Question			Answer	Marks	Part marks and guidance	
1	(a)		6.05×10^6	1		Condone extra zeros and notation such as 6.05×10^{06} and $6.05 \cdot 10^6$ but not $6.05^{\times 10^6}$ or 6.05^{06}
	(b)		[0].00458	1		Condone extra zeros
2			29.575	2	**M1** for 43.2 or $\frac{216}{5}$ or 13.625 or $\frac{109}{8}$ oe	Condone for **2** marks $\frac{1183}{40}$ or $29\frac{23}{40}$
3			1640 with correct working	5	**B1** for 1.05 or 1.1025 oe **M2** for $\frac{17640}{1.05^2}$ or $\frac{17640}{1.1025}$ oe or **M1** for $\frac{17640}{1.05}$ oe or $n \times 1.05^k = 17\,640$ (k =1 or 2 or 3) Trials We need value and its result for **M1** **M1** for each correct trial up to a maximum of **M3** **M1** for 17 640 − *their* 16 000 If **0, 1** or **2** scored instead award **SC3** for answer 1640 with no working or insufficient working	"correct working" requires at least **B1 M1** if trials used **M1 M1** **B1** equiv. includes e.g. $\frac{105}{100}$ and 105% **M2** implied by 16 000 **M1** implied by 16 800 . can be implied by answer and *their* 16 000 must be less than 17 640

Question			Answer	Marks	Part marks and guidance	
4			10 with correct working	6		"correct working" requires at least **M1M1** or **M2**
					M2 for a correct method to find the interior angle of a pentagon e.g. 180 – $\frac{360}{5}$ or $\frac{(5-2)\times180}{5}$	**M2** implied by 108
					or **M1** for partial method e.g. $\frac{360}{5}$ or (5 – 2) × 180	**M1** implied by 72 or 540
					AND	
					M1 for 360 – 2 × *their* 108	**M3** implied by 144
					AND	
					M2 for $\frac{360}{180-their144}$	
					or **M1** for 180−*their* 144	**M1** for (*n* – 2)180 = *their*144*n* oe and **M1** for a correct rearrangement e.g. 36*n* = 360
						Alternative method as the third angle is the sum of the two exteriors of the pentagons
					If **0**, **1** or **2** scored, instead award **SC3** for answer 10 with no working or insufficient working	**M3** for $2 \times \frac{360}{5}$ [= 144] or **M1** for $\frac{360}{5}$ and
						M2 for $\frac{360}{360-their144-180}$ oe or **M1** for 360 – *their* 144 – 180 oe

Question			Answer	Marks	Part marks and guidance	
5	(a)		2 points accurately plotted	2	**B1** for each	tolerance ± $\frac{1}{2}$ small square radially and ignore other plotted points
	(b)		Negative	1		Ignore embellishments
	(c)		ruled straight line of best fit 5 − 6.5	B1 B1	If **B0 FT** *their* ruled straight line of best fit with negative gradient and meeting both 500 and 1500	Overlay is a guide only, *their* line must be between or through (500, 8) to (500, 10) and (1500, 1) to (1500, 3) and meeting both 500 and 1500 lines
	(d)		(1200, 9.2) indicated	1		Ignore points indicated as answers for parts (a), (c) and (f)
	(e)		Accept any correct explanation	1		see appendix
	(f)		40	3	**B1** for 6 if **2** not scored in **(a) FT** *their* diagram **M1** for $\frac{6 \text{ or their } 6}{15 \text{ or their} 15}$ [× 100] **M1** for correctly converting *their* fraction to a percentage (less than 100%) rounded or truncated	for **B1 FT** *their* diagram must not include a point for part **(c)** for **M1** *their* 6 is their number of points under 6°C *their* 15 is the total number of **plotted** points (may include one for **(c)**) e.g. $\frac{7}{15}$ = 46 or 47 or 46.6 to 46.7

Question			Answer	Marks	Part marks and guidance	
6	(a)		122	4	**B3** for 121.5[…] leading to an answer 121[.5…] or 1215.2[…] leading to an answer 1215 or 12.15[…] leading to an answer 12 OR **M3** for $\frac{3.5\times1000\times100}{2\times60\times24}$ oe OR **M1** for correct time conversion to a day e.g. [2×] 60×24 and **M1** for one distance km to cm or one distance cm to km or two distances to metres and **M1** for distance divided by rate e.g. $\frac{3.5\times100\times100}{2\times60\times24}$ to a maximum of **M2**	ignore any units throughout e.g. 3500 ÷ 28.8 **M1 M1** may be implied by 0.0288 **M1** may be implied by e.g. 1440 or 14.4 or 0.0144 or 2880 or 28.8 **M1** may be implied by e.g. 0.02 **and** 28.8 or 3500 **and** (0.02 or 28.8) or 0.000 02 or 350 000 **M1** may be implied by e.g. $\frac{figs35}{figs288}$ or $\frac{3.5\times1000\times100}{2\times60\times60\times24}$ or figs 175
	(b)		It will take less time [than *their* 122 days]	1		accept any correct explanation (see appendix) and select best comment if more than one providing they do not conflict

Question			Answer	Marks	Part marks and guidance	
7			5.73 to 5.74 or 5.7 with correct working	5	**M4** for $[r^3 =] \frac{1}{3} \times 12.3^2 \times 15.7 \div \frac{4}{3}\pi$ oe or for $[r^3 =]$ *their* 791.8 $\div \frac{4}{3}\pi$ OR **M3** for $\frac{4}{3}\pi r^3 = (\frac{1}{3} \times 12.3^2 \times 15.7)$ oe or $\frac{4}{3}\pi r^3$ = *their* 791.8 OR **M1** for $\frac{1}{3} \times 12.3^2 \times 15.7$ oe **A1** for 791.7 to 791.8 or 792 <u>Trials</u> We need value and its result for **M1** **M1** for $\frac{1}{3} \times 12.3^2 \times 15.7$ oe **A1** for 791.7 to 791.8 or 792 **M1** for a correct trial **M1** for another correct trial If **0**, **1** or **2** scored instead award **SC3** for answer 5.73 to 5.74 or 5.7 with no working or insufficient working If **0** or **1** scored instead award **SC2** for 188.99 to 189.03 with no working or insufficient working If **0** scored **SC1** for 791.7 to 791.8 or 792 with no working or insufficient working	"correct working" requires at least **M3** or if trials are used **M1 M1 M1** Notes: allow 151[.29] or 151.2 or 151.3 for 12.3^2, for $\frac{1}{3}$ accept 0.33 or better and for $\frac{4}{3}$ accept 1.33 or better and for $\frac{4}{3}\pi$ accept 4.17 to 4.19 *their* 791.8 is 791.7 to 791.8 or 792 or from correct use of given formula **M3** implied by $V = \frac{4}{3}\pi r^3$ and V = *their* 791.8 do not lose **M1 A1** if further work on a sphere does not include this

Question			Answer	Marks	Part marks and guidance	
8	(a)		accurate curve	3	**B2** for 6 or 7 points accurately plotted or **B1** for 4 or 5 points accurately plotted	tolerance $\pm\frac{1}{2}$ small square radially for curve and points, condone a wobbly curve and slight feathering or tram lines in no more than 3 sections but no ruled lines
	(b)		$x = -1$ oe	1		
	(c)		−2.8 or −2.7 0.7 or 0.8	2	**B1** for either If **0** or **1** scored **FT** *their* curve for **1** or **2** marks or **SC1** for an answer in each of −2.8 to −2.7 and 0.7 to 0.8	tolerance $\pm\frac{1}{2}$ small square radially
9			23.2 to 23.25… with correct working	5	**M2** for $\sqrt{3.7^2 + 6.4^2}$ or **M1** for $3.7^2 + 6.4^2$ and **M2** for π × *their* 7.39…oe or **M1** for 2 × π × *their* 7.39… or π × *their* 7.39… × $\frac{1}{2}$ If **0** or **1** scored award **SC2** for answer 23.2 to 23.25 with no working or insufficient working	"correct working" requires at least **M1** and **M1** or **M2** from use of Pythagoras' theorem or full and correct method using trigonometry **M2** implied by 7.39… *their* 7.39 includes 54.65 or $\frac{1093}{20}$

Question			Answer	Marks	Part marks and guidance	
10	(a)		Any correct criticism e.g. small sample sample not random as many in the population cannot be in the sample i.e. they may be at work no control over the number of adults and children	3	**B1** for each	Question asks for criticisms so criteria is : i.e larger sample size i.e not randomly selected as some are excluded i.e reasonable proportions of adults and children do not allow a repeated point
	(b)		overlapping groups oe or there is no option for over 20h	1		e.g where does 2 go? select best comment
11			42.5 or 42.49[9..] ÷ 1.75	M3	**B1** for 1.75 **B1** for 42.5 or 42.49[9…]	**B1** seen anywhere and mark figures crossed out if you think they have been “rejected” for use
			25	A1	If **0** scored award **B3** for 24.29 or 24.28[5…] or if **0** or **1** scored award **SC1** as well for *their* 24.29 seen and correctly rounded up	
12	(a)		53 alternate segment [theorem]	1 1		 condone ‘rule’ for ‘theorem’

Question			Answer	Marks	Part marks and guidance	
	(b)		38 with correct working	**5**	**B1** for OGH = 52 **B1** for JHG = 26 **B2** for [OGJ =] 64 or **M1** for 180 – 52 [÷2] If **0** or **1** scored award **SC2** for answer 38 with no working or insufficient working Note: If answer is 38 and the working is incorrect only award the **B** marks.	"correct working" requires at least **B2** or **B1B1** angles may be on diagram Alt. 1: **B1** for JHG = 26 **B1** for OJH = 26 **B2** for [OJG =] 64 Alt.2: **B1** for tangent at G **B1** for OGH = 52 **M2** for 90 ─ 52
13	**(a)**		280	**2**	**M1** for 5 × 8 × 7 or 5 × 56 or 40 × 7 or 35 × 8 If **0** scored **SC1** for 6 × 8 × 7	Condone for **M1** e.g. $\frac{12}{280}$
	(b)		$\frac{12}{280}$ oe	**2**	**M1** for 2 × 3 × 2 or 12 or $\frac{2}{5}\times\frac{3}{8}\times\frac{2}{7}$ **FT** 280 from *their* answer to **(a)** for **2** marks i.e $\frac{12}{their\ 280}$ If **0** scored **SC2** for $\frac{18}{336}$	Equivs. include $\frac{6}{140}$, $\frac{3}{70}$, 0.043, 0.0429, 0.04286 and 0.04285… and allow percentages with sign e.g 4.3%, isw changing form after correct answer seen
14			[a =] −5 [b =] 2	**2**	**B1** for one correct or **M1** for any pair of original brackets correctly expanded e.g. $3x^2+ax+6x+2a$ or $1[x]\times 3[x]\times b[x]=6[x^3]$ or $2\times a\times 3=-30$ or better	allow seen in a table

Question			Answer	Marks	Part marks and guidance	
15			accept any correct method e.g. $(2n + 1)(2m + 1)$	M1	accept any letters condone poor use of brackets throughout if the terms are correct	for **M1** accept e.g. $(2n + 1)(2m + 1)$ without any explanation BUT only accept e.g. $(x + 1)(x + 3)$ if they state that x is even
			e.g. $4nm + 2n + 2m + 1$ or $4nm + 2(n + m) + 1$	M2	correctly expanding *their* brackets **M1** for any three terms out of the four correct (middle term of three counts as two terms)	for **M1** and **M2** only accept brackets that **could** be the product of two odd numbers e.g. **M2** for $x^2 + [1]x + 3x + 3$ or better
			Statement showing that the expression is odd e.g. first three terms are even and add 1 to an even gives odd	A1	e.g. $2(2nm + n + m) + 1$ and a short statement "even + odd = odd" **A1** dep. on two method marks If **0** scored award **SC1** for $2n + 1$ etc seen or for the correct expansion of any two brackets including e.g. $x(x + 1)$	**A1** for statement showing expression is odd e.g. x is even so x^2 and $4x$ are even so +3 makes odd
16	(a)		1.035 is greater than 1 oe	1		
	(b)		3.5	1		
	(c)		185 000	1		
	(d)		212 300	2	**M1** for $185\,000 \times 1.035^4$ soi 212 291[. …] If **0** scored **B1** for *their* answer to more than 4 figs correctly rounded to 4 s.f.	
	(e)	(i)	any correct method, e.g. 368 110[. …] or 368 111	2	**M1** for $185\,000 \times 1.035^{20}$	Alternate method 1 e.g. 1.035^{20} = 1.98 to 1.99 scores **2** 1.035^{21} = 2.05 to 2.06 scores **1**
			380 994[. …] or 380 995	1		Alternate method 2 184 055 to 184 056 for **2** marks 190 497 to 190 498 for **1** mark
		(ii)	any correct explanation e.g. the rate of increase may not continue	1		see appendix

Question			Answer	Marks	Part marks and guidance	
17			$\frac{100}{210}$ oe	4	**B1** for $\frac{9}{14}$ or $\frac{5}{14}$ or $\frac{10}{14}$ or $\frac{4}{14}$ **M1** for $\frac{10}{15} \times \frac{5}{14}$ or $\frac{5}{15} \times \frac{10}{14}$ or $\frac{50}{210}$ oe **M1** for 2 × *their* $\frac{50}{210}$ oe (must be 2× a product) If **0** scored allow **SC2** for answer $\frac{100}{225}$ oe or **SC1** for answer $\frac{50}{225}$ oe	May be on a diagram or in a calculation Common equivalents for **4** marks include $\frac{10}{21}$ or 0.476… or 47.6…%, condone 0.48 with evidence of some correct working Alt. method **B1** as in mark scheme **M1** for $\frac{10}{15} \times \frac{9}{14} + \frac{5}{15} \times \frac{4}{14}$ or $\frac{110}{210}$ oe **M1** for $1 - \frac{110}{210}$ oe equivs. e.g. $\frac{20}{45}$, $\frac{4}{9}$, 0.444.., 44.4..% equivs. e.g. $\frac{10}{45}$, $\frac{2}{9}$, 0.222.., 22.2..%
18			$x^2 + y^2 = 3^2$ oe final answer	2	**B1** for $x^2 + y^2 = k$ (not 9)	k could be r^2
19	(a)		$\frac{4-6n}{(2n+3)(n^2+1)}$ final answer	4	**M1** for consistent common denominator of $(2n + 3)(n^2 + 1)$ **M1** for $4(n^2 + 1) – 2n(2n + 3)$ **M1** for correct expansion of one bracket	Condone $\frac{4-6n}{2n^3+3n^2+2n+3}$ for **4** marks and allow numerator $2(2 – 3n)$ allow e.g. $\frac{4(n^2+1)}{(2n+3)(n^2+1)} - \frac{2n(2n+3)}{(2n+3)(n^2+1)}$ Condone brackets crossed out
	(b)		$\frac{x+3}{2x+5}$ final answer	5	**M2** for $(x + 3)(x – 4)$ or **M1** for brackets which give 2 correct terms **M2** for $(2x + 5)(x – 4)$ or **M1** for brackets which give 2 correct terms	Condone brackets crossed out

Question			Answer	Marks	Part marks and guidance	
20			$\{x : -6 \leq x \leq 2\}$ final answer and with correct working	**5**		"correct working" requires at least **M2** e.g. $(x + 6)(x - 2)$
					B4 for $-6 \leq x \leq 2$ with correct working and not written separately OR	
					M2 for $(x + 6)(x - 2)$ or $\frac{-4 \pm \sqrt{4^2 - 4 \times 1 \times -12}}{2}$ or **M1** for brackets which give two correct terms or the formula with at most two errors	condone $x(x - 2) + 6(x - 2)$ for **M2** could be seen as roots on a sketch of graph or with incorrect inequality symbols <u>completing the square</u> : allow $(x + 2)^2 - 16$ for **M2** or $(x + 2)^2 + k$ for **M1**
					B1 -6 and 2	**.**
					If **0** or **1** scored award instead **SC2** for $\{x : -6 \leq x \leq 2\}$ If **0** scored **SC1** for $-6 \leq x \leq 2$	