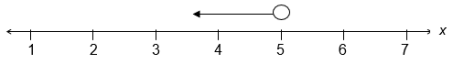
Question			Answer	Marks	Part marks and guidance	
1	(a)		Points plotted at (210, 130) and (100, 80)	2	**B1** for 100 soi or for one point plotted correctly	Half square tolerance May be implied by point plotted at duration 100
	(b)		Point at (220, 64) circled	1		
	(c)	(i)	Ruled line of best fit drawn	1		Use overlay anchored on top right point Line must reach to edges of overlay
		(ii)	*Their* line used to give duration for £90 ± 5 minutes	1 FT	Strict **FT** from their intended straight line of best fit	NB read (*n*, 90) not (90, *n*)
	(d)		[7 hours is] is beyond the given data oe	1		Accept eg the trend may not continue

Question			Answer	Marks	Part marks and guidance	
2			$x < 5$	4	**B2** for $x < 5$ or **M1** for $3x < 19 - 4$ or better	Solution to inequality: Allow **M1** for this expression with other inequality symbols or equals sign or [x =] 5 as solution (can be implied by mark/circle on the diagram) or trials leading to selection of 5 or final correct trial using 5
			AND  		AND **B2FT** for $x < 5$, or *their* inequality, correctly shown or **B1FT** for x < 5, or *their* inequality, shown with a hollow circle and wrong arrow or filled circle and correct arrow	Displaying the solution: Display must show an inequality that fits on the number line for FT Mark to candidate's advantage either $x < 5$ or *their* inequality Accept an arrow of any length or a line reaching 1 If no solution to inequality seen: Hollow circle at 5 arrow to left **M1B2** Filled circle at 5 arrow to left **M1B1** Hollow circle at 5 arrow to right **M1B1** Filled circle at 5 arrow to right **M1B0** Mark at 5 no line or arrow **M1B0** Circle and/or arrow at other than 5 **M0B0**

Question			Answer	Marks	Part marks and guidance	
3	(a)		55.5[0] to 57.[0] nfww	3	**M1** for 1 kwH costs £0.125 oe soi	eg 225 kwH costs £28.125 ± £0.5[0] 200 kwH costs £25 ± £0.5[0] 150 kwH costs £18.75 ± £0.5[0] 100 kwH costs £12.5 ± £0.5[0] 50 kwH costs £6.25 ± £0.5[0]
					M1 for their 0.125 × 450 or cost × $\frac{450}{their \text{ equivalent electricity use}}$	eg $25 \times \frac{450}{200}$
					OR	
					M1 for finding costs of electricity that sum to 450 kwH **M1** for addition of these costs	eg award **M2** for 4 × (£12.5 ± £0.5[0]) + (£6.25 ± £0.5[0]) For the first **M1** mark, costs must be from graph within ±½ small square ie ±£0.5[0]

Question			Answer	Marks	Part marks and guidance	
	(b)		**Method 1:** By performing a calculation for A and comparing with B:		**Method 2:** By performing a calculation for B and comparing with A:	
			12.5 or 0.125 or "cost ÷ usage" using a reading from the graph or *their* (a) ÷ 450	**1**	14.3 × *their* chosen usage soi or [0].143 × *their* chosen usage soi May be implied by line on graph	Mark method not accuracy for first two marks e.g. 6.75 ÷ 50 = 0.135 but not 0.135 with no working
			14.3 or 0.143 stated or comparison against it clearly implied in a statement	**1dep**	Cost in p or £ from graph for *their* chosen usage stated	Dep on first mark scored. Costs for A and B may be in different units. e.g. 1kwH costs 12.5p which is less than Company B's charge
			"B" with 12.5 and 14.3 or "B" with 0.125 and 0.143 or "B" with 12.5 or 0.125 and a comparison against 14.3 or 0.143 clearly implied	**1**	"B" with both costs correct and in same units	No follow through e.g. B because 1kwH costs 12.5p which is less than Company B's charge
4	**(a)**		e.g. $\sqrt{\left(\frac{4\times400}{0.5\times200}\right)^3} = \sqrt{16^3} = 64$	**3**	**B2** for 4, 400, 0.5 and 200 or **B1** for at least two of 4, 400, 0.5 and 200	For full marks, at least one of these intermediate steps leading to 64 must be seen $\sqrt{16^3}$ or 4^3 or $\sqrt{4096}$

Question			Answer	Marks	Part marks and guidance	
	(b)		38.7 to 38.9	**4**	**B2** for 46.1 to 46.11 or 17.89 to 17.9 or **B1** for 12.8 to 12.9 or 3.57 to 3.6[0] or 2125 to 2126 and **M1** for (64 – *their* 46.1 to 46.11) ÷ *their* 46.1 to 46.11 [× 100] oe	Accept 39 with correct working
5	**(a)**		30 final answer	**2**	**B1** for 150 or 30 seen or **M1** for 360 ÷ 12 oe	e.g. $180-\frac{180\times10}{12}$
	(b)		150 or **FT**(180 – **(a)**)	**1**		Only allow **FT** if 0 < *their* **(a)** < 180

Question			Answer	Marks	Part marks and guidance	
6			385 with correct working	6		"Correct working" requires evidence of at least **M2** AND **B1** i.e. correct and consistent units used
					M2 for [mass of one panel =] 2.4 × 1.2 × 0.018 × 750 or 240 × 120 × 1.8 × 0.750 or **M1** for figs 24 × figs 12 × figs 18 × figs 750 or 2.4 × 1.2 × 0.018 or 240 × 120 × 1.8 AND **B1** for 15 000 [kg] or 15 000 000 g seen or *their* mass correctly converted to tonnes **M1** for $\frac{figs\ 15}{their\ mass}$ **A1** for 385.[…] to 387 If **0** or **B1** scored, instead award **SC2** for answer 385 with no working or insufficient working If **0** scored **SC1** for answer 385.[…] to 387 with no working	soi by 38.8 to 38.9 [kg] soi by 38 800 to 38 900 [g] soi by 0.0518 to 0.0519 [m^3] soi by 51 800 to 51 900 [cm^3] Assume *their* mass unit from **M2**, but do not assume from **M1** only Accept any figure **but not** 2.4, 1.2, 1.8 and 750 for *their* mass For **M1** accept one or more trial(s) of *their* mass × an integer in attempt to = *their* figs 15

Question			Answer	Marks	Part marks and guidance	
7	(a)		$\begin{pmatrix}4\\-2\end{pmatrix}$	2	**B1** for 1 component correct If **0** scored, then **SC1** for $\begin{pmatrix}-4\\2\end{pmatrix}$ or $\begin{pmatrix}\frac{4}{}\\-2\end{pmatrix}$ or (4, -2)	Penalise first appearance of vinculum or poor form in vector but condone second use
	(b)		$\begin{pmatrix}1\\\frac{9}{4}\end{pmatrix}$ oe	2	**B1** for 1 component correct or $\begin{pmatrix}4\\9\end{pmatrix}$ seen	

Question			Answer	Marks	Part marks and guidance	
8			31 nfww	4	**M2** for 20 : 10 or $\frac{20}{30}$ and 21 : 9 or $\frac{21}{30}$ and **SC1** for final answer 30 dep on **M2** OR **M1** for at least one other fraction equivalent to $\frac{2}{3}$ seen, or one other fraction equivalent to $\frac{7}{10}$ seen <u>Alternative method using algebra</u> **M1** for $\frac{r-1}{t-1} = \frac{2}{3}$ oe or $\frac{r}{t-1} = \frac{7}{10}$ oe **M1** for $3(r-1) = 2(t-1)$ and $10r = 7(t-1)$ or better **M1** for elimination or substitution of r If **0** scored **SC1** for answer 30 with no working	<u>Notes on alternative method</u> Where number of red = *r.* Does not need to be defined. Accept any other letter. Implies first **M1** mark A correct equation in *b* may imply first **M1M1** marks

Question			Answer	Marks	Part marks and guidance	
9			$z = 1.2x$ or $z = \frac{6x}{5}$	4		Condone ∝ for = in **B1** marks and **SC1** but not at **B3** or full marks
					B3 for a correct equation involving just x and z but not in required form	e.g. $5z = 6x$, or $x = \frac{5z}{6}$
					OR	
					B1 for $y = 6x$ oe **B1** for $y = 5z$ oe **M1** for a correct equation involving just x and z using *their* two equations	*Their* two equations of the form $y = ax$ oe and $y = bz$ oe
					OR	
					B1 for $y = 60$ when $z = 12$ **B1** for x : [y :] z is 10 : [60 :]12 **M1** for a correct equation involving just x and z using *their* triple ratio or *their* two ratios with a common y value	Allow **B2** for other triple ratios of the form $5k : 30k : 6k$ or two correct ratios with a common y value
					If **0** scored **SC1** for $y = kx$ and $k = 6$ found oe or for $y = kz$ and $k = 5$ found oe	

Question			Answer	Marks	Part marks and guidance	
10			22	**3**	**M2** for 1.403 ÷ 1.15 oe soi by 1.22 or **B1** for 1.15 soi <u>Alternative method :</u> If starting from (1 + *k*/100) × 1.15 = 1.403 **M2** for reaching 1.15*k*/100 = 0.253 or **B1** for the 1.15	Condone answer 22%
11	**(a)**	**(i)**	7	**4**	**M2** for 3*x* + 15 = 2(*x* + 11) oe or **M1** for 3*x* + 15 or 2(*x* + 11) oe **M1** for a productive step towards solving *their* linear equation <u>Alternative method by trials:</u> **M2** for at least two complete trials using the same inputs for both functions or **M1** for one complete trial using the same input for both functions **A1** for at least one correct evaluation for A and one for B	Starting equation must have x on both sides e.g. from 3*x* + 15 = 2(*x* + 11): **M1** for 2x + 22 or x + 15 = 22 or 3x = 2x + 7 or 1.5x + 7.5 = x + 11 e.g. from 3x + 15 = 2x + 11: **M1** for x + 15 = 11 or 3x = 2x – 4

Question			Answer	Marks	Part marks and guidance	
		(ii)	Because $3x + 15$ and $2(x + 11)$ are <u>not equivalent</u> oe OR $3x + 15 = 2(x + 11)$ only has one solution oe	**1**		If not using the words 'not equivalent', must clearly imply that the two expressions will not be equal for *all* values of x The mark is unlikely to be awarded unless algebra is used
	(b)		$p = 5, \quad q = 3$	**3**	**B1** for $p = 5$ or $q = 3$ **M1** for $q(x + p)$ oe or $[3x + 15 =] \ 3(x + p)$ or $[3x + 15 =] \ q(x + 5)$ If no working **SC1** for $p = 3$ and $q = 5$ as answers	May be seen with a particular value of x, eg. $q(2 + p)$
12			$\frac{4}{28}$ oe or 0.1428 to 0.143	**3**	**M1** for 4 correct combinations soi by highlighting in list or table or by unsimplified numerator 4 **M1** for 4×7 soi by complete list or table or by 28 <u>Alternative method</u> **M2** for $\left(\frac{1}{4} \times \frac{1}{7}\right) + \left(\frac{1}{4} \times \frac{2}{7}\right) + \left(\frac{1}{4} \times \frac{1}{7}\right)$ oe or **M1** for $\frac{1}{4} \times \frac{1}{7}$ or $\frac{1}{4} \times \frac{2}{7}$ oe seen	Economics Engineering Geography German Geography Graphics Media Music

13			50	**4**	**B1** for 2.5 oe soi **M2** for $8 \times (5 \div 2)^2$ oe or **M1** for $(5 \div 2)^2$ soi by 6.25 oe <u>Alternative method:</u> **B1** for [AB : AC =] 2 : 5 oe soi **M2** for $(8 \div 2^2) \times 5^2$ oe or **M1** for [area ratio] $2^2 : 5^2$ oe soi <u>Alternative method:</u> **B1** for 2.5 oe soi **M1** for numerical $\frac{b \times h}{2} = 8$ where $b \times h = 16$ **M1** for $\frac{2.5\ their\ b \times 2.5\ their\ h}{2}$ <u>If evidence of using 2 : 3 seen:</u> **B0** for [AB : AC =] 2 : 3 or 1.5 oe soi **M2** for $(8 \div 2^2) \times 3^2$ oe or **M1** for [area ratio] $2^2 : 3^2$ or 1.5^2 oe soi <u>If no working:</u> **SC1** for final answer 18	Final answer 20 implies **B1** (from use of linear scale factor) 6.25 scores **B1M1** $2^2 : 5^2$ scores May be seen in stages

Question			Answer	Marks	Part marks and guidance	
14			2.99 [cm] with correct working	5	**M3** for $\frac{5}{3}\pi r^3 + \pi r^3 = 225$ soi by $\frac{8}{3}\pi r^3 = 225$ **A1** for $\sqrt[3]{\frac{675}{8\pi}}$ or $\sqrt[3]{26.8}$ to $\sqrt[3]{26.9}$ or **M2** for $\frac{1}{3}\pi r^2 \times 5r + \pi r^2 \times r$ oe soi by $\frac{8}{3}\pi r^3$ or **M1** for $\frac{1}{3}\pi r^2 \times 5r$ oe or $\pi r^2 \times r$ oe If **0** or **M1** scored, instead award **SC2** for answer 2.99 or greater rot accuracy of 2.9947090608… with no working or insufficient working If **0** scored **SC1** for $\sqrt[3]{\frac{675}{8\pi}}$ or $\sqrt[3]{26.8}$ to $\sqrt[3]{26.9}$ with no working	"Correct working" requires evidence of at least M2 Accept 2.99 or greater rot accuracy of 2.9947090608 with correct working Accept 3[.0] as final answer only after **M3A1** <u>Trials:</u> Full marks for trials leading to an answer 2.99 or greater rot accuracy of 2.9947090608… Trials leading to any other final answer, including 3[.0], only score the **M** marks if seen

Question			Answer	Marks	Part marks and guidance	
15			$\frac{9}{16}$ or [0].5625 oe	**4**	**B1** for 0.75 oe seen **M2** for 0.25 × 0.3 + *their* 0.75 × 0.65 or **M1** for 0.25 × 0.3 soi by 0.075 or $\frac{3}{40}$ oe or for *their* 0.75 × 0.65 soi by 0.4875 or $\frac{39}{80}$ oe	Accept [0].56 or [0].563 as final answer for full marks if **B1M2** earned Award **B** and **M** marks for equivalent working with a base value e.g. 100 buses
16	**(a)**		[angle in a] semi-circle oe	**1**		Accept other reasoning if fully justified
	(b)		13.5 to 13.6	**4**	**B1** for angle BAC = 58˚ or angle ABC = 32˚ **M2** for 16sin(*their* 58) or 16cos(*their* 32) or **M1** for $\sin(their\ 58) = \frac{BC}{their\ 16}$ or $\cos(their\ 32) = \frac{BC}{their\ 16}$ or better If **0** or **B1** scored then instead award **SC2** for 6.7 to 6.8 as final answer <u>Grads or rads:</u> If **0, 1** or **2** scored then instead award **SC3** for 15.8[8…] to 15.9 or 12.6[4…] as final answer **or** If **0** scored award **SC1** for 7.9[4…] or 6.3[2…]	May be seen on diagram or implied by use of sin58 or cos32 Only award **M** marks if *their* angle and trig ratio are consistent ie do not accept 16sin32 unless angle BAC previously seen as 32.

Question			Answer	Marks	Part marks and guidance	
17	(a)		75	1		
	(b)		3 [×]$\left(\sqrt{5}\right)^{n-1}$ oe	3	**M2** for expression of correct form with two correct elements or **M1** for expression of correct form with one correct element	eg 3 [×]$\left(\sqrt{5}\right)^{n}$ eg 5 [×]$\left(\sqrt{5}\right)^{n}$
18			$\frac{412}{990} = \frac{206}{495}$ with correct working or $\frac{41.2}{99} = \frac{206}{495}$ with correct working	3	**M2** for 1000x [–] 10x = 416.16[1...] [–] 4.16[1...] leading to 990x = 412 or for 100x [–] x = 41.616[1…] [–] 0. 416[1...] leading to 99x = 41.2 or **M1** for 10x = 4.16[1…] or 100x = 41.616[1…] or 1000x = 416.16[1…] seen	"Correct working" requires **M2** Subtractions can be implied
19	(a)		[x =] ⁻3, 1.5	2	**B1** for 1 correct	
	(b)	(i)	[a =] 2 [b =] ⁻5	2	**B1** for each or for 2x – 5 seen	

Question			Answer	Marks	Part marks and guidance	
		(ii)	$y = 2x - 5$ or FT $y =$ *their* $ax +$ *their* b ruled on grid	M2	**M2** and **M1** apply to $y = 2x - 5$ or **FT** $y =$ *their* $ax +$ *their* b **M1** for 'correct' y-intercept or for 'correct' gradient or for freehand or broken 'correct' line or for at least 3 'correct' plots and no 'incorrect' plots	For **M2** line must cross curve For **M2** and **M1**, accuracy 1 small square at y-intercept (extended if necessary provided it fits on the grid) and gradient ±1 small square vertically for a run of 1 unit horizontally **Do not FT** if $a = 0$ or $b = 0$
			1.1 to 1.3 and -1.8 to -1.6	A1		Only award if **M2** scored
20			-9	**4**	**M2** for $\binom{7}{2k+11}$ or **M1** for $\binom{7}{}$ or $\binom{}{2k+11}$ or $\binom{4}{2k}$ **M1** for (*their* $2k + 11$) = – (*their* 7)	*their* 7 must follow from their working for **M2** and must not be -1

Question			Answer	Marks	Part marks and guidance	
21			$\frac{2x-1}{x+2}$ as final answer	6	**M1** for $x^2 - 4 = (x + 2)(x - 2)$ soi in the denominator AND **M3** for all 3 fractions combined with quadratic common denominator and expanded numerator or **M2** for correct products on numerator of at least 2 equivalent fractions that are consistent with their common denominators or **M1** for correct product on numerator of 1 fraction that is consistent with an attempted common denominator AND **M1dep** for $\frac{(2x-1)(x-2)}{(x+2)(x-2)}$ or $\frac{(2x-1)(x-2)}{x^2-4}$ (**dep** on previous **M3** earned)	e.g. $\frac{6x}{(x+2)(x-2)}$ seen, or a common denominator of $(x + 2)(x - 2)$ later expanded to $x^2 - 4$ e.g. $\frac{x^2-2x+x^2+x+2x+2-6x}{(x+2)(x-2)}$ soi by $\frac{2x^2-5x+2}{(x+2)(x-2)}$ e.g. $\frac{x(x-2)}{(x+2)(x-2)}$ oe and $\frac{(x+1)(x+2)}{(x+2)(x-2)}$ oe e.g. $\frac{x(x-2)}{(x+2)(x-2)}$ oe Factorises numerator of combined fraction Can earn up to **M1 + M2 + M0** for common denominator used that is not in its lowest terms. eg. **M0 + M2** for $\frac{x(x-2)(x^2-4)}{(x+2)(x-2)(x^2-4)}$ and $\frac{(x+1)(x+2)(x^2-4)}{(x+2)(x-2)(x^2-4)}$ eg. **M1 + M1** for $\frac{x(x-2)(x+2)(x-2)}{(x+2)(x-2)(x+2)(x-2)}$