) or **SC1** for reflection in $x = 2$ seen or a correct translation of $\begin{pmatrix}-1\\3\end{pmatrix}$ seen
12	4	**3**	**M1** for $y = \frac{k}{x^2}$ **M1** for $y = \frac{their\ k}{10^2}$ or **M2** for $5^2 \times 16 = 10^2 \times y$ oe
13 (a)	$5c(3c-1)$ final answer	**2**	**B1** for $5\left(3c^2 - c\right)$ or $c\left(15c - 5\right)$
(b)	$(2p-m)(k+3)$ final answer	**2**	**B1** for $k\left(2p-m\right)+3\left(2p-m\right)$ or $2p\left(k+3\right)-m\left(k+3\right)$
14 (a)	Point at (3, 5)	**1**	
(b)	$\begin{pmatrix}1\\-3\end{pmatrix}$	**1FT**	**FT** their $\overrightarrow{AC}$
(c)	$\begin{pmatrix}0\\4\end{pmatrix}$ or $\begin{pmatrix}0\\-4\end{pmatrix}$	**2**	**M1** for a vector of magnitude 4 or of form $\begin{pmatrix}0\\\pm k\end{pmatrix}$
15 (a)	t^{20} final answer	**1**	
(b)	x^{10} final answer	**1**	
(c)	$27m^6$ final answer	**2**	**B1** for $27m^k$ or km^6 as final answer

Question	Answer	Marks	Part Marks
16 (a)	0.25 or $\frac{1}{4}$	**1**	
(b)	0.45	**3**	**B2** for 450 or **M2** for $\frac{1}{2} \times 60 \times 15 \div 1000$ or **M1** for $\frac{1}{2} \times 60 \times 15$ If 0 scored **SC1** for correct conversion of their distance in metres to kilometres
17 (a) (i)		**2**	**B1** for 2 correct of 4, 2, 5, 9 in the correct places or **SC1** for 
(ii)	9	**1FT**	**FT** *their* 9
(b)		**1**	
18 (a)	$\begin{pmatrix} 27 & -24 \\ -5 & -10 \end{pmatrix}$	**2**	**B1** for two correct elements
(b)	$-\frac{1}{13}\begin{pmatrix} -2 & -3 \\ -1 & 5 \end{pmatrix}$ oe isw	**2**	**B1** for $k\begin{pmatrix} -2 & -3 \\ -1 & 5 \end{pmatrix}$ or det = −13 soi
19 (a)	11.4 or 11.40 to 11.41	**2**	**M1** for $\frac{1}{2} \times 2.8 \times 8.3 \times \sin 79$ oe
(b)	231 or 230.8 to 231.1	**2FT**	**FT** *their* **(a)** $\times 4.5^2$ **M1** for 4.5^2 or 20.25 seen

Question	Answer	Marks	Part Marks
20 (a)	$[y =] -2x + 3$	**3**	**B2** for $[y =] -2x + c$ or **M1** for rise/run and **B1** for $[y =] kx + 3$, $k \neq 0$ or $c = 3$
(b)	$y = \frac{1}{2}x - \frac{5}{2}$ oe final answer	**3**	**M1** for gradient = $-\frac{1}{\textit{their}\text{ gradient in }\textbf{(a)}}$ or gradient = 0.5 oe **M1** for substitution of (3, –1) into *their* $y = mx + c$ oe
21 (a)	10	**2**	**M1** for $\frac{x}{4} - 3 = -0.5$
(b)	$\frac{x+7}{6}$ final answer	**2**	**M1** for $y + 7 = 6x$ or $\frac{y}{6} = x - \frac{7}{6}$ or $x = 6y - 7$
(c)	–2	**2**	**M1** for [f(13) =] $\frac{1}{4}$

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

MATHEMATICS **0580/21**

Paper 2 (Extended) **October/November 2016**

MARK SCHEME

Maximum Mark: 70

Published

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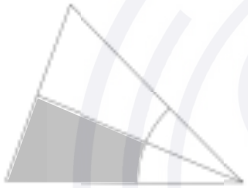
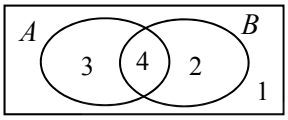
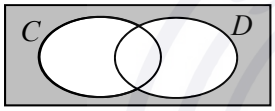
cao correct answer only
dep dependent
FT follow through after error
isw ignore subsequent working
oe or equivalent
SC Special Case
nfww not from wrong working
soi seen or implied

Question	Answer	Mark	Part marks
1	–7	**1**	
2 (a)	[0].0402	**1**	
(b)	[0].040	**1**	
3	[0].67	**2**	**M1** for 14×0.905 [–12] or 12.67 If zero scored, **SC1** for answer [0].74[0]
4	$\frac{8}{12}$ and $\frac{3}{12}$ oe $\frac{5}{12}$ cao	**M1** **A1**	Correct fractions with common denominator
5 (a)	$\frac{1}{125}$	**1**	
(b)	4.56×10^{-3}	**1**	
6	42	**2**	**M1** for $Q = 90$ or $WPQ = 90 - 42$ or $WPQ = 48$
7	$\frac{x^2+2y^2}{xy}$ or $\frac{x}{y}+\frac{2y}{x}$ final answer	**2**	**B1** for $xy(x^2+2y^2)$ or **M1** for $\frac{x^2y+2y^3}{xy^2}$ or $\frac{x^3+2xy^2}{x^2y}$
8	$\frac{pt-2t-3p}{pt}$ final answer	**2**	**B1** for $pt-2t-3p$ or $1-\frac{2t+3p}{pt}$
9	[x =] 55 [y =] 125	**1** **1FT**	 correct or **FT** (180 – their x)

Question	Answer	Mark	Part marks
10	$6x^8$ final answer	**2**	**B1** for $6x^k$, $6\times x^8$ or $kx^8\ (k\neq 0)$ as final answer
11	Correctly eliminating one variable $[x\ =]\ -1$ and $[y\ =\ ]\ 5$	**M1** **A1** **A1**	If zero scored, **SC1** for 2 values that satisfy one of the original equations **or** **SC1** if no working shown, but 2 correct answers given
12 (a)	$\frac{1}{8}$ cao	**1**	
(b)	$\frac{2}{11}$	**2**	**M1** for $18.\dot{1}\dot{8}-0.\dot{1}\dot{8}$ oe or **B1** for $\frac{2k}{11k}$ (k not 0 or 1)
13 (a)	$(2p-3)(2p+3)$ final answer	**1**	
(b)	$(a-2b)(2x-y)$ oe final answer	**2**	**B1** for $2x(a-2b)-y(a-2b)$ or $a(2x-y)-2b(2x-y)$
14	$6\frac{2}{3}$ oe	**3**	**M1** for $y=k\sqrt{x+2}$ oe or better e.g. $2=k\sqrt{7+2}$ **M1** for $[y=]$ their $k\times\sqrt{98+2}$ or **M2** for $\frac{y}{2}=\frac{\sqrt{98+2}}{\sqrt{7+2}}$
15 (a)	$\begin{pmatrix}5\\8\end{pmatrix}$	**1**	
(b)	(8) final answer	**2**	**B1** for final answer 8 without brackets

Question	Answer	Mark	Part marks
16	6.35 or 6.349 to 6.350	**3**	**M2** for $\frac{8}{h} = \sqrt[3]{\frac{0.5}{0.25}}$ oe or **M1** for $\left(\frac{8}{h}\right)^3 = \frac{0.5}{0.25}$ oe or for $\sqrt[3]{\frac{0.5}{0.25}}$ or $\sqrt[3]{\frac{0.25}{0.5}}$ oe
17 (a)	Accurate arc, centre *B*, radius 5 cm meeting both *BA* **and** *BC*	**1**	
(b)	Accurate bisector through angle *B* **with** 2 pairs of correct arcs **and** reaching to at least *AC*	**2**	**B1** for accurate line from *B* to at least *AC* or **M1** for correct arcs
(c)	Correct region identified 	**1**	
18 (a)	4	**2**	**B1** for 25 or –21
(b)	$\sqrt{y - qr}$ oe final answer	**2**	**M1** for $y - qr = p^2$ or **M1** for correctly square rooting *their* function of *y*, *q* and *r*
19 (a)	$6n + 1$ oe final answer	**2**	**B1** for $6n + c$ or for $kn + 1$ ($k \neq 0$)
(b)	$(n+2)^2$ final answer	**2**	**M1** for any quadratic expression or reaching second difference of 2
20 (a)	$\frac{3mx}{50}$ or $0.06mx$	**2**	**M1** for $m \times x \times 60 \div 1000$ oe
(b)	35	**2**	**M1** for $5 \times x \times 60 \div 1000 = 10.5$ oe or for substituting $m = 5$ in *their* **(a)** and equating to 10.5 oe

Question	Answer	Mark	Part marks
21	$y \geqslant 0$ and $x \geqslant 1$ oe and $x + y \leqslant 4$ oe	**4**	**SC3** for $y > 0$, $x > 1$ and $x + y < 4$ oe or **B1** for $y \geqslant 0$ **B1** for $x \geqslant 1$ oe and **B2** for $x + y \leqslant 4$ oe or **M1** for grad = –1 soi If **B0** scored for first two **B** marks, **SC1** for $y = 0$ and $x = 1$ or with incorrect inequality sign
22 (a) (i)		**2**	**B1** for $n(A \cap B) = 4$
(ii)	$\frac{2}{10}$ oe	**1FT**	allow correct answer or **FT** $\frac{their\ 2}{10}$
(b)		**1**	
23	$\sqrt{(3)^2 - 4(2)(-3)}$ oe or better	**B1**	If completing the square, **B1** for $\left(x + \frac{3}{4}\right)^2$ oe
	$\frac{-3 + \sqrt{k}}{2(2)}$ or $\frac{-3 - \sqrt{k}}{2(2)}$ oe	**B1**	**B1** for $-\frac{3}{4} + \sqrt{\frac{3}{2} + \left(\frac{3}{4}\right)^2}$ or $-\frac{3}{4} - \sqrt{\frac{3}{2} + \left(\frac{3}{4}\right)^2}$ oe
	–2.19, 0.69	**B1B1**	**SC1** for –2.2 or –2.186… **and** 0.7 or 0.686.. or –2.19 **and** 0.69 seen but not final answer or 2.19 **and** –0.69 **Maximum score without working is 2**
24 (a)	13.9 or 13.85 to 13.86	**3**	**M2** for $\sqrt{8^2 + 8^2 + 8^2}$ oe or **M1** for $8^2 + 8^2$ or better for one face
(b)	35.1 to 35.5[4…]	**2**	**M1** for sin = $\frac{8}{their\ \textbf{(a)}}$ or cos = $\frac{\sqrt{8^2 + 8^2}}{their\ \textbf{(a)}}$ or tan = $\frac{8}{\sqrt{8^2 + 8^2}}$ oe

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

MATHEMATICS **0580/22**

Paper 2 (Extended) **October/November 2016**

MARK SCHEME

Maximum Mark: 70

Published

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Abbreviations

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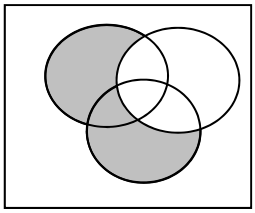
SC Special Case
nfww not from wrong working
soi seen or implied

Question	Answer	Mark	Part marks
1 (a)	15000 cao	**1**	
(b)	1.5×10^4	**1FT**	**FT** *their* **(a)**
2	25	**2**	**B1** for 67 or 113 seen once in correct position or **M1** for $a + 42 = 67$ or $a + 42 + 113 = 180$ or better
3	21	**2**	**M1** for $k - 8 = 13$ or $6k - 48 = 78$ or better
4	58	**2**	**M1** for $\frac{(13+16)\times4}{2}$ or $4\times13+\frac{1}{2}\times4\times3$ oe
5	$9y^3$ final answer	**2**	**B1** for $9y^k$, $9\times y^3$ or ky^3 ($k \neq 0$) as final answer
6	72.25 cao	**2**	**M1** for 8 + 0.5 or better seen
7	1, 2, 3	**3**	**B2** for $t < 4$ or **M1** for $2 + 6 > 3t - t$ oe or better If zero scored, **SC1** for answer 0, 1, 2, 3 or 1, 2, 3, 4
8	correctly eliminating one variable [x =] 9 [y =] 3.5	**M1** **A1** **A1**	If zero scored, **SC1** for 2 values satisfying one of the original equations **SC1** if no working shown but 2 correct answers given
9	234 or 234.3 to 234.4	**3**	**M2** for [dist =] $\frac{300}{\tan 52}$ oe or **M1** for correct implicit trig statement allow **M1** if they use *their* 52 or *their* 38 provided it is marked on the diagram or **B1** for 52 or 38 correctly placed If zero scored, **SC1** for final answer 384

Question	Answer	Mark	Part marks
10	46.3 or 46.29 to 46.30	**3**	**M2** for $53\times\sqrt[3]{\frac{20}{30}}$ oe or **M1** for $\sqrt[3]{\frac{20}{30}}$ or $\sqrt[3]{\frac{30}{20}}$ or $\left(\frac{53}{x}\right)^3=\frac{30}{20}$ or better
11 (a)	Accurate angle bisector with correct arcs	**2**	**B1** for accurate angle bisector **or** correct arcs with no/wrong line
(b)	Equidistant (oe) from AB and AC	**1**	
12 (a)	38	**2**	**M1** for $57 \div (2 + 1)$ or better
(b)	12 : 7	**2**	**M1FT** for *their* $38 - 2$ **and** *their* $19 + 2$ seen dep on sum = 57 If M0 **SC1** for answer 7 : 12
13 (a)	$m\left(m^2+1\right)$ final answer	**1**	
(b)	$(5-y)(5+y)$ final answer	**1**	
(c)	$(x-4)(x+7)$ final answer	**2**	**B1** for $(x-4)(x+7)$ seen then spoiled or **M1** for $(x+a)(x+b)$ where $ab = -28$ or $a + b = 3$ or for $x(x+7)-4(x+7)$ or $x(x-4)+7(x-4)$
14	Common denominator 24	**B1**	accept $k \times 24$
	Two correct from $\frac{18}{24}, \frac{16}{24}$ and $\frac{3}{24}$ oe	**M1**	accept $\frac{18k}{24k}, \frac{16k}{24k}$ and $\frac{3k}{24k}$
	$1\frac{7}{24}$ cao	**A2**	**A1** for $\frac{31}{24}$ or $\frac{31k}{24k}$ or $1\frac{7k}{24k}$
15 (a) (i)	9	**1**	
(ii)	12	**1**	
(b)	$\frac{5}{14}$	**1**	
(c)		**1**	

Question	Answer	Mark	Part marks
16 (a)	$\begin{pmatrix}-7\\3\end{pmatrix}$	**2**	**M1** for $\overrightarrow{CB}=\begin{pmatrix}-2\\-3\end{pmatrix}$ or for correct route allow e.g. $BA - BC$, $CB + BA$
(b)	7.81 or 7.810….	**2**	**M1** for $\sqrt{(-5)^2+6^2}$
17	1024 cao	**5**	**B4** for 1023 to 1024.0… or 1020 or **M3** for $\frac{125}{360}\times\pi\times48^2-\frac{125}{360}\times\pi\times40^2+32\times8$ or **M1** for $\frac{125}{360}\times\pi\times48^2$ or $\frac{125}{360}\times\pi\times40^2$ **and M1** for $32\times8+k\pi$ If B0 scored **B1** for *their* more accurate decimal answer rounded correctly to an integer
18 (a)	Enlargement	**1**	
	[s.f.] $\frac{1}{2}$	**1**	
	[centre] (−1 , 3)	**1**	
(b)	Triangle at (3 ,−1) (5,−1) (5,−5)	**3**	**M2** for 2 correct vertices on grid or in working or **M1** for identifying matrix as a reflection in the x-axis or for $\begin{pmatrix}1&0\\0&-1\end{pmatrix}\begin{pmatrix}3&5&5\\1&1&5\end{pmatrix}$ oe
19 (a)	$\frac{1}{7}\begin{pmatrix}-4&3\\-5&2\end{pmatrix}$ oe isw	**2**	**B1** for $k\begin{pmatrix}-4&3\\-5&2\end{pmatrix}$ or det = 7 soi
(b)	6 nfww	**4**	**M3** for $(w-6)^2=0$ or **M2** for $w^2-12w+36[=0]$ or **M1** for $w(w-12)-4\times(-9)[=0]$ oe or clear attempt at determinant = 0 oe

Question	Answer	Mark	Part marks
20 (a)	(7 , 1)	**1**	
(b)	-1.25 or $-\frac{5}{4}$ or $-1\frac{1}{4}$	**2**	**M1** for rise/run
(c)	$y=\frac{4}{5}x+2$ oe	**3**	**B2** for $\frac{4}{5}x+2$ **or** $y=\frac{-1}{their\textbf{(b)}}x+2$ oe or **M1** for $-\frac{1}{their(\textbf{b})}$ oe or **B1** for $\frac{4}{5}x$ seen or $[y=]\,mx+2$ $(m\neq 0)$

Cambridge International Examinations
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MATHEMATICS **0580/23**

Paper 2 (Extended) **October/November 2016**

MARK SCHEME

Maximum Mark: 70

Published

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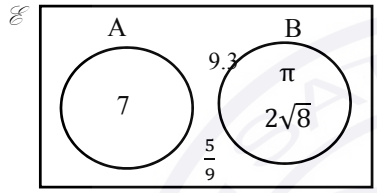
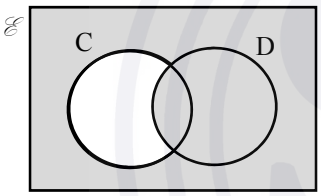
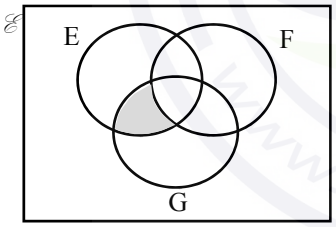
Question	Answer	Mark	Part marks
1	36	**1**	
2	n^7 final answer	**1**	
3	*B*	**1**	
4 (a)	2.47×10^6	**1**	
(b)	7.9×10^{-3}	**1**	
5	$\frac{18}{30}$ and $\frac{5}{30}$ oe must be shown $\frac{23}{30}$ cao	**M1** **A1**	$\frac{18k}{30k}$ and $\frac{5k}{30k}$
6	Thursday	**2**	**M1** for 5.4 found or at least two of: 3.8, 3.6 and 4 found
7	0.4^2 0.6^3 0.22 $\sqrt{0.09}$	**2**	**M1** for decimal conversion 0.216 and 0.3 and 0.16
8	4.25 4.15	**2**	**B1** for each or both answers reversed
9 (a)	*A*	**1**	
(b)	A ruled line joining (65, 23) to (80, 28)	**1**	
10 (a)	2.9[0] or 2.900 to 2.901	**1**	
(b)	3.17 or 3.172 to 3.173	**1**	
11	18 360	**2**	**M1** for $34\,000 \times \left(1-\frac{40}{100}\right)\times\left(1-\frac{10}{100}\right)$ oe
12	32.7 or 32.72 to 32.73	**2**	**M1** for $\left[\frac{1}{2}\times\right]\frac{4}{3}\times\pi\times\left(\frac{5}{2}\right)^3$

Question	Answer	Mark	Part marks
13	$\frac{2}{9}$ oe, must be a fraction	**2**	**M1** for $2.\dot{2} - 0.\dot{2}$ oe or **B1** for $\frac{k}{9}$
14 (a)	30	**1**	
(b)	47.5	**2**	**M1** for 4.5 × 5 oe
15 (a)	68	**1**	
(b)	9	**2**	**M1** for 360 ÷ 40 oe or $\frac{180(n-2)}{n} = 140$ oe
16	1.25	**3**	**M1** for $d = \frac{k}{(w+1)^2}$ or better **M1** for [d=] $\frac{\textit{their } k}{(7+1)^2}$ or **M2** for $3.2(4 + 1)^2 = d(7 + 1)^2$ oe
17	$y = 2x$ oe	**3**	**M1** for $\frac{1-3}{12-8}$ oe **M1** for perpendicular gradient × *their* $\frac{1-3}{12-8} = -1$ oe If zero scored, **SC1** for answer $y = kx$ $k \neq 2$ or 0
18 (a)	25	**1**	
(b)	$\frac{x^2-3}{2}$ oe final answer	**1**	
(c)	$2x + 3$ final answer	**2**	**M1** for correct first step, e.g. $x = \frac{y-3}{2}$ or $2y = x - 3$

Question	Answer	Mark	Part marks
19 (a)	Correct tangent	**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 $x = 0.8$ and $x = 1.2$
	$2.1 \leqslant \text{grad} \leqslant 3.9$	**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
(b)	(–2, 8)	**1**	
20 (a)		**2**	**B1** for 3 elements in the correct place
(b)		**1**	
		**1**	
21 (a)	14.4 or 14.42 to 14.43	**2**	**M1** for $\frac{1}{2} \times 6.2 \times 4.7 \times \sin 82$ oe
(b)	30.7 or 30.72…	**2**	**M1** for $\sin = \frac{2050}{\frac{1}{2} \times 107 \times 75}$
22	1 3.5 1	**4**	**B3** for 2 correct **B2** for 1 correct or **M1** for 2, 7, […] and 2 seen [FDs]
23	$\frac{7n}{2t+3m}$ final answer	**4**	**M1** for $7n(6p - 1)$ seen and **M2** for $(2t + 3m)(6p - 1)$ seen or **M1** for $2t(6p - 1) + 3m(6p - 1)$ or $6p(2t + 3m) - 1(2t + 3m)$

Question	Answer	Mark	Part marks
24	$y \leqslant -\frac{3}{5}x + 6$ oe $x \geqslant 2$ oe $y > x$ oe final answers	**5**	**SC4** for $y < -\frac{3}{5}x + 6, x > 2, y \geqslant x$ oe or **B3** for $y \leqslant -\frac{3}{5}x + 6$ oe or **B2** for $y = -\frac{3}{5}x + 6$ oe or **B1** for gradient $= -\frac{3}{5}$ oe soi and **B2** for $x \geqslant 2$ and $y > x$ oe or **B1** for either $x \geqslant 2$ or $y > x$ oe or for $x = 2$ and $y = x$ with incorrect inequalities
25 (a)	**CB**	**1**	
(b)	$\begin{pmatrix} 36 & -2 \\ 18 & -1 \end{pmatrix}$	**2**	**B1** for two correct entries
(c)	$\frac{1}{47}\begin{pmatrix} 5 & 3 \\ -4 & 7 \end{pmatrix}$ oe isw	**2**	**B1** for $k\begin{pmatrix} 5 & 3 \\ -4 & 7 \end{pmatrix}$ seen or det = 47 soi
(d)	The determinant is 0 oe	**1**	

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MATHEMATICS **0580/21**

Paper 2 (Extended) **May/June 2016**

MARK SCHEME

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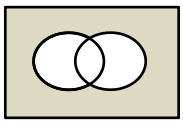
Question	Answer	Mark	Part marks
1	8(h) 52 (min)	**1**	
2	3.75 or 3¾	**1**	
3	[0].00127	**1**	
4	157 900 cao	**2**	**B1** for 158000 or 157860 or 157862 to 157863 If zero scored, **SC1** for *their* answer to more than 4 figs correctly rounded to 4 sf
5	393	**2**	**B1** for 393.1 to 393.2 or **M1** for 2000 ÷ 5.087
6	144	**2**	**M1** for finding a correct product of prime factors or correctly listing a minimum of 3 multiples of 36 **and** 48 or for answer $2^4 \times 3^2$ oe or $144k$
7	11	**2**	**M1** for $-2 \times -7 - 3$ soi
8	$\frac{py}{q}$ final answer	**2**	**M1** for one correct step
9	[a =] 70 [b =] 40	**2**	**B1** for each
10	28.35 cao	**2**	**B1** for 9.45 seen or **M1** for (9.4 + 0.05) × 3
11 (a)	112	**1**	
(b)	56	**1**	
12	$2p^4$ final answer	**2**	**B1** for kp^4 or $2p^k$ as answer
13	$n > 3.75$	**2**	**M1** for $7 + 8 < 5n - n$ oe
14	More than 20m from D oe Nearer to CD than to CB oe	**2**	**B1** for each

Question	Answer	Mark	Part marks
15 (a)	-3	**1**	
(b)	$9 - 2n$ oe	**2**	**B1** for $-2n + k$ or $dn + 9$ where $d \neq 0$
16	$\frac{6}{7} \times \frac{3}{5}$ or $\frac{18}{21} \div \frac{35}{21}$ oe	**M2**	**B1** for $\frac{5}{3}$ oe or **M1** for $\frac{6}{7}$ × *their* $\frac{3}{5}$
	$\frac{18}{35}$ cao	**A1**	
17	145	**3**	**M2** for $(6 - 2) \times 180 - 5 \times 115$ or **M1** for $(6 - 2) \times 180$ Alt method **M2** for $180 - (360 - 5 \times (180 - 115))$ or **M1** for $360 - 5 \times (180 - 115)$
18	1.38 or 1.381 to 1.382	**3**	**M2** for $(36 + 4.3) \div (105 \times \frac{1000}{60 \times 60})$ oe or **M1** for $105 \times \frac{1000}{60 \times 60}$ or for a distance ÷ a speed or **SC2** for answer 1.23(4...)
19	$\frac{5}{6}$ oe	**3**	**M2** for $1 - \frac{2}{3} \times \frac{1}{4}$ or $\frac{1}{3} + \frac{2}{3} \times \frac{3}{4}$ or $\frac{1}{3} \times \frac{3}{4} + \frac{1}{3} \times \frac{1}{4} + \frac{2}{3} \times \frac{3}{4}$ or **M1** for $\frac{2}{3} \times \frac{1}{4}$ or $\frac{1}{3} \times \frac{1}{4} + \frac{2}{3} \times \frac{3}{4}$
20	27	**3**	**M2** for $\frac{6\pi}{\pi \times 2 \times 9} \times \pi \times 9^2$ oe or **M1** for $\frac{6\pi}{\pi \times 2 \times 9}$ oe
21	2	**3**	**M1** for $y = k\sqrt{x}$ **A1** for $k = 4$ or **M2** for $\frac{\sqrt{9}}{12} = \frac{\sqrt{1/4}}{y}$ oe

Question	Answer	Mark	Part marks
22 (a)	3	**1**	
(b)	$\frac{19}{27}$ oe	**1**	
(c)	$\frac{7}{10}$ oe	**1**	
(d)		**1**	
23	69.3 or 69.28…	**4**	**M2** for height = $\sqrt{8^2 - 4^2}$ or **M1** for $4^2 + h^2 = 8^2$ oe **and M1** for $\frac{1}{2}(8+12) \times$ *their* perp height oe
24 (a)	$(a+2)(2+p)$ final answer	**2**	**B1** for $2(a+2) + p(a+2)$ or $a(2+p) + 2(2+p)$
(b)	$2(9+2t)(9-2t)$ oe	**2**	**B1** for $2(81-4t^2)$ oe or $(18+4t)(9-2t)$ oe If 0 scored **SC1** for $(9 + 2t)(9 – 2t)$ final answer
25	$y = -\frac{3}{7}x + 11$ oe	**6**	**B2** for gradient = $-\frac{3}{7}$ **or M1** for [gradient =] $\frac{15-1}{10-4}$ oe **or** for the negative reciprocal of *their* gradient **and** **B2** for [midpoint of AB =] (7, 8) or **B1** for (7, k) or (k, 8) **and M1** for substitution of *their* midpoint or (4, 1) or (10, 15) into a linear equation

Question	Answer	Mark	Part marks
26 (a)	20.1 or 20.07 to 20.08	**2**	**M1** for $\frac{1}{2}\times 7\times 10\times \sin 35$ oe
(b)	5.86 or 5.858…..	**4**	**M2** for $7^2+10^2-2\times 7\times 10\times \cos 35$ **A1** for 34.3 .. or **M1** for $\cos 35=\frac{7^2+10^2-AC^2}{2\times 7\times 10}$

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MATHEMATICS **0580/22**

Paper 2 (Extended) **May/June 2016**

MARK SCHEME

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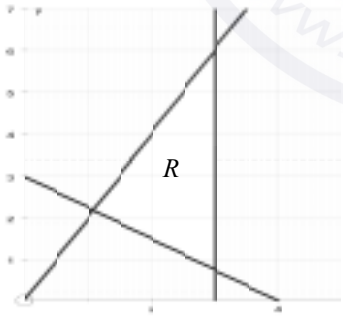
Question	Answer	Mark	Part marks
1	5.74×10^{-5}	**1**	
2	5.89 or 5.885 to 5.886	**1**	
3	3.590 cao	**1**	
4	Parallelogram	**1**	
5 (a)	9 and 16	**1**	
(b)	11	**1**	
6	$\frac{1}{8}x^2$ or $0.125x^2$ final answer	**2**	**B1** for answer $\frac{1}{8}x^k$ or nx^2
7	460	**2**	**B1** for 1 cm^2 : 100 km^2 oe or **M1** for $4.6 \times 1\,000\,000^2 \div 100\,000^2$ oe seen
8	$x > -9$	**2**	**M1** for $\frac{x}{3} > 2 - 5$ oe or $\left(\frac{x}{3} + 5\right) \times 3 > 2 \times 3$ oe
9	45	**3**	**M2** for $360 \div (180 - 172)$ or **M1** for $180 - 172$ or $\frac{180(n-2)}{n} = 172$ oe
10	$p = \frac{8r-5}{r-3}$ oe final answer	**3**	**M1** for correctly collecting terms in p on one side and terms not in p on the other side **M1** for correct factorising **M1** for correct division dependent on p appearing only once in a factorised expression Maximum M2 for an incorrect final answer
11	68 76 78 78	**3**	**B1** for four values with a mode of 78 **B1** for four values with a median of 77 **B1** for total of four values is 300

Question	Answer	Mark	Part marks
12	$\frac{11}{30}$ cao	**3**	**B2** for $\frac{33}{90}$ oe as final answer or **M1** for $36.\dot{6}-3.\dot{6}$ or $36.6^{r}-3.6^{r}$ oe or **B1** for $\frac{k}{90}$
13	10 cao nfww	**3**	**M2** for 42.5 × 2 ÷ 8.5 allowing one error in the UB or LB provided it is still UB × 2 ÷ LB or **M1** for one of 42.5 or 8.5 seen as bounds
14	$\frac{21}{8} \times \frac{3}{7}$ oe $1\frac{1}{8}$ cao final answer	**M1** **A2**	Must be shown **A1** for $\frac{9}{8}$ oe e.g. $\frac{63}{56}$
15	$a = 3.5$ or $\frac{7}{2}$ **and** $b = -17.25$ or $-\frac{69}{4}$	**3**	**B2** for one correct or **M2** for $(x+\frac{7}{2})^2-5-\left(\frac{7}{2}\right)^2$ or **M1** for $(x+\frac{7}{2})^2$ oe or $2a = 7$ or $a^2 + b = -5$ after $x^2 + 2ax + a^2$
16	Correctly eliminating one variable $x = 4$ $y = 0.5$ oe	**M1** **A1** **A1**	If zero scored **SC1** for 2 values satisfying one of the original equations or if no working shown, but 2 correct answers given
17 (a)	Bisector of angle B accurate with two pairs of correct arcs	**2**	**B1** for accurate line with no/wrong arcs or for correct arcs with no/wrong line
(b)	Ruled line parallel to AC at a distance of 3 cm to AC only inside the triangle	**1**	
18 (a)	$3n + 13$ oe final answer	**2**	**M1** for $3n + c$ or $kn + 13$
(b)	3^{n-1} oe final answer	**2**	**M1** for recognition of terms being powers of 3
19 (a)	7.74 or 7.738 to 7.739 [billion]	**2**	**M1** for $7.23 \times \left(1+\frac{1.14}{100}\right)^6$
(b)	2042	**2**	**B1** for 28 or 28.6…or 29 or answer 2043

Question	Answer	Mark	Part marks
20 (a)	240	**2**	**M1** for any three pairs of products from 2.5×12, 2.5×26, 5×15, 5×10, 10×2
(b)	29.2 or 29.16 to 29.17	**2**	**M1** for $(5 \times 10 + 10 \times 2)$ / *their* (a) or for their total of the bars above 10 minutes ÷ *their* (a)
21	62 on answer line or clearly identified as $<ACB$ **and** two correct supporting reasons	**4**	**B1** for $<AOB = 124$ or for *their* $<AOB \div 2$ or other appropriate correct angle one step from $<ACB$ **B1** for any correct reason e.g. isosceles triangle **or** angles in triangle = 180 **B1** for a different correct reason leading directly to $<ACB$ e.g. angle at circumference is ½ angle at centre oe **B1** for 62
22 (a)	$\begin{pmatrix} 20 & 4 \\ -12 & -8 \end{pmatrix}$	**1**	
(b)	$\begin{pmatrix} 22 & 3 \\ -9 & 1 \end{pmatrix}$	**2**	**B1** for two correct elements
(c)	$-\frac{1}{7}\begin{pmatrix} -2 & -1 \\ 3 & 5 \end{pmatrix}$ oe isw	**2**	**M1** for $-\frac{1}{7}\begin{pmatrix} a & b \\ c & d \end{pmatrix}$ or $k\begin{pmatrix} -2 & -1 \\ 3 & 5 \end{pmatrix}$ or det = –7 soi
23	Correct shading with three ruled accurate solid boundary lines  	**5**	**B2** for $3x + 4y = 12$ line through (0, 3) and (4, 0) or **B1** for a diagonal line through one of these points **B1** for $y = 2x$ line through (0, 0) and (1, 2) or through (1, 2) and (3, 6) **B1** for $x = 3$ line

Question	Answer	Mark	Part marks
24 (a)	$\mathbf{a} + \mathbf{b} - \mathbf{c}$	1	
(b)	$\frac{1}{2}\mathbf{a} + \frac{1}{2}\mathbf{b} + \frac{1}{2}\mathbf{c}$	2	**M1** for $\mathbf{c}$ + ½ (*their* (a)) or for a correct route e.g. $\overrightarrow{OC} + \frac{1}{2}\overrightarrow{CB}$, $\overrightarrow{OQ}$
(c)	$\frac{1}{2}\mathbf{c} - \frac{1}{2}\mathbf{a} - \frac{1}{6}\mathbf{b}$	2	**M1** for $\frac{1}{3}\mathbf{b} - \frac{1}{2}$ (*their* (a)) or other correct route e.g. $-\frac{2}{3}\mathbf{b} - \mathbf{a}$ + *their* (b), $\overrightarrow{PO} + \overrightarrow{OQ}$

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

MATHEMATICS **0580/23**

Paper 2 (Extended) **May/June 2016**

MARK SCHEME

Maximum Mark: 70

Published

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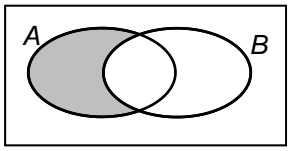
This syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

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	17	**1**	
2	71000 cao	**1**	
3	10.3 oe	**2**	**M1** for $5x = 51.5$ oe
4	0.5 or $\frac{1}{2}$	**2**	**M1** for correct first step e.g. $6y + 6 = 9$ or $y + 1 = \frac{9}{6}$
5	$\frac{1}{12} \times \frac{6}{5}$ oe $\frac{1}{10}$ final answer cao	**M1** **A1**	Must be shown
6	Correct perpendicular bisector with 2 pairs of correct arcs	**2**	**B1** for correct bisector with no arcs or incorrect arcs or for correct intersecting arcs with no/wrong line
7	$8x^6$ final answer	**2**	**B1** for $8x^k$ or cx^6
8	$\frac{29}{90}$ oe, must be a fraction	**2**	**M1** for $32.\dot{2} - 3.\dot{2}$ or **B1** for $\frac{k}{90}$
9	$\frac{1}{4}\mathbf{a} - \frac{1}{4}\mathbf{b} - \frac{1}{4}\mathbf{c}$ oe	**2**	**B1** for $\overrightarrow{GK} = \mathbf{a} - \mathbf{b} - \mathbf{c}$ oe soi or $\overrightarrow{GL} = \frac{1}{4}(\overrightarrow{GK})$ or for any correct route
10	14	**2**	**M1** for $56 = 2\times2\times2\times7$ soi or $70 = 2\times5\times7$ soi or 2×7 as final answer
11 (a)	0.6 oe	**1**	
(b)	20 0.3 oe 0.3 oe	**2**	**B1** for 20 **B1** for 0.3 oe and 0.3 oe
12	110	**3**	**B2** for $ADC = 25$ or **B1** for $AEC = 135$ or $CAE = 25$

Question	Answer	Mark	Part marks
13 (a)	72	**1**	
(b)	123	**2FT**	FT dep. on answer being obtuse **M1** for (360 – *their*(a) – 42) [÷2]
14 (a) (i)	8	**1**	
(ii)	9, 15	**1**	
(b)		**1**	
15	310 or 310.2 to 310.3	**3**	**M2** for $7^3 - \frac{1}{2} \times \frac{4}{3} \times \pi \times \left(\frac{5}{2}\right)^3$ or **M1** for $\frac{1}{2} \times \frac{4}{3} \times \pi \times \left(\frac{5}{2}\right)^3$ or **SC1** for $7^3 - \frac{4}{3} \times \pi \times \left(\frac{5}{2}\right)^3$ soi
16	90	**3**	**M1** for $y = k(x + 2)^2$ **A1** for $k = 2.5$ or **M2** for $\frac{(8+2)^2}{250} = \frac{(4+2)^2}{y}$ oe
17 (a)	10.4675 cao nfww	**2**	**B1** for 3.95 **or** 2.65 seen or **M1** for (4.0 – 0.05) × (2.7 – 0.05)
(b)	34 nfww	**2**	**B1** for 7.65 **or** 0.225 seen or **M1** for (7.6 + 0.05) ÷ (0.23 – 0.005)
18 (a)	2 cao	**2**	**M1** for rise/run attempted e.g. 4/2 or other correct method for finding gradient or **SC1** for $y = 2x - 1$ as answer
(b)	$y = 2x + 6$ oe	**2FT**	**FT** for $y =$ *their(a)*$x + 6$ **B1** for $y = mx + 6$ ($m \neq 0$ or 2) or $y = 2x$ [+ k] or $y =$ *their(a)*x [+ k] ($k \neq 6$) or for answer $2x + 6$ or answer *their(a)*$x + 6$
19 (a)	57 122	**2**	**M1** for $20\,000 \times (1 + \frac{30}{100})^4$ oe
(b)	15	**2**	**M1** for two substitutions greater than 4 e.g. $20\,000 \times (1 + \frac{30}{100})^k$ where $k > 4$

Question	Answer	Mark	Part marks
20	$y < 4$ $y \geqslant 3$ $x \geqslant 2$ $y > x$	**4**	**B1** for each correct answer to a maximum of 3 marks. First two may be combined as a single inequality e.g. $3 \leqslant y < 4$ for **B2** After 0 scored **SC1** for use of = signs or incorrect inequality signs in all four equations
21 (a)	5	**2**	**M1** for $\frac{9}{k} = \frac{6 + 4.8}{6}$ oe
(b)	24	**3**	**M2** for $\sqrt[3]{\frac{2592}{1500}} \times 20$ oe or **M1** for $\sqrt[3]{\frac{2592}{1500}}$ or $\sqrt[3]{\frac{1500}{2592}}$
22 (a)	1.5 nfww	**2**	**B1** for 2.5 or 1
(b)	3.5	**2**	**B1** for 114 soi
(c)	18	**2**	**B1** for 102 soi
23 (a)	9.11 or 9.110…	**4**	**M3** for $\sqrt{5^2 + 3^2 + 7^2}$ or **M2** for $\sqrt{5^2 + 3^2}$ or $\sqrt{3^2 + 7^2}$ or $\sqrt{5^2 + 7^2}$ or **M1** for $5^2 + 3^2$ or $3^2 + 7^2$ or $5^2 + 7^2$
(b)	33.3 or 33.28 to 33.29	**3**	**M2** for sin = $\frac{5}{their(a)}$ oe or **B1** for identifying angle *ECH*

CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International General Certificate of Secondary Education

MARK SCHEME for the March 2016 series

0580 MATHEMATICS

0580/22 Paper 2 (Paper 22 – Extended), maximum raw mark 70

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

Qu.	Answers	Mark	Part Marks
1	7, – 4	**1**	
2	$2x(1 - 2y)$ final answer	**2**	**M1** for $2(x - 2xy)$ or $x(2 - 4y)$ or for correct answer then spoilt
3	75.1 or 75.09 to 75.10	**2**	**M1** for cos […=] $\frac{0.9}{3.5}$
4	$n < 1.5$ oe final answer	**2**	**B1** for 1.5 oe in answer or **M1** for $3 > 8n - 6n$ oe
5	9.1 oe	**2**	**M1** for $\frac{5.2}{PQ} = \frac{12.4}{21.7}$ oe
6	$\frac{4}{9}$ oe, must be fraction	**2**	**M1** for $10 \times 0.\dot{4} - 0.\dot{4}$ oe
7	130 or 130.0 to 130.1	**2**	**M1** for ½ × 22.3 × 27.6 × sin25
8	$\frac{1}{5}\begin{pmatrix} 7 & 2 \\ 8 & 3 \end{pmatrix}$ oe isw	**2**	**M1** for $\frac{1}{5}\begin{pmatrix} a & b \\ c & d \end{pmatrix}$ soi or $k\begin{pmatrix} 7 & 2 \\ 8 & 3 \end{pmatrix}$ $k \neq 0$ or det = 5 soi
9	$\frac{35(or\ 95)}{60} + \frac{39}{60}$ $2\frac{7}{30}$	**M1** **A2**	accept $\frac{35k(or\ 95k)}{60k} + \frac{39k}{60k}$ or **A1** for $\frac{67}{30}$ or $\frac{134k}{60k}$ or $1\frac{74k}{60k}$ or $2\frac{14k}{60k}$
10	64 000	**3**	**M2** for $\frac{1.6 \times 20000^2}{100^2}$ oe or **M1** for figs 64 in answer or $1\,cm^2 = 40\,000\,m^2$

Qu.	Answers	Mark	Part Marks
11	16.58 cao	**3**	**B2** for 16.6 or 16.580 to 16.583 final answer or 16.58 not as final answer or **M1** for $\frac{38}{360}\times2\times\pi\times25$ and **B1** for rounding their more accurate answer correctly to 4sf
12	87 cao nfww	**3**	**B2** for 87.04…. or 87.0 nfww or **M1** for 500.5 or 5.75 seen or for (500 + 0.5) ÷ (5.8 – 0.05) and **B1** for **truncating** their decimal answer to an integer
13 (a)	$2^5\times3^2\times7$ oe final answer	**3**	**B2** for product of two of 2^5, 3^2, 7 or **B1** for 2, 3 and 7 seen or **M1** for 2×1008 or 3×672 or 7×288 soi
(b)	2.016×10^3	**1**	
14 (a)	x^8y^7 final answer	**2**	**B1** for answer x^8y^k or $x^ky^7\ (k\neq0)$
(b)	$27p^6m^{15}$ final answer	**2**	**B1** for 2 correct of 27, p^6, m^{15} in a product as answer
15	111.2 or 111.1 to 111.2	**4**	**M2** for [cos =] $\frac{2.8^2+3.6^2-5.3^2}{2\times2.8\times3.6}$ or **M1** for implicit form **A1** for [cos =] –0.362 to –0.361
16	44.1 or 44.07...	**4**	**M1** for 4 of mid-values 15 30 45 55 75 soi **M1** for $\sum fx$ for any x in intervals including boundaries **M1 dep** for $\sum fx \div 70$ **Dep** on 2nd **M** mark earned

Qu.	Answers	Mark	Part Marks
17	$\frac{-(-11)\pm\sqrt{(-11)^2-4(3)(4)}}{2\times 3}$	**2**	**B1** for $\sqrt{(-11)^2-4(3)(4)}$ or better and, if in form $\frac{p+\sqrt{q}}{r}$ or $\frac{p-\sqrt{q}}{r}$, **B1** for $p=-(-11)$ and $r=2(3)$
	0.41 and 3.26 final ans cao	**B1B1**	**SC1** for 0.4 and 3.3 or 0.409... and 3.257... or -0.41 and -3.26 or 0.41 and 3.26 seen in working
18 (a)	47	**1**	
(b)	117	**2**	**M1** for 360 – (115 + 85 + 97)
(c)	244	**2**	**B1** for 116 seen at centre or 122 seen at circumference
19	$y<2$ oe and $x\geqslant -2$ oe	**2**	**B1** for either correct
	$y\geqslant \frac{1}{2}x+1$ oe and $y\leqslant -x+3$ oe	**3**	**B2** for either $y\geqslant \frac{1}{2}x+1$ oe or $y\leqslant -x+3$ oe or **SC2** for $y=\frac{1}{2}x+1$ oe **and** $y=-x+3$ oe or **SC1** for $y=\frac{1}{2}x+1$ oe **or** $y=-x+3$ oe or **SC4** for $y\leqslant 2$ oe, $x>-2$ oe, $y>\frac{1}{2}x+1$ oe and $y<-x+3$ oe
20 (a)	$9a+3b$	**1**	
(b)	$36a+6b=96$ or $9a+3b=21$	**B1**	
	for correct method to eliminate one variable	**M1**	
	$a=3$	**A1**	If **M0 A0 A0** scored **SC1** for
	$b=-2$	**A1**	2 values satisfying $36a+6b=96$ or $9a+3b=21$ or if no working shown, but 2 correct answers given

Qu.	Answers	Mark	Part Marks
21 (a)	$\frac{2}{3}$ oe	1	
(b)	*their* $\frac{2}{3}$, $\frac{7}{8}$, $\frac{5}{8}$ oe	2	**B1** for either $\frac{7}{8}$ or $\frac{5}{8}$
(c) (i)	$\frac{1}{24}$ oe	2	**M1** for $\frac{1}{3}\times\frac{1}{8}$ seen
(ii)	$\frac{17}{24}$ oe	3	**M2FT** for $\frac{1}{3}\times\frac{7}{8}+\frac{2}{3}\times\frac{5}{8}$ or **M1FT** for $\frac{1}{3}\times\frac{7}{8}$ or $\frac{2}{3}\times\frac{5}{8}$

CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International General Certificate of Secondary Education

MARK SCHEME for the October/November 2015 series

0580 MATHEMATICS

0580/21 Paper 2 (Extended), maximum raw mark 70

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SC Special Case
nfww not from wrong working
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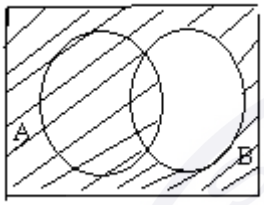
Question	Answer	Mark	Part Marks
1	[+]17	**1**	
2		**1**	
3	Triangle (3, –2), (4, –2), (4, –1)	**2**	**B1** for movement 2 right or 3 down
4	628	**2**	**M1** for $\frac{785}{1+4}[\times 4]$
5	7 nfww	**2**	**M1** for 7.5×8 or for $(7+8+8+y+6+9+10+5) \div 8 = 7.5$ or better oe
6	$\frac{\sqrt{4} \times 30}{9-3}$ 10 nfww	**M1** **A1**	Allow one error and 2 for $\sqrt{4}$ and 6 for 9 – 3
7	18	**2**	**M1** for $36 = 2 \times 2 \times 3 \times 3$ soi or $90 = 2 \times 3 \times 3 \times 5$ soi or listing the correct factors of 36 and 90 showing a minimum of 2, 3, 6, 9 and 18
8 (a)	90	**1**	
(b)	8.29 or 8.289… to 8.29	**2**	**M1** for $\frac{OP}{11} = \tan 37^\circ$ oe

9 **(a)**	$(a+3c)(x+y)$ final answer	**2**	**B1** for $a(x+y)+3c(x+y)$ or $x(a+3c)+y(a+3c)$
(b)	$3(a-2b)(a+2b)$ final answer	**3**	**B2** for $3(a-2b)(a+2b)$ seen and then spoiled or $(3a-6b)(a+2b)$ or $(a-2b)(3a+6b)$ or $(a-2b)(a+2b)$ or **B1** for $3(a^2-4b^2)$
10	$\frac{14}{90}$ oe must be fraction	**2**	**M1** for $15.\dot{5}-1.\dot{5}$ oe or **B1** for $\frac{k}{90}$
11	31.4 or 31.36 to 31.37	**3**	**M2** for $\left[\frac{2}{2}\times\right]6.1\times\pi+2\times6.1$ oe or **B2** for 19.16 to 19.17 or 19.2 or **M1** for $6.1\times\pi$ or for $12.2\times\pi$
12	81	**3**	**M1** for $V=k(r+1)^3$ and **A1** for $k=3$ or **M2** for $\frac{V}{24}=\frac{3^3}{2^3}$ oe
13	$[\pm]\sqrt{\frac{y-b}{a}}$ oe final answer	**3**	**M1** for correctly subtracting to isolate term in x^2 **M1** for correct division **M1** for the final stage of correctly finding the square root
14	19 nfww	**4**	**B3** 19.3 or 19.28 to 19.29 or **M2** for $\frac{300\times60^2}{56\times1000}$ oe or **M1** for distance divided by speed e.g. *their* 300 ÷ *their* 56 or $\frac{56\times1000}{60^2}$ If **B0** then **B1** for seeing their answer in decimal form correctly written to the nearest integer

15		$\frac{x+4}{x+1}$ final answer	**4**	**B1** for $(x-4)(x+4)$ and **B2** for $(x-4)(x+1)$ or **SC1** for $(x+a)(x+b)$ where $a+b=-3$ or $ab=-4$
16		198	**4**	**B3** for 197.7…. or answer 198.00 or **M2** for $1800\times\left(1+\frac{1.5}{100}\right)^7-1800$ or **B2** for answer 1998 or **M1** for $1800\times\left(1+\frac{1.5}{100}\right)^7$ If **B0** then **B1** for seeing their answer in decimal form correctly written to the nearest integer
17	**(a)**	Enlargement $\frac{1}{2}$ origin oe	**1** **1** **1**	
	(b)	$\begin{pmatrix}\frac{1}{2} & 0\\ 0 & \frac{1}{2}\end{pmatrix}$ oe	**2FT**	correct or **FT** *their* **(a)** allow for 2 marks $\begin{pmatrix}k & 0\\ 0 & k\end{pmatrix}$ where k = *their* scale factor in **(a)** **B1** for one correct row or correct column or $\begin{pmatrix}k & 0\\ 0 & k\end{pmatrix}$ $(k\neq 0$ or $1)$
18	**(a)**	$\begin{pmatrix}-9 & -5\\ -7 & -5\end{pmatrix}$	**2**	**B1** for two correct elements
	(b)	$\frac{1}{10}\begin{pmatrix}4 & 2\\ -3 & 1\end{pmatrix}$ oe	**2**	**B1** for $\frac{1}{10}\begin{pmatrix}a & b\\ c & d\end{pmatrix}$ or $k\begin{pmatrix}4 & 2\\ -3 & 1\end{pmatrix}$ seen or det = 10 soi
	(c)	Not the same order oe	**1**	

19	281 or 280.8 to 280.9…	**5**	**M2** for $\frac{25}{360}\times 2\times\pi\times 15\times 5$ oe or **M1** for $\frac{25}{360}\times 2\times\pi\times 15$ oe and **M1** for $[2]\times\frac{25}{360}\times\pi\times 15^2$ oe and **B1** for $15\times 5[\times 2]$
20 (a)	0.16 oe	**2**	**M1** for 0.4×0.4 If zero scored **SC1** for fully correct evaluated method involving a without replacement method
(b)	0.58 oe	**4**	**M3** for $1-(0.4^2+0.5^2+0.1^2)$ oe or **M2** for $0.4^2+0.5^2+0.1^2$ ALT method **M3** for $0.4\times(0.5+0.1)+0.5\times(0.4+0.1)+0.1\times(0.4+0.5)$ oe or **M2** for addition of any **three** of: $0.4\times 0.5, 0.4\times 0.1, 0.5\times 0.4, 0.5\times 0.1, 0.1\times 0.4$ and 0.1×0.5 or **M1** for addition of any **two** of: $0.4\times 0.5, 0.4\times 0.1, 0.5\times 0.4, 0.5\times 0.1, 0.1\times 0.4$ and 0.1×0.5 If zero scored **SC2** for fully correct evaluated method involving a without replacement method
21 (a)	512	**2**	**B1** for $[f(2)=]8$ or **M1** for $(x^3)^3$ or better
(b)	$6x-2$ or $2(3x-1)$ final answer	**2**	**B1** for $3(2x+1)-5$ or better
(c)	$\frac{1}{2}(x-1)$ oe	**2**	**M1** for correct first step eg $y-1=2x$ or $\frac{y}{2}=x+\frac{1}{2}$ or $x=2y+1$ or better

CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International General Certificate of Secondary Education

MARK SCHEME for the October/November 2015 series

0580 MATHEMATICS

0580/22 Paper 2 (Extended), maximum raw mark 70

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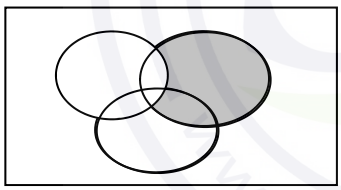
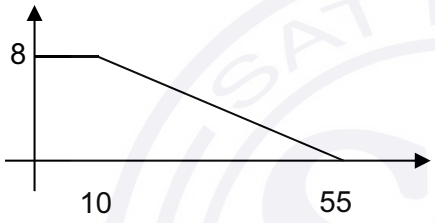
Question	Answer	Mark	Part Marks
1	17	**1**	
2	Parallelogram	**1**	
3	694 or 694.4[4...]	**2**	**M1** for 950 ÷ 1.368
4	5.83 or 5.830 to 5.831	**2**	**M1** for $\sqrt{(-3)^2+5^2}$
5	262 or 261.7 to 261.83…	**2**	**M1** for $\frac{1}{2}\times\frac{4}{3}\pi\times5^3$ If zero scored **SC1** for final answer 524 or 523.5 to 523.7
6 (a)	18	**1**	
(b)		**1**	
7	$\begin{pmatrix} 11 & -8 \\ -6 & 8 \end{pmatrix}$	**2**	**B1** for two correct elements
8	3826 or 3826.38	**2**	**M1** for $8000\times\left(1-\frac{10}{100}\right)^7$ oe
9	0.3	**2**	**M1** for $\frac{k\times50000\times50000}{100000\times100000}$ oe If zero scored **SC1** for figs 3
10	54	**3**	**M2** for $14.4\times\frac{15}{4}$ oe or **M1** for $14.4\div4$ or $\frac{4}{15}$ associated with 14.4 If zero scored **SC1** for final answer 19.6[4]

11	6.24 or 6.244 to 6.245	**3**	**M2** for $\sqrt{8^2 - 5^2}$ or **M1** for $8^2 = 5^2 + x^2$ or better
12	$2\frac{3}{12}$ or $1\frac{15}{12}$ or $\frac{27}{12}$ or $\frac{9\times3}{4\times3}$ *their* $(\frac{27}{12} - \frac{11}{12} = \frac{16}{12})$ oe $1\frac{1}{3}$ or $\frac{4}{3}$ cao	**M1** **M1** **A1**	Accept any correct conversion with common denominator $12k$ Correct resolving of *their* subtraction with denominator $12k$ showing full working Working and then simplified answer must both be seen
13	8.12 or 8.118…	**3**	**M2** for $\frac{12.4}{\sin 74}\times\sin 39$ or **M1** for implicit version $\frac{\sin 39}{y} = \frac{\sin 74}{12.4}$ oe
14	2500 nfww	**3**	**M2** for $2475 \div \left(1 - \frac{1}{100}\right)$ oe or **M1** for 2475 associated with 99%
15 (a)	$(3w+10)(3w-10)$ final answer	**1**	
(b)	$(m+n)(p-6q)$ oe final answer	**2**	**B1** for $p(m+n) - 6q(m+n)$ oe or $m(p-6q) + n(p-6q)$ oe
16	36.8 or 36.80 to 36.81	**3**	**M1** for $\frac{26}{360}\times2\times\pi\times15$ **M1** for 2×15 + a term involving π
17	175	**3**	**M1** for $y = k(x-1)^2$ oe **A1** for $k = 7$ or **M2** for $\frac{63}{(4-1)^2} = \frac{y}{(6-1)^2}$ oe
18	16.2 16.6 nfww	**3**	**M1** for two of 2.35, 5.75, 2.45, 5.85 seen or $2 \times (5.8 - 0.05 + 2.4 \quad 0.05)$ or $2 \times (5.8 + 0.05 + 2.4 + 0.05)$ **A1** 16.2 or 16.6 in either answer space If zero scored **SC2** for both correct reversed answers provided 16.6 nfww

19		$\sqrt{(-6)^2 - 4(5)(-3)}$ or better seen	**B1**	If completing the square **B1** for $\left(x - \frac{3}{5}\right)^2$ oe
		if $\frac{p+\sqrt{q}}{r}$ or $\frac{p-\sqrt{q}}{r}$ seen then $p = -(-6)$ and $r = 2 \times 5$	**B1**	**B1** for $\frac{3}{5} + \sqrt{\frac{3}{5} + \left(\frac{3}{5}\right)^2}$ or $\frac{3}{5} - \sqrt{\frac{3}{5} + \left(\frac{3}{5}\right)^2}$ oe
		–0.38 1.58 cao final answers	**B1** **B1**	If B0, **SC1** for – 0.4 and 1.6 or – 0.379[795..] and 1.579[795..] or – 1.58 and 0.38 as final answers or – 0.38 and 1.58 seen in working
20	**(a)**		**B1** **B1**	line from (0, 8) to (10, 8) line from *their* (10, 8) to (55, 0)
	(b)	260	**3FT**	**M2FT** for $8 \times 10 + 0.5 \times 8 \times 45$ oe or for a fully correct area calculation for *their* graph or **M1FT** for 8×10 or $0.5 \times 8 \times 45$ or for one correct area calculation for *their* graph
21	**(a)**	12	**2**	**M1** for $\frac{7.2}{x} = \frac{15}{25}$ oe or better eg $7.2 \times \frac{25}{15}$
	(b)	12.8	**3**	**M2** for $16 \times \sqrt[3]{\frac{192}{375}}$ oe or **M1** for $\sqrt[3]{\frac{192}{375}}$ or $\sqrt[3]{\frac{375}{192}}$ oe or $\left(\frac{16}{y}\right)^3 = \frac{375}{192}$ oe
22	**(a)**	3.5 nfww	**3**	**M1** for Σfx soi **M1** (dep) for ÷ 24
	(b)	2 nfww	**3**	**M2FT** for $\frac{\text{their } 84 + x}{25} = 3.44$ or better or **M1** for 25×3.44

23	**(a)**	$\frac{8}{14}$ and $\frac{5}{13}$	**1**	
		$\frac{6}{13}$ and $\frac{7}{13}$	**1**	
	(b) **(i)**	$\frac{30}{182}$ oe	**2**	**M1FT** for $\frac{6}{14} \times$ *their* $\frac{5}{13}$
	(ii)	$\frac{126}{182}$ oe	**3**	**M2FT** for $1 - \frac{8}{14} \times \frac{7}{13}$ or $\frac{6}{14} \times \frac{5}{13} + \frac{6}{14} \times \frac{8}{13} + \frac{8}{14} \times \frac{6}{13}$ or $\frac{6}{14} + \frac{8}{14} \times \frac{6}{13}$ oe or **M1FT** for sum of any two of $\frac{6}{14} \times \frac{5}{13}$ or $\frac{6}{14} \times \frac{8}{13}$ or $\frac{8}{14} \times \frac{6}{13}$

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1	170 cao	**1**	
2	[0].101 or [0].1005 to [0].1006	**1**	
3	[0].00017	**1**	
4	6	**1**	
5 (a)	12, 15	**1**	
(b)	11, 13	**1**	
6	$5 - u$ final answer	**2**	**B1** for $5 + ku$ or $j - u$, $k \neq 0$ as final answer
7	$2x(1-2x)$ final answer	**2**	**B1** for $2(x - 2x^2)$ or $x(2 - 4x)$ as final answer
8	4140	**2**	**M1** for $(25-2)\times 180$ or $25\times\left(180-\frac{360}{25}\right)$
9	23.6 or 23.57 to 23.58	**2**	**M1** for $\sin[=]\frac{2}{5}$ oe
10 (a)	625	**1**	
(b)	9	**1**	
11 (a)	$\frac{3x}{2}$ oe final answer	**1**	
(b)	$\frac{x^2+2}{x}$ oe final answer	**1**	
12 (a)	10	**1**	
(b)	$P \cup Q'$ oe	**1**	
13	10	**2**	**B1** for $7\times 3 - 2\times u$

Question	Answer	Mark	Part marks
14	6	**3**	**M2** for $4.5 \times \sqrt[3]{\frac{128}{54}}$ oe or better **M1** for $\sqrt[3]{\frac{128}{54}}$ or $\sqrt[3]{\frac{54}{128}}$ oe or $\frac{54}{128} = \left(\frac{4.5}{x}\right)^3$ oe
15	Any two of $\frac{8}{12}, \frac{2}{12}$ or $\frac{3}{12}$ oe $\frac{8}{12} + \frac{2}{12} - \frac{3}{12}$ oe $\frac{7}{12}$	**M1** **M1** **A1**	**M1** for any 2 correct over a common denominator e.g. $\frac{4}{6}$ and $\frac{1}{6}$ or **SC2** for final answer $\frac{13}{12}$ or $1\frac{1}{12}$ with full working
16	$\frac{2(s-ut)}{t^2}$ oe final answer	**3**	**M1** for correctly isolating term in a **M1** for correctly multiplying by 2 (or -2) **M1** for correctly dividing by t^2 (or $-t^2$)
17	$\frac{x^{16}}{2y^4}$ final answer	**3**	**B2** for fraction as final answer with two of x^{16}, 2, y^4 correct and in correct position or **B1** for fraction as final answer with one of x^{16}, 2, y^4 correct and in correct position
18	0.96 oe	**3**	**M2** for $1 - 0.2 \times 0.2$ or $0.8 + 0.2 \times 0.8$ or $0.8 \times 0.8 + 0.8 \times 0.2 + 0.2 \times 0.8$ or **B1** for one of 0.2×0.2, 0.8×0.8, 0.8×0.2, 0.2×0.8 seen
19	$\frac{18}{(x+2)^2}$ oe	**2**	**M1** for $y = \frac{k}{(x+2)^2}$ or better If zero scored **SC1** for final answer of $y = \frac{k}{(x+2)^2}$ where $k \neq 0$ or 18
20	18 cao nfww	**3**	**M2** for $\frac{877.5}{7.5 \times 6.5}$ or **B1** for any two of 877.5, 7.5 and 6.5 seen

Question	Answer	Mark	Part marks
21	$\sqrt{(4)^2 - 4(3)(-5)}$ or better seen if $\frac{p+\sqrt{q}}{r}$ or $\frac{p-\sqrt{q}}{r}$ seen then $p = -4$ and $r = 2(3)$ – 2.12 0.79 final answers	**B1** **B1** **B1** **B1**	If completing the square **B1** for $\left(x+\frac{2}{3}\right)^2$ oe **B1** for $-\frac{2}{3}+\sqrt{\frac{5}{3}+\frac{2^2}{3^2}}$ or $-\frac{2}{3}-\sqrt{\frac{5}{3}+\frac{2^2}{3^2}}$ If B0, **SC1** for 0.786[299] **and** −2.119[632] – 2.1 **and** 0.8 or – 2.120 or – 2.119 **and** 0.786 or 2.12 and –0.79 final answers –2.12 **and** 0.79 seen not as final answers
22	$\frac{1}{2-5w}$ final answer nfww	**4**	**B1** for $2(2 + 5w)$ **B1** for $2(4 – 25w^2)$ **B1** for $[2](2 + 5w)(2 – 5w)$ ALT method **B3** for $\frac{4+10w}{(4+10w)(2-5w)}$ or **B2** for $(4 + 10w)(2 – 5w)$
23 (a)	$\frac{1}{3}(-\mathbf{a}+\mathbf{b})$ oe	**2**	**M1** for any correct route eg $AO+OB+\frac{2}{3}BA$ or **B1** for $\overrightarrow{AB} = -\mathbf{a}+\mathbf{b}$ oe
(b)	$\frac{2}{3}\mathbf{a}+\frac{1}{3}\mathbf{b}$ oe simplified	**2FT**	**FT** *their* **(a)** + **a** simplified only if in terms of **a** and **b**. **M1** for identifying $\overrightarrow{OC}$ as position vector or correct route in any form or for correct unsimplified answer
24 (a)	6.2	**1**	
(b)	5.8	**2**	**M1** for 24 soi
(c)	70	**2**	**M1** for 10 soi
25	2.9[0] or 2.898 to 2.901	**5**	**M4** for $\frac{30}{360}\times\pi\times8^2 - 0.5\times8\cos30\times8\sin30$ or **M1** for $\frac{30}{360}\times\pi\times8^2$ and **M2** for [area of triangle =] $0.5\times8\cos30\times8\sin30$ oe or **M1** for $\frac{OC}{8} = \cos30$ oe or $\frac{BC}{8} = \sin30$ oe

26	**(a)**	12.5 oe	**2**	**M1** for $45 \times 1000 \div 60 \div 60$ oe
	(b)	1.25 oe	**1FT**	**FT** *their* **(a)** $\div 10$
	(c)	312.5 oe	**3FT**	**FT** for $25 \times$ *their* **(a)** **M2** for $20 \times$ *their* $12.5 + 0.5 \times 10 \times$ *their* 12.5 oe or **M1** for one correct relevant area calculation or **SC2** for final answer 1125

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Question.	Answer	Mark	Part Marks
1	9.5	**1**	
2	7.37 or 7.371...	**1**	
3	2.7×10^5	**1**	
4	$2x^2 + 8x - 35$ final answer	**2**	**B1** for 2 correct terms in final answer or **M1** for $2x^2 + 3x$ or $5x - 35$
5	Sammy and correct reason with 25.7% oe shown	**2**	**B1** for 25.7% or 0.257... seen or conversion of 26% to fraction and common denominator
6	44	**2**	**B1** for 75.5 or 119.5 seen
7	$24u^2w^3$ final answer	**2**	**B1** for 2 correct elements in final answer
8	13.6 or 13.60...	**3**	**M2** for $\sqrt{(-4-7)^2 + (6-(-2))^2}$ oe or **M1** for $(-4-7)$ oe or $(6-(-2))$ oe
9	$\frac{9}{5}$ *their* $\frac{9}{5} \times \frac{7}{3}$ or $\frac{9 \times 7}{5 \times 3}$ $\frac{21}{5}$ or $4\frac{1}{5}$ cao	**B1** **M1** **A1**	or $\frac{63}{35}$ or *their* $\frac{63}{35} \div \frac{15}{35}$ or equivalent division with fractions with common denominators
10	2520	**3**	**M2** for $12 \times (1 + 6) \div 2$ oe or **M1** for 1 area correct If zero scored **B1** for top speed = 720 m per min or total time = 360 sec

Question.	Answer	Mark	Part Marks
11 (a)	$4n$ oe final answer	1	
(b)	$3n^2 + 8$ oe final answer	2	**M1** for a quadratic expression as final answer or $3n^2 + 8$ oe in working
12	18	3	**M2** for $2(2 + 4)^2 = p(-2 + 4)^2$ oe **M1** for $p = \frac{k}{(q+4)^2}$ **A1** for $k = 72$
13	72	3	**M2** for $\frac{1280}{64} \times \frac{60 \times 60}{1000}$ **M1** for working out distance ÷ speed e.g. figs $1280 \div 64$ or figs $\frac{1280}{\textit{their speed}}$ or for working out km/h to m/s conversion e.g. $64 \times \frac{1000}{60 \times 60}$ oe or *their* $\left(\frac{1280}{64}\right) \times \frac{60 \times 60}{1000}$ oe
14 (a)	**a** + 2**b** – **a** or **a** – (**a** – 2**b**) oe	1	
(b)	Parallelogram	1	
	PM **equal** and parallel to *QR* **or** *PM* or *PS* parallel to *QR* **and** *MR* found = **a** so 2 pairs of parallel sides	1	**SC1** for answer trapezium with reason *PM* parallel to *QR*
15	$y < 8$	1	
	$y \geqslant 6 - x$ oe **and** $y \geqslant x + 2$ oe	3	**B2** for either $y \geqslant 6 - x$ oe **or** $y \geqslant x + 2$ oe or **SC2** for $y = 6 - x$ oe **and** $y = x + 2$ oe or **SC1** for $y > 6 - x$ or $y = 6 - x$ **or** $y > x + 2$ or $y = x + 2$

Question.	Answer	Mark	Part Marks
16	1597 cao	**4**	**B3** for 1597.39.. or 1597.3[9...] or 1597.4 or 6597 or **B2** for 6597.3[9...] or 6597.4 or **B1** for $5000\left(1+\frac{2}{100}\right)^{14}$ If **B1** scored or **B0** scored and an attempt at compound interest is shown **SC1** for *their* 6597[...] – 5000 evaluated correctly provided answer positive and **SC1** for *their* final answer rounded correctly to nearest $ from their more accurate answer
17 (a)	$2\times3\times5$	**2**	**B1** for 2, 3, 5 as prime factors
(b)	90	**2**	**B1** for 90*k* or for listing multiples of each up to 90 or $2\times3^2\times5$
18	Correctly equating one set of coefficients	**M1**	
	Correct method to eliminate one variable	**M1**	Dependent on the coefficients being the same for one of the variables Correct consistent use of addition or subtraction using their equations
	$x = 0.8$	**A1**	If zero scored **SC1** for 2 values satisfying one of the original equations
	$y = -3$	**A1**	or if no working shown, but 2 correct answers given
19 (a)	7.5	**2**	**M1** for $[10]\times\frac{6}{8}$ oe
(b)	12 cao	**2**	**M1** for $9\times\frac{8}{6}$ oe or $9\times\frac{10}{\textit{their}}$ **(a)**
20 (a)	$(p+t)(y+2x)$ final answer	**2**	**B1** for $y(p+t)+2x(p+t)$ or $p(y+2x)+t(y+2x)$
(b)	$7(h+k)(h+k-3)$ final answer	**2**	**B1** for $7\left((h+k)^2-3(h+k)\right)$ or $(h+k)(7(h+k)-21)$

Question.	Answer	Mark	Part Marks
21	285 cao	**4**	**M1** for $\frac{1}{3}\times\pi\times4^2\times9$, 48π **M1** for $\frac{1}{2}\times\frac{4}{3}\times\pi\times4^3$, $\frac{128\pi}{3}$ **A1** for 284.8 to 284.9, $\frac{272\pi}{3}$ If **A0** then **B1** for *their* final answer rounded correctly to nearest whole number from their more accurate answer dependent on at least **M1**
22 (a)	$\begin{pmatrix}22 & 17\\ 18 & 7\end{pmatrix}$	**2**	**M1** for a 2 × 2 matrix with 2 correct elements
(b)	$\frac{1}{2}\begin{pmatrix}4 & -3\\ -6 & 5\end{pmatrix}$	**2**	**M1** for $\frac{1}{2}\begin{pmatrix}a & b\\ c & d\end{pmatrix}$ or $k\begin{pmatrix}4 & -3\\ -6 & 5\end{pmatrix}$ soi or det = 2 soi
23 (a)	-13	**1**	
(b)	$-3x-1$ or $5-3(x+2)$	**1**	
(c)	$9x-10$ cao	**2**	**M1** for $5-3(5-3x)$
(d)	$\frac{5-x}{3}$ final answer oe	**2**	**M1** for correct first step e.g. $y+3x=5$ or $\frac{y}{3}=\frac{5}{3}-x$ or $y-5=-3x$ or better or for interchanging x and y, e.g. $x=5-3y$, this does not need to be the first step

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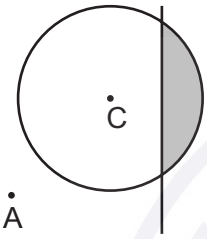
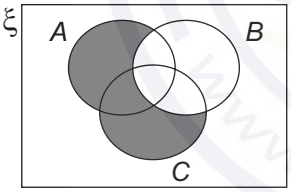
1	5.34×10^7	**1**	
2	9 [h] 30 [min] cao	**1**	
3	$\frac{1}{4}$ or 0.25	**1**	
4 (a)	7	**1**	
(b)	Any number except 3, 7 or 20	**1**	
5	0.2 oe	**2**	**M1** for $1 – (0.15 + 0.3 + 0.35)$
6	8×10^3 or 8000 nfww	**2**	**M1** for $w + 4 \times 10^3 = 1.2 \times 10^4$ oe or $5w + 20 \times 10^3 = 6 \times 10^4$ oe
7	Parallel	**1**	
	Same length	**1**	
8	$2n^2 + 3$ oe final answer	**2**	**M1** for a quadratic expression as final answer or $2n^2 + 3$ oe in working
9	$\frac{23}{90}$ oe, must be fraction	**2**	**M1** for $25.\dot{5} - 2.\dot{5}$ oe e.g. $2.55^r – 0.25^r$ or **B1** for $\frac{k}{90}$
10	7	**2**	**B1** for 120.5 or 113.5 seen
11	$\frac{1}{5}\begin{pmatrix} -2 & -1 \\ 11 & 3 \end{pmatrix}$ oe	**2**	**M1** for $k\begin{pmatrix} -2 & -1 \\ 11 & 3 \end{pmatrix}$ soi or $\frac{1}{5}\begin{pmatrix} a & b \\ c & d \end{pmatrix}$ or det = 5 soi

12		$\frac{8}{3}$ $\frac{4}{5} \times \textit{their} \frac{3}{8}$ oe $\frac{3}{10}$ cao	**B1** **M1** **A1**	or $\frac{40}{15}$ accept $\frac{3}{8}$ or $\frac{15}{40}$ or $\frac{12}{15} \div \textit{their} \frac{40}{15}$ or equivalent division with fractions with common denominators
13	**(a)**	11	**1**	
	(b)	8	**2FT**	**FT** 30 – 2 × *their* **(a)** or **M1** for $4 \times 7 = 2(x - 1) + FG$ oe or $4(x - 4) = 2(x - 1) + FG$ oe or $2 \times 7 + 2(x - 4) = 2(x - 1) + FG$ oe Allow x to be *their* **(a)** in each
14		684	**3**	**M2** for $0.95 \times 4 \times 3 \times 60$ or **M1** for 0.95×4 [× 3] or $4 \times 3 \times 60$ or $0.95 \times 3 \times 60$ or $0.95 \times 4 \times 60$
15		$\frac{2x - 23}{(x + 2)(2x - 5)}$ final answer	**3**	**B1** for a common denominator of $(x + 2)(2x - 5)$ **B1** for $3(2x - 5) - 4(x + 2)$ or better or **SC2** for final answer $\frac{2x - 7}{(x + 2)(2x - 5)}$ or **SC1** for numerator of $2x - 7$ in final answer
16	**(a) (i)**	0.5 or – 0.5 or $\frac{1}{2}$ or $-\frac{1}{2}$	**1**	
	(ii)	4	**1**	
	(b)	1.37 or 1.37[4…]	**1**	
17	**(a)**	[y =] $2x + 3$ cao	**3**	**M2** for correct unsimplified equation or **B1** for gradient = $(11 - 3) \div (4 - 0)$ or better and **B1** for $c = 3$
	(b)	$-\frac{1}{2}$ oe	**1FT**	$-1 \div$ *their* m

18	**(a)**	78	**3**	**M2** for $5 \times 12 + \frac{1}{2} \times 12 \times (8 - 5)$ **or** $\frac{1}{2} \times 6 \times (5 + 8) \times 2$ oe or **M1** for 5×12, $\frac{1}{2} \times 12 \times (8 - 5)$, $\frac{1}{2} \times 6 \times (5 + 8)$ or $12 \times 8 - (\ldots)$
	(b)	1170	**1FT**	$15 \times$ *their* **(a)**
19	**(a)**		**1**	Correct circle, radius 4 cm centre *C*
	(b)		**2**	**B2** for correct bisector with 2 pairs of correct arcs or **B1** for correct bisector with no/wrong arcs
	(c)		**1**	Correct complete boundary and correct shading. Dep on at least **B1** in **(b)**
20	**(a) (i)**	4	**1**	
	(ii)	{3, 9}	**1**	
	(iii)	fewer than 6 numbers from {1, 3, 5, 7, 9, 11} or ∅	**1**	
	(b)		**1**	
21	**(a)**	$m = 2$ $n = -10$	**2**	**B1** for $m = 2$ **B1** for $n = -10$ If 0 scored **SC1** for $(x + 2)^2$ in working or $x^2 + 2mx + m^2 + n$ and equating coefficients $2m[x] = 4[x]$ or $m^2 + n = -6$
	(b)	**1.16** or 1.16[2…] from completing square	**2FT**	**FT** dep on negative *n* **B1** for $(x + \textit{their } m)^2 = -\textit{their } n$ or **SC1** for correct answer from using formula or for both answers 1.16 **and** –5.16 whatever method used

22	**(a)**	44	**2**	**M1** for 48 soi
	(b)	24	**2**	**M1** for 40 or 16 or both lines drawn from 15 **and** 45 across and down to the horizontal axis
	(c)	5	**2**	**M1** for answer 55 or line or mark on graph indicating 55
23	**(a)**	0.4 or $\frac{2}{5}$	**1**	
	(b)	1430	**3**	**M2** for correct, complete, area statement e.g. $120 \times 10 + \frac{1}{2} \times 20 \times 8 + \frac{1}{2} \times 30 \times 10$ oe or **M1** for one area calculation e.g. 10×120 or $\frac{1}{2} \times 20 \times 8$ or $\frac{1}{2} \times 30 \times 10$
	(c)	11.9 or 11.91 to 11.92	**1FT**	*their* **(b)** ÷ 120
24	**(a)**	$9x^2$	**1**	
	(b)	$\frac{x-5}{3}$	**2**	**M1** for correct first algebraic step e.g. $y - 5 = 3x$ or $\frac{y}{3} = x + \frac{5}{3}$ or better or for interchanging x and y, e.g. $x = 3y + 5$, this does not need to be the first step
	(c)	$9x + 20$ cao final answer	**2**	**M1** for $3(3x + 5) + 5$

CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International General Certificate of Secondary Education

MARK SCHEME for the May/June 2015 series

0580 MATHEMATICS

0580/23 Paper 2 (Extended), maximum raw mark 70

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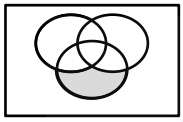
nfww not from wrong working
soi seen or implied

Question	Answer	Mark	Part Marks
1	168	**2**	**M1** for 240 ÷ (7 + 3) or better
2	$3x(3x-2)$ final answer	**2**	**B1** for $3(3x^2-2x)$ or $x(9x-6)$
3	66.4[2…]	**2**	**M1** for cos […=] $\frac{2}{5}$ oe
4	18.45 18.75	**1** **1**	If 0 scored, **SC1** for 6.15 **and** 6.25 seen or for correct answers reversed
5	$(2x+1)(x-3)$	**2**	**B1** for $(2x+a)(x+b)$, where $ab=-3$ or $a+2b=-5$
6	$\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$	**2**	**B1** for one correct column
7	1.60 cao	**3**	**B2** for 1.597…. or 1.6 or **M1** for 2 ÷ 1.252
8	$\frac{15}{8}$ *their* $\frac{15}{8}\times\frac{9}{5}$ oe $\frac{27}{8}$ or $3\frac{3}{8}$ cao	**B1** **M1** **A1**	or $\frac{135}{72}$ or $\frac{135}{72}\div\frac{40}{72}$ or equivalent division with fractions with common denominators
9	2.8 oe	**3**	**M2** for $12+2=8x-3x$ or better or **M1** for $3x+12$ or $8x-2$
10	20.6 or 20.58 to 20.59	**3**	**M2** for $\frac{85-67.5}{85}\times100$ or $\left(1-\frac{67.5}{85}\right)\times100$ or **M1** for $\frac{85-67.5}{85}$ or $\frac{67.5}{85}\times100$ If zero scored **SC1** for $\frac{67.5-85}{85}\times100$

Question	Answer	Mark	Part Marks
11	12.2 or 12.18 to 12.19	**3**	**M2** for $\frac{24\sin 30}{\sin 100}$ or **M1** for correct implicit equation e.g. $\frac{\sin 100}{24}=\frac{\sin 30}{BC}$
12 (a)	5	**3**	**M2** for $\frac{u\times 10}{2}+2u\times 10=125$ oe or **M1** for evidence that area represents distance e.g. $\frac{u\times 10}{2}$, $2u\times 10$ or $3u\times 10$
(b)	2	**1FT**	**FT** 10 ÷ *their u* correctly evaluated
13 (a)	$4x^9$ final answer	**2**	**B1** for answer kx^9 or $4x^k$ $(k\neq 0)$
(b)	$2y^{32}$ final answer	**2**	**B1** for answer ky^{32} or $2y^k$ $(k\neq 0)$
14	$\sqrt{1^2-4(2)(-2)}$	**B1**	If completing the square **B1** for $\left(x+\frac{1}{4}\right)^2$ oe
	If in form $\frac{p+\sqrt{q}}{r}$ or $\frac{p-\sqrt{q}}{r}$ $p=-1$, $r=2(2)$ or 4	**B1**	**B1** for $x=-\frac{1}{4}+\sqrt{1+\left(\frac{1}{4}\right)^2}$ or $x=-\frac{1}{4}-\sqrt{1+\left(\frac{1}{4}\right)^2}$
	– 1.28 0.78	**B1** **B1**	If **0** scored for the last two **B** marks then **SC1** for – 1.3 **and** 0.8 or – 1.281 to – 1.280 **and** 0.781 or 0.7807 to 0.7808 or 1.28 **and** – 0.78 or – 1.28 **and** 0.78 seen in the working
15 (a)	4.77 or 4.774 to 4.775	**2**	**M1** for 30 ÷ [2]π
(b)	35.7 or 35.8 or 35.74 to 35.82	**2**	**M1** for 0.5 × π × (*their* **(a)**)^2 or 0.5 × π × (30 ÷ 2π)^2

Question	Answer	Mark	Part Marks
16 (a) (i)	14	**2**	**M1** for any two of 1, 11, 14, 4 correctly placed on Venn diagram or for $1 + 25 - x + x + 18 - x = 30$ oe
(ii)	$\frac{11}{30}$ oe	**1FT**	**FT** $\frac{25 - \textit{their}\ (\mathbf{a})(\mathbf{i})}{30}$ or $\frac{\textit{their}\ 11}{30}$ from diagram
(iii)	$\frac{11}{12}$ oe	**1FT**	**FT** their diagram e.g. $\frac{\textit{their}\ 11}{12}$ or $\frac{25 - \textit{their}\ (\mathbf{a})(\mathbf{i})}{12}$
(b)		**1**	
17 (a)	6	**1**	
(b)	2	**2**	**M1** for 7 identified as the UQ or 5 identified as the LQ or both lines drawn from the 150 and 50 across and down to the horizontal axis
(c)	180	**2**	**M1** for answer 20 or line or mark on graph indicating 20
18	912 or 912.2…	**5**	**M4** for $4 \times 0.5 \times 20 \times \sqrt{8^2 + 10^2} + 20 \times 20$ or better **or** **M3** for $4 \times 0.5 \times 20 \times \sqrt{8^2 + 10^2}$ or better **or** **M1** for $\sqrt{8^2 + 10^2}$ **and** **M1** for $0.5 \times 20 \times \sqrt{8^2 + 10^2}$ **and** **M1** for 20×20

Question	Answer	Mark	Part Marks
19 (a) (i)	$-\mathbf{b} + \mathbf{a}$	1	
(ii)	$\mathbf{b} + \frac{1}{2}\mathbf{a}$	1	
(b)	$[\overrightarrow{OX} =]\ \mathbf{b} + \frac{1}{3}(-\mathbf{b} + \mathbf{a})$ oe	M1	
	$\frac{1}{3}\mathbf{a} + \frac{2}{3}\mathbf{b}$ oe	A1	
	2 statements from: $\overrightarrow{OM} = \mathbf{b} + \frac{1}{2}\mathbf{a}$ oe or $[\overrightarrow{OX} =]\ \frac{2}{3}(\mathbf{b} + \frac{1}{2}\mathbf{a})$ oe or $\overrightarrow{OX} = \frac{2}{3}\overrightarrow{OM}$ oe	B2	**B1** for any one of these statements
20	9.37 or 9.370 to 9.371	6	**M2** for $\sin[P] = \frac{38.5}{0.5 \times 9 \times 10}$ or **M1** for $0.5 \times 10 \times 9 \times \sin = 38.5$ **M3** for $\sqrt{(9^2 + 10^2 - 2\times9\times10 \times \cos(\textit{their } P))}$ or **M2** for $9^2 + 10^2 - 2\times9\times10 \times \cos(\textit{their } P)$ or **M1** for a correct implicit expression e.g. $\cos(\textit{their } P) = \frac{9^2 + 10^2 - RQ^2}{2 \times 9 \times 10}$ Note: 87.8, 87.81[…] or 87.7[55…] score 4 marks or M is foot of perpendicular from R to PQ **M2** for perp.ht = $38.5 \div \frac{1}{2} \times 10$ or 7.7 or **M1** for $\frac{1}{2} \times 10 \times [\ldots] = 38.5$ **M1** for $PM = \sqrt{(9^2 - 7.7^2)}$[= 4.659… or 4.66] **M1** for $QM = 10 - \textit{their}$ 4.659…[= 5.34…] **M1** for $QR = \sqrt{((\textit{their } QM)^2 + 7.7^2)}$

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MARK SCHEME for the March 2015 series

0580 MATHEMATICS

0580/22 Paper 2 (Paper 22 – Extended), maximum raw mark 70

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

Qu.	Answers	Mark	Part Marks
1	Negative	**1**	
2	96	**2**	**B1** for $96k$ or $2^5 \times 3$ or for listing multiples of each up to 96
3	572.4	**2**	**M1** for figs $(120 \times 90 \times 53)$
4	$7p(2p+3q)$	**2**	**B1** for $7(2p^2+3pq)$ or $p(14p+21q)$
5	$18-5n$ oe	**2**	**M1** for $5n$ or $-5n$
6 (a)	Correct arc centre *B,* radius 5.7	**1**	
(b)	Shading below *CN* outside arc	**1FT**	FT shading below *CN* outside their arc centre *B*
7	37	**2**	**M1** for $180-90-53$ oe or **B1** for 53 or the right angle, either marked in correct place on diagram
8 (a)	68	**1**	
(b)	15	**2**	**M1** for $\frac{360}{n}=24$ or $(n-2)180=156n$
9	400 350 250	**3**	**M1** for $\frac{1000}{8+7+5}$ implied by 50 **A1** for one clearly assigned correct answer or **SC2** for 3 correct answers in wrong order
10 (a)	$x+x+4+x+4=26$ oe	**1**	
(b)	6[.00] cao	**2**	**M1** for their linear eqn simplified to $ax=b$

11	Correctly eliminating one variable $[x =]\ 6$ $[y =]\frac{1}{4}$	**M1** **A1** **A1**	 If 0 scored **SC1** for 2 values satisfying one of the original equations **SC1** if no working shown but correct answers given
12	44 300 cao	**3**	**M1** for $50\,000 \times (0.97)^4$ oe and **B1** for 44260 or better or **SC1** for correct method for 3% increase with final answer of 56300
13	12	**3**	**M1** for $x = k\sqrt[3]{y}$ oe **A1** for $k = 3$ or **M2** for $\frac{6}{\sqrt[3]{8}} = \frac{x}{\sqrt[3]{64}}$ oe
14	$3y + x = 19$ oe	**3**	**M1** for *their* $m \times 3 = -1$ oe or $-\frac{1}{3}$ soi **M1** for $4 = 7 \times$ *their* $m + c$
15 (a) **(b)**	$\begin{pmatrix} 76 & 30 \\ 40 & 16 \end{pmatrix}$ $\frac{1}{4}\begin{pmatrix} 2 & -3 \\ -4 & 8 \end{pmatrix}$ oe	**2** **2**	**B1** for two correct elements **B1** for $k\begin{pmatrix} 2 & -3 \\ -4 & 8 \end{pmatrix}$ soi or $\frac{1}{4}\begin{pmatrix} a & b \\ c & d \end{pmatrix}$ seen or det $= 4$ soi
16	$\frac{25}{9}$ $\frac{a}{b} \times \frac{6}{5}$ where $a > b$ *Their* $\frac{150}{45}$ or *their* correct full cancelling $\frac{10}{3}$ or $3\frac{1}{3}$ nfww	**B1** **M1** **M1FT dep** **A1**	(Alt) $\frac{25}{9}$ $\frac{\textit{their}25 \times 2}{9 \times 2} \div \frac{5 \times 3}{6 \times 3}$ oe $\frac{\textit{their}25 \times 2}{5 \times 3}$ oe or $\frac{50}{18} \div \frac{15}{18}$ oe with 18's cancelled

17	**(a)**	**b – a**	**2**	**M1** if unsimplified or correct route in terms of *P,Q,R, S*
	(b)	$\frac{5}{8}\mathbf{x} + \frac{3}{8}\mathbf{y}$	**2**	**M1** for a correct route e.g. $OX + XM$ or for $\frac{3}{8}\overrightarrow{XY}$ or $\frac{5}{8}\overrightarrow{YX}$
18		14.4 or 14.36...	**4**	**M3** for tan = $\frac{6}{their\sqrt{15^2+18^2}}$ oe or better or **M1** for $AC = \sqrt{15^2+18^2}$ and **M1** for identifying required angle
19		95	**4**	**B1** for 2.3 or $2\frac{18}{60}$ **M1** for 75 ÷ 30 (= 2.5) **M1** for $\frac{381+75}{their\ 2.3 + their\ 2.5}$
20	**(a)**	35	**2**	**M1** for [*Z* =] 180 – 88 – 57 or *VWX* = 57 or *YZX* = 35
	(b)	10.8	**2**	**M1** for $\frac{AC}{7.2} = \frac{12.6}{8.4}$ oe
21	**(a) (i)**	1	**1**	
	(ii)	m^7	**1**	
	(iii)	$2p^2$	**2**	**SC1** for $2p^k$ or kp^2 $k \neq 0$
	(b)	$\frac{2}{5}$ or 0.4	**2**	**B1** for 3^5 or 3^{5x} or $243^{\frac{1}{5}}$ or $243^{\frac{2}{5}}$ seen
22	**(a)**	17	**2**	**M1** for [g(–2) =] 4 seen or for $5x^2 - 3$
	(b)	$25x^2 - 30x + 9$ or $(5x-3)^2$ as final answer	**2**	**M1** for $g(5x-3)$
	(c)	$\frac{x+3}{5}$	**2**	**M1** for $5x = y + 3$ or $x = 5y - 3$ or $\frac{y}{5} = x - \frac{3}{5}$

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0580/22 Paper 2 (Extended), maximum raw mark 70

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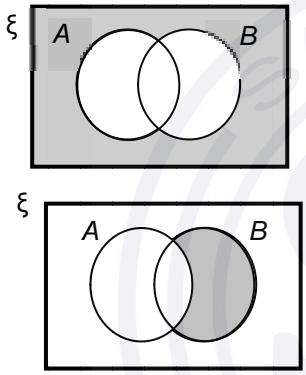
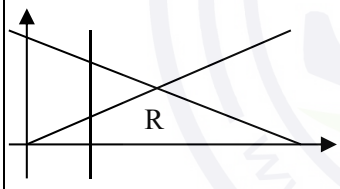
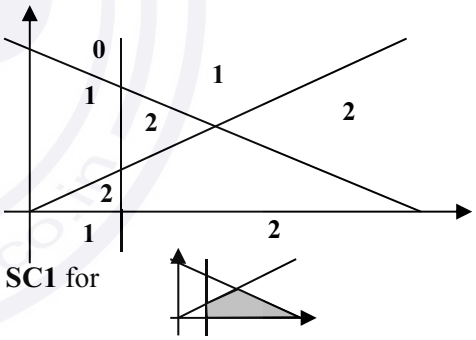
Qu.	Answers	Mark	Part Marks
1	$6 + 5 \times (10 - 8) = 16$	**1**	One pair of brackets only
2	20	**1**	
3	8	**1**	
4		**1**	
		1	
5	$v^3 - p$	**2**	**M1** for $v^3 = p + r$
6	95.5 96.5 in correct places cao	**2**	**B1** for 95.5 or 96.5 in correct place or for answers reversed
7 (a)	700	**2**	**M1** for 2800×0.325
(b)	0.28	**1**	
8	$\frac{7}{6}$ oe	**B1**	
	their $\frac{7}{6} \times \frac{8}{7}$ oe	**M1**	Or **M1** for $\frac{56}{\cancel{48}} \div \frac{42}{\cancel{48}}$ or equivalent division with fractions with common denominator
	$\frac{4}{3}$ or $1\frac{1}{3}$ cao must see working	**A1**	

9	9.13 or 9.127 to 9.1271	**3**	**M2** for $\sqrt[3]{\frac{1000}{440}}$ [1.31] oe or $\sqrt[3]{\frac{440}{1000}}$ [0.761] oe Or **M1** for $\frac{1000}{440}$ [2.27] oe or $\frac{440}{1000}$ [0.44] oe or $\sqrt[3]{\frac{figs440}{figs1000}}$ or $\sqrt[3]{\frac{figs1000}{figs440}}$
10	97.2[0]	**3**	**M1** for $C = kr^2$ **A1** for $k = 30$ or **M2** for $\frac{202.8}{2.6^2} = \frac{c}{1.8^2}$ oe
11 (a)	$\begin{pmatrix} 6 & -4 \\ -8 & 38 \end{pmatrix}$	**2**	**M1** for a 2 by 2 matrix with two correct elements **SC1** for $\begin{pmatrix} 16 & -14 \\ -18 & 28 \end{pmatrix}$
(b)	14	**1**	
12		**3**	 **SC1** for
13	13.5 or 13.45[..]	**3**	**M2** for $\sqrt{\frac{2 \times 85}{\sin 110}}$ or **M1** for ½ × a^2 × sin 110 = 85 or $\frac{2 \times 85}{\sin 110}$ oe [180.9..]
14 (a)	2.47 or 2.474 to 2.4744	**2**	**M1** for $\frac{56}{360} \times \pi \times 2.25^2$ oe
(b)	0.742 or 0.7422 to 0.74232	**1FT**	FT *their* **(a)** × 0.3[0] correctly evaluated.

15 **(a)**	$2 \times 3 \times 3 \times 5$	**2**	**B1** for 2, 3, [3] and 5 identified as only prime factors or **M1** for partial prime factorisation $6 \times 3 \times 5$ or $2 \times 9 \times 5$ or $3 \times 3 \times 10$ or $2 \times 3 \times 15$
(b)	630	**2**	**M1** for $2 \times 3^2 \times 5 \times 7$ oe or for listing multiples of 90 and 105 at least up to 630
16 **(a)**	108	**1**	
	Angle at **centre** is **twice** angle at **circumference** oe	**1**	
(b) **(i)**	$-\frac{4}{3}$ oe	**1**	
(ii)	−1	**1**	
17	[0.]08	**4**	**M3** for $200\times\left(1+\frac{2}{100}\right)^2-200-\frac{200\times2\times2}{100}$ oe or **M1** for $200\times\left(1+\frac{2}{100}\right)^2$ **and M1** for $\frac{200\times2\times2}{100}$ [+200]
18 **(a)**	56	**2**	**B1** for 16 soi or **M1** for 72 – *their* 16
(b) **(i)**	63 or 63 to 63.5	**1**	
(ii)	22 or 21.6 to 23 nfww	**2**	**B1** for 49.8 to 50.2 seen or 71.8 to 72.8
19 **(a)** **(i)**	**c – a**	**1**	
(ii)	$-\frac{1}{3}$ **a** + $\frac{1}{3}$ **c**	**3**	**M2** for **–a** + $\frac{1}{3}$ **(c** + 2**a)** **oe** e.g. **–a + c** + 2**a** $-\frac{2}{3}$ **(c** + 2**a)** Or **M1** for a correct route from *A* to *X*
(b)	$\overrightarrow{AC}$ is a multiple of $\overrightarrow{AX}$	**1**	oe
	and they share a common point [A]	**1**	oe

20	**(a)**	102 to 106	**2**	**B1** for 5.1 to 5.3 seen
	(b)	Correct position of F with correct arcs for angle bisector	**5**	**B2** for Correct ruled angle bisector of *A* with correct arcs or **B1** for correct bisector with no/wrong arcs **and** **B2** for Arc centre *C*, radius 8 cm or **B1** for arc centre *C* with incorrect radius or correct conversion to 8cm **and** **B1** for marking position of F on *their* bisector and 8cm from *C* or on *their* arc centre *C*
21	**(a)**	$\frac{x+7}{(2x-1)(x+2)}$ Final answer	**3**	**B1** for $3(x+2)-1(2x-1)$ seen or better **B1** for denominator $(2x-1)(x+2)$ oe seen **SC2** for final answer $\frac{x+5}{(2x-1)(x+2)}$
	(b)	$\frac{2x}{x+7}$ Final answer	**4**	**M1** for $4x(x-4)$ or partial factorisation of numerator and **M2** for $[2](x+7)(x-4)$ oe or **M1** for $[2](x^2+3x-28)$ or $[2](x+a)(x+b)$ where $ab=-28$ or $a+b=3$ **SC3** for answer $\frac{4x}{2x+14}$ oe

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0580 MATHEMATICS

0580/23 Paper 2 (Extended), maximum raw mark 70

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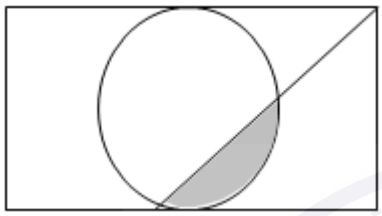
Qu.	Answers	Mark	Part Marks
1	2870	**2**	**M1** for 350×8.2
2	$0.34 \quad 0.7^3 \quad 0.6^2 \quad \sqrt{0.6}$	**2**	**M1** for decimal conversion: 0.7 [7…] or 0.8 for $\sqrt{0.6}$ and 0.36 for 0.6^2 and 0.343 for 0.7^3 or **B1** for three in the correct order
3	2.4×10^8	**2**	**B1** for 240 000 000 oe or **B1** for $k\times10^8$ or 2.4×10^k
4	30	**2**	**M1** for $2x + 3x + 4x + 90 = 360$ oe
5	48	**2**	**M1** for $52 \div 65$ [$\times 60$] oe implied by 0.8
6	9.5 or $\frac{19}{2}$	**3**	**M2** for $2x = (8 \times 3) - 5$ or better oe or **M1** for $2x + 5 = 8 \times 3$ or better
7	160	**3**	**M2** for $180 - \frac{360}{18}$ or $\frac{180\times(18-2)}{18}$ oe or **M1** for $180 \times (18 - 2)$ or $\frac{360}{18}$
8	$8 + (y - 2)^2$ oe final answer	**3**	**M1** for $y - 2 = \sqrt{(x - 8)}$ **M1** for squaring both sides completed correctly **M1** for adding *their* 8 completed correctly on answer line
9	4	**3**	**M2** for $6(3 + 5) = y(7 + 5)$ oe or **M1** for $y = \frac{k}{x+5}$ oe **A1** for $k = 48$
10	13891.5[0]	**3**	**M2** for $12000\times\left(1+\frac{5}{100}\right)^3$ oe or **M1** for $12000\times\left(1+\frac{5}{100}\right)^n$ oe $n \geqslant 2$

11	**(a)**	608 400 cao	**2**	**M1** for $\frac{1}{4}\times 39^2\times(39+1)^2$
	(b)	$2n^2(n+1)^2$ oe	**1**	
12	**(a)**	Complete circle centre *E* radius 3cm	**1**	
	(b)	Correct ruled bisector with two pairs of correct arcs	**2**	**B1** for correct bisector with no/wrong arcs
	(c)		**1**	dep on attempt at bisector of *C* and enclosed region
13		$\frac{16x^2+18x+9}{6x}$ final answer	**4**	**M2** for 9 [+] $4x^2$ [+] $18x$ [+] $12x^2$ or better or **M1** for 2 of these and **M1FT** for adding their four 'numerators' together correctly and **B1** for denominator $6x$ to a maximum of **3** marks
14	**(a)**	$\frac{1}{2}\mathbf{b}-\frac{1}{2}\mathbf{a}$ oe	**2**	**M1** for $\frac{1}{2}(\overrightarrow{AO}+\overrightarrow{OB})$ oe or correct unsimplified route e.g. $\overrightarrow{AO}+\overrightarrow{OB}+\overrightarrow{BP}$ or $-\mathbf{a}+\mathbf{b}+\frac{1}{2}\overrightarrow{BA}=-\mathbf{a}+\mathbf{b}+\frac{1}{2}(\mathbf{a}-\mathbf{b})$
	(b)	$\frac{1}{4}\mathbf{a}+\frac{3}{4}\mathbf{b}$ oe	**2**	**M1** for $\overrightarrow{OA}+\overrightarrow{AQ}$ oe or correct unsimplified route
15	**(a)**	19 2 1 8	**2**	**B1** for any two correct
	(b)	1 8 19 2	**2FT**	**B2FT** for a correct ft from **(a)** or **B1FT** for any two correct or for any correct two ft from **(a)**
16	**(a)**	64	**2**	**B1** for [f(1) =] 4 or **M1** for $((x-3)^2)^3$ or better
	(b)	$4x+1$ oe	**2**	**M1** for $x=\frac{y-1}{4}$ or $4y=x-1$
	(c)	$\frac{x^3-1}{4}$ oe final answer	**1**	
	(d)	3 nfww	**1**	

17	**(a)**	3.08 to 3.22 nfww	**2**	**B1** for 502.5 to 502.62 or 505.7 to 505.8
	(b)	$\frac{16}{200}$ oe	**2**	**B1** for 16 soi or **M1** for $\frac{\textit{their}16}{200}$
	(c)	18.5 26 3	**2**	**B1** for 18.5 and 26 **B1** for 3
18	**(a)**	3	**4**	**B3** for 3.536 to 3.54 as an answer or **M2** for $2000 \div \frac{1}{3}\pi \times 6^2 \times 15$ or **M1** for $\frac{1}{3}\pi \times 6^2 \times 15$ and **SC1** for truncating *their* 3.54 to a whole number
	(b)	303 to 304	**3**	**M2** for 2000 – *their* 3 × *their* volume or **M1** for *their* 3 × *their* volume
19	**(a)**	rotation 90 clockwise [about] origin oe	**3**	**B1** for each
	(b)	$\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$	**2**	**M1** for any one column or row correct
	(c)	Triangle at (3, 3), (6, 3) and (3, 5)	**2**	**M1** for any two vertices correct or correct answer translated horizontally

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Question	Answers	Mark	Part Marks
1	1.37	**2**	**B1** for 0.866… or $\frac{\sqrt{3}}{2}$ or 0.5 or $\frac{1}{2}$ or **B1** for 1.366… as final answer
2	$18\frac{1}{18}$	**2**	**M1** for $\frac{2}{36}+\frac{36}{2}$ or better
3	30	**2**	**M1** for $n-8=22$ or $\frac{n}{2}=15$
4 (a)	$\frac{5\times 2}{20}$	**1**	
(b)	0.5 or $\frac{1}{2}$ cao	**1**	
5	0.5^3 0.5^2 0.5 $\sqrt[3]{0.5}$	**2**	**B1** for 0.25 , 0.125 and 0.793… seen or for three in correct order
6	1.6[0]	**3**	**M1** for 800 × 1.5 and **M1** for *their* 1200 ÷ 750
7	$4\pm\sqrt{y-6}$	**3**	**M1** for *their* 6 moved correctly **M1** for *their* √ taken correctly **M1** for *their* 4 moved correctly
8	$\frac{2}{x(x+1)}$	**3**	**B1** for common denominator $x(x+1)$ seen **M1** for $2(x+1)-2x$ oe or better
9 (a)	119	**3**	**M2** for 18 × 6 + 11 oe or **B1** for 18 or 11 or 108
(b)	[0] 1 [00] pm cao	**1**	
10 (a)	$(a+b)(x+y)$	**2**	**B1** for $a(x+y)+b(x+y)$ or $x(a+b)+y(a+b)$
(b)	$(x-1)(3x-2)$	**2**	**B1** for $(x-1)(3(x-1)+1)$ If **B0** then **SC1** for $(x+a)(3x+b)$ where $3a+b=-5$ or $ab=2$ or $3(x-1)(x-⅔)$

11		113.9 to 114.0	**4**	**M2** for [cos =] $\frac{8^2+2^2-9^2}{2\times8\times2}$ or **M1** for $9^2 = 8^2 + 2^2 - 2 \times 8 \times 2 \times \cos x$ **A1** for –0.406 or –0.4063 to –0.4062 or $-\frac{13}{32}$ If **0** scored **SC2** for 54.3[1…] or 11.7 or 11.71 to 11.72 **SC1** for [cos =] $\frac{9^2+2^2-8^2}{2\times9\times2}$ or [cos =] $\frac{9^2+8^2-2^2}{2\times9\times8}$
12	**(a)**	2×10^{10}	**2**	**B1** for 20×10^9 or 20 000 000 000
	(b)	1.25×10^{-1}	**2**	**B1** for 0.125 oe
13	**(a)**	32	**2**	**B1** for $AOC = 116$
	(b)	35	**2**	**B1** for $CDA = 122$
14		$y = \frac{2}{3}x - 2$ oe	**4**	**B1** for (9, 4) and **M2** for $y = kx - 2$ $(k \neq 0)$ or $y = \frac{2}{3}x + k$ $(k \neq 0)$ or $\frac{2}{3}x - 2$ or **M1** for $y = \frac{2}{3}x$ or $\frac{2}{3}x + k$ $(k \neq 0)$
15		[0], 1, 2, 3	**4**	**M1** for moving the 5 correctly **M1** for collecting *their* terms **A1** for a correct inequality for x eg $[0 \leq] x < 4$
16	**(a)**	8	**2**	**B1** for 2^{12} or 4096
	(b)	$2q^{\frac{3}{2}}$	**3**	**B2** for $kq^{\frac{3}{2}}$ as the answer or **B1** for $2q^2$ and **B1** for $q^{\frac{1}{2}}$ oe nfww
17	**(a)**	correct working	**2**	**M1** for 1 holiday = 5 or 360 ÷ 72 = 5 and **B1** for 24 × 5 [= 120] or **M2** for $\frac{24}{72} \times 360$ [=120] oe
	(b)	6 nfww	**3**	**M1** for 150 + 120 + x + 2x = 360 oe **A1** for 30 identified as the required angle
18	**(a)**	correct working	**2**	**B2** for $\sqrt[3]{\frac{1}{8}} = \frac{1}{2}$ or $\sqrt[3]{8} = 2$ AND $\frac{10}{2} = 5$ oe and $\frac{4}{2} = 2$ oe or **B1** for $\sqrt[3]{\frac{1}{8}}$ or $\sqrt[3]{8}$ or $8 = 2^3$ or $\frac{1}{8} = (\frac{1}{2})^3$

(b)	147 or 146.5 to 146.6…	**4**	**M3** for $\frac{7}{8}\times\frac{1}{3}\times\pi\times4^2\times10$ or **M1** for $\frac{1}{3}\times\pi\times4^2\times10$ and **M1** for $\frac{1}{3}\times\pi\times2^2\times5$ and **M1** for subtracting *their* volumes
19	1.38 or 1.39 or 1.384 to 1.389	**7**	**M3** [Area Δ =] $\frac{1}{2}\times8\cos 60\times8\sin 60$ or **M1** for [*AE* =] 8cos 60 and **M1** for [*ED*] = 8sin 60 and **M1** for Area sector $\frac{30}{360}\times\pi\times8^2$ and **M1** for Area rectangle = 8 × 8cos60 or 8 × 4 **M1** for *their* 32 – (*their* 13.86 + *their* 16.76) or better

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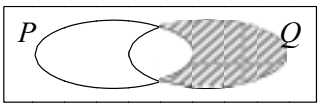
Qu		Answers	Mark	Part Marks
1		1.49 or 1.491…	**1**	
2	**(a)**	570 000	**1**	
	(b)	5.69×10^5	**1**	
3		$[x =]$ 2, $[y =]$ – 3	**2**	**B1 B1** or **SC1** for reversed answers
4		7.06 or 7.063 to 7.064	**2**	**M1** for $\frac{[\ ]}{8} = \cos 28$ or better
5	**(a)**	(0, 5)	**1**	
	(b)	– 1	**1**	
6		101.4, 102.6	**2**	**M1** for 8.45 and 8.55 seen If 0 scored, **SC1** for one correct value in correct position on answer line or for two correct reversed answers
7		$2\frac{1}{2}$ %, 0.2, $\frac{43}{201}$, $\sqrt{0.1}$	**2**	**B1** for 0.3… , 0.21… and 0.025 seen or for three in correct order
8		$\left[\frac{1}{2}\times1\frac{1}{2}=\right]\frac{3}{4}$ oe $\frac{5\times2}{6\times2}$ and $\frac{3\times3}{4\times3}$ oe or better $\frac{1}{12}$ oe **working must be shown**	**B1** **M1FT** **A1**	

9		3.17 or 3.174 to 3.175	**3**	**M2** for $\frac{63-61}{63}\times 100$ oe or $100-\frac{61}{63}\times 100$ oe or **M1** for $\frac{63-61}{63}$ oe or $\frac{61}{63}\times 100$
10	**(a)**	35	**1**	
	(b)	$\frac{3V}{A}$ or $3VA^{-1}$	**2**	**M1** for multiplying by 3 or for dividing by $\frac{1}{3}$ or **M1** for dividing by A
11		460	**3**	**M2** for $\frac{391\times 100}{(100-15)}$ oe or **M1** for recognising 391 as (100 – 15)% soi
12		$-\frac{3}{5}$ oe	**3**	**B2** for $5x + 3 = 0$ oe or **B1** for a numerator of $3(x+1)+2x[=0]$ seen
13		1.6 oe	**3**	**M1** for $w=\frac{k}{\sqrt{x}}$ **A1** for $k = 8$ Alternative method: **M2** for $w\sqrt{25}=4\sqrt{4}$ oe
14	**(a)**	$\mathbf{p}+\mathbf{r}$	**1**	
	(b)	$\frac{3}{2}\mathbf{p}+\frac{1}{2}\mathbf{r}$	**2**	**M1** for correct route from O to M or **M1** for $\mathbf{p}$ + ½*their*(a)
15	**(a)**	$\begin{pmatrix}22 & 18\\ 27 & 31\end{pmatrix}$	**2**	**B1** for any correct column or row
	(b)	14	**1**	

16	**(a)**	$2pq(2p-3q)$	**2**	**B1** for $pq(4p-6q)$ or $2q(2p^2-3pq)$ or $2p(2pq-3q^2)$
	(b)	$(u+4t)(1+x)$	**2**	**B1** for $1(u+4t)+x(u+4t)$ or $u(1+x)+4t(1+x)$
17	**(a)**	$5t^{25}$	**2**	**B1** for $5t^k$ or mt^{25} $(m \neq 0)$
	(b)	–2	**1**	
	(c)	64	**1**	
18		576	**4**	**M1** for $\frac{1458}{3456}$ or $\frac{3456}{1458}$ **M1 dep** for $\sqrt[3]{\textit{their}\ \text{fraction}}$ **M1** for (*their* cube root)^2
19		$\frac{x-1}{3}$ final answer	**4**	**B2** for $(x-1)(x+7)$ or **SC1** for $(x+a)(x+b)$ where $ab = -7$ or $a + b = 6$ **B1** for $3(x+7)$
20	**(a)**	–3	**1**	
	(b)	$39 - 7n$ oe	**2**	**M1** for $-7n$ [+ k]
	(c)	53	**2**	**M1** for *their* (b) = –332 shown provided *their*(b) is linear and their answer for (c) is a positive integer
21	**(a)**	4.47 or 4.472[…]	**3**	**M2** for $\sqrt{6^2-4^2}$ or **M1** for $[PM]^2+4^2=6^2$ or 6^2-4^2
	(b)	48.2 or 48.18 to 48.19	**3**	**M2** for cos[correct angle] $=\frac{4}{6}$ oe or **M1** for recognising a correct angle

22	**(a)**	i, j	**1**	
		i, j, k, m, n	**1**	
		2	**1**	
	(b)	$\frac{2}{3}$	**1**	
	(c)		**1**	
	(d)	$\subset$ or $\subseteq$	**1**	

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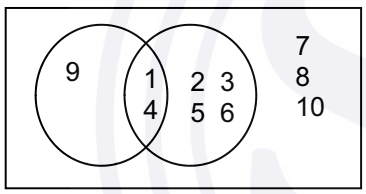
Qu.	Part	Answers	Mark	Part Marks
1		– 16	1	
2		84	2	**M1** for $\frac{7}{6+8+9+7}$ or $\frac{360}{6+8+9+7}$
3		1030	2	**M1** for $1350 \div 1.313$
4		$5a(3a^2 - b)$	2	**B1** for $a(15a^2 - 5b)$ or $5(3a^3 - ab)$
5	(a)	0.059161...	1	
	(b)	$5.9161... \times 10^{-2}$	1FT	ft *their* part (a)
6		$3x^6y^4$	2	**B1** for x^6 or y^4 in a product on answer line
7	(a)	74	1	
	(b)	8.69	1	
8		48	2	**M1** for 15^2 or $\left(\frac{1}{15}\right)^2$ or $\frac{1}{15^2}$ or $\sqrt{10800}$ or $\frac{1}{\sqrt{10800}}$
9		$t < -\frac{6}{7}$	2	**M1** for $5t + 2t < 17 - 23$ If zero scored **SC1** for $-\frac{6}{7}$ with incorrect inequality sign or equals sign

10		$\frac{5}{4}$ oe $\frac{5\times9}{4\times9}$ and $\frac{7\times4}{9\times4}$ oe or better $\frac{17}{36}$ **oe working must be shown**	**B1** **M1** **FT** **A1**	Do not allow decimals for the **B1**, **M1**, or **A1** e.g. $\frac{45}{36}$ and $\frac{28}{36}$ Follow through *their* $\frac{5}{4}$ for the **M1** mark. Alt method 1: **B1** for $\frac{1}{4}+\frac{2}{9}$ **M1** for $\frac{1\times9}{4\times9}$ and $\frac{2\times4}{4\times9}$ oe e.g. $\frac{9}{36}$ and $\frac{8}{36}$ Alt method 2: **B1** for $\frac{1}{4}-\frac{7}{9}+1$ **M1** for oe e.g. $\frac{9}{36}$ and $\frac{8}{36}$ ISW converting fraction answer to a decimal.
11		3.5	**3**	**M1** for $y = k\sqrt[3]{x+3}$ **A1** for $k = \frac{1}{2}$ Alternative method: **M2** for $\frac{y}{\sqrt[3]{340+3}} = \frac{1}{\sqrt[3]{5+3}}$ oe
12	**(a)**	$(3x-4)(x+2)$	**2**	**M1** for $(3x+a)(x+b)$ where $a+3b=2$ *or* $ab=-8$ if M0 then **SC1** for $3\left(x-\frac{4}{3}\right)(x+2)$
	(b)	$1\frac{1}{3}$, -2	**1FT**	**dep** on **M1**
13		$y = -0.5x + 11.5$ oe	**3**	**B2** for $y = -0.5x + k$ oe or $y = kx + 11.5$, $k \neq 0$ oe or $-0.5x + 11.5$ oe or **B1** for gradient = –0.5 oe and **B1** for y-intercept = 11.5 oe If zero scored then, **SC1** for $9 =$ *their* $m \times 5 + c$ or $13 =$ *their* $m \times -3 + c$

14		8.23 or 8.234 to 8.235	**3**	**M2** for $[PR=]\ \dfrac{12.5\times\sin 37}{\sin 66}$ or **M1** for $\dfrac{PR}{\sin 37}=\dfrac{12.5}{\sin 66}$ oe
15		427.8 427.4	**3**	**M2** for $2\times(127.35+86.55)$ or $2\times(127.35+86.45)$ or **B1** for two of these figures: 127.35, 86.55, 127.25, 86.45 seen If zero scored, **SC2** for upper bound 427.8 or lower bound 427.4 provided nfww
16		65.4 or 65.37 to 65.4	**4**	**M3** for $\cos=\dfrac{5}{12}$ or $\dfrac{\sqrt{3^2+4^2}}{12}$ oe or **M1** for $\sqrt{3^2+4^2}$ and **M1** for clearly identifying angle *GAC*
17	**(a)**		**2**	**B1** for 2 of the 4 regions correct
	(b)	7 8 10	**1FT**	
	(c)	1	**1FT**	
18	**(a)**	$\begin{pmatrix}33 & 16\\ 32 & 17\end{pmatrix}$	**2**	**B1** for one column or row correct
	(b)	$\frac{1}{7}\begin{pmatrix}3 & -2\\ -4 & 5\end{pmatrix}$ oe	**2**	**B1** for $\frac{1}{7}\begin{pmatrix}a & b\\ c & d\end{pmatrix}$ seen or $k\begin{pmatrix}3 & -2\\ -4 & 5\end{pmatrix}$ seen
19		$3x+4y=10.8$ $5x+2y=14.50$ 2.6[0] 0.75	**1** **1** **3**	**M1 FT** for correctly eliminating one variable **Al** for 2.6 **A1** for 0.75 If **M0** then or **SC1** for correct substitution and correct evaluation to find the other value

20	**(a)**	34	**1**	
	(b)	16	**2**	**B1** for 24 or 40 seen
	(c)	30	**1**	
	(d)	120	**1**	
21		62.3 or 62.26 to 62.272	**5**	**M1** for $\frac{2}{3}\times 2\pi\times 6$ and **M2** for $(\frac{2}{3}+\frac{1}{3})\times 2\pi\times 4$ oe or **M1** for $\frac{2}{3}\times 2\pi\times 4$ or $\frac{1}{3}\times 2\pi\times 4$ and **M1** for $2\times(2+4)+k\pi, k\neq 0$
22	**(a)**	Triangle at $(2,-1)$ $(2,1)$ $(1,-2)$	**2**	**B1** for translation by $\begin{pmatrix}k\\-4\end{pmatrix}$ or $\begin{pmatrix}3\\k\end{pmatrix}$
	(b)	Rotation [centre] (1, 0) 180° or half turn	**1** **1** **1**	**OR** enlargement [centre] (1, 0) [scale factor] −1
	(c)	Triangle at $(2,3)$ $(4,2)$ $(2,5)$	**3**	**B2** for 2 correct vertices plotted **or** If no/wrong plots allow **SC2** for 3 correct coordinates shown in working or **SC1** for any 2 correct coordinates shown or a triangle of the correct size and orientation but wrong position or **M1** for $\begin{pmatrix}-2&0\\0&1\end{pmatrix}\begin{pmatrix}-1&-1&-2\\3&5&2\end{pmatrix}$ oe shown

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0580 MATHEMATICS

0580/21 Paper 2 (Extended), maximum raw mark 70

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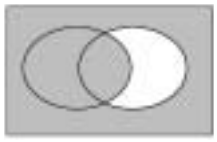
ft follow through after error
isw ignore subsequent working
oe or equivalent
SC Special Case
www without wrong working

Qu.	Answers	Mark	Part Marks
1	86.7 or 86.74 to 86.75	**1**	
2	5.293 cao	**2**	**B1** for 5.29 or 5.292 to 5.2927
3	125	**2**	**B1** for 55 or 125 in any other correct position on diagram or **M1** for 180–55
4	7.7	**2**	**M1** for $44 \times \frac{17.5}{100}$ oe
5	4.8 oe	**2**	**M1** for $5 + 19 = 3x + 2x$ oe or better or **B1** for $24 - 2x = 3x$ oe or $5 = 5x - 19$ oe
6	**(a)** $\frac{2}{6}$ oe **(b)** 200	**1** **1FT**	 FT 600 × *their* **(a)** providing *their* **(a)** is a probability
7	435, 445 cao	**2**	**B1** for one value in the correct place or **SC1** for both values correct but reversed
8	134	**3**	**M2** for $\frac{20.1 \times 100}{3 \times 5}$ oe or **M1** for $\frac{x \times 3 \times 5}{100} = 20.1$ or 3% = 4.02 oe If 0 scored **SC1** for answer of figs 134
9	**(a)** $\frac{n}{n+2}$ oe final answer **(b)** n^2–1 oe final answer	**1** **2**	 **B1** for any quadratic in final answer
10	$[\pm]\sqrt{c^2 - a^2}$ oe final answer	**3**	**M1** for correct square **M1** for correct re-arrangement **M1** for correct square root

11	150	**3**	**M1** for m^3 to cm^3 or cm^3 to m^3
12	**(a)** 110	**1**	
	(b) 79	**2**	**B1** for $DAC = 42$ or $ACB = 79$ or $ACD = 28$
13	**(a)** $\frac{5}{4}$ oe	**1**	
	(b) $4y^6$	**2**	B1 for ky^6 or y^6 or $4y^k$ or 4 as final answer
14	$\frac{2t-5}{t-1}$ final answer	**3**	**B1** for $\frac{3(t-1)}{t-1}$ or better **B1** for $3(t-1)-(t+2)$ oe or better
15	**(a)** $\frac{9}{12}-\frac{1}{12}$ oe	**M1**	Must be shown
	[=] $\frac{8}{12}$ oe [=] $\frac{2}{3}$	**M1**	Both fractions must be shown
	(b) $\frac{5}{2}\times\frac{4}{25}$ oe	**M1**	Must be shown
	Cancelling shown or $\frac{20}{50}$ oe [=] $\frac{2}{5}$	**M1**	**Dependent** and cancelling shown or a fraction and then $\frac{2}{5}$ must be shown
16	**(a)** $\begin{pmatrix}9\\6\end{pmatrix}$	**1**	
	(b) 10.8 or 10.81 to 10.82	**2FT**	**M1** for $\sqrt{(their\ 9)^2+(their\ 6)^2}$ **A1** for 10.8 or FT correctly evaluated
	(c) (17, 13)	**1FT**	FT *their* 9 and 6. (8 + *their* 9, 7 + *their* 6) correctly evaluated
17	**(a)** $(a+b)(1+t)$	**2**	**B1** for 1(a + b) + t(a + b) or $a(1+t)+b(1+t)$
	(b) $(x-6)(x+4)$	**2**	**SC1** for answer of $(x+a)(x+b)$ where $ab = -24$ or $a+b=-2$
18	486 cao	**4**	**M1** for $\frac{1}{2}\times 4\pi r^2+\pi r^2=243\pi$ or better **A1** for [r =] 9 **M1** for $\frac{1}{2}\times\frac{4}{3}[\pi](\text{their } r)^3$

19	**(a)** 40	**2**	**M1** for $\frac{144\times1000}{60\times60}$ oe
	(b) 3.5	**2FT**	FT 140 ÷ *their* **(a)** **M1** for dist ÷ *their* **(a)** or dist ÷ 40 or dist × $\frac{60\times60}{144\times1000}$ or **B1** for 140 seen
20	**(a) (i)** Accurate bisector of angle *B* with correct arcs	**2**	**B1** for correct line or correct arcs
	(ii) Accurate perpendicular bisector of *BC* with correct arcs	**2**	**B1** for correct line or correct arcs
	(b) correct region shaded	**1**	
21	**(a)** 73.7 or 73.73 to 73.74	**3**	**M1** for $\frac{20}{3+2}\times2$ or **B1** for $BX = 8$ **M1** for tan [ ] = $\frac{6}{\textit{their}\ 8}$ or better
	(b) 120	**2**	**M1** for $\frac{1}{2}\times20\times12$ oe
22	**(a) (i)** $\frac{5}{50}$ oe	**1**	
	(ii) $\frac{11}{50}$ oe	**1**	
	(b) $\frac{11}{16}$ oe	**1**	
	(c) $\frac{380}{2450}$ oe	**2**	**M1** for $\frac{20}{50}\times\frac{19}{49}$
	(d) 	**1**	

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12	$p = 71.4025$ cao $q = 73.1025$ cao	**3**	**B1** for 8.45 and 8.55 seen **M1** for *their* LB^2 [π] or *their* UB^2 [π] If 0 scored, **SC1** for one correct.
13	10[.00]	**3**	**M2** for 1.90 and 2.90 and 5.20 only or **M1** for two of 1.90, 2.90, 5.20 in a list of three or two values from the table or **SC1** FOR 1.90, 2.90, 4.30 $\left[\text{from } \frac{3.40+5.20}{2}\right]$
14	52	**3**	**B2** for $AOB = 104$ or **B1** for OAB or $OBA = 38$
15	(8, 2)	**3**	**M1** for correctly eliminating one variable **A1** for $x = 8$ **A1** for $y = 2$ If 0 scored, **SC2** for correct substitution and correct evaluation to find the other value.
16	$x < 6.8$	**4**	**B3** for 6.8 with wrong inequality or equal as answer. Or **M1** for first move completed correctly and **M1** for second move completed correctly and **M1** for third move completed correctly
17	**(a)** $\begin{pmatrix} 11 & 5 \\ 26 & 30 \end{pmatrix}$ **(b)** $\frac{1}{8}\begin{pmatrix} 6 & -1 \\ -4 & 2 \end{pmatrix}$ oe	**2** **2**	**SC1** for one correct row or column **B1** for $k\begin{pmatrix} 6 & -1 \\ -4 & 2 \end{pmatrix}$ or **B1** for $\frac{1}{8}\begin{pmatrix} a & b \\ c & d \end{pmatrix}$
18	**(a)** (1.5, 12.5) oe **(b)** $y = 3x + 8$ oe **(c)** Most common methods: Correctly substituting P (3, 17) into $y = 3x + 8$ Showing the gradient of AP or $BP = 3$ Other methods possible.	**2** **3** **1**	**B1** for either coordinate **B2** for $y = mx + 8$ or $y = 3x + c$ or $3x + 8$ or **B1** for gradient (or m) = 3 and **B1** for $c = 8$ If 0 scored, **SC1** for 23 = *their* $m \times 5 + c$ or for 2 = *their* $m \times -2 + c$ or for 12.5 = *their* $m \times 1.5 + c$

19	**(a)** $-2\mathbf{a} - 2\mathbf{c}$ oe	**2**	**M1** for $\mathbf{BO} = -\mathbf{a} - \mathbf{c}$ or for any correct route or correct unsimplified expression
	(b) $2\mathbf{a} + \mathbf{c}$	**2**	**M1** for any correct route or correct unsimplified expression
	(c) $-\mathbf{a} - \mathbf{c}$ oe	**2FT**	FT *their* **(a)** or correct answer Or **M1** for a correct non direct route from O to E or for correct unsimplified expression or for correct FT unsimplified
20	**(a)** 4.05 to 4.2	**1**	
	(b) 2.6 to 2.75	**2**	**B1** for 9.6 seen
	(c) 2.05 to 2.25	**2**	**B1** for [UQ] 5.0 to 5.1 and [LQ] 2.85 to 2.95 seen
	(d) $\frac{5}{48}$	**2**	**M1** for 5
21	**(a)** 37.2 or 37.17 to 37.19	**3**	**M2** for $\sin[\ ] = \frac{4 \times \sin 65}{6}$ or **M1** for $\frac{4}{\sin[]} = \frac{6}{\sin 65}$ oe
	(b) 11.7 or 11.72 to 11.74	**3**	**M1** for [B =] 160 – 65 – *their* **(a)** **M1** for $\frac{1}{2} \times 4 \times 6 \times \sin$ *their* 77.8

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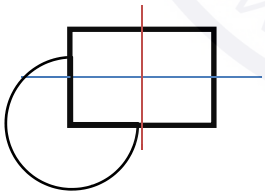
Qu.	Answers	Mark	Part Marks
1	39	2	**M1** for 52 × 45 ÷ 60 oe
2	Any two of (20, 8) (–4, 0) (12, 24)	2	**B1** for one correct
3	–8	2	**M1** for $2x = -16$ or $\frac{1}{2} + x = -7.5$ oe or better
4	tan 100, cos 100, 1/100, $100^{-0.1}$	2	**B1** for decimals –0.1[[7..], –5.[67..], [0.01], 0.6[3..] or for three in the correct order
5	**(a)** 600 000 **(b)** 79.2	1 2	 **M1** for 22 × 60 × 60 ÷ 1000 oe
6	25[.00]	3	**M2** for $30 \times \frac{100}{120}$ oe or **M1** for 30 associated with 120% e.g. $1.2x = 30$
7	5	3	**M2** for $(x – 5)(x – 1)$ or **M1** for evidence of a factorisation which gives the correct coefficient of x or positive prime constant term e.g. $(x – 7)(x + 1)$, $(x – 4)(x – 2)$, $(x – 3)(x – 1)$
8	1.6 oe	3	**M1** for $m = kx^3$ **A1** for $k = 25$
9	**(a)** $a^2 + 2ab + b^2$ **(b)** 22	2 1	**B1** for a^2 [+] ab [+] ab [+] b^2 or better seen
10	160	3	**M1** for $\sin 15 = \frac{[]}{628}$ oe or better

11	**(a)** $\begin{pmatrix} 3 & -1 \\ 4 & 2 \end{pmatrix}$	**1**	
	(b) $\frac{1}{10}\begin{pmatrix} 2 & 1 \\ -4 & 2 \end{pmatrix}$ oe	**2**	**B1** for $\frac{1}{10}\begin{pmatrix} a & b \\ c & d \end{pmatrix}$ or **B1** for $k\begin{pmatrix} 2 & 1 \\ -4 & 3 \end{pmatrix}$
12	**(a)** 7.5×10^{-2}	**2**	**M1** for 0.075 or $\frac{3}{40}$ or $\frac{6}{80}$ or 0.75×10^{-1} oe
	(b) 9.3×10^{7}	**2**	**M1** for 93 000 000 or 93×10^{6} or 0.93×10^{8} oe
13	**(a)** 24	**2**	**M1** for $MOC = 48$
	(b) 24	**2**	**M1** for $ACM = 66$ or **B1** for 48 – *their* **(a)**
14	**(a)** $8q^{-1}$ or $\frac{8}{q}$	**2**	**B1** for $8q^{k}$ or kq^{-1}
	(b) 1/5 or 0.2	**2**	**M1** for 5^{-2}, $\frac{1}{5^2}$ or [0].04 seen oe
15	**(a)** Circle, radius 3 cm, centre *A*, not inside the rectangle	**2**	**M1** for arc or full circle centre A radius 3 cm or for an incorrect size circle at A outside rectangle
	(b) One line of symmetry with correct arcs. E.g.: 	**2**	**B1** for correct ruled line (must reach or cross two sides) **B1** for 2 pairs of intersecting arcs
16	**(a)** 8.61 or 8.609 to 8.6102	**4**	**M1** for $\frac{1}{2} \times 3^2 \times \pi \times \sin 120$ **M1** for $\frac{30}{360} \times \pi \times 3^2 [\times 2]$ **M1** for area of triangle + 2 sectors
	(b) 430 or 431 or 430.4 to 430.41	**1FT**	FT their **(a)** × 50

17	**(a)** triangle at (0, 3) (2, 3) and (2, 4)	**3**	**B1** for each correct vertex If 0 scored then **M1** for correct reflection in the y axis or correct translation of their first stage 3 right 2 up
	(b) reflection in y axis	**2**	**B1** for reflection **B1** for y axis or $x = 0$
18	**(a)** 19–19.1	**1**	
	(b) 3	**2**	**M1** for 47 seen
	(c) 4.9 to 5.7	**2**	**B1** for [UQ] 21.7 to 22.2 and [LQ] 16.5 to 16.8
	(d) $\frac{45}{50}$ oe	**2**	**B1** for 45 seen or **SC1** for $\frac{5}{50}$ isw
19	**(a)** 75	**2**	**B1** for [g(6) =] 36
	(b) 3.5 –6.5	**3**	**M1** for $(2x + 3)^2 = 100$ **M1** for $2x + 3 = [\pm]10$ If 0 scored, **SC1** for one correct value as answer
	(c) $\frac{x-3}{2}$ oe final answer	**2**	**M1** for $x = 2y + 3$ or $y - 3 = 2x$ or $\frac{y}{2} = x + \frac{3}{2}$ or better
	(d) 5	**1**	

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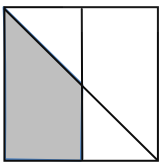
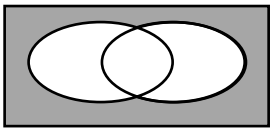
Qu.	Answers	Mark	Part Marks
1	11 or –11	**1**	
2 (a)	1.32656...	**1**	
(b)	1.327	**1ft**	
3	72	**2**	**M1** for 84 ÷ 7
4	105	**2**	**M1** for 180 – 55 – 50 or **B1** for 55 or 75 seen in the correct angle inside the triangle
5	correct working; e.g. $\frac{3k}{2k} \times \frac{16n}{3n} = 8$	**2**	**M1** for $\frac{3k}{2k}$ and **A1** for $\frac{3k}{2k} \times \frac{16n}{3n} = 8$
6	$3x(4y - x)$ final answer	**2**	**B1** for $3(4xy - x^2)$ or $x(12y - 3x)$
7 (a)	Equidistant from *A* and *B* (or *C* and *D* or *AD* and *BC*)	**1**	
(b)		**1**	
8	$x \geq -\frac{3}{8}$ oe	**2**	**M1** for $-3 \leq 8x$ oe If 0 then **SC1** for $-\frac{3}{8}$ with incorrect inequality.
9	48.15, 48.45 cao	**2**	**B1 B1** If 0 then **M1** for 16.0 and 16.15 soi
10	$(a + b)(p - 2)$	**2**	**B1** $p(a + b) - 2(a + b)$ or $a(p - 2) + b(p - 2)$
11	$3x^4$	**2**	**B1** for kx^4 or $3x^k$

12 **(a)**	$\frac{3}{11}$	**1**	
(b)		**1**	
13	175 cao final answer	**3**	**B2** for 175.4 ... or **M1** for 200 ÷ 1.14
14	454.27 cao final answer	**3**	**M1** for $420 \times (1+\frac{4}{100})^2$ oe and **A1** for 454 or 454.2 to 454.3 or **SC2** for answer 34.27 or **SC1** for answer 34.2 to 34.3
15	2.67 or 2.672 to 2.67301	**3**	**M2** for $\sqrt[3]{(80 \div \frac{4}{3}\pi)}$ oe or **M1** for $80 \div \left(\frac{4}{3}\pi\right)$ oe
16	35.4 or 35.36 to 35.37	**3**	**M2** for $1000 \div (\pi \times 0.75^2 \times 16)$ oe or **M1** for $\pi \times 0.75^2 \times 16$ oe or $1000 \div (\pi \times 0.75^2)$
17	$y = 2x - 1$	**3**	**B2** for $y = mx - 1$ or $y = 2x + c$ or $2x - 1$ or **B1** for gradient = 2, **B1** for $c = -1$ or **SC1** for $\frac{6}{3}$ or $\frac{5--1}{3[-0]}$
18 **(a)**	$(x + 6)(x–5)$	**2**	**SC1** for $(x + a)(x + b)$ where $ab = –30$ or $a + b$
(b)	$\frac{x+4}{x+6}$ final answer	**1**	
19	$\frac{6}{7}$ or 0.857[1…]	**3**	**M1** for $t = \frac{k}{\sqrt{u}}$ oe **A1** for $k = 6$
20 **(a)** **(i)**	$\mathbf{p} + \frac{1}{2}\mathbf{r}$	**1**	
(ii)	$2\mathbf{p} + \mathbf{r}$	**1ft**	2 × *their* (i)
(b)	Midpoint of *R*Q	**1**	

21	52.3 or 52.27 to 52.28	**3**	**SC2** for 28.3 or 28.7 to 28.8 If 0, **M2** for $\frac{135}{360}\times\pi\times 24+2\times 12$ or **M1 f**or $\frac{135}{360}\times\pi\times 24$
22	$\frac{5x+13}{(x+3)(x+2)}$ oe final answer	**3**	**B1** for common denominator $(x + 3)(x + 2)$ seen **M1** for $2(x + 2) + 3(x + 3)$ soi
23	24.8 or 24.77 to 24.78	**4**	**M1** for recognition of angle *CEA* **M1** for $\sqrt{12^2+5^2}$ **M1** for tan = $\frac{6}{\text{their } AE}$ oe
24 (a)	$\begin{pmatrix} 6 & 7 \\ 16 & 17 \end{pmatrix}$	**2**	**B1** for 1 correct row or 1 correct column
(b)	$\frac{1}{5}\begin{pmatrix} 2 & -3 \\ -1 & 4 \end{pmatrix}$	**2**	**B1** for $k\begin{pmatrix} 2 & -3 \\ -1 & 4 \end{pmatrix}$ or $\frac{1}{5}\begin{pmatrix} a & b \\ c & d \end{pmatrix}$
25 (a)	2.8 oe	**1**	
(b)	700	**3**	**M2** for ½(20 + 30) × 28 oe or **M1** for a correct area statement
26	420	**5**	**M1** for $[CB =]\sqrt{4^2+(9-6)^2}$ **M1** for *their CB* from Pythagoras × 15 **M1** for $[2\times]\ \frac{1}{2}(6+9)\times 4$ **M1** for 4 × 15, 9 × 15, 6 × 15 with intention to add

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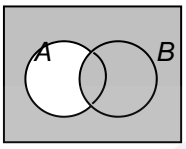
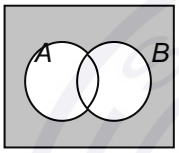
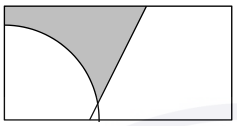
Qu	Answers	Mark	Part Marks
1		**1**	
		**1**	
2	$(p + 3)(k + m)$	**2**	**B1** for $k(p + 3) + m(p + 3)$ or $p(k + m) + 3(k + m)$
3	$17 - 4n$	**2**	**B1** for $\pm 4n$ seen
4	4.55×10^8	**2**	**B1** for figs 455 seen
5	10.5 www	**2**	**M1** for $42 = \frac{1}{2} \times BC \times 8$ or better
6	2.2[0...]	**2**	**M1** for $11.99 \div 0.626$ soi by 19.2 or 19.15...
7 (a)	5.17225...	**1**	
(b)	5.2	**1FT**	**FT** *their* (a)
8	6.1 final answer	**2**	**M1** for [$\sqrt{37.8225}$=] 6.15
9	**40.3** or 40.31 to 40.32	**3**	**M2** for $4.4 \times \sqrt[3]{\frac{0.05}{65}}$ soi **or M1** for $\sqrt[3]{\frac{0.05}{65}}$ soi or $\sqrt[3]{\frac{65}{0.05}}$ soi
10 (a)	95	**1**	
(b)	77	**2**	**B1** for [angle] $ACD = 58°$ or [angle] $BAC = 19°$ or [angle] $ANB = 103°$ or [angle] $CAE = 66°$

Qu	Answers	Mark	Part Marks
11	with 2 correct steps seen $\frac{18k}{35k}$	**3**	**B1** for $\frac{5k}{3k}$ and **M1** for $\frac{6}{7}\times$ *their* $\frac{3}{5}$
12	14.5 oe	**3**	**M2** for complete correct method or **M1** for one correct step
13	6632.55 cao final answer	**3**	**M2** for $6250 \times (1+\frac{2}{100})^3$ oe **or M1** for $6250 \times (1+\frac{2}{100})^2$ oe **SC2** for answer 382.55 final answer
14	0.625 oe	**3**	**M1** for $y=\frac{k}{x^3}$ **A1** for $k=40$
15	$\frac{-7\pm\sqrt{7^2-4(2)(-3)}}{2\times 2}$ 0.39, –3.89 cao	**B2** **B1,B1**	**B1** for $\sqrt{7^2-4(2)(-3)}$ or better seen **B1** for $p = -7$ and $r = 2 \times 2$ or better as long as in the form $\frac{p+\sqrt{q}}{r}$ or $\frac{p-\sqrt{q}}{r}$ After **B0B0** for the two answers, **SC1** for 0.4 or 0.386[0009...] and –3.9 or –3.886[0009...] or **SC1** for −0.39 and 3.89
16	15	**4**	**M2** for $\frac{1}{2}\times 40\times(26+19)$ oe or **M1** for one valid area calculation **Indep M1** for ÷ 60 **SC3** for answer 900
17 (a)	7 correct plots	**2**	**P1** for 5 or 6 correct
(b)	Negative	**1**	
(c)	ruled line of best fit within tolerance	**1**	

Qu		Answers	Mark	Part Marks
18		-1 -2 -3 -4	**4**	**B3** for $x < -\frac{3}{5}$ and $x > -4.5$ oe or **B2** for $x < -\frac{3}{5}$ or $x > -4.5$ oe or **B1** for $5x < -3$ or $-9 < 2x$ oe Or mark on answer line -1 oe
19	**(a)**	arc centre A radius 5 cm	**2**	**B1** arc with centre A
	(b)	ruled perpendicular bisector of DB with 2 pairs of correct arcs	**2**	**B1** correct ruled line **B1** 2 pairs of correct arcs
	(c)	cao 	**1**	
20	**(a)**	$10 < h \leq 13$	**1**	
	(b)	12.1[2] www	**4**	**M1** for at least 5 correct mid-values seen **M1** for $\sum fx$ where x is in the correct interval
	(c)	70, 115, 153, 185, 200	**2**	**M1** for their $\sum fx \div 200$ **B1** for 3 or 4 correct
21	**(a)**	4.5 oe	**2**	**B1** for [g(5)=] 0.1 oe
	(b)	x	**2**	**M1** for $\frac{1}{2\left(\frac{1}{2x}\right)}$ seen oe
	(c)	$\frac{x-4}{5}$ oe	**2**	**M1** for a correct first step e.g. $y - 4 = 5x$ or $\frac{y}{5} = x + \frac{4}{5}$ or $x = 5y + 4$
	(d)	-3	**2**	**M1** for $\left(\frac{1}{2}\right)^{-3} = 8$ or $\left(\frac{1}{2}\right)^{x} = \left(\frac{1}{2}\right)^{-3}$ or $2^{x} = \frac{1}{8}$ oe or $2^{-x} = 2^{3}$

CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2013 series

0580 MATHEMATICS

0580/23 Paper 2 (Extended), maximum raw mark 70

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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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
soi seen or implied

Qu	Answers	Mark	Part Marks
1	£ or pound[s] **Correct working must be shown**	2	**M1** for 425 ÷ 1.14 or 365 × 1.14
2	$\frac{30}{300}$ oe www	2	**M1** for 30 seen or $\frac{k}{300}$ seen
3	1500 or 3 pm	2	**B1** for 1h50 or 2h[0]5 or **SC1** for 1255 + *their* 1h50 + 15mins correctly evaluated
4 (a)	[±] **2.28** or 2.282 to 2.2822	1	
(b)	**0.109** or 0.1094[3…]	1	
5	$\left(\frac{2}{3}\right)^{1.5}$ $\left(-\frac{2}{3}\right)^{\frac{2}{3}}$ $(1.5)^{\frac{2}{3}}$ $\left(\frac{2}{3}\right)^{-1.5}$	2	**M1** for at least 2 correct decimals seen 1.3[1..] 0.5[4..] 1.8[3..] or 1.84 0.7[6..]
6	6	3	**M2** for $3\times\sqrt[3]{\frac{288\pi}{36\pi}}$ or **M1** for $3\times\sqrt[3]{\frac{288\pi}{36\pi}}$ or $3\times\sqrt[3]{\frac{36\pi}{288\pi}}$
7	260	3	**M2** for [2 ×](4 × 10 + 18 × 5) oe or **M1** for a correct area statement
8	2500	3	**M1** for $m = kr^3$ **A1** for $k = 20$
9 (a)	1.1×10^5	2	**B1** for 110 000 oe e.g.11×10^4
(b)	5×10^3	2	**B1** for 5000 oe e.g. 0.5×10^4

10	25	**4**	**M1** for correct method to eliminate one variable **A1** for $x = 11$ **A1** for $y = 3$ **B1 FT** for 2 × *their x* + *their y* correctly evaluated
11 (a)	77	**2**	**M1** for 11,13,17,19 clearly identified, ignore numbers less than 8 with no other numbers greater than or equal to 8 besides possibly an extra 17
(b)	either 18 or 19 or both	**2FT**	**M1** for 11,13,17 clearly identified, ignore numbers less than 8 with no other numbers greater than or equal to 8 besides possibly an extra 17 or for *their* (a) − 58
12 (a)	$\frac{5}{25}$ oe	**2**	**B1** for answer $\frac{5}{k}$ or $\frac{k}{25}$
(b)	$\frac{4}{25}$ oe	**2**	**B1** for answer $\frac{4}{k}$ or $\frac{k}{25}$
13	$\frac{8x}{(x-3)(x+1)}$	**4**	**B1** for common denominator $(x – 3)(x + 1)$ seen **B1** for $(x + 3)(x + 1) – (x – 1)(x – 3)$ soi **B1** for $x^2 + 3x + x + 3$ or $x^2 – 3x – x + 3$ soi
14 (a)	$n < 9$	**2**	**M1** for $2n < 18$ or $2n – 18 < 0$ oe If 0 scored **SC1** for 9 with incorrect inequality.
(b)	$(b + d)(a + c)$	**2**	**B1** for $b(a + c) + d(a + c)$ or $a(b + d) + c\,(b + d)$
15 (a)	4	**2**	**M1** for attempt at sum of all numeric and x terms equated to 74
(b)	26	**1FT**	=18 + 2 × their (a)
(c)	8	**1**	
16 (a)	1.5	**2**	**B1** for [g(18) =] 4
(b)	$2(x + 5)$ or $2x + 10$	**2**	**M1** for correct first step e.g. $x = \frac{y}{5} – 5$ or $\frac{x}{2} = y + 5$ or $2y = x – 10$

17	**(a)**	$\begin{pmatrix} 7 & 23 & 16 \\ 12 & 45 & 27 \end{pmatrix}$	**2**	**B1** for any one row or column correct, must be in a 2 by 3 matrix
	(b)	$\frac{1}{3}\begin{pmatrix} 6 & -3 \\ -3 & 2 \end{pmatrix}$	**2**	**B1** for $k\begin{pmatrix} 6 & -3 \\ -3 & 2 \end{pmatrix}$ or $\frac{1}{3}\begin{pmatrix} a & b \\ c & d \end{pmatrix}$
18		**15.4** or 15.35 to 15.36	**4**	**M1** for $\frac{120}{360}\times\pi\times5^2$ oe **M1** for $\frac{1}{2}\times5^2\times\sin120$ oe **M1** for $\frac{120}{360}\times\pi\times5^2-\frac{1}{2}\times5^2\times\sin120$ oe
19	**(a)**	hexagon	**1**	
	(b) (i)	$-\mathbf{b}+\mathbf{c}$	**1**	
	(ii)	$\mathbf{b}-\frac{1}{2}\mathbf{c}$	**2**	**B1** for **OB** + **BA** or any correct route
	(iii)	$-\mathbf{b}+\mathbf{c}$	**1FT**	= *their* (b)(i)
20	**(a)**	[±] 3.1623 cao	**2**	**M1** for $\sqrt{10}$ seen
	(b)	$\frac{4}{y^2-8}$ oe final answer	**4**	**M1** first move completed correctly **M1** second move completed correctly **M1** third move completed correctly **M1** final move completed correctly on answer line