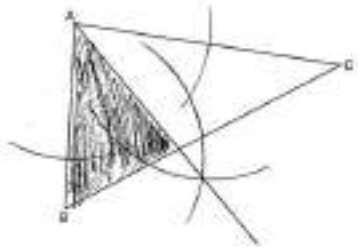
Question			Answer	Mark	Part marks and guidance	
1			40	2	**M1** for 120 ÷ 3	Accept 1200 ÷ 30, $\frac{600}{15}$, $\frac{120}{100} \div \frac{3}{100}$ Do not allow M1 if extra step after 120 ÷ 3 e.g. 120 ÷ 3 then divide by 100
2	(a)		First card Difference | 0 | 2 | 5 | 9 Second card 0 | | 2 | 5 | 9 2 | 2 | | 3 | 7 5 | 5 | 3 | | 4 9 | 9 | 7 | 4 |	2	**B1** for 3 or 4 correct entries	For 2 marks, ignore entries in shaded squares if they are 0's For B1 ignore shaded squares
2	(b)		$\frac{6}{12}$ oe nfww	2	If shaded squares are blank or <u>all</u> have zeros FT *their* 12 entries for 2 marks **M1** for all *their* even numbers and all factors of 10 identified only <u>IF Shaded SQUARES are counted</u>: FT *their* 16 entries **B2FT** *their* table Or **M1** for all *their* even numbers and all factors of 10 identified only If 0 scored **SC1** for answer $\frac{6}{16}$	isw conversion/cancelling after *their* correct probability Do not accept ratio or words If table correct and shaded squares have zeros allow answer $\frac{10}{16}$ oe for 2 marks M1 may be seen on table by e.g. ringing values or listing We only accept the 16 squares in the Grid, not the card values Count zero as an even number If table correct apart from <u>all</u> zeros in shaded squares allow all even numbers and factors of 10 [0's in shaded squares] identified For SC1 allow answer $\frac{3}{8}$ if $\frac{6}{16}$ seen first

Question			Answer	Mark	Part marks and guidance	
3	(a)		12 26 with correct working	6	**B5** for 3 hours 36 mins with correct working or 12 26 am with correct working OR <u>Method to find time in 1st stage</u> **M2** for $\frac{1}{10} \times 200 \div 40$ [× 60] oe or **M1** for $\frac{1}{10}$ × 200 oe AND <u>Method to find time in 2nd stage</u> **M2** for $0.4 \times 200 \div 50$ oe or **M1** for 0.4 × 200 oe AND **M1dep on M2M2** for *their* 30[mins] + *their* 96[mins] + 1hr30[mins] If 0 or 1 or 2 scored, instead award **SC3** for answer 12 26 or 12 26 pm If 0 or 1 scored, instead award **SC2** for 3 h 36 [mins] or 12 26 am	Correct working requires evidence of at least M2M2 Accept 12 26 pm for 6 marks M2 implied by 0.5[h], $\frac{1}{2}$ [h] or 30 [mins] nfww M1 implied by 20 [miles] nfww M2 implied by $\frac{8}{5}$ [h], $1\frac{3}{5}$ [h], 1.6 [h] isw, 96[mins] or 1[h] 36[min] nfww M1 implied by 80 [miles] nfww M1 implied by addition onto 0850

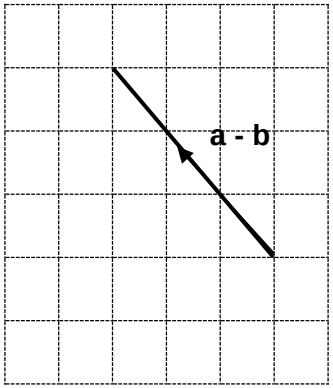
Question			Answer	Mark	Part marks and guidance	
3	(b)		Correct response e.g. Ryan drives at the speed limit and does not drive slower or is delayed	1		Accept any valid reason why Ryan may not be able to travel at Maximum Speed at all times e.g. Ryan does not get stuck in traffic There are no roadworks etc He does not stop on the journey Car does not breakdown Do not accept incorrect statements e.g he travels at a constant speed Mark best response as long as not contradictory or incorrect See Appendix 1
4	(a)		Positive	1		Ignore embellishments
4	(b)		Indicates the point (39, 10)	1		Ignore circles around the points ≤ 30 for both Science and Maths as this is working for part (e)

Question			Answer	Mark	Part marks and guidance	
4	(c)		Ruled line of best fit **and** answer **FT** ± 0.5 *their* straight ruled line at 28 Science marks	2	**B1** for ruled line of best fit or answer **FT** ± 0.5 *their* straight ruled line with positive gradient	Use overlay for LOBF, ruled line needs to reach both gates set at: (8,11) and (8,22) (49,35) and (49,46) Gates include circles on overlay Ignore LOBF beyond gates
4	(d)		Correct explanation e.g. It is beyond the range of the data provided on the scatter diagram. The pupil may not follow the trend/pattern of the data	1		<u>Accept</u> The line of best fit should not extend beyond the data provided Outside range of data provided oe Small sample Data only goes up to 49 No one scores 60 Do not Accept You cannot extend past the LOBF otherwise it is inaccurate Ignore incorrect statements See Appendix 2
4	(e)		35[%]	3	**M2** for $\frac{7}{20}$ × 100 oe **or** **B1** for 7 [pupils] If 0 scored, **SC1** for $\frac{their7}{20}$ correctly converted to a percentage.	B1 implied by $\frac{7}{20}$ oe or $\frac{7}{k}$ (k > 7)

Question			Answer	Mark	Part marks and guidance	
5			acceptable bisector of angle A with two pairs of supporting arcs	M2	**M1** for acceptable bisector of angle A with no or incorrect arcs	Tolerance ± 2° Use overlay Accept dashed or solid line for bisector If additional incorrect bisectors are drawn then this is choice and M0 unless the shading indicates they have chosen the correct bisector
			Region to the left of their bisector shaded 	B1	**Dep** on ruled line from angle A reaching BC	Accept any clear indication for shading
6			1800 final answer and 200 and 9 shown	3	**M2** for 200 × 9 or **M1** for *their* 200 × *their* 9 or **B1** for 200 and 9 seen	For M1 e.g. uses 198 and 8.9 or uses incorrectly rounded values

Question			Answer	Mark	Part marks and guidance	
7			84 with correct working	6		Correct working requires evidence of at least B1M3 (could be done in stages) or other alternate correct approach leading to 84 accept use of equivalent decimals throughout
					B1 for $\frac{1}{8}$ or 8 soi	
					M4 for $\frac{7}{4}\times\frac{6}{1}\times\frac{8}{1}$ oe or better	e.g. M4 for 1750 ÷ 1000 × 6 × 8
					or **M3** for $\frac{7}{4}\times\frac{6}{1}$ oe isw or better $\frac{7}{4}\times\frac{8}{1}$ oe isw or better	M3 implied by $\frac{42}{4}$ oe or 10.5 nfww or $\frac{56}{4}$ oe or 14 nfww oe e.g. M3 for 1750 ÷ 1000 × 6 [or × 8] oe
					or 1750 × 6 × 8 oe or better	If $\frac{1}{7}$ or 7 used as ratio then max mark is M3 for $\frac{7}{4}\times\frac{6}{1}$ oe isw (leads to answer 73.5)
					or **M2** for $\frac{7}{4}\div\frac{1}{6}$ oe or $\frac{7}{4}\div\frac{1}{8}$ oe	or for equivalent improper fraction to $\frac{7}{4}$ M2 oe for both decimal values correct e.g. 1.75 ÷ 0.167 or 1.75 ÷ 0.125, For M2, allow error in decimal e.g. 0.160 for 0.167 if 1 ÷ 6 method shown
					or for $\frac{1}{6}\times\frac{1}{8}$ oe or better or 1750 × 6 oe or 1750 × 8 oe or better	Accept 8 × 6
					or **M1** for $1\frac{3}{4}\div\frac{1}{6}$ oe or $1\frac{3}{4}\div\frac{1}{8}$ oe	Allow M1 for 1.75 ÷ $\frac{1}{6}$ or 1.75 ÷ $\frac{1}{8}$
					If 0 or 1 scored, instead award **SC2** for answer 84 If 0 scored **SC1** for $\frac{7}{4}\times 7$ oe seen	Implied by $\frac{49}{4}$ oe seen , 12.25 seen See AG

Question			Answer	Mark	Part marks and guidance	
8	(a)		100	1		Not e.g. 100x, 100k
8	(b)		50	1		Not e.g. –50, 50x, 50k
9			24 nfww	4	**M1** for [v =] [0+] 3 × 4 **M2** for *their* $(3 \times 4)^2 \div (2 \times 3)$ or better or **M1** for *their* $(3 \times 4)^2 = 2 \times 3 \times s$	nfww – not from 2 × 3 × 4 M1 implied by [v =] 12 but not if obtained from $0 = u + 3 \times 4$, this gets M0 If eqn not used and $d = st$ answer 12 then M0 Condone other variable used for s but not v, u, a or t See AG if other kinematics formulas used
10			8	4	**M2** for $a + a + a + 5 + a + 5 = 42$ oe or **M1** for 3 × 14 oe or $a + a + a + 5 + a + 5$ oe AND **M1** for $a = \frac{42-10}{4}$ oe or FT *their* equation of the form $ka + c = d$ oe to $a = \frac{d-c}{k}$ oe	Allow M2 if correct expression <u>seen first</u> and then incorrectly simplified before in eqn = 42 M1 implied by 42 or $4a + 10$ oe FT only from written equation Where k, c and d are positive integers and $k > 1$ Allow **M1** for one trial into $2(a + 5) + 2a$ evaluated correctly
11	(a)		$\begin{pmatrix} -3 \\ 1 \end{pmatrix}$	2	**B1** for answer $\begin{pmatrix} -3 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ 1 \end{pmatrix}$	No fraction line in vector – but penalise 1 mark only in (a) and (b)
11	(b)		Correct response e.g. a vector $\begin{pmatrix} p \\ q \end{pmatrix}$ where $p^2 + q^2 = 10$ or FT *their (*a)	1FT	Allow correct or FT *their* (a) Must be numeric and column vector	e.g. $\begin{pmatrix} \pm 3 \\ \pm 1 \end{pmatrix}$ or $\begin{pmatrix} \pm 1 \\ \pm 3 \end{pmatrix}$ or $\begin{pmatrix} \sqrt{10} \\ 0 \end{pmatrix}$ etc but not *their* $\begin{pmatrix} -3 \\ 1 \end{pmatrix}$ from (a)

Question			Answer	Mark	Part marks and guidance	
11	(c)		Vector **a** – **b** correctly drawn with correct direction arrow on the resultant  	3	**B2** for **a** – **b** correctly drawn but with an incorrect or no direction arrow or or **B1** for *their* $\begin{pmatrix}-3\\1\end{pmatrix} - \begin{pmatrix}0\\-2\end{pmatrix}$ or $\begin{pmatrix}-3\\3\end{pmatrix}$ or for drawing $\begin{pmatrix}-3\\1\end{pmatrix} - \begin{pmatrix}0\\-2\end{pmatrix}$ oe on grid as two sides of a potential triangle (condone missing/wrong arrows) If 0 scored, **SC1** for vector $\begin{pmatrix}-3\\5\end{pmatrix}$ drawn on grid with correct direction arrow	Full marks may be within a triangle with correct direction arrow B2 may be within a triangle with no direction arrow[s]
12	(a)		No oe AND correct valid reason or correct supporting values e.g. • The value of the interest changes each year as the amount grows • It is exponential growth • Compound interest means the interest grows each year	1		e.g. Accept e.g. • There will 5% interest on the £50 as well as an extra £50 oe • It will increase by 5% of 1050 • Finds £1102.5[0] or 102.5[0] or 52.50 for 2nd year If they show a calculation in their reason it must be correct See appendix 3

Question			Answer	Mark	Part marks and guidance	
12	(b)		[a =] 8000 [b =] 0.8	4	**B1** for [a =] 8000 AND **B3** for [b =] 0.8 oe or **M2** for $\frac{6400}{8000}$ oe or 80% oe or $\frac{8000-6400}{8000}$ oe 0.2 oe or **M1** for 6400 = $a \times b$[1] soi or better	Allow M2 for e.g. a = 0.8 M2 for e.g. 20% e.g. For M1 6400 = *their* $a \times b$[1] seen or 6400 = 8000× b [1] For M1 accept 8000 – 6400 = 8000b [1] seen
13			Both inequalities $x \geq 10$, $x \leq -10$ as final answer	3	**B2** for answer one of $x \geq 10$ or $x \leq -10$ or **M1** for $x^2 \geq 100$ or for $(x+10)(x-10)$	Allow 3 marks for $-10 \geq x \geq 10$ final answer B2 implied by answer e.g. $-10 \leq x \geq 10$ or $x \geq \pm 10$ as one element of inequality correct M1 implied by 10 **or** –10 seen in answer

Question			Answer	Mark	Part marks and guidance	
14			$\frac{2n}{4n+1}$ oe final answer	**3**	**B2** for denominator $4n + 1$ oe or for $2n$ **and** $4n + 1$ seen or **B1** for $2n$ oe or for $4n + c$ oe	Condone consistent use of different variable for all marks e.g. B2 for denominator $4x + 1$ For B marks isw attempts to cancel after seen in fraction B2 for denominator e.g. $5 + 4(n – 1)$ oe May not be in a fraction For B1 expressions do not need to be in a fraction where c is any number including zero, or 'c' B1 for e.g. $4n$, $4n + c$, $4n – 1$, $3 + 4(n – 1)$ Do not allow as part of an incorrect expression e.g. $2n^2 + 4n$
15			$4x^3 + 5x^2 – 23x – 6$ final answer	**3**	**B2** for correct but unsimplified answer or for 3 correct terms in final answer with no more than 4 terms or **B1** for expansion of any two of the given brackets with three correct terms	e.g. $4x^3 + 13x^2 – 8x^2 – 26x + 3x – 6$ $4x^3 + 4x^2 + x^2 – 24x + x – 6$ $4x^3 + 12x^2 – 7x^2 – 21x – 2x – 6$ For B2 accept correct terms on grid the simplified x term counts as two correct terms $4x^2 + 12x + x + 3$ [+] $13x$ counts as two terms $x^2 + 3x – 2x – 6$ [+1] x counts as two terms $4x^2 – 8x + x – 2$ $– 7x$ counts as two terms For B1 accept e.g. x^2, [+] $3x – 2x$, $– 6$ on grid If in a longer train of 'random' terms only award B1 if four correct consecutive terms are given

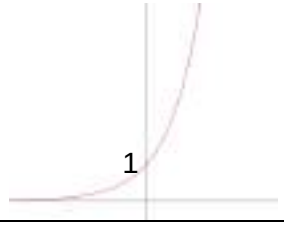
Question			Answer	Mark	Part marks and guidance	
16			9 nfww	**3**	**M2** for $\frac{6}{\sqrt[3]{8}} \times \sqrt[3]{27}$ oe or **M1** for $\sqrt[3]{8} : \sqrt[3]{27}$ soi or for $\frac{8}{27} = \frac{6^3}{x^3}$ oe or better	M2 implied by ratio 6 : 9 or 9 : 6 M1 accept in any order, e.g. 3 : 2 oe accept as fraction e.g. $\frac{2}{3}$ oe or $\frac{3}{2}$ oe

Question			Answer	Mark	Part marks and guidance	
17			$2\frac{1}{9}$ final answer with correct working	5	**M2** for $0.\dot{4}$ or 0.44[4…] oe or **M1** for $1.\dot{6}$ - $1.\dot{2}$ oe seen **M2** for $2.\dot{1}$ oe or **M1** for $1.\dot{6}+ 0.\dot{4}$ oe If 0 or 1 scored, instead award **SC2** for answer $2\frac{1}{9}$ <u>Alt method</u> **M2** for $\frac{11}{9}$ oe fraction or **M1** for $1.\dot{2}$ and $12.\dot{2}$ oe seen **M2** for $\frac{15}{9}+\left(\frac{15}{9}-\textit{their}\frac{11}{9}\right)$ oe or **M1** for $\left(\frac{15}{9}-\textit{their}\frac{11}{9}\right)$ oe If 0 or 1 scored, instead award **SC2** for answer $2\frac{1}{9}$	Correct working requires evidence of at least M2 M1 or other alternate correct approach leading to $2\frac{1}{9}$, correct working may be shown on a diagram For M1 accept 1.66[6…] – 1.22[2…] or better For M2, accept any clear indication that the decimal figure 1 recurs e.g. 2.1r, 2.111… For M1 accept 1.66[6…] + 0.44[4…] or better Accept oe e.g. $1.\dot{2}+ 2(0.\dot{4}$**)** Allow oe for any pair allowing 'recurrence' to be removed, accept e.g. 1.22… and 12.22… For M2 and M1 must be using a common denominator for FT and could work with mixed numbers . The method must be shown for FT e.g. M2 for *their* $\frac{11}{9}+ 2\left(\frac{15}{9}-\textit{their}\frac{11}{9}\right)$ oe The method must be shown for FT

Question			Answer	Mark	Part marks and guidance	
18			$R = \sqrt[3]{2}\,x$ or $R = \sqrt[3]{2x^3}$ final answer	**4**	**M3** for $12[\pi]x^3 = 6[\pi]R^3$ or better Or **M2** for $\frac{4}{3}[\pi]x^3 = \frac{1}{3}[\pi] \times R^2 \times 2R$ oe or **M1** for $\frac{1}{3}\pi \times R^2 \times 2R$	Condone *r* for *R* throughout Answer $\sqrt[3]{2}\,x$ or $\sqrt[3]{2x^3}$ allow M3 For method marks condone 3.14, 3.142 or $\frac{22}{7}$ for π For method marks ignore any units For M3 removes fractions and simplifies terms in *R* M3 accept e.g. $2x^3 = R^3$ Must see correct expression in *R* for M1
19	**(a)**		Rotation about the origin and 50˚ clockwise oe	**2**	**B1** for each	Accept 0, 0 or O for origin More than one transformation scores zero marks Extra properties treat as choice Accept 310˚ anticlockwise
19	**(b)**		(1, 4) and (5, 4)	**1**		Condone omission of bracket[s] if otherwise correct If additional coordinates listed then scores zero

Question			Answer	Mark	Part marks and guidance	
20			$12\sqrt{3} + 16\pi$ final answer with correct working	7	**M1** for angle of major sector = 240° or $\frac{240}{360}$ oe soi **M1** for $\frac{their\ 240}{360} \times 2 \times \pi \times 12$ **A1** for 16π AND **M2** for [2 ×] 12 cos30° oe or **M1** for $\frac{x}{12} = \cos 30$ oe **B1** for cos 30 = $\frac{\sqrt{3}}{2}$ soi **A1** for $12\sqrt{3}$ If 0, 1 or 2, scored instead award **SC3** for answer $12\sqrt{3} + 16\pi$ If 0 or 1 scored, instead award **SC2** for $12\sqrt{3}$ or 16π in answer	Correct working requires evidence of at least M1M1M2 For M1 accept e.g. $\frac{2}{3}$ soi 240 may be on diagram For M1 120 ≤ *their* 240 ≤ 300 but not 180 $24\pi \div 3 \times 2$ oe eg done in stages implies M1M1 M2 oe accept e.g. $[AB^2 =] 12^2 + 12^2 - 2.12.12.\cos 120$ or $\frac{12\sin 120}{\sin 30}$, [2×] $\sqrt{12^2 - (12\sin 30)^2}$ oe where *x* is ½ AB M1 for any correct implicit method for finding AB or ½ AB In this method and other methods used, B1 is awarded for the correct trig value[s] <u>associated</u> with their method for find [½]AB, even if their method is incorrect, not just seen in a table of trig values unless selected Award maximum of 6 marks if answer incorrect SEE AG

Question			Answer	Mark	Part marks and guidance	
21			$\left(-\frac{5}{3}, \frac{25}{3}\right)$ oe and (1, 3) with correct working	6		Accept (–1.67 or –1.666 to –1.667 , 8.33[3]…) Correct working requires evidence of at least M2M2
					M2 for $3x^2 + 2x – 5$ [= 0] or **M1** for $3x^2 = 5 – 2x$	For M2 accept e.g. $5 – 2x – 3x^2$ [= 0]
					M2 for $(3x + 5)(x – 1)$ [= 0] or **M1** for $(3x + a)(x + b)$ where $ab = –5$ or $3b + a = 2$ or for correct partial factors $3x(x – 1) + 5(x – 1)$ or $x(3x + 5) – [1](3x + 5)$	Strict FT *their* 3-term quadratic equation or expression e.g.If M2 awarded for $5 – 2x – 3x^2$ [= 0] then factors should be correct for this equation for M2 or M1 Accept correct use of quad formula or completing the square, M2 if completely correct, M1 if one error in substitution in formula or $(x + a)^2$ correct if completing the square
					A1dep on M2M2 for either pair of coordinates correct or for both x values correct or both y values correct If 0, 1 or 2 scored, instead award **SC3** for answers $\left(-\frac{5}{3}, \frac{25}{3}\right)$ oe and (1, 3) If 0 or 1 scored, instead award **SC2** for answer $\left(-\frac{5}{3}, \frac{25}{3}\right)$ oe or for both x values correct or both y values correct If 0 scored, **SC1** for one answer (1, 3)	If A1 for correct x–values or y – values after correct partial factorisation award M2 for factors See AG for work with equations in terms of y

Question			Answer	Mark	Part marks and guidance	
22	(a)		Correct sketch with y – intercept 1 indicated  	2	**B1** for increasing exponential curve with no ruled sections or for any sketch with a single y – intercept at 1	For 2 marks, condone curve touching but not crossing x- axis For 2 marks or B1 mark intention For 2 marks no ruled sections See AG
22	(b)		Correct sketch of $y = \cos x$ with 90 and 270 indicated and starting at 1 on y-axis  	2	**B1** for cos shape graph with period 360 starting at (0, k), $k > 0$ and amplitude k Or for cos shape graph starting at (0, 1) with amplitude 1 and with a period a factor of 360 Or for cos shape graph with period 360 with 90 and 270 indicated where graph crosses x - axis	For 2 marks mark intention e.g. $y = 2\cos x$ For B1 allow poor curvature, mark intention e.g. $y = \cos 2x$, May be errors with amplitude See AG
23	(a)		$\frac{9}{16}$ oe	2	**B1** for answer $\frac{k}{16}$ or $\frac{9}{k}$ and must be a proper fraction	Do not accept ratio or words isw conversion/cancelling
23	(b)		$\frac{10}{50}\times\frac{7}{49}+\frac{7}{50}\times\frac{10}{49}$ oe leading to $\frac{2}{35}$ with no errors in processing seen	3	**M2** for $[2]\left(\frac{10}{50}\times\frac{7}{49}\right)$oe or **M1** for $\frac{10}{50}$ oe and $\frac{7}{49}$ oe **or** $\frac{7}{50}$ oe and $\frac{10}{49}$ oe seen	Award 3 marks for e.g. $\frac{10}{50}\times\frac{7}{49}=\frac{1}{35}$ and $\frac{1}{35}\times 2 = \frac{2}{35}$ 0.2 and 0.142 to 0.143 **or** 0.35 and 0.204…