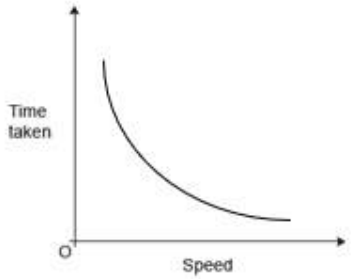
Question			Answer	Marks	Part marks and guidance	
1			The [age] groups overlap oe	1		See appendix Mark the best part of a single statement provided no contradiction or incorrect statements If more than one criticism, mark the worst Allow describing one or more common values or giving correct scales
2	(a)		$u = [\pm]\sqrt{v^2 - 2as}$ as final answer	2	**M1** for [u^2 =] $v^2 - 2as$	Mark intent eg $u = \sqrt{v^2 - 2as}$ as 2bod but not $u = \sqrt{v^2} - 2as$
	(b)		3924 to 3924.3	3	**M2** for $\sqrt{8000^2 - 2 \times 90 \times 270000}$ or **M1** for $\sqrt{8000^2 - 2 \times 90 \times figs\ 27}$ or $8000^2 - 2 \times 90 \times 270000$ or $8000^2 = u^2 + 2 \times 90 \times 270000$ or for correct substitution seen of $v = 8000$, $a = 90$ and $s =$ figs 27 in *their* final answer to part (a) If **0** scored **SC1** for 7996 to 7997 as final answer	Condone 3920 as final answer for full marks, following **M2** For **SC1**, condone 8000 following 7996 to 7997.

Question			Answer	Marks	Part marks and guidance	
3	(a)		83 or 84	3	**M2** for $150 \times \frac{5}{9}$ oe implied by answer 83.3… or **M1** for $\frac{5}{9}$ or for $\frac{150}{9}$	Non calculator methods must be fully correct, see appendix, and would lead to 83.3 May be implied by 0.55 to 0.56 or 55% to 56% May be implied by 16.6 to 16.7
	(b)		$\frac{3}{5}$	2	**B1** for $\frac{12}{20}$ oe	For **B1** accept 0.6 or 60% or $\frac{12}{20} \times 150$
	(c)		[Ling has] more results [than Riley] oe	1		See appendix Accept he/they/she as reference to Ling May be inverse: [Riley has] fewer results [than Ling] oe Do not accept comments about more/less in the bag
4	(a)		Correct shape, not touching the axes  	2	Condone slight curvature away from axes at the extremes **B1** for correct curve but touching, not crossing, one or both axes	Ignore scales

Question			Answer	Marks	Part marks and guidance	
	(b)		100	2	**M1** for $\frac{40 \times 5}{2}$ oe or **B1** for 200 or 2.5 or 0.4	
5			Accurate ruled perpendicular bisector of AB with two correct pairs of supporting arcs	2	**B1** for accurate ruled bisector perpendicular bisector of AB with no or incorrect arcs	Use overlay as a guide Put ruler on screen to check 2 cm if needed Tolerance ±2 mm and ±2°. Line length at least 2 cm Bisector crosses between circles of overlay but does not cut them and perpendicular by eye
			Accurate ruled bisector of angle ABC with two correct pairs of supporting arcs	2	**B1** for accurate ruled bisector of angle ABC with no or incorrect arcs	Tolerance ±2°. Line length at least 2 cm Bisector between or on red lines of overlay arcs
			Correct position of boat clearly identified at point of intersection of two straight lines	1 dep	Dep on at least **B1** and **B1**	
6	(a)		[They should have] divided by 1.25 or multiplied by 0.8 oe or 2625 increased by 25% is 3281.25/not 3500	1		See appendix Mark the best part of the statement unless there is contradiction or an incorrect statement

Question			Answer	Marks	Part marks and guidance	
	(b)		3304	**4**	**M3** for 3500 ÷ 1.25 × 1.18 oe or **M2** for [k ×] 1.18 ÷ 1.25 soi by 0.944 or for 3500 ÷ 1.25 soi 2800 or for m × 1.18 where m is *their* value for 2020 or **M1** for 1.25 or 1.18 seen	For non-calculator methods see appendix May be 1.25 ÷ 1.18 soi 1.059... m can be 2625 (which gives 3097.5) May be implied by 1.475 NC 1.25 may be e.g. $k \div 4 + k$, k = a number
7	**(a)**		Correct substitution of (x, y) from integer point on curve into equation leading to $k = 3$ e.g. (2, 4) $4 = 2k - 2^2 + 2$ or $4 = 2k - 4 + 2$ leading to $k = 3$ with at least one correct intermediate step	**2**	**M1** for correct substitution of (x, y) from integer point on curve into $y = kx - x^2 + 2$ or $y = 3x - x^2 + 2$ OR **M1** for e.g. $x = 2$ correctly substituted in $y = 3x - x^2 + 2$ and finding $y = 4$ Max **M1** if $k = 3$ substituted	(-1, -2) : $-2 = -[1]k - (-1)^2 + 2$ (1, 4) : $4 = [1]k - 1^2 + 2$ (2, 4) : $4 = 2k - 2^2 + 2$ (3, 2): $2 = 3k - 3^2 + 2$ (4, -2): $-2 = 4k - 4^2 + 2$ Use of (0, 2) scores 0 but may be replaced with another point (ie do not treat as a choice) <u>Examples of intermediate steps</u> $4 = 2k - 2^2 + 2$ then $4 = 2k - 4 + 2$ is a sufficient int step or $4 = 2k - 2$ is a sufficient int step or $6 = 2k$ is a sufficient int step $3 = k$

Question			Answer	Marks	Part marks and guidance	
	(b)		0.4 and 2.6	2	**B1** for 0.4 or 2.6 or **M1** for line $y = 3$ drawn or for (0.4, 3) and (2.6, 3) indicated	Line to cut curve twice Treat $x = 3$ drawn or multiple horizontal lines as choice unless $y = 3$ clearly chosen Condone good freehand line eg circled or lines drawn down to x-axis

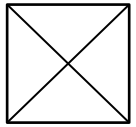
Question			Answer	Marks	Part marks and guidance	
8			2.1[0…] nfww	4	**M1** for $\frac{360}{60}$ oe soi by 6 AND **Method 1 using tan:** **M2** for [*h* =] 20 tan(*their* 6) oe or **M1** for correct use of tan(*their* 6) oe or **Method 2 using sine rule:** **M2** for [*h* =] $\frac{20\sin(their\ 6)}{\sin(90-their\ 6)}$ or **M1** for $\frac{\sin(their\ 6)}{h} = \frac{\sin(90-their\ 6)}{20}$ oe or **Method 3 using cos and Pythagoras:** **M2** for $\sqrt{(\frac{20}{\cos(their\ 6)})^2 - 20^2}$ or **M1** for $(\frac{20}{\cos(their\ 6)})^2 - 20^2$	May be on diagram In all methods, if their angle is not 6 then method must be seen, not implied by interim answers unless stated otherwise Accept any acute angle used for *their* 6 eg [*h* =] $\frac{20}{\tan(90-their\ 6)}$ eg tan(*their* 6) = $\frac{h}{20}$ NBs $\frac{\text{approx. circumference}}{60} = \frac{40\pi}{60}$ = 2.1 scores **0** 20sin6 = 2.1 scores **M1** for 6 Solution from scale drawing scores a maximum of **M1** if 6 seen

9			78	**4**	**Ratios:** **B3** for 32 : 48 and 30 : 48 identified or for 32 : 48 : 30 or **M2** for 16*k* : 24*k* and 15*k* : 24*k* or for 16*k* : 24*k* : 15*k* where *k* is a positive integer or for $\frac{2}{3}-\frac{5}{8}$ oe implied by $\frac{1}{24}$ or **M1** for 16*k* : 24*k* or 15*k* : 24*k* where *k* is a positive integer or for $\frac{2}{3}$ or $\frac{5}{8}$ or $\frac{2}{5}$ or $\frac{3}{5}$ or $\frac{5}{13}$ or $\frac{8}{13}$ or their reciprocals seen or used **Listing:** **M3** for multiples of 13 reaching at least 78 and multiples of 5 reaching at least 80 or for reaching 39 and 40 and then doubling or **M2** for listing multiples of 13 and 5 reaching at least 39 and 40 or **M1** for listing at least three multiples of 13 and 5 **Fractions and ratios:** **B3** for $\frac{32}{80}:\frac{48}{80}$ and $\frac{30}{78}:\frac{48}{78}$ identified or **M2** for $\frac{16}{40}:\frac{24}{40}$ and $\frac{15}{39}:\frac{24}{39}$ or **M1** for $\frac{16}{40}:\frac{24}{40}$ or $\frac{15}{39}:\frac{24}{39}$ **All methods:** If **0** scored **SC1** for answer 30, 32, 48 or 80	**Alternative methods using equations:** **M2** for correct unsimplified equation(s) to find original or new numbers of fiction, non-fiction or total **A1** for correct solution(s) of the equation(s), no FT or **M1** for one correct equation involving two variables eg using ***t* as new total** **M2**: $\frac{3}{5}(t+2)=\frac{8}{13}t$ oe $\frac{2}{5}(t+2)-\frac{5}{13}t=2$ oe should lead to [*t* =] 78, full marks eg using ***t* as old total** **M2**: $\frac{3}{5}t=\frac{8}{13}(t-2)$ oe $\frac{2}{5}t-\frac{5}{13}(t-2)=2$ oe **A1**: [*t* =] 80 eg using ***f* as new number of fiction**, *n* as number of non-fiction **M2**: 8*f* = 5*n* and 3(*f* + 2) = 2*n* **A1**: *f* = 30 and *n* = 48 eg **using *f* as old number of fiction**, *n* as number of non-fiction **M2**: 8(*f* – 2) = 5*n* and 3*f* = 2*n* **A1**: *f* = 32 and *n* = 48 eg **M**1: 8*f* = 5*n* or 3(*f* + 2) = 2*n* or 8(*f* – 2) = 5*n* or 3*f* = 2*n*

Question			Answer	Marks	Part marks and guidance	
10	(a)		Divisible by 5 or divisible by 19 or 95 ÷ 5 = 19 or 95 ÷ 19 = 5 or 5 × 19	1		Accept factor tree showing 95, 5 and 19 Accept 5 and 19 are factors of 95 Do not accept 5 and 19 are multiples of 95
	(b)	(i)	250	2	**B1** for 2 [×] 5^3	Venn diagram on its own scores 0 unless 2 and 5^3 selected
		(ii)	$2^{13} \times 5^{12}$	2	**M1** for $10^k = 2^k \times 5^k$ where k is a positive integer implied by final answer of the form $2^{k+1} \times 5^k$ or **SC1** for $2^{12} \times 5^{12}$	e.g. $10 = 2 \times 5$

Question			Answer	Marks	Part marks and guidance	
11			$\frac{A}{10} - 3$ or $\frac{1}{10}(A - 30)$ or $\frac{A-30}{10}$ with correct working or other simplified equivalents	5	**B4** for $\frac{A\text{cm}^2}{10} - 3$ etc with correct working OR The below assumes PQ = *x*. Mark similarly use of SR = *x*. **M2** for $10x + \frac{1}{2} \times 6 \times 10$ or $\frac{10(x+x+6)}{2}$ oe or for $10x$ and 30, may be indicated on diagram **A1** for [*A* =] $10x + 30$ or $10(x + 3)$ or **M1** for lengths *x* and *x* + 6 oe or for area $10x$ or area 30 AND **M1FT** for $10x = A - 30$ or $x + 3 = \frac{A}{10}$ If **0** or **1** scored, instead award **SC2** for $\frac{A}{10} - 3$ or $\frac{1}{10}(A - 30)$ or $\frac{A-30}{10}$ with no or insufficient working	'Correct working' requires evidence of at least **M2** Condone use of PQ, PQ + 6 etc instead of *x* and *x* + 6 Working may be on diagram For **M2** accept area *A* – 30 for area 10x For **A1** accept equivalents such as $\frac{A}{5} = 2x + 6$, $2A = 20x + 60$ For **M** and **A** marks, both lengths must be in terms of the same variable eg PQ and PQ + 6, not *x* and *y* unless *y* = *x* + 6 subsequently seen FT $ax + b = A$ or $a(x + b) = A$ ($a \neq \pm 1$ or 0, $b \neq 0$)
12	(a)		195 [≤ *n* ≤] 204	2	**B1** for 195 or 204 in correct position or for both 195 and 204 but in wrong position	Do not accept < 205 where ≤ has been crossed out and replaced

Question			Answer	Marks	Part marks and guidance	
	(b)		$\frac{247.5}{7.5 \times 5.5} = 6$	3	Max 2 marks if answer is incorrect **B1** for 247.5 **B1** for 7.5 and 5.5 **M1** for $\frac{their247.5}{their7.5 \times their5.5}$ where 247.5 ≤ *their*247.5 ≤ 248.5, 6.5 ≤ *their*7.5 ≤ 7.5 and 4.5 ≤ *their*5.5 ≤ 5.5	May be done in stages. 6 must not come from a rounded answer or other wrong working. If choice, mark the bounds used in the calculation. If no calculation, then 0 each time upper and lower bounds are both given 7.5 × 5.5 × 6 = 247.5 scores just the second mark. If they then explicitly state that 247.5 is the lower bound of 248 they also get the first mark but not for "247.5 rounds to 248"
13	(a)	(i)	32	3	**M1** for 18 ÷ 20 soi by 0.9 **M1** for 2*k* × 10 [+] 0.3*k* × 40 implied by 20 and 12 may be on diagram	May be soi on the vertical axis (eg. labelling the scale with [0.5,]1, [1.5, 2]. Where *k* is a consistent scaling of the height of the bars eg 4 × 10 [+] 0.6 × 40, 40 × 10 [+] 6 × 40 etc Ignore extras
		(ii)	Unlikely the largest value will be 80 oe or The longest distance could be anywhere between 40 and 80 oe or Unlikely the smallest value will be 0 oe or The shortest distance could be anywhere between 0 and 20 oe	1		Accept: Exact distances are not known The data is in groups

Question			Answer	Marks	Part marks and guidance	
	(b)		Median for July = 26 July distances were lower [on average] oe	**1** **1dep**	Condone mean or average for July = 26	See appendix Condone not repeating the given values for December Need figures in comment/work space Comparison comment must be general and have context for second and fourth marks Accept for first mark "median is 4 more in Dec" oe Accept for third mark "IQR is 16 less in Dec" oe
			IQR for July = 36 July distances were more varied oe	**1** **1dep**	If **0** scored overall **SC1** for two correct comparisons lacking values	eg **SC1** for "median for July was lower" and "IQR for July was higher" oe
14	**(a)**		 with side 5 cm	**2**	**B1** for a square drawn with side 5 cm or for a square of any length with two diagonals	Mark intention 2mm tolerance radially on centre point by eye

Question			Answer	Marks	Part marks and guidance	
	(b)		$\frac{200\sqrt{41}}{3}$ or 426.6 to 427 with correct working	5	**M3** for $\sqrt{14.5^2 - 10^2 - 10^2}$ oe or **M2** for $14.5^2 - 10^2 - 10^2$ oe or **M1** for $14.5^2 = 10^2 + 10^2 + h^2$ or for $10^2 + 10^2$ oe implied by 200 or for $\sqrt{10^2 + 10^2}$ oe implied by 14.1…or $10\sqrt{2}$ or for $20^2 + 20^2$ oe implied by 800 or for $\sqrt{20^2 + 20^2}$ oe implied by 28.2[8..], 28.3 …or $20\sqrt{2}$ AND **M1** for $\frac{1}{3} \times 20 \times 20 \times$ *their* 3.2[0] or for $\frac{1}{3} \times 400 \times$ *their* 3.2[0] If **0** or **1** scored, instead award **SC2** for $\frac{200\sqrt{41}}{3}$ or 426.6 to 427 with no or insufficient working If **0** scored, **SC1** for $\frac{\sqrt{41}}{2}$ or $\sqrt{10.25}$ or 3.2[0] to 3.211 with no or insufficient working	'Correct working' requires evidence of at least three **M** marks Working may be on diagram May be seen in stages Method must be seen for **M3** (3.2[0] to 3.211 or $\frac{\sqrt{41}}{2}$ or $\sqrt{10.25}$) (10.25) May be seen in stages For **M3** and **M2** condone $10\sqrt{2}^{\,2}$ for $(10\sqrt{2})^2$ which may lead to wrong answer for **M2** of 190.25 or for **M3** of 13.79… *Their* 3.2[0] must be in the range 3.2[0] to 3.211 and must come from an attempt at 3D trig or 3D Pythagoras

Question			Answer	Marks	Part marks and guidance	
15			55.5 to 55.6 nfww	4	**M3** for $35 \times \sqrt[3]{\frac{2}{0.5}}$ oe or $35 \div \sqrt[3]{\frac{0.5}{2}}$ oe or **M2** for $\sqrt[3]{\frac{2}{0.5}}$ oe soi by 1.58 to 1.59 or $\sqrt[3]{\frac{0.5}{2}}$ oe soi by 0.62 to 0.63 or $\frac{h^3}{35^3} = \frac{2}{0.5}$ oe or **M1** for $\frac{2}{0.5}$ oe soi by 4 or $\frac{0.5}{2}$ oe soi by $\frac{1}{4}$ If **0** scored then **SC1** for 140 as final answer	Accept 56 as final answer after **M3** May see as length ratio, eg **M2** for $\sqrt[3]{2}$: $\sqrt[3]{0.5}$ soi by 1.2599(…) to 1.26 : 0.7937(…) to 0.794 May see as volume ratio, eg. **M1** for 2 : 0.5 oe May also be seen as part of wrong approach eg. 35×4 scores **M1**
16	(a)		[0].9	1		
	(b)		49×1.009^{39} = 69.49… or 69.5[0]	2	**M1** for [49 ×] 1.009^{39}	Accept 69 after correct method

Question			Answer	Marks	Part marks and guidance	
17			1.316	4	**B3** for answer 1.3160 to 1.3161 OR **M3** for [r =] $\sqrt[4]{3}$ oe or **M2** for $r^4 = 3$ or **M1** for $r^6 = 3r^2$ <u>Trials or insufficient method:</u> **B4** for answer 1.316 or **B3** for answer 1.3160 to 1.3161 or **M2** for at least three correct trials of r^4 oe or of r^6 <u>and</u> $3r^2$ oe or **M1** for at least two correct trials of r^4 oe or of r^6 <u>and</u> $3r^2$ oe	eg **M3** for $\sqrt{3}$ = 1.73[2…] and $\sqrt{1.73[2\ldots]}$ Accept evaluations to 2sf rot Accept evaluations to 2sf rot
18	(a)		Circle Centre (0, 0) oe Radius $\sqrt{20}$ or $2\sqrt{5}$ or 4.47[2..] or 4.5	1 1 1		Accept circular graph Accept origin or O for (0, 0) but not turning point (0, 0) If their description uniquely defines the circle then award full marks eg After “circle” and “centre (0, 0)”, passes through one correct stated point, scores 3 “circle” and ($\pm\sqrt{20}$, 0) and (0, $\pm\sqrt{20}$), scores 3 “circle” and two correct stated points, scores 1

Question	Answer	Marks	Part marks and guidance	
(b)	(-2, 4) and (-4, -2) with correct working	6		'Correct working' requires evidence of at least **M1M1M1**
			M1 for $x^2 + (3x + 10)^2 = 20$	Award equivalent marks if working in terms of y
			M1 for expanding *their* square term e.g. $9x^2 + 30x + 30x + 100$	May be in a grid May be implied by subsequent working
			M1 for simplifying *their* quadratic equation e.g. $10x^2 + 60x + 100 = 20$ or better	*Their* quadratic must include an x term Simplified: $10x^2 + 60x + 80$ [= 0] or $x^2 + 6x + 8$ [= 0]
			M1 for correctly factorising *their* 3-term quadratic equation or for correct use of quadratic formula for *their* 3-term quadratic equation	e.g. $(x + 2)(x + 4)$, $(5x + 10)(2x + 8)$
			or for correct completing the square	e.g. reaching $d(x + e)^2 + f$
			A1 for one correct point or two correct x-values	
			If **0** or **1** scored, instead award **SC2** for 2 correct points with no or insufficient working	
			If **0** scored **SC1** for 1 correct point or 2 correct x-coordinates or 2 correct y-coordinates with no or insufficient working	

Question			Answer	Marks	Part marks and guidance	
19	(a)		$[\sqrt{11}\sqrt{22} =]$ $\sqrt{242} = \sqrt{121 \times 2}$ or $\sqrt{121} \times \sqrt{2}$ $[= 11\sqrt{2}]$ or $[\sqrt{11}\sqrt{22} =]$ $\sqrt{11} \times \sqrt{11}\sqrt{2}$ or $\sqrt{11} \times \sqrt{11 \times 2}$ or $\sqrt{11 \times 11 \times 2}$ $[= 11\sqrt{2}]$	1		
	(b)		$\frac{\sqrt{11}(13 - \sqrt{22})}{(13 + \sqrt{22})(13 - \sqrt{22})}$	M1	Condone missing bracket for this **M1** if recovered later in numerator or denominator	Multiplying by $\sqrt{22} - 13$ is eligible for **M1** and then FT but **A1** must be correct form Multiplying by $13 + \sqrt{22}$ scores **0**
			$13\sqrt{11} - \sqrt{11}\sqrt{22}$ oe or better	M1	May be in a grid	Equivalents likely to be seen for $\sqrt{11}\sqrt{22}$ include $\sqrt{242}$ and $11\sqrt{2}$
			$169\ [+13\sqrt{22} - 13\sqrt{22}] - 22$	M1	May be in a grid	
			$\frac{13\sqrt{11} - 11\sqrt{2}}{147}$	A1	Dep on **M1M1M1** and no errors seen	An error is eg missing bracket in first **M1**

20	**(a)**		$2\left(x+\frac{3}{4}\right)^2-\frac{169}{8}$ as final answer with correct working	**5**		'Correct working' requires evidence of at least **M1** Accept decimal and mixed number equivalents throughout eg. $2(x + 0.75)^2 – 21.125$ $2\left(x+\frac{3}{4}\right)^2-21\frac{1}{8}$
					Method 1: **B3** for $2\left(x+\frac{3}{4}\right)^2$ in final answer with correct working or **M1** for $2x^2 – 5x + 8x – 20$ oe **M1** for $2\left(x^2+\frac{3}{2}x\right)$ [– 20] oe AND **M1** for [-*b* =] $-2\left(their\frac{3}{4}\right)^2$ – 20 soi by $-\frac{169}{8}$	May be in a grid
					Method 2: **B3** for $2\left(x+\frac{3}{4}\right)^2$ in final answer with correct working or **M1** for $2x^2 – 5x + 8x – 20$ oe or for $2(x^2 + ax + ax + a^2) – b$ oe **M1** for $4ax = 3x$ soi by [a =] $\frac{3}{4}$ AND **M1** for [-*b* =] $-2\left(their\frac{3}{4}\right)^2$ – 20 soi by $-\frac{169}{8}$	May be in a grid

Question			Answer	Marks	Part marks and guidance	
					Method 3: **B3** for $2\left(x+\frac{3}{4}\right)^2$ in final answer with correct working or **M1** for roots -4 and 2.5 **M1** for turning point at [x =] $\frac{-4+2.5}{2}$ soi by $-\frac{3}{4}$ AND **M1** for [-b =] $(2(their-\frac{3}{4})-5))((their-\frac{3}{4})+4)$ soi by $-\frac{169}{8}$ If no or insufficient working **SC2** for $2\left(x+\frac{3}{4}\right)^2-\frac{169}{8}$ or **SC1** for $2\left(x+\frac{3}{4}\right)^2$ [+k]	

Question			Answer	Marks	Part marks and guidance	
	(b)		Charlie with at least one bullet point and no incorrect statements: • The roots are ⁻4 and 2.5 • The turning point is at [x =] $-\frac{3}{4}$ oe and only one root is positive/negative • The turning point is at [x =] $-\frac{3}{4}$ oe and y-intercept is ⁻20 or negative	**2**	**B1** for Charlie with one bullet point and no incorrect statements: • Turning point is at [x =] $-\frac{3}{4}$ oe • y-intercept is ⁻20 or negative or **SC1** for any of the following with no incorrect statements: Dev and y-intercept is ⁻20 or negative or Eve and turning point is at [x =] $-\frac{3}{4}$ oe or A person linked correctly to a FT turning point from (a)	Turning point position may **FT** from **(a)**