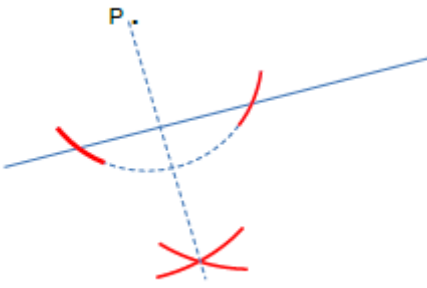


Question		Answer	Mark	Part Marks and Guidance	
1	(a)	6.54×10^4	1		Condone trailing zeros
	(b)	[0].00082	1		Condone trailing zeros
2 (18)		2439	4	<p>B3 for [LCM=] 420 or answer $2439 + 420n$ OR B2 for listing the next 3 multiples for both comets 168, 252, 336 and 210, 315, 420 or [84 =] $2^2 \times 3 \times 7$ and [105=] $3 \times 5 \times 7$ or [LCM=] $420k$ or B1 for listing the next 3 multiples for one comet or [84 =] $2^2 \times 3 \times 7$ or [105=] $3 \times 5 \times 7$ allow in a factor tree or table</p> <p>Alternative method 1 B2 for listing the next 3 years for both comets 2103, 2187, 2271 and 2124, 2229, 2334 or B1 for listing the next 3 years for one comet</p> <p>Alternative method 2 B2 for Venn diagram with 3, 7 in the intersection 2,2 in set 84 and 5 in set 105 or B1 for the diagram with one error</p>	$n = 1, 2, 3 \dots$
3 (23)		61 with correct working	5	<p>M1 for [0] $.65 \times 60$ or 39 M1 for [0].7 $\times 40$ or 28 M1 for [0].64 $\times 200$ or 128 M1 for <i>their</i> 128 – <i>their</i> 28 – <i>their</i> 39</p> <p>If 0 or M1 scored, instead award SC3 for answer 61 with no or insufficient working If 0 scored, instead award SC1 for answer 67 with no or insufficient working</p>	<p>“Correct working” requires evidence of at least M1M1. For 5 marks allow for answer $\frac{61}{100}$ or 61%.</p> <p>Do not lose the first two M1 M1 if further work does not include these.</p>

Question		Answer	Mark	Part Marks and Guidance	
4	(a)	[0].0625 or $\frac{6}{96}$ oe or 6.25%	1		e.g. $\frac{1}{16}$ but not in words or as a ratio
	(b)	770	2	FT <i>their</i> (a) for 2 marks, answer must be an integer M1 for $12\,321 \times \textit{their}$ [0].0625 or $12\,320 \times \textit{their}$ [0].0625	condone 771 as answer. M1 implied by 770.06... or 770.1
5 (24)		Accurate and correct isosceles triangle with A, B and C points labelled and angles 45° , 45° and 90° correctly labelled	4	B1 for B 6 cm (± 2 mm) due east of A ($\pm 2^\circ$) B1 for C from A B1 for C from their B For those who put B due west of A, award the second B1 if <i>their</i> C is marked at $225 \pm 2^\circ$ from A and the third B1 if <i>their</i> C is marked at $135 \pm 2^\circ$ from B	condone dotted lines and accept symbol for 90° line accurately drawn or point B marked 6 cm (± 2 mm) and east ($90 \pm 2^\circ$) from A line accurately drawn or C marked at $135 \pm 2^\circ$ from A line accurately drawn or C marked at $225 \pm 2^\circ$ from B
6	(a)	39	2	M1 for $3 \times 4 \times 5$ oe	
6	(b)	A and 120 000 or [0].095 or A and 1200 and 950	2	M1 for correct use of $(10^3)^2$ oe or correct use of $(10^2)^2$ or $(10^1)^2$ if converted to cm^2	for M1 ignore units and can be implied by one correct result e.g. 1200 or 950

Question		Answer	Marks	Part Marks and Guidance	
7 (26)	(a)	Ruled line through P and perpendicular to AB constructed with correct arcs (one pair intersecting AB)	2	<p>B1 for correct arcs (one pair intersecting AB) only but no line or correct ruled line but no, or incomplete, construction arcs</p> 	<p>Condone dotted lines Set protractor to 90° and check 88° to 92° at AB Correct construction arcs as shown (may be two pairs of arcs used to draw line through P) Ignore other arcs if correct arcs clearly used to construct line Condone perpendicular extending beyond AB but must pass through P and reach AB (no daylight) <u>Alternative arcs (eg a kite construction)</u> One centred on A length AP and one centred on B length BP meeting below AB (may also pass through P). Candidates may use points on AB other than A and B for this construction. In such cases check radii of arcs using on-line ruler to judge See appendix for exemplars</p>
	(b)	accurate and correct ruled angle bisector of angle M with supporting arcs and accurate and correct ruled perpendicular bisector of MN with supporting arcs and 'cannot' with full evidence	5	<p>B2 for accurate and correct ruled angle bisector of angle M with supporting arcs or B1 for accurate and correct ruled angle bisector of angle M</p> <p>B2 for accurate and correct ruled perpendicular bisector of MN with supporting arcs or B1 for accurate and correct ruled perpendicular bisector of MN</p> <p>B1 dep for correct decision (No) with full evidence dep on at least B1 B1</p>	<p>tolerance on angles $\pm 2^\circ$ and on radius of arcs $\pm 2\text{mm}$</p> <p>For 5 marks the diagram must be fully correct with no extra constructions and lines touching the opposite sides of the triangle.</p> <p>Bisectors to be at least 2 cm long</p> <p>full evidence means two correct ruled lines within tolerance</p>

Question		Answer	Marks	Part Marks and Guidance	
8 (27)		14 1 with correct working	5	<p>B2 for 21 and 14 or M1 for $\frac{35}{3+2}$ oe</p> <p>AND</p> <p>B2 for 35 and 15 OR B1 for 42 with 18 or 21 with 4 or 49 with 21 or 28 with 7 etc</p> <p>If 0, 1 or 2 scored, instead award SC3 for answer 14 and 1 with no or insufficient working</p> <p>If 0 or 1 scored, instead award SC2 for answer red = 14 or for answer [red=] 1 and [green=] 14 with no or insufficient working</p>	<p>“Correct working” requires evidence of at least the first B2</p>

Question		Answer	Mark	Part Marks and Guidance	
9	(a)	it should be -17	1		accept any correct explanation allow correct equation if written in the question just missing "x = "
		$x = \frac{y-17}{3}$	1		
	(b)	it should be 2x	1		Do not accept $\pm 2x$ or "the error is that they missed the \pm " Do not penalise twice missing the "x =". allow correct equation if written in the question just missing "x = "
		$x = \frac{\sqrt{A}}{2}$ or $x = \sqrt{\frac{A}{4}}$	1		
10		140	4	<p>M1 for $11 = 3 + 20a$ oe implied by [0].4</p> <p>A1 for $[a =]$ [0].4</p> <p>M1 for $3 \times 20 + \frac{1}{2} \times$ <i>their</i> 0.4×20^2</p> <p>Alternative method</p> <p>M3 for $3 \times 20 + \frac{1}{2} \times (11 - 3) \times 20$ oe</p> <p>OR</p> <p>M1 for 3×20</p> <p>M1 for $\frac{1}{2} \times (11 - 3) \times 20$</p> <p>M1 for <i>their</i> $(3 \times 20) +$ <i>their</i> $(\frac{1}{2} \times (11 - 3) \times 20)$</p>	<p>Condone one error in second M1. If <i>their a</i> is clearly stated do not count as an error.</p> <p>Equivalent includes $\frac{1}{2} (11 + 3) \times 20$</p> <p>may be implied by 60 may be implied by 80</p>

Question	Answer	Mark	Part Marks and Guidance
11	9.6 with correct working	6	<p>M5 for $\sqrt{8.3^2 + (5.4\tan 42)^2}$</p> <p>OR</p> <p>M2 for $5.4 \times \tan 42$ oe or M1 for $\tan 42 = \frac{opp}{5.4}$ oe A1 for 4.8[6...] or 4.9</p> <p>and</p> <p>M2 for $\sqrt{8.3^2 + (their\ 4.8[6\ \dots])^2}$ or M1 for $8.3^2 + (their\ 4.8[6\ \dots])^2$</p> <p>If 0, 1 or 2 scored, instead award SC3 for answer 9.6 with no or insufficient working</p> <p>If 0 or 1 scored, instead award SC2 for answer 9.619... or 9.62 with no or insufficient working</p> <p>If 0 scored, instead award SC1 for 4.8[6...] or 4.9 with no or insufficient working</p> <p>“Correct working” requires evidence of at least M1 M1 or M2 and also accept 2sf numbers</p> <p>4.8[6...] or 4.9 can imply M2 if M1 given</p> <p>Alternative method (sine rule): M2 for $\frac{5.4 \times \sin 42}{\sin (their48)}$ oe or M1 for $\frac{x}{\sin 42} = \frac{5.4}{\sin (their48)}$ oe</p> <p>9.619... or 9.6[2] can imply M2 if M1 awarded</p> <p>Allow full and correct equivalent trig. methods to score M2 in both triangles e.g. using the other angle in the first triangle, i.e. <i>their 48</i></p>

Question	Answer	Mark	Part Marks and Guidance
12	10.1 or 10.07 to 10.08 with correct working	6	<p>M4 for $\frac{4}{3} \times \pi \times 4^3 = \frac{1}{3} \times \pi \times (\frac{1}{2} d)^2 \times d$ oe</p> <p>M1 for rearranging <i>their</i> equation OR</p> <p>M1 for $\frac{4}{3} \times \pi \times 4^3$ implied by 268.[08...] or 268.1</p> <p>B1 for [radius of water =] $\frac{1}{2} d$</p> <p>M2 for $\frac{1}{3} \times \pi \times (\frac{1}{2} d)^2 \times d = \textit{their} 268.08\dots$ or M1 for $\frac{1}{3} \times \pi \times (\frac{1}{2} d)^2 \times d$ condone one error</p> <p>M1 for rearranging <i>their</i> equation e.g. $d^3 = \frac{\textit{their} 268.08\dots \times 12}{\pi}$ implied by [$d^3 =$] 1024</p> <p>Alternative method</p> <p>M4 for $\frac{\frac{256\pi}{3}}{\frac{1}{3}\pi \times 15^2 \times 30} = \left(\frac{d}{30}\right)^3$ oe</p> <p>M1 for rearranging <i>their</i> equation OR</p> <p>M1 for $\frac{4}{3} \times \pi \times 4^3$ implied by 268.[08...], 268.1 or $\frac{256\pi}{3}$</p> <p>M1 for $\frac{1}{3}\pi \times 15^2 \times 30$ implied by 2250π or 7068[.58...] or 7069 or 7068.6</p> <p>M2 for [sf=] $\sqrt[3]{\frac{\frac{256\pi}{3}}{\frac{1}{3}\pi \times 15^2 \times 30}}$ oe or 0.33597... rot</p> <p>or M1 for $\frac{\frac{256\pi}{3}}{\frac{1}{3}\pi \times 15^2 \times 30}$ oe or 0.0379...</p> <p>M1 for <i>their</i> sf $\times 30$</p> <p>If 0 or 1 scored, instead award SC3 for answer 10.1 or 10.07 to 10.08 with no or insufficient working</p> <p>allow 10 only if working supports it “Correct working” requires evidence of at least M2 or M1 M1</p> <p>M1 implied by $\frac{256\pi}{3}$</p> <p>Note they can use $h = 2r$ so apply the scheme accordingly, 1024 will become 256</p> <p>Complete method with trials giving the correct answer can score 6 marks</p> <p>M1 for each correct trial up to a maximum of M3</p>

Question		Answer	Mark	Part Marks and Guidance	
13		$y = 0.25\sqrt{x}$ oe	3	M1 for $y = k\sqrt{x}$ oe B1 for $k = 0.25$ or $\frac{1}{4}$ oe	M1 includes e.g. $y = k\sqrt{16}$ and $1 = k\sqrt{16}$
14	(a)	2[%]	1		
	(b)	$5200 \div 1.02^5$ oe 4709 to 4710	2	M1 for $5200 \div 1.02^k$ or 4700×1.02^5 or $5200 = n \times 1.02^5$	equivalent is 5200×1.02^{-5} condone : $4700 \times 1.02^5 = 5189$ to 5190 for 2 marks accept $1.104\dots$ for 1.02^5 and $0.9057\dots$ for 1.02^{-5}
15	(a)	Correct cumulative frequency curve	5	B2 for 8 22 30 42 59 64 can be implied from plots or M1 for cf calculated with one arithmetic error M2 for accurately plotting these frequencies against the upper group values or M1 for accurately plotting these frequencies against a group value condoning one error B1 for an accurate curve FT <i>their</i> frequencies and dep on increasing frequencies	tolerance for plotting and drawing the curve is $\pm \frac{1}{2}$ small square and ignore curve before (20, 8), if they draw bars award M1 if the bars are the same widths as the groups.
	(b)	cycling and medians [cycling] 40 to 43 [tennis] 51	2	FT <i>their</i> curve for medians providing it is increasing frequencies B1 for one correct median or a statement with one error	See appendix condone a statement which is equivalent and condone tennis median of 50 to 52 and condone 'average' for 'median'
16		$\frac{17}{25}$ or 0.68 or 68%	2	B1 for $\frac{17}{n}$ or $\frac{n}{25}$ and it must be a proper fraction	
17		$y = -\frac{1}{2}x + 7$ final answer oe	3	M1 for $m_2 = -\frac{1}{2}$ M1 for $5 = \textit{their } m_2 \times 4 + c$ or $y - 5 = \textit{their } m_2 (x - 4)$	implied by (4,5) satisfying <i>their</i> answer but not when <i>their</i> $m_2 = 2$

Question			Answer	Mark	Part Marks and Guidance	
18	(a)	(i)	$[u_3 =] x + y$ $[u_4 =] y + x + y [= x + 2y]$	1 1		
		(ii)	3 2 with correct working	6	<p>M2 for $[u_7 =] 7 + x + y + 7 + x + y + 7$ oe or better</p> <p>or M1 for $[u_5 =] x + y + 7$ oe or better and B1 for $x + 2y = 7$ oe B1FT for <i>their</i> $(2x + 2y + 21) = 31$ oe M1 for solving <i>their</i> equations e.g. subtracting equations to give $x = 3$</p> <p>If 0 or 1 scored, instead award SC2 for answers $[x =] 3$ and $[y =] 2$ with no or insufficient working If 0 scored, instead award SC1 for $[x =] 3$ or $[y =] 2$ or both correct answers switched, with no or insufficient working</p>	<p>“Correct working” requires evidence of at least B1 B1 or M2 or M1 M1 e.g. $2x + 2y + 21$ or $2x + 3y + x + 2y + 2x + 3y$ or $5x + 8y$ e.g. $x + y + x + 2y$ or $2x + 3y$</p> <p>e.g. $5x + 8y = 31$ FT <i>their</i> u_7 e.g. multiplying one equation and correctly adding or subtracting to eliminate one variable</p> <p>correct answers with trials will score 6 marks M1 for each correct trial (value of x and a value of y) up to a maximum of M3 e.g. $x = 1$ $y = 4$ gives 1 4 5 9 [14 23 37]</p>
	(b)		$(\sqrt{3})^{n-1}$ or $3^{\frac{1}{2}(n-1)}$ oe	2	M1 for common ratio of $\sqrt{3}$ implied by answer of $(\sqrt{3})^k$	
	(c)		3 -5	3	<p>B2 for $b = 3$ OR M1 for $[-1 \ 5 \ 13 \ 23] - [1 \ 4 \ 9 \ 16]$ implied by $-2 \ 1 \ 4 \ 7$ B1 for $c = -5$</p>	<p>condone $3n$ for 2 marks If equations used M1 for e.g. $1 + b + c = -1$ oe $4 + 2b + c = 5$ oe Allow any correct method</p>

Question		Answer	Mark	Part Marks and Guidance	
19		translation	1		If more than one transformation score 0
		$\begin{pmatrix} -3 \\ 5 \end{pmatrix}$	2	B1 for $\begin{pmatrix} -3 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ 5 \end{pmatrix}$ or a correct vector with a line	condone 3 left and 5 up for B2 or B1 for either correct
20		1080	3	M2 for $8 \times 9 \times 15$ or M1 for $8 \times 9 \times 15$ with at most one error If 0 scored award SC2 for $\frac{1}{8} \times \frac{1}{9} \times \frac{1}{15}$ or $\frac{1}{1080}$ or SC1 for $1 \times 1 \times 2 = 2$	e.g. M1 for $8 \times 9 \times 17$ or 1224 condone $8 \times 9 \times 1$ for M1 not 8×9
21	(a)	correct histogram with four bars with frequency densities 2.4, 1.9, 1.2, [0].55 and correct width bars	3	B2 for two correct bar heights or B1 for one correct bar height or two correct frequency densities from 2.4, 1.9, 1.2, [0].55 so	bar heights should be accurate, condone for height $0.5 \leq \text{bar} \leq 0.6$ tolerance for plotting and drawing the bars is $\pm \frac{1}{2}$ small square
	(b)	e.g. the mean should be higher because these people would have taken longer than 50 minutes	1		
22		Some algebraic working leading to an answer of 3 -3	5	M1 for e.g. $x^2 + (x - 6)^2 = 18$ M1 for expanding <i>their</i> square term e.g. $x^2 - 12x + 36$ M1 for $2x^2 - 12x + 18 = 0$ or better M1 for $[2](x - 3)^2$ or $(2x - 6)(x - 3)$ If 0 scored SC2 for correct answers with no algebraic working	condone one error in expanding brackets simplifying to $ax^2 - bx + c$ e.g. solving <i>their</i> quadratic equation by e.g. factors or quadratic formula Note : apply scheme to substitution for x e.g. M1 for $(y + 6)^2 + y^2 = 18$ etc