Extended Mathematics
Topic : Number
Year :May 2013 -May 2024
Paper - 4
Answers

Question 1

(a)	2814 final answer	2	**M1** for 2345 ÷ 5 soi by 469 or ans = 2810
(b)	257.95 final answer	2	**M1** for 2345 × 0.11 oe or ans = 258
(c) (i)	280.5[0] final answer	2	**M1** for 330 × (1 – 0.15) oe or ans = 281
(ii)	375	3	**M2** for 330 ÷ (1 – 0.12) oe Or **M1** for 330 = (100 – 12)% oe
(d)	1605.89 or 1605.9[0]	3	**M2** for $1500 \times (1 + 0.023)^3$ oe soi by 1605.898751 or 1500 × 1.07(05…) Or **M1** for $1500 \times (1 + 0.023)^2$ oe
(e)	23.1 or 23.07 to 23.08	3	**M2** for $\frac{325 - 250}{325} \times 100$ oe Or **M1** for $\frac{325 - 250}{325}$ soi by 0.2307… 3sf or better or $\frac{250}{325} \times 100$ soi by 76.9…

Question 2

$a = 1/3$ oe, $b = 1/2$ oe	6	**B1** for any one of $1 = a + b + 1/6$ oe $5 = 8a + 4b + 2/6$ oe $14 = 27a + 9b + 3/6$ oe $30 = 64a + 16b + 4/6$ oe Or any other correct equation **and B1** for another of the above equations **and M1** for equating one coefficient or correct rearrangement to give a or b as subject **and M1** for subtracting to eliminate a or b or correct substitution for *their* a or their b **A1** for $a = 1/3$ oe or $b = 1/2$ oe

Question 3

(a) (i)	$\frac{6}{5+6+3}\times 560$ [= 240]	**2**	Accept 'of' used instead of × **M1** for $560 \div (5 + 6 + 3)$
(ii)	120	**1**	
(b)	90	**2**	**M1** for $\frac{3}{8}\times 240$ oe
(c) (i)	96120 final answer	**2**	**M1** for *their*(*a*)(ii) × 75 + (560 – *their* (*a*)(ii)) × 198 oe
(ii)	187.5[0] final answer	**3**	**M2** for $\frac{198}{1+0.056}$ oe or **M1** for (100 + 5.6)[%] = 198 oe seen
(d)	184[.2....]	**3**	**M2** for $\frac{36\times 0.75-9.5}{9.5}\times 100$ oe **or M1** for $\frac{36\times 0.75}{9.5}\times 100$ or $36\times 0.75-9.5$ [17.5] used implied by answer 84.2 or **SC1** for final answer 284[.2..]
(e)	69.4 and 69[.0] cao	**3**	**SC2** for one correct or both correct but reversed **M1** for two of 10.85, 10.95, 23.65 or 23.75 seen or 2(23.7 + 10.9) + 4(0.05) or 2(23.7 + 10.9) – 4(0.05)

Question 4

(a)	$3^2 + 1^2$	**1**	Ignore attempt to evaluate $\sqrt{10}$
(b) (i)	$\frac{\sqrt{10}}{3}$ final answer	**1**	
(ii)	$\frac{10}{3}$ final answer	**2**	**M1** for *their* $\frac{\sqrt{10}}{3} \times \sqrt{10}$ or *their* $\left(\frac{\sqrt{10}}{3}\right)^2 + \left(\sqrt{10}\right)^2$ implied by 3.33 seen
(c)	$\frac{100}{27}$ or $3\frac{19}{27}$ isw conversion or 3.7[03] to 3.7[04]	**2**	**M1** for $3 \times \left(\frac{\sqrt{10}}{3}\right)^n$ oe where n is 3 or 4 or for $[OP_4 =] \sqrt{\frac{1000}{81}}$ or for their (b)(ii) $\times \left(\frac{\sqrt{10}}{3}\right)^n$ where n is 1 or 2
(d) (i)	18.43...	**2**	**M1** for $\tan [P_1OP_2] = \frac{1}{3}$ oe
(ii)	18.4[3…]	**1**	
(iii)	20	**3**	**SC2** for 19 **or M1** for $\frac{360}{18.4[3...]}$

Question 5

(a)	**(i)**	[0]8 15	**1**	
	(ii)	$\frac{1.8}{27} \times 60$ [= 4] oe	**M2**	**M1** for $\frac{1.8}{27}$ oe [0.0667 or better]
(b)	**(i)**	275	**3**	**M2** for $\frac{15-4}{4} \times 100$ or $\frac{15}{4} \times 100 - 100$ oe or **M1** for $\frac{15-4}{4}$ or $\frac{15}{4} \times 100$ or oe 375
	(ii)	73.3[3…]	**3**	**M2** for $\frac{1.8}{15} \times 60$ [=7.2 min] and $\frac{27 - \textit{their}\ 7.2}{27} \times 100$ oe or **M1** for $\frac{1.8}{15} \times 60$ [=7.2 min] or final answer of 26.6[6…] or 26.7
	(iii)	25	**2**	**M1** for $\frac{9}{\textit{figs}\ 36}$ oe

Question 6

(a)	50, 70	**1**	
	$10n$ oe	**1**	
	51, 71	**1**	
	$10n + 1$ oe	**1**	
(b) (i)	212	**1**	
(ii)	$20n + 12$	**1**	
(iii)	$20n + 152$	**1**	
(c) (i)	$5 \times 3^2 + 6 \times 3 = 63$	**1**	
	and $11 + 21 + 31 = 63$		
	or $32 + 31 = 63$ or $11 + 52 = 63$	**1**	
(ii)	560	**1**	
(d)	Complete solution with no errors seen and a conclusion e.g. $5n^2 + 6n + 10(n + 1) + 1$ $= 5n^2 + 6n + 10n + 10 + 1$ $= 5n^2 + 10n + 5 + 6n + 6$ $= 5n^2 + 10n + 5 + 6n + 6$ $= 5(n + 1)^2 + 6(n + 1)$	**4**	**B1** for $5n^2 + 6n + 10n + 10 + 1$ or better **B1** for use of $5(n + 1)^2 = 5n^2 + 10n + 5$ oe at any stage **B1** for use of $6n + 6 = 6(n + 1)$ oe at any stage

Question 7

(a) (i)	45	**2**	**M1** for $5 \times 63 \div 7$
(ii)	20	**2**	**M1** for $5 \times 56 \div 14$
(iii)	23.4 or 23.38 to 23.41	**3**	**M2** for $\frac{13 \times 4.9 - 48.8}{13 \times 4.9} \times 100$ or $\frac{4.9 - 48.8 \div 13}{4.9} \times 100$ Or **M1** for $\frac{13 \times 4.9 - 48.8}{13 \times 4.9}$ or $\frac{48.8}{13 \times 4.9} \times 100$ or 76.6[…]
(b)	128	**4**	Using fractions (percentages / decimals): **M1** for $\frac{3}{4} \times \frac{3}{8}$ $\left[= \frac{9}{32}\right]$ or $\frac{75}{100} \times 37.5$ [= 28.125%] **A1** for $\frac{9}{32}$ or 28.125[%] **M1** for $36 \div \frac{9}{32}$ oe or $36 \times \frac{100}{28.125}$ oe Partial percentages **M1** for (Remaining) $\frac{100 \times 36}{37.5}$ [= 96] **A1** for 96 **M1** for $96 \div \frac{75}{100}$ oe **SC1** for 288

Question 8

(a)	15 18 $3n+3$ or $3(n+1)$ 6 10 25 36 $(n+1)^2$	**9**	**B2** for 15, 6, 25 or **B1** for two correct values **B3** for 18, 10, 36 or **B1** for each correct value **B2** for $3n+3$ oe or **M1** for $3n+k$, for any k **B2** for $(n+1)^2$ oe or **M1** for a quadratic expression
(b)	14	**2**	**M1** for $(n+1)(n+2)=240$ or better or $15\times16=240$
(c) (i)	$½+p+q=9$	**1**	
(ii)	$[p=]\ 3$ $[q=]\ \frac{11}{2}$	**5**	**B2** for $4p+2q=23$ or **B1** for $½\times2^3+p\times2^2+q\times2$ oe **M1** for correct multiplication and subtraction of *their* equations **A1** for $[p=]\ 3$ or $[q=]\ \frac{11}{2}$ If 0 scored then **SC1** for either correct

Question 9

(a) (i)	3216 Final answer	**2**	**M1** for $(18900-5500)\times0.24$ oe
(ii)	1307 Final answer	**2FT**	**FT** (18900 – *their* **(a)(i)**) ÷ 12 correctly evaluated **M1** for (18900 – *their* **(a)(i)**) ÷ 12
(b)	4.5[%] nfww	**2**	**M1** for $\frac{19750.50\,[-18900]}{18900}\times100$ or $\frac{19750.50-18900}{18900}$
(c)	A by 31.05… or 31.04 to 31.05 or 31.[0] 31.1[0]	**5**	**M1** for $1500\times4.1/100\times3$ [+ 1500] oe **M1** for 1500×1.033^3 [– 1500] oe **A1** for 1684.5 or 184.5 **or** 1653[.45..] or 153[.45..] **and M1dep** for subtraction of *their* amounts or *their* interests

Question 10

(a)	14 10 or 2 10 pm final answer	**2**	**M1** for (0)8 10 oe or answer 14 hours and 10 minutes or answer 2 10 [am]
(b)	5 hours 45 minutes cao	**2**	**M1** for 345 [mins] seen or for 805 /7 × 3 oe or 5.75 seen
(c) **(i)**	798 or 798.2 to 798.4….	**2**	**M1** for $10712 / 13\frac{25}{60}$ or $10712 \div 13.4\ldots$
(ii)	1.82×10^5 or 1.815×10^5 to 1.816×10^5	**4**	**B3** for 182000 or 181500 to 181600 seen **or M2** for 10712000/59 oe **or M1** for figs 10712/figs 59 soi by figs 182 or figs 1815 to 1816 **and B1 FT** for their number of litres correctly converted to standard form rounded to 3sf or better
(d)	8600	**3**	**M2** for $10148 \div 1.18$ oe **or M1** for 10148 associated with 118[%]

Question 11

(a)	48 and 57,	$9n + 3$ oe	**1**	**2**	**B1** for $9n + k$ oe
(b)	56 and 50,	$86 - 6n$ oe	**1**	**2**	**B1** for $k - 6n$ oe
(c)	125 and 216,	n^3 oe	**1**	**1**	
(d)	130 and 222	$n^3 + n$ oe	**1**	**1FT**	FT *their* **(c)** + n dep on expression in n in **(c)**

Question 12

(a)	**(i)** $\frac{2}{5}$ cao	**1**	
	(ii) 3 : 2 cao	**1**	
(b)	**(i)** 1.22	**2**	**M1** for 86.38 – 28 × 1.56
	(ii) 1.3 [0] nfww	**3**	**M2** for 1.56 ÷ 1.2 oe **or M1** for 1.56 = 120% soi
(c)	33.6[0]	**2**	**M1** for (667 – 314.2) ÷ 10.5 oe

Question 13

(a)	3 correct lines on grid (0, 0) to (40, 5) (40, 5) to (100, 5) (100, 5) to (120, 0)	**2**	Allow good freehand **SC1FT** for 2 lines correct, **FT** from an incorrect line
(b)	$\frac{5}{40}$ oe	**1**	
(c)	3.75	**4**	**M2** for 0.5 × 40 × 5 + 60 × 5 + 0.5 × 20 × 5 oe [450] or **M1** for evidence of a relevant area = distance and **M1**dep *their* area (or distance) ÷ 120

Question 14

(a)	**(i)**	$1+2+3+4+5=15$	**1**	
	(ii)	Correct substitution equating to sum e.g. $\frac{2(2+1)}{k}=3$ **and** $k=2$ stated with no errors seen	**2**	**M1** for using a value of n in $\frac{n(n+1)}{k}$ e.g. $\frac{2(2+1)}{k}=3$ or for a verification using $k=2$ e.g. $\frac{2(2+1)}{2}=3$
	(iii)	1830	**1**	
	(iv)	30	**2**	**M1** for $\frac{n(n+1)}{2}=465$ or better
	(v)	$n-8$	**1**	
(b)	**(i)**	225, 15	**2**	**B1** either
	(ii)	$\frac{n^2(n+1)^2}{4}$ oe	**1**	
	(iii)	36100	**2**	**M1** for $\frac{19^2(19+1)^2}{4}$ oe or 190^2

Question 15

(a)	62100[.00] Final answer	**2**	**B1** for 62 074[. 35] or 62 070
(b)	39300	**3**	**M2** for $45\,981 \div 1.17$ oe **or M1** for 45 981 associated with 117 [%]
(c)	20436	**2**	**M1** for $45\,981 \div (3+4+2)$ or $45\,981 \times 4$
(d)	4	**3**	**M2** for $\frac{1.5\times1000}{330}$ oe **or M1** for figs 4545... or 455
(e)	25545	**2**	**M1** for $45\,981 \times \frac{5}{9}$

Question 16

(a)	$\frac{1}{8}\ \frac{1}{16}\ \frac{1}{32}$	**2**	**B1** for 2 correct
	$\frac{1}{2^{n-1}}$ oe	**2**	**SC1** for $\frac{1}{2^n}$ oe
	$2^{-3}\ 2^{-4}\ 2^{-5}$	**1**	
	2^{1-n} or $2^{-(n-1)}$	**1**	
(b) (i)	64 256 1024	**1**	
	$2^6\ 2^8\ 2^{10}$	**1**	
(ii)	$2^{2(n-1)}$ or 2^{2n-2}	**1**	
(c)	16 384	**2**	**B1** for $n = 8$

Question 17

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

Question 18

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

Question 19

(a)	8	**2**	**M1** for 12 ÷ 1.5 oe
(b)	[Distance =] 36 *their*36 ÷ 3 [= 12] oe	**B1** **M1**	
(c)	200	**2**	**M1** for 12 × 1000 ÷ 60 oe e.g. 36000 ÷ 180
(d)	Horizontal line at 36 to 13 45 (*their* 13 45, 36) joined to (16 42, 0)	**1** **1FT**	

Question 20

(a)	62 705	**2**	**M1** for 75 246 ÷ 6 soi by 12 541 or 75 246 × 5
(b)	10.9 or 10.88…	**3**	**M2** for $\frac{(150\,675-135\,890)}{135\,890} \times 100$ oe **or** **M1** for correct fraction soi by 0.1088… or $\frac{150\,675}{135\,890} \times 100$ soi by 110.88…
(c)	127 000	**3**	**M2** for 135 890 ÷ 1.07 oe **or** **M1** for 135 890 associated with 107%

Question 21

(a) **(i)**	$\frac{920}{8} \times 7$ [=805] oe	**1**	$\frac{2990}{26} \times 7$ [= 805]
(ii)	30.8 or 30.76 to 30.77	**2**	**M1** for $\frac{8}{(11+8+7)}$ [× 100]
(b)	1211 final answer	**5**	**B4** for 13 926.5[0] [area A total sales] or **B3** for 11 040 [area B] **and** 10 867.50 [area C] or 21 907.5 [area B + area C] or **B2** for 11 040 [area B] **or** 10 867.50 [area C] or **M1** for 736 [B tickets] and **M1** for 483 [C tickets] After 0 scored **SC2** for answer of 1196 or **SC1** for 13754 (A total sales)
(c)	37 720	**3**	**M2** for $\frac{35834}{0.95}$ oe or **M1** for 35834 associated with 95[%]

Question 22

(a)	**(i)**	49.5[0]	**3**	**M2** for $16.5[0] \div 5 \times (5 + 3 + 7)$ or **M1** for $16.5[0] \div 5$
	(ii)	66	**1FT**	**FT** *their* **(a)(i)** $\div 75 \times 100$ to 3 sf or better
(b)		2 hours 39 mins 45 secs	**3**	**B2** for 159.75 oe, e.g. 2.6625 [h] 9585 [s] or **M1** for 3 hrs 33 mins oe / $(2 + 9 + 1)$ oe
(c)		18.75 **final answer**	**3**	**M2** for $16.5[0] \div 0.88$ oe or **M1** for 16.5[0] associated with 88[%]

Question 23

(a)		28 45 17 21 45 66	**1, 1** **1** **1**	
(b)	**(i)**	$4n - 3$ oe	**2**	**M1** for $4n + k$
	(ii)	237	**1**	
	(iii)	50	**2FT**	**FT** *their* **(b)(i)** = 200 solved and then answer truncated **dep** on linear expression of form $an + k$ **M1** for *their* $4n - 3 = 200$ or *their* $4n - 3 \leqslant 200$
(c)		$p = 2$ and $q = -5$ with some correct supporting working leading to the solutions	**5**	**M2** for any 2 of $p + q + 3 = 0$ oe, $2^2 p + 2q + 3 = 1$ oe, $3^2 p + 3q + 3 = 6$ oe, $4^2 p + 4q + 3 = 15$ oe , $5^2 p + 5q + 3 =$ *their* 28 oe, etc. or **M1** for any one of these **M1** indep for correctly eliminating p or q from pair of linear equations **A1** for one correct value If 0 scored **SC1** for 2 values that satisfy one of their original equations After **M0**, 2 correct answers **SC1**
(d)		$2n^2 - n$ or $n(2n - 1)$	**2**	**B1** for answer $2n^2 + k[n]$ or **M1** for *their quadratic* from **(c)** + *their linear* from **(b)(i)**

Question 24

(a)	$\frac{1.5}{100} \times 450000$ oe	**1**	Accept equivalent methods
(b)	6000	**3**	**M2** for $\frac{6750}{112.5} \times 100$ oe or **M1** for 112.5% associated with 6750 oe
(c)	376.25 cao final answer	**2**	**B1** for 21.5 and 17.5 seen
(d)	22.4	**2**	**M1** for 200^2 or 2^2 seen oe
(e)	5184	**2**	**M1** for $12 \times 16 \times 27$
(f)	9023	**3**	**M1** for $12000 \div 1.33$ **A1** for 9022.55 to 9022.56 or 9022.6 or 9020 **B1indep** for their answer rounded to the nearest euro if possible

Question 25

(a)		**1**	
(b)	30 10	**1** **1**	
(c)	$n(n+1)$ oe	**2**	**B1** for $an^2 + bn + c$ a, b, c numeric $a \neq 0$
(d)	$\frac{1}{2}n(n-1)$ oe	**2**	**B1** for using $\frac{1}{2}$ oe in expression of form $\frac{1}{2}(an^2 + bn + c)$ $a \neq 0$ or $kn(n-1)$ $k \neq 0$

Question 26

(a)	**(i)**	640×1.02^6 oe $= 720.7\ldots$	**M1** **B1**	Must be seen
	(ii)	3.02 or 3.020 to 3.024… nfww	**4**	**M3** for $[x =]\ \sqrt[4]{721 \div 640}$ or better (implied by answer of 1.03[02…] or $r = 0.0302$[4…] or **M2** for $(\textit{their } x)^4 = 721 \div 640$ or **M1** for $640 \times (\textit{their } x)^4 = 721$ oe
(b)		874.8[0] final answer	**2**	**M1** $1200 \times (1 - 0.1)^3$ oe

Question 27

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

Question 28

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

Question 29

(a) (i)	$\frac{13}{13+8+3} \times 12000$ with no subsequent errors	**1**	
(ii)	4000	**1**	
(b)	$2 \times 6500 + 5 \times$ *their* **(a)(ii)** + $(12000 - 6500 -$ *their* **(a)(ii)**$)$ or $(13 \times 2 + 8 \times 5 + 3 \times 1) \times 500$	**2**	**B1** for any two of 2×6500, $5 \times$ *their* **(a)(ii)**, $(12000 - 6500 -$ *their* **(a)(ii)**$)$ seen or $13 \times 2 + 8 \times 5 + 3 \times 1$
(c)	37 500	**3**	**M2** for $\frac{34500}{100-8} \times 100$ oe or **M1** for 34500 associated with $(100 - 8)\%$
(d)	$\frac{11}{26}$ cao	**2**	**M1** for any correct simplified version of $\frac{2750}{6500}$
(e)	89 500	**1**	

Question 30

(a) (i)	3.9[0]	**2**	**M1** for $2.6 \div 2$
(ii)	$\frac{13}{18}$ cao	**2**	**B1** for any correct unsimplified fraction
(iii)	24	**3**	**M2** for $9 \div 0.375$ oe or **M1** for associating 9 with $(100 - 62.5)\%$
(b)	109 cao	**3**	**B2** for 108.5 to 108.6 or **M1** for $250 \times \left(1 - \frac{8}{100}\right)^{10}$ oe

Question 31

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

Question 32

(a)	$\frac{8}{8+15+9} \times 640$ oe	**1**	With no errors seen
(b)	300 and 180	**2**	**B1** for each or **SC1** for answers reversed
(c)	10 nfww	**2**	**M1** for $160 \div 15.25$ implied by 10.5 or 10.49... nfww
(d)	$\frac{7}{24}$	**3**	**M1** for $\frac{3}{8} + \frac{1}{3}$ oe **M1dep** on previous **M1** for $1 -$ *their* $(\frac{3}{8} + \frac{1}{3})$ oe

Question 33

(a)		8 25 17	**2**	**B1** for 2 correct
(b)		$n+2$ oe	**1**	
(c)	**(i)**	$(n-1)^2$ oe	**2**	**M1** for $(n+k)^2$ for integer k
	(ii)	92	**2**	**M1** for $\sqrt{8281}$ or 91 seen
(d)	**(i)**	n^2-3n-1 final answer	**2**	**M1** for *their* $(n-1)^2$ – *their* $(n+2)$ soi
	(ii)	39	**1**	
(e)		1 and $-\frac{1}{2}$ oe	**1**	
		$\frac{1}{4}$ oe	**1**	
		$-\frac{1}{8}$ oe	**1**	

Question 34

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

Question 35

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

Question 36

(a)	$\frac{8}{8+15+9}\times 640$ oe	**1**	With no errors seen
(b)	300 and 180	**2**	**B1** for each or **SC1** for answers reversed
(c)	10 nfww	**2**	**M1** for 160 ÷ 15.25 implied by 10.5 or 10.49... nfww
(d)	$\frac{7}{24}$	**3**	**M1** for $\frac{3}{8}+\frac{1}{3}$ oe **M1dep** on previous **M1** for $1 - \textit{their}\ (\frac{3}{8}+\frac{1}{3})$ oe

Question 37

(i)	$\frac{9}{200}$ or 0.045	**1**	
(ii)	10800	**3**	**M2** for ½ (900 + 1500) × 9 oe or **M1** for method of finding a relevant area
(iii)	7.2	**1FT**	**FT** (*their* 10800) ÷ 1500

Question 38

(a)	6250	**3**	**M2** for $\frac{6000}{100-4}\times 100$ oe or **M1** for 6000 associated with 96 [%]
(b)	4441	**3**	**B2** for 4441.1 to 4441.2 or 4440 or **M1** for $\frac{6000}{1.351}$
(c)	1.58 or 1.581…	**5**	**M1** for $6000\times\left(1+\frac{1.5}{100}\right)^{8}$ oe **A1** for 6758.95…... or 6758.96 to 3 sf or better or 758.95 or 758.96 rounded or truncated to 3 sf and **M2** for $\{\textit{their}(6000\times 1.015^{8})-6000\}\times\frac{100}{6000\times 8}$ oe or **M1** for $\frac{6000\times r\times 8}{100}$ oe

Question 39

(a)	**(i)**	36600	**3**	**M2** for $6100 \div 2 \times (2 + 7 + 3)$ oe or **M1** for $6100 \div 2$ soi
	(ii)	$16\frac{2}{3}$ or 16.7 [16.66 to 16.67]	**1**	
(b)		1231 708 final answer nfww	**5**	**M4** for $5964 \times 15 + 28400 \times 35 + 8236 \times 18$ or **M3** for 5964×15 **and** $28\,400 \times 35$ or for $5964 \times 15 + 42\,600 \times$ *their* decimal $\frac{2}{3}$ $\times 35 + (42\,600 - 5964 - 42\,600 \times$ *their* decimal $\frac{2}{3}) \times 18$ or **M2** for 5964×15 **or** $28\,400 \times 35$ or for $42\,600 \times$ *their* decimal $\frac{2}{3} \times 35$ or **M1** for $0.14 \times 42\,600$ or $42\,600 \div 3 \times 2$
(c)		27.2[0] nfww	**5**	**M2** for $23.80 \div 0.7$ oe or **M1** for 23.80 associated with 70% oe and **M2** for *their* $(23.80 \div 0.7) \times 0.8$ or **M1** for *their* $(23.80 \div 0.7) \times 0.2$

Question 40

(i)	2.5	**1**	
(ii)	1312.5 final answer	**3**	**M2** for any complete correct method e.g $25 \times 10 \div 2 + 45 \times 25 + 5 \times 25 \div 2$ **M1** for any correct method for a relevant area under the graph

Question 41

(a)	10 15 15 21 35 48	**6**	**B1** for each correct entry
(b) (i)	3	**2**	**M1** for any correct substitution in $n^2 + 4n + p$ = number of tiles eg $2^2 + 4(2) + p = 15$
(ii)	143	**1FT**	**FT** 140 + *their* (b)(i)
(c)	$a = \frac{1}{2}$ oe $b = \frac{3}{2}$ oe nfww	**5**	**B1** for a correct simplified equation e.g. $a + b + 1 = 3$, $4a + 2b + 1 = 6$, $9a + 3b + 1 = 10$ etc **B1** for a 2nd correct simplified equation **M1** for correctly eliminating one variable for *their* equations in a and b **A1** for $a = \frac{1}{2}$ nfww **A1** for $b = \frac{3}{2}$ nfww
(d) (i)	171	**2FT**	**FT** *their* $a \times 17^2$ + *their* $b \times 17 + 1$ **M1** for *their* $a \times 17^2$ + *their* $b \times 17 + 1$
(ii)	673	**1FT**	**FT** *their* (d)(i) × 4 – 11

Question 42

(a)	**(i)**	12 45 [pm]	**2**	**B1** for 20 45 seen or 8 45 pm seen or [0]1 35 seen
	(ii)	788 or 787.8 to 788.1	**2**	**M1** for 8800 ÷ 11h 10 mins oe
(b)	**(i)**	4230[.00]	**2**	**M1** for 2350 ÷ 5 oe
	(ii)	22.2 or 22.2…	**1**	
(c)	**(i)**	3808 final answer	**2**	**M1** for $2240 \times \frac{100+70}{100}$ oe
	(ii)	800	**3**	**M2** for $2240 \div \frac{100+180}{100}$ oe or **M1** for 2240 associated with 280%
(d)	**(i)**	1130	**4**	**M3** for $(826.5[0] - 12 \times (28 + 6.5[0])) \div 1.25$ seen or **M2** for $826.5[0] - 12 \times (28 + 6.5[0])$ seen or **M1** for $12 \times (28 + 6.5[0])$ seen
	(ii)	$146.9[0] final answer	**2FT**	**FT** *their*(d)(i) × 0.13 correctly evaluated If answer not exact to at least 3 sf or better **M1** for *their* (d)(i) ÷ 10 × 1.3

Question 43

(a)	**(i)**	48	**2**	**M1** for $\frac{72}{3}$
	(ii)	32.4[0]	**1**	
	(iii)	$\frac{13}{30}$	**2**	**M1** for $\frac{72 - \textit{their}(ii) - 8.4}{72}$ oe
	(iv)	24	**3**	**M2** for $\frac{19.2}{0.8}$ oe or **M1** for recognising 19.2 is 80%
(b)		660	**3**	**M2** for $\frac{550 \times 2 \times 10}{100} + 550$ oe or **M1** for $\frac{550 \times 2 \times 10}{100}$ oe
(c)		663.9[0]	**2**	**M1** for 550×1.019^{10} oe
(d)		1.5[0]	**3**	**M2** for $\sqrt[10]{\frac{638.3[0]}{550}}$ oe or **M1** for $550 \times m^{10} = 638.3[0]$

Question 44

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

Question 45

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

Question 46

(a)	**(i)**	11 054.25 final answer	**2**	**M1** for $18000\times\left(1-\frac{15}{100}\right)^3$ oe
	(ii)	16 500	**3**	**M2** for $14025\div\left(1-\frac{15}{100}\right)$ oe or **M1** for recognition of 14 025 as 85% soi
(b)		260 final answer	**2**	**M1** for $P\left(1+\frac{5}{100}\right)^2=286.65$ oe
(c)	**(i)**	6.18	**3**	**M2** for $\frac{224.72-200}{200\times2}\times100$ oe or $\frac{1}{2}\left(\frac{224.72}{200}\times100-100\right)$ or **M1** for $\frac{200\times r\times2}{100}$ oe or $\frac{224.72-200}{200\times2}$ or $\frac{224.72}{200}\times100-100$ soi by 12.36 If zero scored, **SC1** for 56.18 or 56.2 as final answer
	(ii)	6	**3**	**M2** for $\sqrt{\frac{224.72}{200}}$ or $\sqrt{\frac{224.72}{2}}$ soi by 1.06 or 106 or 10.6 or **M1** for $200\left(1+\frac{r}{100}\right)^2=224.72$ oe

Question 47

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

Question 48

(a)	22.9 or 22.85 to 22.86	**2**	**M1** for $\frac{8}{10+17+8}$ [× 100] oe
(b)	$5635 \times \frac{17}{10+17+8}$ or better [= 2737]	**2**	**M1** for $\frac{5635}{(10+17+8)}$
(c)	5000	**3**	**M2** for $5635 = k\left(1+\frac{2.42}{100}\right)^5$ oe or **B1** for $\left(1+\frac{2.42}{100}\right)$
(d)	9950	**2**	**M1** for 2 × 2500 or 3 × 1650
(e)	1.98 final answer	**2**	**B1** for 1.976 or 1.98 not final answer or **M1** for 130 × 0.0152

Question 49

(a)	4 5 6 7	**1**	
	8 16 32 64 128	**3**	**B2** for 3 or 4 correct or **B1** for first 2 correct If 0 scored, **SC1** for 4 values correctly doubled **FT** one error
(b)	2^n oe	**1**	
(c) (i)	2 + 4 + 8 = 14	**1**	
	16 – 2 = 14	**1**	or for $14 + 2 = 16 = 2^4$
(ii)	62 and 6	**2**	**B1** for each
(iii)	$2^{n+1} - 2$ oe	**1**	
(iv)	9	**1**	

Question 50

(a)(i)	9550	**1**	
(a)(ii)	23 158 750	**2FT**	**FT** *their* **(a)(i)** × 2425 correctly evaluated **M1** for *their* lower bound × 2425
(a)(iii)	23 160 000	**1FT**	**FT** *their* **(a)(ii)** rounded to 4 sf
(a)(iv)	2.316×10^7	**1FT**	**FT** *their* **(a)(iii)** or *their* **(a)(ii)** rounded to 3sf or more and in standard form
1(b)	520 nfww	**3**	**M2** for $546 \times \frac{100}{(100+5)}$ oe or **M1** for 105[%] associated with 546 oe
1(c)	3380 or 3376 to 3377	**2**	**M1** for $3\,000 \times \left(1+\frac{3}{100}\right)^4$ oe

Question 51

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

Question 52

(a)(i)	600 ÷ (11+ 9) × 11 [=330] with no errors seen	**M1**	Could be in separate steps
(a)(ii)	270	**1**	
(b)(i)	372 cao nfww	**3**	**B2** for answer 371.7… or **M1** for $330 \times \left(1+\frac{1.5}{100}\right)^{8}$ oe not spoiled After zero scored, **SC1** for answer 42 or 41.7…
(b)(ii)	12.6 or 12.7 or 12.63 to 12.73	**2**	**M1** for $\frac{\textit{their}\,\textbf{(b)(i)}-330}{330}$ or $\frac{\textit{their}\,\textbf{(b)(i)}}{330}\times 100$ soi by 112.7 or 113 After zero scored, **SC1** for answer 12%
(c)(i)	$\frac{99}{280}$ cao final answer	**1**	
(c)(ii)	27.5[0]	**3**	**M2** for $24.75 \div \frac{100-10}{100}$ oe or **M1** for recognising 24.75 as 90[%] oe
(d)(i)	32 cao	**2**	**M1** for $\left(1-\frac{20}{100}\right)\left(1-\frac{15}{100}\right)[x]$oe or for $0.15 \times 0.8\,[x]$ oe
(d)(ii)	13 cao	**2**	**M1** for $\left(1-\frac{20}{100}\right)\left(1-\frac{15}{100}\right)\times x = 40.84 - 32$ oe seen or for *their* **(d)(i)** + $\left(1-\left(\frac{\textit{their}\,\textbf{(d)(i)}}{100}\right)\right)x = 40.84$ oe

Question 53

(a)(i)	100	**1**	
(a)(ii)	92.3 or 92.29… to 92.31	**3**	**M2** for $200 \div (2 + \frac{10}{60})$ oe or **M1** for 200 ÷ *their* time interval or **M1** for $\frac{10}{60}$ soi oe
(b)(i)	240 nfww	**3**	**M2** for $\frac{V}{2}\left(\frac{30}{60} + \frac{20}{60}\right) = 100$ oe or **M1** for any correct relevant area seen in terms of V
(b)(ii)	$\frac{2}{9}$ oe	**2FT**	**FT** for *their* **(b)(i)** ÷ 1080 to 3 sf or better **M1** for *their* **(b)(i)** $\times \frac{1000}{3600}$ soi

Question 54

(a)(i)	275.31	**2**	**M1** for 90 × 23.15 + 1885 × 13.5 oe
(a)(ii)	3202	**3**	**M2** for $\frac{198.16 - 90 \times 0.245}{0.055}$ oe **M1** for 90 × 0.245 or 90 × 24.5 oe
1(b)	17.[0] or 17.00 to 17.01	**2**	**M1** for $13.5 \times \left(1 + \frac{8}{100}\right)^3$
(c)(i)	40	**3**	**M2** for $\frac{7.7 - 5.5}{5.5}$ [×100] oe or $\frac{7.7}{5.5} \times 100$ or **M1** for $\frac{7.7}{5.5}$ oe
(c)(ii)	11.9 or 11.86 to 11.87	**3**	**M2** for $\sqrt[3]{\frac{7.7}{5.5}}$ oe or **M1** for $5.5 \times x^3 = 7.7$ oe
1(d)	150 [million] oe	**2**	**M1** for 390 [million] ÷ (5 + 2 + 6)
1(e)	250 nfww	**3**	**M2** for 258.25 ÷ ((100 + 3.3) ÷ 100) or **M1** for 258.25 associated with 103.3[%]

Question 55

(a)(i)	5 and 13	**1**	
(a)(ii)	$8n - 3 = 203$	**M1**	Evaluation of 25th or 26th term with supporting evidence or explanation
	25.75 or $25\frac{3}{4}$	**A1**	Second evaluation of 25th or 26th terms with supporting evidence or explanation If zero scored, **SC1** for 25.75 or 197 and 205 with partial evidence or explanation
(b)(i)	$6n + 7$ oe final answer	**2**	**B1** for $6n + c$ or $kn + 7$ $k \neq 0$
(b)(ii)	$n^2 + n + 2$ oe final answer	**2**	**B1** for a quadratic expression or second difference = 2
9(c)	[y =] 10	**2**	**M1** for $5(20 - y) = 50$
	[First term =] 14	**2**	**M1** for $5(x - \textit{their } y) = 20$ or for $20 \div 5 + \textit{their } y$

Question 56

(a)(i)	$180 \div (2 + 3 + 5) \times 5$ [= 90]	**1**	with no errors seen
(a)(ii)	7.05 or 7.053….	**3**	**M2** for $\frac{x}{12} = \sin 36$ oe or better or **B1** for 36 or 54 seen
(b)(i)	13	**2**	**M1** for $7.8 \div 3$ soi
(b)(ii)	36.9 or 36.86 to 36.87	**3**	**B1** for smallest angle identified **M1** for $\sin[\ ] = \frac{3}{5}$ oe or $\sin[\ ] = \frac{7.8}{\textit{their}\ \textbf{(b)(i)}}$ oe If zero scored, **SC1** for calculation of 53.1

Question 57

(a)(i)	1890	**2**	**M1** for $126 \div 4$ [$\times 60$] oe If zero scored, **SC1** for answer 31.5
(a)(ii)	103.95	**4**	**M3** for $0.5 \times \left(\frac{44}{60} + \frac{55}{60}\right) \times 126$ oe or **SC3** for figs 10395 or figs 104 or **M2** for two correct area methods or for a full method without minutes to hours conversion or **M1** for one correct area with or without minutes to hours conversion
(b)(i)	$126 \times 1000 \div (60 \times 60)$	**1**	
(b)(ii)	46.3 or 46.28 to 46.29	**3**	**M2** for $(1400 + 220) \div 35$ oe or **M1** for distance ÷ speed or $1400 + 220$
3(c)	180 nfww	**4**	**B3** for final answer 3 OR **M3** for $\frac{217.5}{72.5} \times 60$ oe or **M2** for $217.5 \div 72.5$ oe or $\frac{210 \text{ to } 220}{72.5} \times 60$ or $\frac{217.5}{72 \text{ to } 74} \times 60$ or **M1** for 217.5 or 72.5 seen or $\frac{215}{73} \times 60$

Question 58

(a)(i)	4 : 5	**1**	
(a)(ii)	4 : 5	**1**	
(a)(iii)	3 : 4	**2**	**B1** for 12 : 16 or answer 4 : 3
(b)(i)	26.8 or 26.79…	**3**	**M2** for $\frac{15600-11420}{15600}[\times 100]$ or $\frac{11420}{15600}\times 100$ or **M1** for $\frac{11420}{15600}$
(b)(ii)	16000 nfww	**3**	**M2** for $15600\times\frac{100}{100-2.5}$ oe or **M1** for 15600 associated with 97.5[%] seen
1(c)	1.6 or $\frac{8}{5}$	**2**	**M1** for $\frac{200\times x\times 15}{100}=48$ oe or **M1** for figs 16
1(d)	2.5 or $\frac{5}{2}$ cao nfww	**3**	**B2** for 2.49[9…] or 102.4[99…] or 1.024[99…] or 2.50 or 102.5 or 1.025 or **M2** for $\sqrt[10]{\frac{256}{200}}$ oe or **M1** for $256=200(x)^{10}$ seen

Question 59

(a)(i)	23.27 final answer	**2**	**M1** for 9×2.97 soi
(a)(ii)	2.75 final answer	**3**	**M2** for $2.97\div\frac{108}{100}$ oe or **M1** for 108[%] associated with 2.97 oe
1(b)	12.4[0] or 12.41 to 12.42	**2**	**M1** for $35\div 0.0153$ oe If 0 scored, **SC1** for answer 0.19
1(c)	70 nfww	**3**	**M2** for $(600+2.5)\div(9-0.5)$ or **B1** for one of $600+2.5$ or $9-0.5$ seen

Question 60

1(a)	25 9 16	**3**	**B1** for each
(b)(i)	$(n-1)^2$ oe	**2**	**B1** for any quadratic of form [1]n^2[+bn+c]
b)(ii)	$n+3$ oe	**1**	
1(c)	25	**2**	**M1** for *their* $(n-1)^2 = 576$
(d)(i)	n^2-3n-2 final answer	**3**	**M1** for *their* $(n-1)^2$ – *their* $(n+3)$ oe or 2nd diff = 2 soi **B1** for $n^2-n-n+1$ or better or $-n-3$ or for expression of form $n^2-2n-n+k$ or correct expression not in simplest form
d)(ii)	808 cao	**2**	**M1** for substituting 30 in *their* **(d)(i)**

Question 61

(a)(i)	13.5	**3**	**M2** for $\frac{45.4[0]-40}{40}$ [× 100] or $\frac{45.4[0]}{40} \times 100$ or **M1** for $\frac{45.4[0]}{40}$ [× 100]
(a)(ii)	35.5[0]	**3**	**M2** for $42.6[0] \div \left(1+\frac{20}{100}\right)$ or better or **M1** for recognising 42.6[0] as 120[%]
1(b)	150 cao	**2**	**M1** for $\frac{500\times2\times15}{100}$ oe
(c)(i)	7800 cao	**3**	**B2** for 7790 or 7785 to 7786 or **M1** for $21000\times\left(1-\frac{18}{100}\right)^5$ oe isw If 0 or 1 scored, **SC1** for *their* 7785… seen and rounded correctly to nearest 100
(c)(ii)	9[.00…]	**3**	**M2** for $\sqrt[12]{\frac{42190}{15000}}$ or better or **M1** for $15000\left(1+\frac{x}{100}\right)^{12}$ =[42190]

Question 62

(a)(i)	85	**1**	
(a)(ii)	455	**2**	**M1** for $260 \div 20 \times 35$ oe
(a)(iii)	61	**3**	**B2** for 61.5… seen or **M1** for $2000 \div 650$ soi or for $\frac{x}{2000} = \frac{20}{650}$ oe or other attempt at scaling up with 650 or for $650 \div 20$ oe
(b)(i)	40	**3**	**M2** for $\frac{1.89 - 1.35}{1.35}$ [$\times 100$] oe or $\frac{1.89}{1.35} \times 100$ oe or **M1** for oe $\frac{1.89}{1.35}$[$\times 100$] soi
(b)(ii)	1.75 nfww	**3**	**M2** for $1.89 \div \left(\frac{100+8}{100}\right)$ or better or **M1** for 1.89 associated with 108 [%]
1(c)	10.1 or 10.06…	**3**	**M2** for $\sqrt[3]{\frac{20.8}{15.6}}$ oe or **M1** for $15.6 \times k^3 = 20.8$ oe
(d)(i)	14:15	**3**	**B2** for correct unsimplified 3 term ratio A: B: C or correct unsimplified two term ratio A : C or **M1** for attempt to find common multiple of 4 and 10 or other common value for B or for $7 \times \frac{4}{10}$ oe or $3 \times \frac{10}{4}$ oe
(d)(ii)	147	**3**	**M2** for $\frac{45}{15}(14 + 20$ [$+15$]$)$ oe or $45 \div 3 \times 4 + (45 \div 3 \times 4) \div 10 \times 7$ [$+ 45$] or **M1** for $45 \div 3$ oe or $45 \div$ *their* **(d)(i)** value for C shown

Question 63

(a)	$\frac{9}{9+7+4}\times 680$	**1**	
(b)	238 136	**3**	**B2** for 238 or 136 or **M1** for $\frac{7}{9+7+4}\times 680$ oe or $\frac{4}{9+7+4}\times 680$ oe seen
(c)	272	**2**	**M1** for $306 \div 1.125$
(d)	1.37	**3**	**M2** for $(17.56-5\times 2.69)\div 3$ or **M1** for $17.56-5\times 2.69$ or **B1** for 13.45 [cost of apples]
(e)	40.8[0]	**3**	**3FT** for $0.3\times$ *their* 136 from part **(b)** or **M2** for *their* $136(\frac{1}{2}+\frac{1}{5})$ or better or **M1** for *their* $136\times\frac{1}{2}$ or *their* $136\times\frac{1}{5}$ or **B1** for 68 or 27.2 or $\frac{3}{10}$ or 0.3 seen

Question 64

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

Question 65

(a)(i)	1200	**2**	**M1** for $1962 \div 1.635$
(a)(ii)	1667.7[0] final answer	**2**	**M1** for $1962 \times (1 - \frac{15}{100})$ oe or **B1** for 294.3[0] If 0 scored, **SC1** for answer 1020
a)(iii)	275	**2**	**M1** for $220 \div$ *their* $(5 - 1)$ soi
b(i)	165	**3**	**M2** for $\frac{9752 - 3680}{3680}[\times 100]$ oe or $\frac{9752}{3680} \times 100$ oe or **M1** for $\frac{9752}{3680}$ or $9752 - 3680$
b(ii)	51 200	**3**	**M2** for $\frac{74240}{100 + 45}[\times 100]$ oe or **M1** for 74 240 associated with 145[%] oe

Question 66

(a)	0.6	**1**	
(b)	50.7	**3**	**M2** for $1.2 \times 19 + \frac{1}{2}(19 + 12) \times 1.8$ oe or **M1** for method for finding any relevant area
(c)	17.9	**3**	**M2** for *their* $50.7 - 1.2 \times 19$ [– 10] oe or **M1** for 1.2×19 oe seen isw

Question 67

(a)(i)	2.25 final answer	**2**	**M1** for $\frac{3}{5+3}$ or $\frac{6}{5+3}$ oe
(a)(ii)	37.5	**1**	**FT** *their* $\frac{\textbf{(a)(i)}}{6}\times 100$
a)(iii)	5.5[0] or 5.499 to 5.500	**2**	**M1** for $6 \div 1.091$
1(b)	21	**3**	**M2** for $15\times\sqrt{\frac{352.8}{15\times 12}}$ oe or **SC2** for answer 16.8 or **M1** for $\sqrt{\frac{352.8}{15\times 12}}$ or $\sqrt{\frac{15\times 12}{352.8}}$ seen or **M1** for a correct implicit statement for the length
1(c)	525	**3**	**M2** for $\frac{483}{100-8}$[×100] oe or **M1** for 483 associated with 92 [%]

Question 68

(a)	473	**2**	**M1** for $645 \div (11 + 4)$
(b)	212.5	**2**	**M1** for 50×4.25
(c)	31.5 or 31.45 to 31.46	**3**	**M2** for $54 \div 1\frac{43}{60}$ oe or **M1** for time =1h 43min or 103 [mins] or $54 \div$ *their* time
(d)	875	**1**	
(e)	10.4 or 10.38 to 10.39	**1**	
f)(i)	30 [×] 70 and 2100	**1**	
f)(ii)	both numbers rounded up oe	**1**	

Question 69

(a)(i)	6h 27 mins	**2**	**B1** for answer .....h 27 mins
(a)(ii)	150 km/h	**3**	**M2** for $\frac{90}{36} \times 60$ or **M1** for $\frac{90}{\textit{their}\ \text{time}}$ or **B1** for 36 [mins] seen
(a)(iii)	780	**4**	**M3** for $\left(90 \times \frac{35}{3600}\right) \times 1000 - 95$ oe or **M2** for $\left(90 \times \frac{35}{3600}\right) \times 1000$ oe or **B1** for figs 875 or **M1** for $90 \times \frac{35}{3600}$ seen or for $90 \times \frac{1000}{3600}$ oe If 0 scored, **SC1** for *their* distance (> 95) – 95
(b)(i)	7 : 5	**1**	
(b)(ii)	66.7 or 66.66 to 66.67	**3**	**M2** for $\frac{140-84}{84}$ [× 100] oe or for $\frac{140}{84} \times 100$ oe or **M1** for $\frac{140}{84}$ oe
(b)(iii)	24 576	**5**	**M4** for complete method, $40 \times 60 + 0.7 \times 220 \times 84 + 0.3 \times 220 \times 140$ oe OR **B1** for 40 [children] **M1** for $0.7 \times 220 \times 84$ oe **M1** for $0.3 \times 220 \times 140$ oe **B1** for 2400 or 12936 or 9240 nfww
(c)	3.5×10^5 nfww	**3**	**M2** for $3.08 \times 10^5 \div \left(\frac{100-12}{100}\right)$ oe or **M1** for 3.08 [$\times 10^5$] associated with (100–12)%

Question 70

)(a)(i)	3, –1	**2**	**B1** for each
)(a)(ii)	$23 - 4n$ oe final answer	**2**	**M1** for $k - 4n$ or $23 - jn$ $(j \neq 0)$
(a)(iii)	22	**2**	**M1** for *their* **(a)(ii)** = –65
10(b)	23	**2**	**B1** for 37 or 60

Question 71

(a)	16.5 or 16.49...	**3**	**M2** for $\frac{1.13 - 0.97}{0.97}$[×100] oe or $\frac{1.13}{0.97} \times 100$ oe or **M1** for $\frac{1.13}{0.97}$ oe
b)(i)	35	**2**	**M1** for $60 \div (5 + 7)$
)(ii)	140	**1**	
(c)	\$1.26 final answer	**3**	**B2** for 1.259... or 1.26 but not as final answer or **M1** for $2.25 \div 0.9416$ If 0 scored, **SC1** for 1.13×0.9416
(d)	15[.0…]	**3**	**M2** for $\sqrt[21]{\frac{58000}{1763000}}$ oe or **M1** for $58000 = 1763000\ (k)^{21}$
(e)	1239.75	**2**	**B1** for 43 + 0.5 or 28 + 0.5 oe seen

Question 72

(a)	40 54 26 34	**4**	**B1** for each
(b)	$n^2 + 3n$ or $n(n+3)$ oe	**2**	**B1** for a quadratic expression or for 2nd common difference 2 (at least 2 shown) or for 2 correct equations seen or for subtracting n^2
(c)	100	**2**	**M1** for *their* **(b)** = 10300 seen
(d)	$[a =] \frac{1}{2}$ oe and $[b =] \frac{5}{2}$ oe	**2**	**B1** for each or **M1** for one correct equation or for 2nd difference = 1 soi (at least 2 shown)

Question 73

(a)	6 nfww	**3**	**M2** for $\frac{2.65-2.50}{2.50}[\times 100]$ or for $\frac{2.65}{2.50}\times 100$ or **M1** for $\frac{2.65}{2.50}$
(b)	552.5[0]	**3**	**B2** for 52.5[0] or **M2** for $500\times\frac{1.5}{100}\times 7+500$ oe or **M1** for $500\times\frac{1.5}{100}$ [$\times 7$] oe
(c)	37.4 or 37.36…	**2**	**M1** for $\left(1+\frac{1.6}{100}\right)^{20}$ oe soi 1.37…
(d)	4[.00...]	**3**	**M2** for $\sqrt[22]{\frac{2607}{6400}}$ or **M1** for $6400\times x^{22}=2607$ oe or better

Question 74

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

Question 75

(a)(i)	5 : 6	**1**	
(a)(ii)	2.0736[0] × 10^5 final answer	**3**	**B2** for 207360 oe or **M1** for 16 × 18 × 720
(b)(i)	26780	**2**	**M1** for 18540 ÷ 9 soi
(b)(ii)	1.36	**2**	**M1** for 0.85 × 1.6 oe or **B1** for 0.51 or 51
1(c)	66.7 or 66.66 to 66.67	**5**	**M4** for $\frac{(2.3-1.5\times0.92)}{1.5\times0.92}[\times100]$ oe or $\frac{2.3\times100}{1.5\times0.92}$ oe **OR** **Working in euros** **B2** for [€]1.38 or **M1** for 1.5[0] × 0.92 **M2dep on B2 or M1** for $\frac{2.3-\textit{their}\ 1.38}{\textit{their}\ 1.38}[\times100]$ oe or $\frac{2.3-\textit{their}\ 1.38}{\textit{their}\ 1.38}\times100$ oe or **M1** for 2.3 – *their* 1.38 or $\frac{2.3}{\textit{their}\ 1.38}$ **OR** **Working in dollars** **B2** for [$]2.50 or **M1** for or 2.3[0] ÷ 0.92 **M2dep on B2 or M1** for $\frac{\textit{their}\ 2.5-1.5}{1.5}[\times100]$ oe or $\frac{\textit{their}2.5}{1.5}\times100$ or **M1** for *their* 2.5 – 1.5 or $\frac{\textit{their}2.5}{1.5}$
(d)	219 000 or 218814[.3….] rounded to 4 sf or more	**3**	**B2** for 414000 or 414414[.3….] rounded to 4 sf or more or **M2** for $195600\times\left(1+\frac{8.7}{100}\right)^9$ [– 195600] or **M1** for $195600\times\left(1+\frac{8.7}{100}\right)^k$ or better (k >1 and an integer)

Question 76

)(a)	171 or 171.0…	**3**	**M2** for $\frac{7.6}{160} \times 60 \times 60$ oe or **M1** for $\frac{7.6}{160}$ or $\frac{7.6}{2\frac{2}{3}}$ or $\frac{7.6}{2\,\text{min}\,40\,\text{sec}}$ If 0 scored, **SC1** for answer 189 or 188.6 to 188.7
b)(i)	77 [min] 20 [s]	**4**	**M3** for $\frac{32}{12} \times 29$ oe or **B2** for 4640 or 1.29 or 1.288 to 1.289, $\frac{58}{45}$ oe or 32 laps or 29 laps or **M2** for $2^5 \times 5 \times 29$ oe or **M1** for 2 m 40 sec ÷ (2 m 40 sec – 2 m 25 sec) soi for 2 m 25 sec ÷ (2 m 40 sec – 2 m 25 sec) soi or for an attempt to find LCM or 23 200 seen or correctly find prime factors of 145 or 160 or for $\frac{7.6}{145}$ or $\frac{7.6}{2\frac{5}{12}}$ or $\frac{7.6}{2\,\text{min}\,25\,\text{sec}}$ oe, provided SC1 not earned in part (a)
b)(ii)	220.4	**2**	**M1** for *their* (b)(i) ÷ 2min 40 sec [× 7.6] oe or *their* (a) × *their* (b)(i) ÷ 60 oe

Question 77

:(a)	[Ali] 2700 [Mo] 2100	**3**	**B2** for one correct or for correct values reversed or **M1** for 600 ÷ (9 – 7) or for any equation that would lead to an answer of 300, 2700 or 2100, or 4800 (for the total)
:(b)	11	**3**	**M2** for $\frac{220-195.8}{220}[\times 100]$ or for $[100 -]\frac{195.8}{220}\times 100$ or **M1** for 220 – 195.8 or for $\frac{195.8}{220}$ or a correct implicit equation for percentage reduction or for $\frac{195.8-220}{220}$
:(c)	84	**3**	**M2** for $\frac{63}{1-\frac{25}{100}}$ oe or **M1** for associating 63 with (100 – 25)% or a correct implicit equation for the original price.

Question 78

3(a)	662.45	**2**	**M1** for $600\times\left(1+\frac{2}{100}\right)^5$ oe
(b)(i)	800	**2**	**M1** for $x\left(1+\frac{5}{100}\right)^2=882$ oe or **SC1** for answer 82
b)(ii)	5 nfww	**2**	**M1** for trial with $882\times\left(1+\frac{5}{100}\right)^n$ with $n>1$

Question 79

)(a)	– 7 $13 - 4n$ oe 36 $(n + 1)^2$ oe 125 n^3 oe 128 2^{n+2} oe	**11**	**B1** **B2** or **B1** for $13 - kn$ $(k \neq 0)$ or for $k - 4n$ **B1** **B2** or **B1** for any quadratic **B1** **B1** **B1** **B2** or **B1** for 2^k oe
)(b)	...., ..., 6, 10, 16 .... , 3, 4, 7, ... 2, ..., 1, 0, ...	**3**	**B1** for each correct row
(c)(i)	$\frac{q}{p+q}$	**1**	
c)(ii)	$\frac{18}{29}$	**1**	

Question 80

(a)(i)	295	**2**	**M1** for [87 +] 4×52 oe
(a)(ii)	29.5 or 29.49…	**1**	**FT** $\frac{87}{\textit{their}\textbf{(a)(i)}} \times 100$
1(b)	11	**2**	**M1** for 18×4 [± 61] oe
1(c)	4160 cao nfww	**2**	**M1** for $64 \div 0.0154$ or **B1** for rounding *their* answer to nearest 10
1(d)	2.4[0] nfww	**2**	**M1** for $\left(1+\frac{12.5}{100}\right)x = 2.7[0]$ oe
1(e)	53 : 36	**3**	**M2** for 265 : 180 oe or for answer 36 : 53 or 53 min: 36 min or **M1** for 4h 25 [mins] or 265 [mins] seen
1(f)	6[.00] or 5.999…	**3**	**M2** for $\sqrt[5]{\frac{736}{550}}$ or **M1** for $736 = 550 \times (x)^5$

Question 81

(a)	187	**2**	**M1** for $220 \times \left(1-\frac{15}{100}\right)$ oe or **B1** for 33 seen
(b)	19.8	**3**	**M2** for $29.7 \times \sqrt[3]{\frac{0.4}{1.35}}$ oe or **M1** for $\sqrt[3]{\frac{0.4}{1.35}}$ or $\sqrt[3]{\frac{1.35}{0.4}}$ oe seen or for $\frac{29.7^3}{x^3} = \frac{1.35}{0.4}$ oe
(c)	12.4 or 12.44…	**3**	**M1** for $90 \times 75 \times h = 7 \times$ figs 12 **B1** for 1000 cm^3 = 1 litre soi

Question 82

(i)	$6 - 2n$ oe final answer	**2**	**B1** for answer $6 - kn$ $(k \neq 0)$ oe or answer $j - 2n$ oe or for correct expression shown in working and then spoilt
(ii)	$2n^2 - 1$ oe final answer	**2**	**B1** for 2nd diff = 4 or a quadratic expression or for correct expression shown in working and then spoilt

Question 83

1(a)	1260	**2**	**M1** for $15 \times 54 + 25 \times 18$
1(b)	38 800	**2**	**M1** for $37054 \div \left(1 - \frac{4.5}{100}\right)$ oe
(c)(i)	15 : 12 : 28	**2**	**M1** for correct attempt to find a common multiple for the women oe
c)(ii)	216	**3**	**M2** for $224 \div$ *their* $28 \times$ *their* $(15 + 12)$ or **M1** for $224 \div$ *their* 28
1(d)	55.25	**2**	**M1** for $8 + 0.5$ or $6 + 0.5$ seen
1(e)	156 or 156.3…	**2**	**M1** for $\left(1 + \frac{1.5}{100}\right)^{30}$

Question 84

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

Question 85

(a)(i)	7680	**2**	**M1** for $0.24 \times 32\,000$ oe
(a)(ii)	34 240	**2**	**M1** for $32\,000 \times \frac{100+7}{100}$ oe
1(b)	5306.04	**2**	**M1** for $5000 \times \left(1+\frac{2}{100}\right)^3$ oe
1(c)	26.7 or 26.66... to 26.67	**4**	**B3** for 96 or $\frac{96}{360}$ oe OR **M3** for $(1-\frac{1}{5}) \times (1-\frac{2}{3}) \times 100$ oe or **M2** for $(1-\frac{1}{5})$ and $(1-\frac{2}{3})$ oe OR **M1** for $360 \div 5$ [$\times 4$] oe **M1** for *their* $288 \div 3$ [$\times 2$]
1(d)	33 500	**2**	**M1** for $36\,515 \div \frac{100+9}{100}$ oe
1(e)	6525	**4**	**M3** for $\left(\frac{65}{45}-\frac{63}{45}\right)[A]=290$ oe or **M2** for $\left(\frac{13}{9}-\frac{7}{5}\right)[A]=290$ oe or **M1** for correct attempt to convert to a common ratio value for Arjun or for $\frac{13}{9}-\frac{7}{5}$ oe

Question 86

A	24	**B1**	
	$5n-1$ oe	**B2**	**B1** for $5n-k$ or $jn-1$ oe $j \neq 0$
B	127	**B1**	
	n^3+2 oe	**B2**	**B1** for n^3 oe
C	256	**B1**	
	$4^{(n-1)}$ oe	**B2**	**B1** for 4^k oe

Question 87

(a)(i)	$5.101[00\ldots] \times 10^8$ final answer	**1**	
(a)(ii)	361 150 800 oe	**2**	**FT** *their* **(a)(i)** **M1** for $\frac{70.8}{100} \times 510\,100\,000$ or for $\frac{70.8}{100} \times$ *their* **a(i)**
(b)(i)	6070 oe	**1**	
(b)(ii)	32 000 oe	**2**	**B1** for figs 32
(b)(iii)	6.68 or 6.677 …	**2**	**M1** for $\frac{6.41\times10^5}{9.6[0]\times10^6}$ [$\times$ 100] oe
(b)(iv)	1250 or 1248 to 1249 oe	**2**	**B1** for figs 125 or figs1248 to figs 1249
(c)(i)	25.1 or 25.08…	**2**	**M1** for $\frac{7.53[\times10^9] - 6.02[\times10^9]}{6.02[\times10^9]}$ oe or $\frac{7.53[\times10^9]}{6.02[\times10^9]} \times 100$
(c)(ii)	1.33 or 1.325…	**3**	**M2** for $\sqrt[17]{\frac{7.53[\times10^9]}{6.02[\times10^9]}}$ or $\sqrt[17]{1+\frac{\textit{their}\ \textbf{(c)(i)}}{100}}$ or **M1** for $6.02[\times10^9] \times p^{17} = 7.53[\times10^9]$ or $p^{17} = 1+\frac{\textit{their}\ \textbf{(c)(i)}}{100}$

Question 87

(a)	A : –3 $17-4n$ oe	**3**	**B1** for –3 **B2** for $17-4n$ oe or **B1** for $k-4n$ oe or $17-pn$ oe, $p \neq 0$
	B : 124 n^3-1 oe	**3**	**B1** for 124 **B2** for n^3-1 oe or **B1** for any cubic
	C : $\frac{11}{128}$ $\frac{n+6}{2^{n+2}}$ oe	**4**	**B1** for $\frac{11}{128}$ **B3** for $\frac{n+6}{2^{n+2}}$ oe or **B2** for 2^{n+2} oe seen or **B1** for 2^k oe or $n+6$ seen
(b)	$\frac{p+1}{2q}$ oe	**2**	**B1** for $p+1$ or $2q$ oe

Question 88

(a)(i)	2210 or 2208 or 2208.2, or 2208.16…	**2**	**M1** for $2000\times\left(1+\frac{2}{100}\right)^5$ oe
(a)(ii)	10.4 or 10.5 or 10.40 to 10.41	**2**	**M1** for $\frac{\textit{their}\,\textbf{(a)(i)}-2000}{2000}$ [×100] or $\frac{\textit{their}\,\textbf{(a)(i)}}{2000}\times100$ or $\left(1+\frac{2}{100}\right)^5-1$ or $\left(1+\frac{2}{100}\right)^5\times100$ oe
(a)(iii)	12	**3**	**B2** for 11.3 or 11.26 to 11.27 **OR** **M2** for [2000 ×] $\left(1+\frac{2}{100}\right)^{11}$ oe or [2000 ×] $\left(1+\frac{2}{100}\right)^{12}$ oe seen or **M1** for [2000 ×] $\left(1+\frac{2}{100}\right)^{n}$ oe, $n>5$ oe or for $2000\times\left(1+\frac{2}{100}\right)^{n}$ = or > or ⩾ 2500 oe

(b)	490 cao	**3**	**M2** for $p\times\left(1-\frac{4}{100}\right)^{16}=255$ oe soi by 490.0... or **M1** for $p\times\left(1-\frac{4}{100}\right)^{n}=255$ oe, $n>1$ oe

Question 89

(a)	9080 cao	**3**	**B2** for 9078 to 9081… or **M1** for 813 × *their* 11h 10min
(b)(i)	654 or 653.5…	**2**	**M1** for 10260 ÷ 15 h 42 min oe
(b)(ii)(a)	21.8 or 21.82 to 21.83	**1**	
(b)(ii)(b)	4.58 or 4.59 cao	**2**	**M1** for 470 ÷ (10260 ÷ 100) oe or 100 ÷ *their* **(b)(ii)(a)**
(c)	12.97	**1**	

Question 90

(a)	25 36 10 15 35 51	**2**	**B1** for 3, 4 or 5 correct
(b)	n^2	**1**	
(c)(i)	92	**1**	
(c)(ii)	$\frac{1}{2}(n^2-n)$ oe	**2**	**M1** for $\frac{1}{2}(3n^2-n)-n^2$ oe or for final quadratic answer with $\frac{1}{2}n^2$ oe or $-\frac{1}{2}n^2$ oe but not both

'(d)	$a = \frac{1}{2}$, $b = \frac{1}{2}$	**5**	**B2** for 2 correct equations eg $a + b = 1$, $8a + 4b = 6$ or **B1** for 1 correct equation **B2** for one correct value or **M1** (dep on at least B1) for correctly eliminating one variable from two linear equations in a and b OR **B2** for $a = \frac{1}{2}$ or **B1** for $6a = 3$ or for 3rd difference = 3 **B2** for $b = \frac{1}{2}$ or **M1** for substituting *their* a into a correct equation of first differences

Question 91

(a)	1 : 5 : 12	**2**	**M1** for 2 : 10 : 24 or 7 : 35 : 84 or $\frac{1}{18} : \frac{5}{18} : \frac{12}{18}$
(b)(i)	266 and 95	**3**	**B2** for 266 or 95 or 266 and 95 reversed or **M1** for $\frac{114}{6}$
(b)(ii)	15	**2**	**M1** for $\frac{114 - 96.9}{114}$ [× 100] oe or $\frac{96.9}{114} \times 100$
(c)(i)	2h 50min	**1**	
(c)(ii)	636	**2**	**M1** for 1802 ÷ *their* 2h 50min

Question 92

(a)	245	**1**	
(b)	8	**2**	**M1** for $40 + 26.5x = 252$ oe or **B1** for 212 seen
(c)	6	**2**	**M1** for $(224 - 2 \times 48) \div 32$ oe or $2 \times 48 + 32(x - 2) = 224$ soi
(d)	35 : 36 : 32 final answer	**2**	**B1** for *their* (a) : 252 : 224 or equivalent ratio

Question 93

(a)(i)	–5	**1**	
(a)(ii)	Subtract 4 oe	**1**	
(a)(iii)	$15 - 4n$ oe final answer	**2**	**B1** for $k - 4n$ or $15 - jn$ $j \neq 0$
(b)(i)	$\frac{1}{21}$ or equivalent fraction	**2**	**B1** for $\frac{12}{7}$ and $\frac{10}{6}$
(b)(ii)	$n = \frac{3}{5}$ oe or $2n \geqslant n + 1$ but $3 < 4$.	**M2**	**M1** for $\frac{3}{4} = \frac{2n}{n+1}$ oe or **M1** for $2n > n + 1$ but $3 < 4$
	No, n is not an integer oe or No, $\frac{3}{4}$ is less than 1, oe	**A1**	

Question 94

(a)(i)	120	**2**	**M1** for $6 \div (21 - 19)$ oe soi or for $\frac{2x}{40} = 6$
(a)(ii)(a)	34	**2**	**M1** for $40 - \frac{15}{100} \times 40$ oe or better or **B1** for 6
(a)(ii)(b)	35	**2**	**M1** for $\left(1 - \frac{15}{100}\right) \times p = 29.75$ or better
(b)(ii)	2019 nfww	**3**	**M2** for one correct trial of $n = 8$ or $n = 9$ either to find a salary or, if working with 1.02^n and 47 500÷ 40 100 [= 1.1845], to find a value of 1.02^n or **B2** for final answer 9 or 4 nfww or **M1** for *their* $44\,274 \times \left(1 + \frac{2}{100}\right)^n = 47\,500$ oe or $40\,100 \times \left(1 + \frac{2}{100}\right)^n = 47\,500$ oe or for at least one trial giving a value greater than *their* 44 274
(c)	2.9 [increase]	**2**	**M1** for $\left(1 + \frac{5}{100}\right) \times \left(1 - \frac{2}{100}\right)$ oe implied by 1.029 or 102.9[%]

Question 95

125 n^3 oe final ans	**B2**	**B1** for 125 **B1** for n^3
29 $6n-1$ oe final ans	**B3**	**B1** for 29 **B2** for $6n-1$ oe or **B1** for $6n+k$ or $an-1$ $(a \neq 0)$
2^{n-3} oe final ans	**B2**	**B1** for $2^{n\,[+k]}$ oe
25 $6n-1-2^{n-3}$ oe final ans OR 25.25 $-\frac{1}{24}n^3+\frac{1}{8}n^2+\frac{17}{3}n-1$ oe final ans	**B2**	**FT** *their* 29 – 4 and *their* $6n-1-$ *their* 2^{n-3} **B1FT** for each OR **B1** for each

Question 96

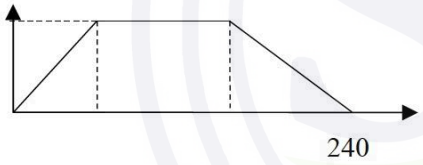
(a)(i)	11.61 final answer	**2**	**M1** for $13.5[0] \times \left(1-\frac{14}{100}\right)$ oe or **B1** for 1.89
(a)(ii)	197.37 final answer	**2**	**FT** 17 × *their* (a)(i) exact or correct to nearest cent **M1** for 42.5 ÷ 2.5
(b)(i)	53.3 or 53.33…	**1**	
(b)(ii)	7.5	**2**	**M1** for 22.5 ÷ (2 + 8 + 5) oe soi

(c)	20.55×2.45 oe	**M2**	**M1** for 20.5 + 0.05 oe seen or 2.4 + 0.05 oe seen If 0 scored, **SC1** here for 20.45 × 2.35 oe
	3 nfww	**A2**	**M1** for *their* area ÷ 10 ÷ 2.5 oe

Question 96

(a)(i)	438 cao	**2**	**M1** for $\frac{500}{1.142}$
(a)(ii)	14.95	**2**	**M1** for [329 –] 275×1.142 oe
(b)	14	**2**	**M1** for $5.25 \times \frac{8}{3}$ oe
(c)	1.7[0] or 1.699…	**3**	**M2** for $\sqrt[5]{\frac{6669}{6130}}$ or **M1** for $6669 = 6130\ (k)^5$

Question 97

(a)	0.18 or $\frac{9}{50}$	**1**	
(b)	$1944 \times \frac{1000}{3600 \times 3600}$	**M1**	
	$9 \div 0.15 = 60$	**M1**	
(c)		**1**	ruled line to axis with point of contact at 240
(d)	6.9375	**4**	**M2** for area = $\frac{1}{2} \times (130 + 240) \times 9$ oe or **M1** for one correct partial area **M1dep** for *their* total area ÷ 240

Question 98

(a)(i)	28	**2**	**M1** for $32 \times 0.50 + 30 \times 0.40$
(a)(ii)	$98 - 100 \times 0.5$ $48 \div 0.4 = 120$ [minutes] = 2 [hrs]	**M3**	**M1** for $100 \times 0.50 + x \times 0.40 = 98$ **M1** for $50 + 0.4x = 98$ or $0.4x = 48$ **M1** for $x = \frac{48}{0.4}$ $x = 120$ [min] = 2 [hr] OR **M1** for $100 \times 0.5 [= 50]$ **M1** for $98 - 50 [= 48]$ **M1** for $48 \div 0.4 = 120\ [\text{min}] = 2\ [\text{hr}]$

(b)	2925 1170 4095	**3**	**B2** for one correct answer or **M1** for $8190 \div (5 + 2 + 7)$
(c)	58	**2**	**M1** for $\left(1+\frac{45}{100}\right)k = 84.1$ oe

Question 99

(a)(i)	105	**2**	**M1** for $\frac{3}{100} \times 500[\times 7]$
(a)(ii)	115 or 114.9...	**3**	**M2** for $500 \times \left(1+\frac{3}{100}\right)^{7}[-500]$ or **M1** for $500 \times \left(1+\frac{3}{100}\right)^{k}$, k integer $\geqslant 2$
(b)	8600	**3**	**M2** for $\frac{6269.4}{\left(1-\frac{10}{100}\right)^{3}}$ oe or **M1** for $C \times \left(1-\frac{10}{100}\right)^{3} = 6269.4$ oe

Question 100

(a)(i)	$\frac{450}{8+7+3}\times 8$ oe	**2**	**M1** for $\frac{450}{8+7+3}$
(a)(ii)	75	**1**	
(a)(iii)	56	**2**	**M1** for $\frac{32}{100}\times(450-200-$ *their* $75)$ oe or $\frac{32}{100}\times\frac{450}{8+7+3}\times 7$ oe If 0 scored, **SC1** for answer 231
(a)(iv)	59 000 nfww	**3**	**B2** for 58 600 to 58 800 or **B1** for 293 to 294 or **M1** for $\frac{\text{figs}485\times 200}{165}$ oe If 0 scored, **SC1** for *their* more accurate answer seen and rounded to the nearest 1000
(b)(i)	3 075 000	**1**	
(b)(ii)	3.075×10^6	**1**	**FT** *their* (b)(i)
(c)	32.5	**2**	**M1** for $x\times\left(1+\frac{16}{100}\right)=37.7$ or better
(d)	2460 or 2458. …	**2**	**M1** for $1800\left(1+\frac{2.1}{100}\right)^{15}$ oe

Question 101

(a)(i)	71.4 or 71.42 to 71.43	**1**	
(a)(ii)	97 [min] 25 [s]	**3**	**B2** for 13 min 55 sec seen or 97.4 or 97.41 to 97.42 seen or 5845 seen OR **M2** for $55.66\ldots \div 4 \times 7$ oe or $3340 \div 4 \times 7$ oe or for $7/4 \times 55 + 7/4 \times 40$ oe or **M1** for 55 min 40 sec ÷ 4 oe or **M1** for **total time** ÷ 16 soi
(b)(i)	60.8[0]	**2**	**M1** for $47.5 \times \left(1+\frac{28}{100}\right)$ oe or **B1** for 13.3[0]
(b)(ii)	71.25	**3**	**B2** for 118.75 Or **M2** for $47.50 \div \left(1-\frac{60}{100}\right) - 47.50$ or **M1** for $x \times \left(1-\frac{60}{100}\right) = 47.50$ oe or better
(c)	15 380	**4**	**M3** for $(1\,120\,000 - 5000) \div (70 + 2.5)$ oe or **B2** for answer figs 15 379 to figs 15 380 or **M2** for $(1\,120\,000 \pm 5000) \div (70 \pm 2.5)$ oe or **M1** for one of figs 675, 725, 1115, 1125 seen
(d)	1.8[0] or 1.801 to 1.802 [million] nfww	**2**	**M1** for figs $16 \times \left(1+\frac{2.4}{100}\right)^5$ oe

Question 102

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

Question 103

(a)(i)(a)	187 or 186.7 to 186.8 or $186\frac{42}{53}$	**1**	
(a)(i)(b)	2 : 7 : 42 cao	**2**	**B1** for 106 : 371 : 2226 or any equivalent ratio If 0 scored, **SC1** for 2 : 7 : 42 in the wrong order
(a)(ii)	33.3 or 33.28 to 33.29	**2**	**M1** for $\frac{2967-2226}{2226}$ [× 100] oe or $\frac{2967}{2226} \times 100$ [– 100] oe
(a)(iii)	1706 cao nfww	**3**	**B2** for 1705 to 1706.0… or 1710 or **M1** for $\left(1+\frac{30.48}{100}\right)x = 2226$ oe or better If 0 or M1 scored, **SC1** for rounding *their* decimal answer seen to nearest integer
(b)	3897	**5**	**B1** for $a = 2000$ **M2** for $[b =] \sqrt[3]{\frac{2662}{2000}}$ or **M1** for $2662 = 2000b^3$ **M1** for *their* $2000 \times \left(\sqrt[3]{\frac{2662}{\textit{their}\,2000}}\right)^7$ or for *their* $a \times (\textit{their}\ b)^7$ provided *their a* and *their b* are clearly identified in the working If 0 or M1 scored, **SC1** for rounding *their* decimal answer seen to nearest integer.

Question 104

(a)	10 07	**1**	
(b)	123	**2**	**M1** for 10 30 – 8 27 soi or 10 30 – 8 52 + 25 soi or 25 + 50 + 48
(c)	25.2, $25\frac{1}{5}$	**2**	**M1** for figs 29.4 ÷ 70 [× 60] oe
(d)	\$142.1[0] cao	**4**	**M2** for [adults =] 56 ÷ 8 × 5 and [child =] 56 ÷ 8 × 3 or better or **M1** for 56 ÷ (5 + 3) × k where k = 1, 3 or 5 **M1** for *their* 35 × 2.80 + *their* 21 × 2.80 × $\frac{3}{4}$ oe

Question 105

42 028	**2**	**M1** for $\frac{380}{500}$ oe soi isw

Question 106

52	**2**	**M1** for $x \times \frac{100-16}{100} = 43.68$ oe or better

Question 107

(i)	70 or 70.16[5…] or 70.17 or 70.2	**3**	**M2** for $\frac{29\,750 \text{ to } 29\,800}{400+25}$ or $\frac{29\,750 \text{ to } 29\,800}{400+24}$ or $\frac{29\,800-50}{400 \text{ to } 425}$ or **B1** for 29 750 or 29 850 or 29 849 or 375 or 425 or 424 seen
(ii)	2399 or 2400 nfww	**2**	**B1** for 27 450 or 27 550 or 27 549 or 29 850 or 29 849 seen

Question 108

(a)	150	**2**	**B1** for answer $150k$ or **M1** for prime factors of 30 or 75 seen or a list of multiples of both 30 and 75 with at least 3 of each or for $\frac{30\times 75}{15}$ oe or for answer $2 \times 3 \times 5^2$
(b)	152 190 266	**3**	Accept in any order **B2** for two correct answers or **M1** for $\frac{608}{4+5+7}\times k$ oe where k =1, 4, 5, 7
(c)	2.61×10^{-2} 2.61×10^{-2} or $2.608\ldots \times 10^{-2}$	**2**	**B1** for figs 2608 or 261 seen If 0 scored, **SC1** for answer $2.6[0] \times 10^{-2}$ without more accurate value in standard form seen
(d)	$\frac{27}{99}$ oe fraction	**1**	
(e)	2.8	**1**	
	g/cm^3 or $g\ cm^{-3}$	**1**	

Question 109

(a)	42	**2**	**M1** for $12 \div 2$ or better
(b)(i)	5.72	**2**	**M1** for $\frac{100-12}{100}\times 6.50$ oe or **B1** for 0.88 oe
(b)(ii)	12.5[0]	**2**	**M1** for $\frac{100-12}{100}\times x = 11$ or better oe
(c)	4	**2**	**M1** for $\frac{100+2.5}{100}\times[\ldots]=\frac{100+6.6}{100}$ oe
(d)(i)	72.3 or 72.31...	**2**	**M1** for $80\times\left(\frac{100-2}{100}\right)^5$ oe
(d)(ii)	4 nfww	**3**	**B2** for answer 9 nfww or **M2** for correct trials with values giving either side of 67 or **M1** for $80\times\left(\frac{100-2}{100}\right)^n = 67$ or $their(i)\times\left(\frac{100-2}{100}\right)^k = 67$ or an evaluated trial with $n \geqslant 6$ or $k \geqslant 1$

Question 110

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

Question 111

3, 12, 27	**2**	**B1** for 12 or 27

Question 112

(c)(i)	$3n + 10$ oe final answer	**2**	**B1** for $3n + k$ oe or $jn + 10$ oe ($j \neq 0$) or for correct expression shown in working and then spoilt
(c)(ii)	$2n^3 + 1$ oe final answer	**2**	**B1** for 3rd diff = 12 (both needed) or for cubic answer or for correct expression shown in working and then spoilt

Question 113

(a)(i)	75	2	**M1** for $\frac{45}{3}$ [$\times k$] where k is 1, 5 or 8
(a)(ii)	2.332 oe	2	**M1** for 2.65 [million] $\times \left(1-\frac{12}{100}\right)$ oe or **B1** for 0.318[million] seen
(a)(iii)	23 280 cao	2	**M1** for $\frac{6.25}{100} \times x = 1455$ or better
(a)(iv)	1450 or 1449 to 1450	3	**M2** for $1631 = k\left(1+\frac{4}{100}\right)^3$ oe or better or **B1** for $\left(1+\frac{4}{100}\right)^3$ oe seen or **M1** for $1631 = k\left(1+\frac{4}{100}\right)^n$, $n > 0$ oe
(b)(i)	$\frac{7x}{2}$ oe	1	
(b)(ii)	$x + 12$ $\frac{7x}{2} - 26$ oe final answer	2	**FT** *their* **(b)(i)** **B1** for $x + 12$ **B1** for *their* $\frac{7x}{2} - 26$
(c)	18 nfww	3	**M2** for $\frac{200 \text{ to } 210}{11.5 - 0.25}$ or $\frac{200+5}{11 \text{ to } 11.5}$ oe or **M1** for 200 + 5, 200 – 5, 11.5 + 0.25 or 11.5 – 0.25

Question 114

(a)(i)	550 nfww	3	**M2** for $\frac{500 \times 2 \times 5}{100} + 500$ oe or **M1** for $\frac{500 \times 2 \times 5}{100}$ oe
(a)(ii)	546.65	2	**M1** for $500 \times \left(1+\frac{1.8}{100}\right)^5$ oe
(a)(iii)	8 nfww	3	**B2** for final answer 13 OR **M2** for trials correctly comparing both investments to 7 and 8 more years or **M1** for at least two trials correctly comparing both investments

(b)	1476 cao	**3**	**B2** for 1480 or 1476.2 ... OR **M1** for $2500\times\left(1-\frac{10}{100}\right)^5$ oe **B1** for their more accurate answer seen correctly rounded to the nearest dollar.
(c)	3.2[0] or 3.200 to 3.201	**3**	**M2** for (...) = $\sqrt[22]{2}$ oe isw or **M1** for $[N] \times (...)^{22} = 2[N]$

Question 115

(a)(i)	2990 cao	**1**	
(a)(ii)	1.0 cao	**1**	
(a)(iii)	2100 cao	**1**	
(b)	97	**1**	
(c)	$\frac{1}{64}$ final answer	**1**	
(d)	$7.01[0] \times 10^{-3}$	**1**	
(e)	1.65×10^x	**2**	**M1** for final answer figs 165 or for $15\times10^{x-1}$ seen or for 0.15×10^x seen
(f)	37.7... – 3.7... [= 34] oe	**M1**	
	$\frac{34}{90}$ oe fraction	**B1**	

Question 116

(a)(i)	$\frac{750}{8+7}\times 8$ [= 400]	**M1**	
(a)(ii)(a)	37.5	**1**	
(a)(ii)(b)	275	**3**	**M2** for $250+\frac{250\times 2\times 5}{100}$ oe or **M1** for $\frac{250\times 2\times 5}{100}$ oe
(a)(iii)	407[.00] cao nfww	**3**	**B2** for 406.5 to 406.7 or **M1** for $350\times\left(1+\frac{0.25}{100}\right)^{60}$ oe isw If 0 scored **SC1** for answer 354 or answer 406
(b)	24	**2**	**M1** for [C : D =] 6 : 10 oe and [C : E =] 6 : 9 oe or for $\frac{6}{6+10+9}$[×100] oe
(c)	56 000 nfww	**3**	**M2** for $60564\div\left(1+\frac{3}{100}\right)\div\left(1+\frac{5}{100}\right)$ oe or **M1** for [x×]$\left(1+\frac{3}{100}\right)\times\left(1+\frac{5}{100}\right)$ or for $60564\div\left(1+\frac{3}{100}\right)$ oe or $60564\div\left(1+\frac{5}{100}\right)$ If 0 scored, **SC1** for answer 65499 to 65500
(d)	2.5[0] or 2.499...	**3**	**M2** for $\sqrt[8]{\frac{609.20}{500}}$ oe or **M1** for $500\times(...)^8=609.2[0]$ oe

Question 117

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

(b)	56.55	**2**	**M1** for $\frac{725\times1.3[\times6]}{100}$ oe
(c)	48.5[0]	**2**	**M1** for $x \times \left(1-\frac{24}{100}\right) = 36.86$ oe

Question 118

(a)(i)	$\frac{1}{5}$, $\frac{2}{7}$, $\frac{3}{9}$ final answer	**2**	**B1** for 2 correct terms isw or for 0.2 and (0.286 or 0.2857…) and 0.333…
(a)(ii)	36	**2**	**M1** for $k = \frac{12(2k+3)}{25}$ or better
(b)(i)	$n^3 + 5$ oe final answer	**2**	**B1** for any cubic or common third differences of 6 (at least 2) or for correct answer seen and spoilt
(b)(ii)	$100 \times 2^{1-n}$ oe final answer	**2**	**B1** for $2^{-n\,[+k]}$ oe or $\left(\frac{1}{2}\right)^{n[+k]}$ oe in answer or for correct answer seen and spoilt

Question 119

(a)	249.98 to 250[.0…]	3	**M2** for $830 - 500 \times 1.16$ or **M1** for 500×1.16 OR **M1** for $830 \div 1.16$ **M1** for (*their* 715.5… – 500) × 1.16
(b)(i)	33.5 or 33.51…	2	**M1** for $\frac{12400}{37000}[\times 100]$ oe If 0 scored, **SC1** for answer 66.5 or 66.48 to 66.49
(b)(ii)	38 184 cao	2	**M1** for $37\,000 \times \left(1+\frac{3.2}{100}\right)$ oe or **B1** for 1184
(c)(i)	441 or 440.6 or 440.64 to 440.65	3	**B2** for answer 3941 or 3940.6 or 3940.64 to 3940.65 or **M2** for $3500 \times \left(1+\frac{2.4}{100}\right)^5 - 3500$ or **M1** for $3500 \times \left(1+\frac{2.4}{100}\right)^5$ oe isw
(c)(ii)	16	3	**B2** for 15[.0] nfww to 15.1 or **M2** for $3500 \times \left(1+\frac{2.4}{100}\right)^{15}$ oe seen or $3500 \times \left(1+\frac{2.4}{100}\right)^{16}$ oe seen or **M1** for (3500 or *their* 3941) $\times \left(1+\frac{2.4}{100}\right)^n$ associated with 5000 oe

Question 120

(b)(i)	25000	**1**	
(b)(ii)	2.473×10^4	**1**	
(c)(i)	166 650 or 165816 nfww	**3**	**M2** for (500 + 5) × '320 to 340' or '500 to 510' × (320 + 10) or **M1** for 500 − 5 or 500 + 5 or 320 −10 or 320 +10 Alternative method **M2** for 504 × '320 to 340' or '500 to 510' × 329 or **M1** for 504 or 329
(c)(ii)	285 or 286 nfww	**2**	**M1** for 800 −10

Question 121

(a)(i)	600	**2**	**M1** for $\frac{1250}{12+9+4}\times k$ where $k = 1, 4, 9, 12$ oe
(a)(ii)	80	**2**	**M1** for 1250 × 64 [÷ 1000]
(a)(iii)	60	**2**	**M1** for $x\times\left(1-\frac{10}{100}\right)=54$ oe
(a)(iv)	1000	**2**	**M1** for 1250 – (1250 ÷ 5) oe or **B1** for 250
(b)(i)	3.52	**2**	**M1** for [10 –] 12 × 0.54 or **B1** for 6.48
(b)(ii)	0.08	**3**	**B2** for 0.077[4...] or **M1** for 0.51 ÷ 0.826 If 0 or 1 scored award instead **SC2** for 0.93 final answer OR If 0 scored **SC1** for 0.06 as answer

Question 122

(a)	18593 cao	**2**	**M1** for $7437.05 \times 250 \div 100$ oe
(b)	804.53 cao	**2**	**M1** for $5400 \div 671.20$ [$\times 100$] oe
(c)(i)	2000	**2**	**M1** for $3500 \div (4 + 3)$ [$\times k$] oe
(c)(ii)	1354.13 …	**3**	**M2** for $(3500 - \textit{their}\ \textbf{(c)(i)}) \times \frac{77.05}{85.35}$ oe or **M1** for $(3500 - \textit{their}\ \textbf{(c)(i)}) \div$ figs 85.35 oe or for $\frac{77.05}{85.35}$ oe or for $(3500 - \textit{their}\ \textbf{(c)(i)}) \times$ figs 77.05
(c)(iii)	2 [h] 52 [min] nfww	**3**	**M2** for $\frac{2100 \text{ to } 2200}{740 + 10}$ or $\frac{2200 - 50}{740 \text{ to } 760}$ or **M1** for $2200 + 50$ or $2200 - 50$ or $740 + 10$ or $740 - 10$

Question 123

(a)(i)	6925.5[0] cao	**2**	**M1** for $7695 \times \frac{100 - 10}{100}$ oe or **B1** for answer 769.5
(a)(ii)	8550	**2**	**M1** for $X \times \frac{100 - 10}{100} = 7695$ oe
(b)	660	**3**	**B2** for 60 or **M2** for $600 + \frac{600 \times 2 \times 5}{100}$ oe or **M1** for $\frac{600 \times 2[\times 5]}{100}$ oe
(c)	1.55 or 1.549 to 1.550	**3**	**M2** for $\sqrt[12]{\frac{601.35}{500}}$ or **M1** for $500 \times (...)^{12} = 601.35$

(d)(i)	26.3 or 26.25 to 26.26	**2**	**M1** for $[k]\left(\frac{100-3}{100}\right)^{10}$ oe
(d)(ii)	23	**3**	**M2** for a correct trial evaluated with n =22 or $n = 23$ or **M1** for $[k]\ (0.97)^n < 0.5[k]$ oe soi or for $[k](0.97)^n = 0.5[k]$ oe soi, implied by one correct trial $n > 10$ or for $[k](0.97)^{23}$ oe seen If 0 scored **SC1** for answer 22

Question 124

(a)	A 9	**B1**	
	$4n - 11$ oe final answer	**B2**	**B1** for $4n - k$ or $jn - 11$ oe $j \neq 0$
	B 55	**B1**	
	$2n^2 + 5$ oe final answer	**B2**	**B1** for any quadratic or second differences = 4
	C $\frac{6}{2187}$ oe	**B1**	
	$\frac{n+1}{3^{n+2}}$ oe final answer	**B3**	**B2** for 3^{n+2} oe OR **B1** for 3^{n+k} seen oe **B1** for $n + 1$ as the numerator of a fraction
(b)	331 cao	**1**	

Question 125

(a)(i)	227 900 000	**1**	
(a)(ii)	51 200 or 51 190 or 51 194	**2**	**M1** for $\frac{35.8}{100} \times 143\,000$ After 0 scored SC1 for answer figs 512 or figs 5119 or figs 51194
(a)(iii)	2.43 or 2.434…	**1**	
(a)(iv)	3000 or 3004 to 3005	**2**	**M1** for $\frac{4.495\times10^{9}}{1.496\times10^{8}}$ [× 100] oe After 0 scored SC1 for answer figs 3 or figs 3004…. or figs 3005
(a)(v)	1.52 or 1.522…	**2**	**B1** for 1AU = 1.5[0] × 10^8 or 1.497… × 10^8 [km] or $1\text{km} = 6.68\times10^{-9}$ *or* $6.678\ldots\times10^{-9}$ [AU] OR **M1** for $\frac{5.2\times2.279[\times10^{8}]}{7.786[\times10^{8}]}$ oe After 0 scored **SC1** for answer figs 152 or figs 1522……
(a)(vi)	4890 or 4885…	**2**	**M1** for $d \times \left(1+\frac{39.2}{100}\right) = 6800$ oe
(b)(i)	2.9979 × 10^5 × 60^2 × 24 × 365.25	**M1**	After **M0** **SC1** for 2.9979 × 10^5 × 31557600 oe
	= 9.4606… × 10^{12}	**A1**	
(b)(ii)	2.54 or 2.536 to 2.537	**2**	**M1** for $\frac{2.4\times10^{19}}{9.461\times10^{12}}$ oe

Question 126

(a)(i)	5	**3**	**M2** for $\frac{(12800-8000)\times 100}{8000\times 12}$ or **M1** for $[12800-8000=]\frac{8000\times 12\times r}{100}$ or 400 seen If 0 scored, **SC1** for answer 13.3 or 13.33…
(a)(ii)	4[.0] or 3.99…	**3**	**M2** for $\sqrt[12]{\frac{12800}{8000}}$ or **M1** for $12800=8000\times k^{12}$ for any k
(b)	9 nfww	**3**	**M2** for $260\,000\times\left(1+\frac{1.8}{100}\right)^{8}$ oe evaluated to 4 sf or better or $260\,000\times\left(1+\frac{1.8}{100}\right)^{9}$ oe evaluated to 2 sf or better or **M1** for $[300\,000 =]\ 260\,000\times\left(1+\frac{1.8}{100}\right)^{n}$ oe soi (Accept any inequality sign in [300 000 =])

Question 127

(a)	8.24 cao	**2**	**M1** for $3\times 1.04+4\times 1.28$
(b)(i)	32	**2**	**M1** for $\frac{8}{11+8+6}[\times 100]$ oe
(b)(ii)	360	**2**	**M1** for $\frac{1500}{11+8+6}\times k$ where k = 1 , 11, 8 or 6
(b)(iii)	270	**1**	**FT** 0.75 × *their* 360
(b)(iv)	1.25 cao	**2**	**M1** for $x\times\left(1-\frac{8}{100}\right)=1.15$ oe or better

Question 128

(a)(i)	40	**2**	**M1** for $\frac{50}{75}$ [× 60] oe
(a)(ii)	36 nfww	**3**	**M2** for $\frac{47-0.5}{75 \text{ to } 80}$ [× 60] or $\frac{46 \text{ to } 47}{75+2.5}$ [× 60] or **M1** for 47+0.5 or 47 – 0.5 or 75 + 2.5 or 75– 2.5
'(b)	107 or 107.2...	**6**	**M5** for [speed =] $\frac{240}{\left(2\times\frac{260}{7}+60\right)}$ × 60 oe OR **B5** for [total time =] 134 or 134.2 to 134.3 or 2.24 or 2.238... or **B4** for (t =) 37.1 or 37.14... OR **M2** for $\frac{t}{60}\times 100+\frac{t+60}{60}\times 110=240$ oe or **M1** for $\frac{t}{60}\times 100$ or $\frac{t+60}{60}\times 110$ oe **M1** for correct equation of form $at = b$ from *their* equation containing two terms in t and involving the speeds. **M1** for $\frac{240}{2\times \textit{their}\, t+60}$ [× 60]

Question 129

(a)(i)	56	**1**	
(a)(ii)	11	**2**	**M1** for $120 - n^3 = -1211$ or $120 - 11^3 = -1211$
(b)	0.0048 or $\frac{3}{625}$ oe	**1**	
(c)	A: –5; $10 - 3n$ B: $\frac{5}{8}$; $\frac{n}{n+3}$ C: 20; $n^2 - n$	**8**	**B1** for –5 **B2** for $10 - 3n$ oe or **B1** for $k - 3n$ or for $10 - kn$ **B1** for $\frac{5}{8}$ **B1** for $\frac{n}{n+3}$ oe **B1** for 20 **B2** for $n^2 - n$ oe or **B1** for any quadratic or for at least two second differences of 2

Question 130

(a)(i)	3050	**2**	**M1** for $50 \times 40 + 70 \times 15$ or better
(a)(ii)	91.1 or 91.14 to 91.15	**1**	**FT** $\frac{2780}{\textit{their}\ 3050} \times 100$
(a)(iii)	125 nfww	**2**	**M1** for [...] $\times \frac{100-4}{100} = 120$ oe

(a)(iv)(a)	132	**2**	**B1** for increase of 6 in adult or junior or **M1** for 56 : 76 or for multiples of 33 seen 33, 66, 99, 132, … or $50 + x : 70 + x = 14 : 19$ oe or $(70 - 50) \times \frac{19+14}{19-14}$ oe or $50 + x = (120 + 2x) \times \frac{14}{19+14}$ oe
(a)(iv)(b)	10	**2**	**FT** $\frac{\textit{their}\textbf{(a)} - 120}{120} \times 100$ dep on *their* **(a)** > 120 **M1** for $\frac{\textit{their}\textbf{(a)} - 120}{120}[\times 100]$ or $\frac{\textit{their}\textbf{(a)}}{120} \times 100\ [-100]$
(b)(i)	2280 or 2281 to 2282 nfww	**2**	**M1** for $2500 \times \left(1 - \frac{3}{100}\right)^3$ oe
(b)(ii)	8	**2**	**M1** for $2500 \times \left(1 - \frac{3}{100}\right)^n$ or 0.97^n evaluated with $n > 3$

Question 131

(a)	$125x^9$ final answer	**2**	**B1** for answer $125x^k$ or mx^9 or for correct answer seen then spoilt
(b)	6^{n-2} oe final answer	**2**	**B1** for answer of form 6^k oe or answer of the form $\left(\frac{1}{6}\right)^{-k}$ oe or for correct answer seen

Question 132

(a)	10 : 3 final answer	**2**	**M1** for 1500 : 450 oe in ratio form If 0 scored **SC1** for answer 3 : 10
(b)	360 240 400	**3**	**B2** for answer 0.36 0.24 0.4 or for answer two of 360 240 400 or **M1** for $\frac{1000}{9+6+10}[\times k]$ where k = 1, 9, 6 or 10 If 0 scored, **SC1** for answer with 3 values in ratio 9 : 6 : 10 in that order
(c)	3.68 cao	**2**	**M1** for $\left(1+\frac{15}{100}\right)\times 3.2$ oe or **B1** for answer 0.48
(d)	18 804[.0...]	**2**	**1** for $16\,620\times\left(1+\frac{2.5}{100}\right)^5$ oe
(e)	3.95	**3**	**M2** for 22.5 – (18.5 to 18.6) or (22 to 23) −18.55 or **M1** for 23 – 0.5 oe seen or 23 + 0.5 oe seen or 18.5– 0.05 oe seen or 18.5 + 0.05 oe seen

Question 133

(a)(i)	4.55 or 4.545…	**1**	
(a)(ii)	50 : 263 : 400 cao	**2**	**M1** for a correct simplification from 250 000 : 1 315 000 : 2 000 000
(a)(iii)	83 cao	**3**	**M2** for $\frac{43\frac{1}{3}}{100}\times(100-60-10)$ oe or **M1** for 100 – 60 – 10 seen
(a)(iv)	10 200 000 cao	**3**	**B2** for 10 185 185 to 10 185 200 or **M1** for 5 500 000 ÷ 27 [× 50]
(a)(v)	3.19×10^7 or $3.190\ldots \times 10^7$	**3**	**B2** for 31903920 or **M1** for 60.7 × 60 × 24 × 365 If B0 scored **SC1** for correctly converting *their* number seen to standard form to 3sf or better
(b)	2095 nfww	**3**	**M2** for 6445 – C where $4300 \leqslant C < 4400$ oe or A – 4350 where $6440 < A \leqslant 6450$ oe or **M1** for 6440 +5 or 6440 –5 or 4400 + 50 or 4400 – 50 seen oe