

Question			Answer	Marks	Part marks and guidance	
1			8, 8, 13 and 15	3	B2 for 3 or 4 numbers with at least two conditions met out of: - At least two numbers are 8 - The range is 7 - The total is 44 or B1 for 4 numbers with one condition met or 44 seen	Accept any order Examples: B2 for 8, 8, 10.5, 17.5 B2 for 8, 8, 8, 20 B2 for 8, 8, 28 B2 for 1, 8, 8 B1 for 8, 8, 8, 8 B0 for 8, 8
2			18 nfww	4	B1 for [green] 36 or ratio(s) equivalent to 5 : 9 : 36 AND M2 for $\frac{\text{their } 9}{\text{their } (5 + 9 + 36)} [\times 100]$ or M1 for <i>their</i> (5 + 9 + 36) soi	For B1 accept 5 : 36 or 9: 36 or ratio(s) involving a common term for blue eg 10 : 18 and 18 : 72 eg 1 : 1.8 : 7.2 eg $\frac{5}{9} : 1$ [: 4] (decimals should be accurate rot to 3 figs) <i>Their</i> (5 + 9 + 36) must come from a ratio (or ratios) with a common term. 1 + 4 + 5 + 9 = 19 followed by $\frac{5}{19}$ scores 0.

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3			$\frac{300 \times (7-3)}{60} = 20$ AND it is close to 19.5 oe or 19.5 rounds to 20 oe or [Asha's estimate] is reasonable	3	B2 for 300, 7, 3 and 60 seen or B1 for two of 300, 7, 3 and 60 seen or 300, 4 and 60 seen or 300.0, 7.0, 3.0. 60.0 AND B1dep for result 20 and correct conclusion following B1 or B2	Actual answer 19.475959...(may be rounded) scores 0 Accept "Yes" or "She's right" or "It is" or equivalent comment
4	(a)		$a^5 \times a^6 = a^{5+6} = a^{11}$ or $a^5 \times a^3 \times a^3 = a^{5+3+3} = a^{11}$	2	B1 for $[(a^3)^2 =] a^6$ or $a^3 \times a^3$ <u>Alternative:</u> B2 for $[a^5 \times (a^3)^2 =]$ $a \times a \times \dots \times a [= a^{11}]$ or B1 for $[(a^3)^2 =] a \times a \times a \times a \times a \times a$	a^{5+6} or a^{5+3+3} or intent to add indices stated or unambiguously indicated (eg 5 + 6, add indices etc) written in full with eleven a's. written in full with six a's May be implied by $(a \times a \times a \times a \times a \times a)$ seen within an incorrect lengthier product.
	(b)		5^{15}	3	B1 for $\left[\frac{1}{125} =\right] 5^{-3}$ or $[125 =] 5^3$ B1 for 5^{18}	

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5	(a)		$y = 0.75x + 2$ oe	3	B2 for $y = 0.75x [+ c]$ or answer $0.75x + 2$ OR M1 for attempt at $\frac{\text{change in } y}{\text{change in } x}$ soi by $\frac{\pm(5-2)}{\pm(4-0)}$ or ± 0.75 and B1 for $y = kx + 2$ with $k \neq 0$	ISW after a correct equation if attempting rearrangement Accept oe throughout eg B2 for $4y = 3x$ Examples: M1B1 for $y = -0.75x + 2$ M1B0 for $0.75, 0.75x, -0.75, -0.75x$ If gradient inverted: M0B1 for $y = 1.3x + 2$ M0B0 for $1.3x + 2, y = 1.3x$ Condone poorly written $\frac{3}{4}x$ unless clearly 3 over 4x.
	(b)		3 nfww	3	M2 for $12 = 16 - 4k + 8$ or better OR M1 for $12 = -4^2 + -4 \times k + 8$ or sign errors in $12 = 16 - 4k + 8$ or better or $k = \frac{y - x^2 - 8}{x}$	Condone -4 not in brackets but $12 = -4^2 + k - 4 + 8$ with no times sign or dot between k and -4 scores 0 unless subsequently clarified.

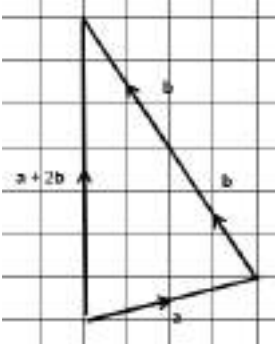
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(c)	<u>Using symmetry:</u> Q is (0, 8)	1	dep mark is always dependent on 3 marks being achieved	For first mark in all methods, condone [Q =] 8 or [QA =] 8-2 or 6, seen in working or on diagram.
	Midpoint, M, of AQ is at (0, 5)	1	Accept implied symmetry	eg $8 - 5 = 3$ and $5 - 2 = 3$ so B is in the middle of A and Q May see “midpoint” or any other letter for M
	MB is perpendicular to QA	1		
	So isosceles/Diann is correct	1dep		
	OR	OR	<u>Using gradients, vectors or descriptions of translations</u> 1 for Q is (0, 8) 1 for gradients/vectors/descriptions of translations for both AB and QB (must be seen together in part (c): eg gradients: AB = $\frac{3}{4}$ and QB = $-\frac{3}{4}$ (may be implied from the equations of the two lines) descriptions: AB is 4 along (treat as in positive sense) and 3 up and QB is 4 along and 3 down oe To score more than 2 marks, the approach needs to be developed to justify isosceles, such as by switching to the 3rd and 4th marks of the Pythagoras or trig methods.	Condone poor notation, such as missing vector brackets or fraction lines in vectors if intention is clear. eg gradient AB = $\frac{3}{4}$ and gradient QB = $-\frac{3}{4}$ scores a max of 1 1 0 0 eg gradient AB = $\frac{3}{4}$ and gradient QB = $-\frac{3}{4}$, so triangle is isosceles also scores a max of 1 1 0 0 Warnings: dimensions of triangle shown as (8 – 2), 4, 4 and isosceles stated is B1 only; blank answer space but BQ drawn on diagram is 0 not NR .
	<u>Using Pythagoras:</u> Q is (0, 8)	1		
	AB ² = 4 ² + 3 ² oe or AB = 5 nfw	1		
	or QB ² = 4 ² + (their 8 – 5) ² or QB = 5 nfw	1		
	AB = 5 and QB = 5 or AB ² = 25 and QB ² = 25	1		
	AB = QB or “two sides are equal” oe so isosceles/Diann is correct	1dep		
	OR	OR		
	<u>Using trig:</u> Q is (0, 8)	1		
	tan BAQ = $\frac{4}{3}$ [=53.1]	1		
	tan BQA = $\frac{4}{3}$ [= 53.1]	1		
	BAQ = BQA or “two angles are equal” oe so isosceles/Diann is correct	1dep		

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6			0.1 oe nfww	3	M2 for $80 \times 0.04 = y \times 32$ or $3.2 = 32y$ or $y = \frac{3.2}{32}$ oe OR M1 for 80×0.04 soi by 3.2 or $\frac{16}{5}$ or $y = \frac{k}{x}$ soi	
7			$r = 5$ $t = 2$	4	M2 for $u = 14$, may be seen in table A1 for $r = 5$ or $t = 2$ OR M1 for $\pm(u - 3) = 11$ oe soi by $u = -8$ or $\pm(u - 8) = 6$ oe soi by $u = 2$ A1FT for $r = 17$ and $t = 20$ following $u = -8$ or $r = 7$ and $t = 10$ following $u = 2$	If no credit-worthy working B2 for $r = 5$ B2 for $t = 2$ FT only from a partially correct value for u (ie. -8 or 2)

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8	(a)		0.3 oe	2	M1 for $\frac{[\pm]6}{85-65}$ oe or answer -0.3 If 0 scored, allow SC1 for 0.092[3...] or $\frac{6}{65}$ as final answer	Allow unsimplified equivalents for full marks eg. $\frac{6}{20}$
	(b)		255	3	M2 for valid method to find complete area under the graph using one or more parts OR M1 for attempt to find partial area below the graph	M2 examples: eg $\frac{85 \times 6}{2}$ oe or two triangles soi by 195 and 60 or [rectangle] 6×85 – two triangles oe M1 examples a triangle between $t = 0$ and 65 or a triangle between $t = 65$ and 85 or [rectangle] 6×85 – one triangle M0 for [rectangle] 6×85 Allow full marks for equivalent with units stated eg. 0.255 km

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	(c)		21.6 or $\frac{108.}{5}$ or $21\frac{3}{5}$ nfwv	4	B1 for 6 soi AND M2 for $\frac{their 6 \times 60 \times 60}{1000}$ oe or M1 for $their 6 \times 60 \times 60$ oe soi 21 600 or $their 6 \div 1000$ oe soi 0.006 or $\frac{60 \times 60}{1000}$ oe soi 3.6	Condone missing or incorrect units in working eg 6 m for 6 m/s <i>their</i> 6 could be the average speed 255/85 21600 or 0.006 imply B1M1
9	(a)		-6	1		
	(b)		$[x = 4,] y = 24$ Change of sign, so p lies between 3 and 4 oe	2	B1 for 24 seen If using $3.27 < x < 4$ rather than 4: SC2 evaluate y correctly (see table in (c)), state change of sign oe and that because $3 < p < their\ x\text{-value}$, then so $3 < p < 4$. 0 for just evaluating y.	After $x = 4, y = 24$ scored: Examples just sufficient for second mark include: change of sign $-6 < 0 < 24$ $x = 3$ gives an answer < 0 and $x = 4$ gives an > 0 Examples insufficient for second mark: so p lies between 3 and 4

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	(c)	Examples: when $x = 3.5$, $y = 6.4$, so $3 < p < 3.5$ when $x = 3.1$, $y = -3.9$, so $3.1 < p < 4$ when $x = 3.1$, $y = -3.9$ and when $x = 3.5$, $y = 6.4$, so $3.1 < p < 3.5$	3	M2 for one further value of y evaluated correctly, possibly rot to 2 or more sf, for a value of x such that $3 < x < 4$ OR M1 for working shown to calculate one further value of y for a value of x such that $3 < x < 4$ Note after SC considered in (b): if SC2 was awarded then they must use a value of x that produces a smaller interval than $3 < x < 4$ applies If 0 scored, award SC1 or SC2 if evidence for M1 or M2 has not yet been credited in (b)	Solution is approx. 3.2670 Common values: <table><tr><th>x</th><th>y</th></tr><tr><td>3.1</td><td>-3.909</td></tr><tr><td>3.2</td><td>-1.632</td></tr><tr><td>3.25</td><td>-0.422</td></tr><tr><td>3.26</td><td>-0.174</td></tr><tr><td>3.27</td><td>0.0758</td></tr><tr><td>3.3</td><td>0.837</td></tr><tr><td>3.4</td><td>3.504</td></tr></table> A correct narrower range scores 0 unless accompanied by the relevant correct calculation(s). eg M2 only for when $x = 3.1$, $y = -3.9$ so $3.1 < p < 3.5$ (as 3.5 has not been correctly justified) Calculations in support of $x = 3$ or $x = 4$ need not be repeated from parts (a) or (b).	x	y	3.1	-3.909	3.2	-1.632	3.25	-0.422	3.26	-0.174	3.27	0.0758	3.3	0.837	3.4	3.504
x	y																				
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10	Correct triangle drawn with $\mathbf{a} + 2\mathbf{b}$ labelled and with correct arrows or $\mathbf{a}$ and $2\mathbf{b}$ labelled and with correct arrows AND length 7cm indicated on diagram  OR $\begin{pmatrix} 4 \\ 1 \end{pmatrix} + 2 \begin{pmatrix} -2 \\ 3 \end{pmatrix} = \begin{pmatrix} 0 \\ 7 \end{pmatrix} \text{ with brackets}$	3	M1 for vector $2\mathbf{b}$ drawn on grid M1 $\mathbf{a} + k\mathbf{b}$ drawn on grid The two vectors must be joined end to end but arrows may be contradictory. $k\mathbf{b}$ should be in the direction of $\mathbf{b}$ OR B1 for $\begin{pmatrix} 4 \\ 1 \end{pmatrix}$ B1 for $\begin{pmatrix} -2 \\ 3 \end{pmatrix}$ or $\begin{pmatrix} -4 \\ 6 \end{pmatrix}$	If both methods shown/started, mark the better one For M marks condone missing or incorrect arrows and labels on vectors Mark intent: end of vectors within 2mm of vertices of relevant square Examples (ignore arrows): M1M1 for $\mathbf{a} + 2\mathbf{b}$ drawn (3 marks if labelled and 7 cm indicated) M1M1 for $\mathbf{a} - 2\mathbf{b}$ M1M0 for $2\mathbf{b}$ or $-2\mathbf{b}$ M0M1 for $\mathbf{a} + \mathbf{b}$, $\mathbf{a} - 1.5\mathbf{b}$ etc For B1 marks, condone missing brackets and fraction lines

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11	angle $BCA = 44^\circ$ and angles [in a] triangle [= 180°] or angle $DCA = 56^\circ$ and angles [in a] triangle [= 180°] Best two statements from: (i) [side] AC is common (ii) [angle] $ACB =$ [angle] CAD (iii) [angle] $BAC =$ [angle] ACD (iv) angle $B =$ angle D or [angle] $ABC =$ [angle] CDA Conclusion and third statement [congruent because] ASA after stating (i), (ii), (iii) AAS after stating (i), (ii), (iv) or (i), (iii), (iv)	1 2 1	B1 for each to a max of 2 If 0 (or 1 for statements) scored then, to a maximum total of 2 marks, allow: SC1 for angle $BCA = 44^\circ$ and angle $DCA = 56^\circ$ stated or on diagram and SC1 for a correct statement lacking precision eg "both triangles have a common side", "both triangles have an angle of 80°", "all the angles are the same"	$C = 44$ (or 56) is not sufficient. Accept angles shown on diagram. 0 if alternate angles is given as the reason unless the parallelogram has been justified Notation needed for these marks. $44 = 44$ is not sufficient. $56 = 56$ is not sufficient "angle" required if using just B or D Final mark needs a third statement (ignore superfluous ones) and the appropriate congruence conclusion. Possible marks (without SC): 1 + 2 + 1, 1 + 2 + 0, 1 + 1 + 0, 0 + 2 + 1, 0 + 2 + 0, 0 + 1 + 0, 0 + 0 + 0.

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12			[QS =] $\sqrt{80}$, $4\sqrt{5}$ oe or 8.9[4..] Best two from: (i) shows a pair of corresponding angles are equal (ii) shows a second pair of corresponding angles are equal or states [angle] QRS = [angle] PQS (iii) shows two pairs of corresponding sides are in the same ratio (iv) shows the third pair of corresponding sides have the same ratio. Ratios of corresponding sides need to be seen in equivalent form. Conclusion: two (or three) equal angles oe after showing (i) and (ii) or three pairs of corresponding sides in the same ratio after showing (iii) and (iv) or two pairs of corresponding sides in the same ratio and an equal angle between them oe after showing relevant combination of (i)/(ii) and (iii)	2 2 1	M2 for [QS =] $\sqrt{4^2 + 8^2}$ oe or M1 for $4^2 + 8^2$ B1 for each to a max of 2 For these marks, answers to calculations are sufficient, but corresponding pairs must be either exact or the same when rot to 3sf. In (ii) accept QRS and PQS are both right angles oe (iii) and (iv) can be shown using scale factors eg QS = $1.118 \times RS$ and PS = $1.118 \times QS$ Note: there is no mark for just finding QP = $\sqrt{20}$ In all cases, it must be clear which angles and ratios are being used to support the conclusion made, usually by using labels or from values on a diagram. If it is not clear, withhold the final mark. Where more than two facts are shown, allow the final mark if the conclusion is fully supported.	Accept QS on diagram First M2 may be implied by $QP = 2\sqrt{5}$ oe or 4.47[...] Example values: angle RSQ = $\tan^{-1}\left(\frac{4}{8}\right) = \cos^{-1}\left(\frac{8}{\sqrt{80}}\right)$ $= \sin^{-1}\left(\frac{4}{\sqrt{80}}\right) = 26.5(\dots)$ or 26.6 angle QSP = $\tan^{-1}\left(\frac{\sqrt{20}}{\sqrt{80}}\right) = \cos^{-1}\left(\frac{\sqrt{80}}{10}\right)$ $= \sin^{-1}\left(\frac{\sqrt{20}}{10}\right) = 26.5(\dots)$ or 26.6 Accept as fractions or ratios. $\frac{PS}{QS} = \frac{10}{\sqrt{80}} = \frac{\sqrt{5}}{2} = 1.118[\dots]$ $PS : QS = 10 : \sqrt{80}$ oe $\frac{QS}{RS} = \frac{\sqrt{80}}{8}$ with any of the above $\frac{PS}{QS}$ is insufficient for (iii) and (iv) as it is not clear that the ratios are the same.
13	(a)		288π or 904.3 to 905	2	M1 for $\frac{4}{3} (\times) \pi (\times) 6^3$	Accept 904 if M1 scored

Question	Answer	Marks	Part marks and guidance	
(b)	20.0[9...] to 20.1[...] or $\frac{32}{5}\pi$ oe nfw	5	M1 for [hemisphere=] $0.5 \times \text{their (a)}$ soi or $0.5 \times \frac{4}{3} (\times) \pi (\times) 6^3$ or [pyramid=] $\frac{1}{3} \times 15 \times 15 [\times'h']$ soi M1 for [hemisphere=] $0.5 \times \text{their (a)}$ soi or $0.5 \times \frac{4}{3} (\times) \pi (\times) 6^3$ and [pyramid=] $\frac{1}{3} \times 15 \times 15 [\times'h']$ soi OR $0.3 \times \text{their pyramid} [\times'h']$ or $\frac{\text{their hemisphere}}{0.3}$ oe M1 for hemisphere soi and $0.3 \times \text{their pyramid} [\times'h']$ OR $\frac{\text{their hemisphere}}{0.3}$ oe and pyramid $[\times'h']$ soi M1 for $\frac{\text{their hemisphere}}{0.3} \div \text{their pyramid}$ oe If 0 scored, allow SC3 for $\frac{64}{5}\pi$ or 40.[1..] to 40.2[...] as final answer	

Accept answer 20 after full working.
No requirement at any stage for a formal equation.
Values below provided as a guide to method being used, but mark method not accuracy:
ie hemisphere (144π or 452(..))
or
pyramid (75[h])
ie hemisphere (144π or 452(..))
and pyramid (75[h])

OR
30% of pyramid (22.5[h])
or
“reverse %” using hemisphere
(480π or 1507(..))
ie hemisphere (144π or 452(..))
and 30% of pyramid (22.5[h])

OR
“reverse %” using hemisphere
(480π or 1507(..)) and pyramid (75[h]).
To receive **M1M1M1** they should have both parts of the “ands” correct

If correct, at this stage, it should be
(480π or 1507(..)) $\div 75$ oe

1507(..) $\div 225$ is likely to score **M1M1M0M1**

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14	(a)		$21.45 \times 4663 \div 100\,000 = 1.000\,2[1..]$ (km) or $21.45 \times 4663 =$ $100\,020$ to $100\,021.4 > 100\,000$ (cm) or. $100\,000 \div 21.45 = 4662[0..] < 4663$ or $100\,000 \div 4663 = 21.44[5..] < 21.45$ Note the first method does not require a comparison against 1 (km)	4	B1 for (minimum length =) 21.45 seen B1 for 1 km = 100 000 cm so ie such as $\div 100$ then $\div 1000$ or use of 1m = 100cm and 1km = 1000m if working in metres. M1 for <i>their</i> $21.45 \times 4663 (\div 100\,000)$ or $100\,000 \div \text{their } 21.45$ or $100\,000 \div 4663$ If M0 scored, allow SC1 for $k \times 4663 (\div 100\,000)$ or $100\,000 \div k$ with k in the range 10.25 to 10.35 or 6.45 to 6.55	Allow access to all marks if brick and 1 km are in consistent units. Allow these conversions even with <i>their</i> volume or surface area. eg $21.5 \times 10.3 \times 6.5 = 1439.425$ $\text{cm}/\text{cm}^2/\text{cm}^3 = 0.014\,394\,25 \text{ km}$ <i>their</i> 21.45 must be in the range 21.45 to 21.55 but accept equivalent if attempting the unit conversion first eg B0B0M1 for 21.5 cm = 0.0215 km followed by 0.0215×4663 Thus, use of width or height of the brick may score B0,B1,SC1 whereas use of volume may score B0/1,B1,SC0 Accept equivalent if working in m or km
	(b)	(i)	7017 to 7020	3	B1 for 20 000 or 2.849[...] or 2.85 or 0.0028[...] seen M1 for <i>their</i> $20\,000 \div \text{their } 2.85$ or $20 \div \text{their } 0.00285$	Ignore other bound ie a division after an attempt to reach consistent units <i>their</i> 2.85 must be in the range 2.75 to 2.85 inc.; <i>their</i> 0.00285 must be in the range 0.00275 to 0.00285. B0M0 for $20 \div 2.8$ as no attempt to reach consistent units

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		(ii)	The truck may not have enough room oe Safety regulations may not allow it	1		Mark their best reason. 0 for we do not know the exact weight of the bricks oe 0 for because the truck may need to carry other loads 0 there may not be enough bricks available
15			7.2[0] or 7.19[9...] nfw	4	M3 for $\sqrt{\frac{1379.02}{1200}}$ oe soi by 1.067[...] to 1.072{...} OR M2 for $\frac{1379.02}{1200}$ oe soi by 1.14 to 1.15 OR M1 for $1200x^2 = 1379.02$ Trials or no working: SC4 for correct answer 7.2[0] or 7.19[9...] on answer line OR SC3 for $1200 \times 1.072[0]^2 = 1379.02$ or $1200 \times 1.0719[9...]^2 = 1379.02$ OR SC1 for use of $1200x^2$ oe	Condone % symbol with correct answer. Warning: $1200 \div 179.02 = 6.7$ Allow $(1 + \frac{r}{100})$ or any letter, including r, in place of x.

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17	(a)		$\frac{x}{5} - 14$ oe	2	M1 for $\frac{x}{5}$ If 0 scored then SC1 for $\frac{x-14}{5}$ oe	Condone use of another letter for M1 max Must use x in SC1 0 for $x - 14 \div 5$
	(b)		-17.5 or $-\frac{35}{2}$ oe nfw	3	M1 for $5('k' + 14) = 'k'$ or $'k' = \frac{k}{5} - 14$ M1FT for $4'k' = -70$ or better or re-arrangement of <i>their</i> comparable $f(k) = g(k)$ equation into the form $ak = b$. M1FT solving <i>their</i> $ak = b$ Alternative (FT as above): M1 for $'k' = \frac{k}{5} - 14$ M1FT for $\frac{4k}{5} = -14$ or better M1FT solving <i>their</i> $ak = b$ Trials or no working: SC3 for -17.5	eg $5k+14=k$ becomes $4k=-14$ and then $k=-3.5$ scores M0 M1FT M1FT $k + 70 = k$ is not comparable Answers may be in decimal or fractional form but fractions equating to integers should be simplified

Question			Answer	Marks	Part marks and guidance	
18	(a)		Bars are of different width oe	1		0 for large tin looks larger than it is 0 for the bars are different sizes 0 for incorrect/no x-axis
	(b)		11.4[...] nfww	4	B1 for 1.5 or $\frac{3}{2}$ or 3 : 2 soi AND M2 for $10 \times \sqrt[3]{1.5}$ or M1 for $\sqrt[3]{1.5}$ soi by 1.14(47...) If 0 scored allow SC1 for 15 as final answer or seen radius of large tin <u>Alternative:</u> B1 for 0.666 to 0.667 or $\frac{2}{3}$ or 2 : 3 soi AND M2 for $10 \div \sqrt[3]{0.666 \text{ to } 0.667}$ oe or M1 for $\sqrt[3]{0.666 \text{ to } 0.667}$ oe soi 0.873(...)	

Question	Answer	Marks	Part marks and guidance	
19	$\frac{(2x+5)(x+4)}{(2x+5)(x-2)} = \frac{x+4}{x-2}$	4	M3 for $(2x+5)(x+4)$ and $(2x+5)(x-2)$ seen OR M2 for $(2x+5)(x+4)$ or $(2x+5)(x-2)$ seen OR M1 for any two linear factors giving two correct terms in numerator or denominator <u>Alternative:</u> M1 for $(2x^2 + 13x + 20)(x - b)$ and $(2x^2 + x - 10)(x + a)$ seen M1 two correct from $-10a = -20b$ oe $a - 10 = 20 - 13b$ oe $2a + 1 = 13 - 2b$ oe M1dep (on M1M1) valid attempt to solve <i>their</i> simultaneous equations (condone one error) If 0 scored, allow SC2 for $\frac{x+4}{x-2}$ as final answer from incomplete working, or SC1 for $\frac{x+4}{x-2}$ seen.	Warning: $\frac{2(x+5)(x+4)}{2(x+5)(x-2)} = \frac{x+4}{x-2}$ scores SC1 eg. $(2x+10)(x+2)$ which gives $2x^2$ and 20