



Mark Scheme (Results)

Summer 2026

Pearson Edexcel International GCSE

In Mathematics B (4MB1) Paper 02R

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

- **Types of mark**
 - M marks: method marks
 - A marks: accuracy marks
 - B marks: unconditional accuracy marks (independent of M marks)
- **Abbreviations**
 - cao – correct answer only
 - ft – follow through
 - isw – ignore subsequent working
 - SC – special case
 - oe – or equivalent (and appropriate)
 - dep – dependent

- indep – independent
- awrt – answer which rounds to
- eeo – each error or omission
- wr – working required
- cas – correct answer scores (unless from obvious incorrect working)

- **No working**

If no working is shown then correct answers normally score full marks

If no working is shown then incorrect (even though nearly correct) answers score no marks.

- **With working**

If there is a wrong answer indicated on the answer line always check the working in the body of the script (and on any diagrams), and award any marks appropriate from the mark scheme.

If it is clear from the working that the “correct” answer has been obtained from incorrect working, award 0 marks.

If a candidate misreads a number from the question. Eg. Uses 252 instead of 255; method marks may be awarded provided the question has not been simplified. Examiners should send any instance of a suspected misread to review. If there is a choice of methods shown, then no marks should be awarded, unless the answer on the answer line makes clear the method that has been used.

If there is no answer on the answer line then check the working for an obvious answer.

- **Ignoring subsequent work**

It is appropriate to ignore subsequent work when the additional work does not change the answer in a way that is inappropriate for the question: eg. Incorrect cancelling of a fraction that would otherwise be correct.

It is not appropriate to ignore subsequent work when the additional work essentially makes the answer incorrect eg algebra.

Transcription errors occur when candidates present a correct answer in working, and write it incorrectly on the answer line; mark the correct answer.

- **Parts of questions**

Unless allowed by the mark scheme, the marks allocated to one part of the question CANNOT be awarded to another.

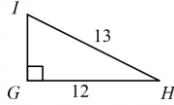
Question		Working	Answer	Mark	Notes
1	(a)	$\frac{2400}{15+3+2} \times 15$		2	M1 For a correct method to divide into the given ratio
		<i>Cas</i>	1800(g)		A1 cao (ignore units) Allow 1.8 [kg]
	(b)	$2400 \times 29.51 [= 70824]$		3	M1 For a correct method to find the total received for 2400g May be implied by 70824 (Award for $2400 \times "26.559" [= 63741.6]$)
		$"70824" \times 0.9 [= 63740]$			M1 For a correct method to reduce by 10% e.g. $"70824" - 0.1 \times "70824"$ Allow $"70824" \times (1 - 10\%)$ (Award for $29.51 \times 0.9 [= 26.559]$ allow awrt 26.56)
		<i>Wr</i>	63 700		A1 All M marks must be awarded and final answer of 63 700 (but allow both method marks if 63 741. 6 seen) As the answer is given no incorrect working can be seen
	(c)	$\frac{63700 - 56000}{56000} [\times 100]$ or $\left(\frac{63700}{56000} - 1 \right) [\times 100]$ oe		2	M1 For a correct method for finding percentage profit (allow more accurate value for 63 700)
		<i>Cas</i>	13.8%		A1 awrt 13.8% or allow 13.7%
	(d)	$1 - \frac{3}{4} - \frac{1}{6} \left[= \frac{1}{12} \right]$		4	M1 For a correct method to find the proportion of pieces which are necklaces. May be implied by $\frac{1}{12}$
		$\frac{3}{4}n \times 6 + \frac{1}{6}n \times 24 + \frac{1}{12}n \times 78 [= 15n]$			M1 For a correct expression for the total weight of n pieces of jewellery
		$15n = 3600$			M1 For forming a correct equation in n , may be unsimplified
		<i>Cas</i>	240		A1 cao

	(e)	51 855 or 51 865 or 895 or 905 73.15 or 73.25		4	M1 For any correct bound seen.
		$\frac{(51\,855,, V,, 51\,865)-(895,, U,, 905)}{(73.15,, a,, 73.25)^2}$			M1 For a calculation using $h = \frac{V-U}{a^2}$ The values of V , U and a must be within the limits stated
		$\frac{(51\,860 < V,, 51\,865)-(895,, U < 900)}{(73.15,, a < 73.2)^2}$			M1 For a calculation using $\frac{UB-LB}{LB^2}$ The values of V , U and a must be within the limits stated
			$\frac{51865-895}{73.15^2}=9.53$		A1 awrt 9.53 must see the correct calculation to award this. Condone 9.52 if correct calculation shown
		<i>Wr</i>			Total 15 marks

Question		Working	Answer	Mark	Notes
2	(a)	20 or 16 or $\frac{k}{12}$ or $\frac{k}{15}$		4	M1 For finding the number of litres per minute for either tap. Allow for k being algebraic or numerical including 1 If working in hours allow 1200 or 960 If working in seconds allow $\frac{1}{3}$ oe or $\frac{4}{15}$ oe
		"20"+"16"[=36] or " $\frac{k}{12}$ "+" $\frac{k}{15}$ "= $\left[\frac{9k}{60}\right]$ oe			M1 Dep on 1 st M1 For combining their rates. May be implied by $\frac{1}{36}$ If working in hours allow "1200"+"960"[2160] If working in seconds allow " $\frac{1}{3}$ "+" $\frac{4}{15}$ " $\left[=\frac{3}{5}\right]$
		$\frac{240}{36}$ or $\frac{k}{\frac{k}{12} + \frac{k}{15}}$			M1 For a full method to find the correct time. May be implied by awrt 6.6 or 6.7 minutes If working in hours you may see $\frac{240}{2160} \times 60$ oe If working in seconds you may see $\left(\frac{240}{3/5}\right) \div 60$ oe
	Cas		6 minutes 40 seconds		A1 cao
	(b)	$\frac{240}{100}[=2.4]$ or $240 \div \frac{100}{60}[=144]$ oe		2	M1 a correct expression to find time in mins or seconds May be seen in parts e.g. 200 litres = 2mins and 40 litres = $0.4 \times 60 [=24]$
	Cas		2 mins 24 seconds		A1 cao
					Total 6 marks

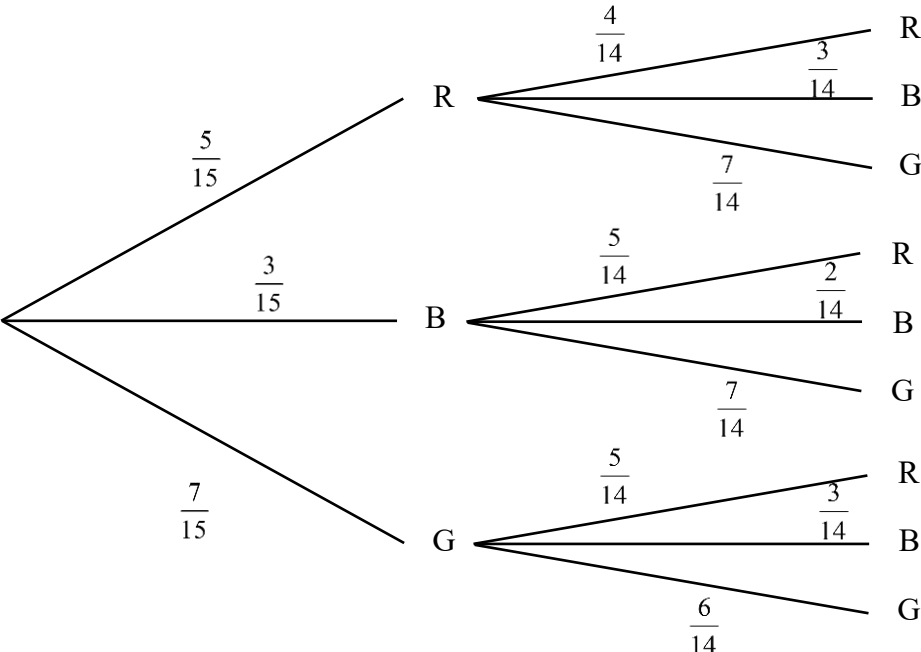
Question		Working	Answer	Mark	Notes
3	(a)	$(6+5+6+5)BC + 2 \times 6 \times 5 [= 236] \text{ oe}$		2	M1 For a correct expression for the total surface area in terms of BC Allow $2 \times 8 \times 5 + 2 \times 8 \times 6 + 2 \times 6 \times 5$
	<i>Wr</i>	$22BC = 176 \text{ oe}$	8		A1 cao Must gain M mark and have working equivalent to that shown Allow for $2 \times 8 \times 5 + 2 \times 8 \times 6 + 2 \times 6 \times 5 = 236$ and a conclusion eg $BC = 8[\text{cm}]$
	(b)	$[AG =] \sqrt{5^2 + 6^2} [= \sqrt{61} = 7.81]$ or $[AC =] \sqrt{6^2 + 8^2} [= 10]$ or $[AE =] \sqrt{5^2 + 8^2} [= \sqrt{89} = 9.43]$		3	M1 For a correct method to find the length of AG or AC or AE
		$AF = \sqrt{7.81^2 + 8^2} [= 5\sqrt{5}]$ or $AF = \sqrt{10^2 + 5^2} [= 5\sqrt{5}]$ or $AF = \sqrt{9.43^2 + 6^2} [= 5\sqrt{5}]$			M1 For a correct method to find the length of AF ft their $AG / AC / AE$ NB $[AF =] \sqrt{5^2 + 6^2 + 8^2} [= 5\sqrt{5}]$ scores M2
	<i>Cas</i>		11.2		A1 awrt 11.2 Do not allow $5\sqrt{5}$
					Total 5 marks

Question		Working	Answer	Mark	Notes
4		$[v=]15t^2 - t^3$		5	M1 for an attempt to differentiate i.e. $x^n \rightarrow x^{n-1}$ for at least one term
		$[a=]30t - 3t^2$			M1 dep on previous mark. For an attempt to differentiate again (at least 1 term correct for their v)
		$"15t^2 - t^3" = 0 \Rightarrow t = \dots [15]$			M1 dep on first M mark and having a 2 term expression. For setting their v to 0 and attempting to solve
		$"30" \times "15" - "3" \times ("15")^2$			M1 dep on all previous M marks substituting their value of t into their expression for a
			-225		A1 allow 225
<i>Wr</i>					Total 5 marks

Question	Working	Answer	Mark	Notes
5	$[GI =] \sqrt{13^2 - 12^2} [= 5]$ 		6	<p>M1 A correct method to find GI or $\angle GHI$ or $\angle GIH$</p> <p>$\cos \angle GHI = \left(\frac{12}{13}\right) [\Rightarrow \angle GHI = 22.6]$ or</p> <p>$\sin \angle GIH = \left(\frac{12}{13}\right) [\Rightarrow \angle GIH = 67.4]$</p> <p>May be implied by $GI = 5$</p>
	$[\text{Area } HGI =] \frac{1}{2} \times 12 \times 5 [= 30]$			<p>M1 A correct expression for the area of HGI ft their GI</p> <p>Allow $[\text{Area } HGI =] \frac{1}{2} \times 12 \times 13 \sin 22.6 [= 30]$ or</p> <p>$\frac{1}{2} \times 5 \times 13 \sin(67.4) [= 30]$</p>
	$10 \times 2x$ or $10 \times x$ or $x(10 - 2x)$ or $2x(10 - x)$ or $(10 - 2x)(10 - x)$			M1 A correct method to find an area of a rectangle required for the full area of the first shape $ABCDEF$
	$10 \times 2x + x(10 - 2x) = 30$ $[x^2 - 15x + 15 = 0]$			M1 A correct method to find the area of the first shape $ABCDEF$ in terms of x and equate to 30 ft their area of their triangle
	$x = \frac{[-]15 \pm \sqrt{([-]15)^2 - 4[\times 1] \times 15}}{2[\times 1]}$			<p>M1 for a correct method to solve the quadratic equation</p> <p>If using formula must use a fully correct formula allow one sign error when substituting in</p> <p>If completing the square need to see $\left(x - \frac{15}{2}\right)^2 + c [= 0]$ or where c is a numerical expression that does not equal 15</p> <p>As the question asks for answer to 3 sf do not allow attempt at factorisation</p> <p>May be implied by 1.08 or 13.9</p>
		1.08		A1 awrt 1.07 or awrt 1.08 do not condone inclusion of 13.9
Cas				Total 6 marks

Question		Working	Answer	Mark	Notes
6	(a)	$\frac{\sin(BCD)}{22} = \frac{\sin(45)}{17}$		3	M1 Use of the sine rule to find an equation involving BCD May be implied by 2nd M mark
		$[\sin(BCD) =] \frac{22 \times \sin 45}{17} [= 0.915]$			M1 for a correct expression for $\sin(BCD)$ May be implied by awrt 0.915 or angle $BCD = 66$
	Cas		114		A1 awrt 114
	(b)		66	1	B1 awrt 66 ft their BCD e.g. $180 - "114"$
	(c)	$\angle BDA = 50$ or $\angle ABD = 64$		3	M1 may be seen on diagram. May be implied by $\angle BAF = 50$ If they have $\angle BCD = 66$ allow $\angle ABD = 16$
	Cas		50		A1 cao
			<u>Alternate segment theorem</u>		B1 dependent on using either $\angle DAE = \angle ABD$ or $\angle BAF = \angle ADB$ with correct reason(s)
					Total 7 marks

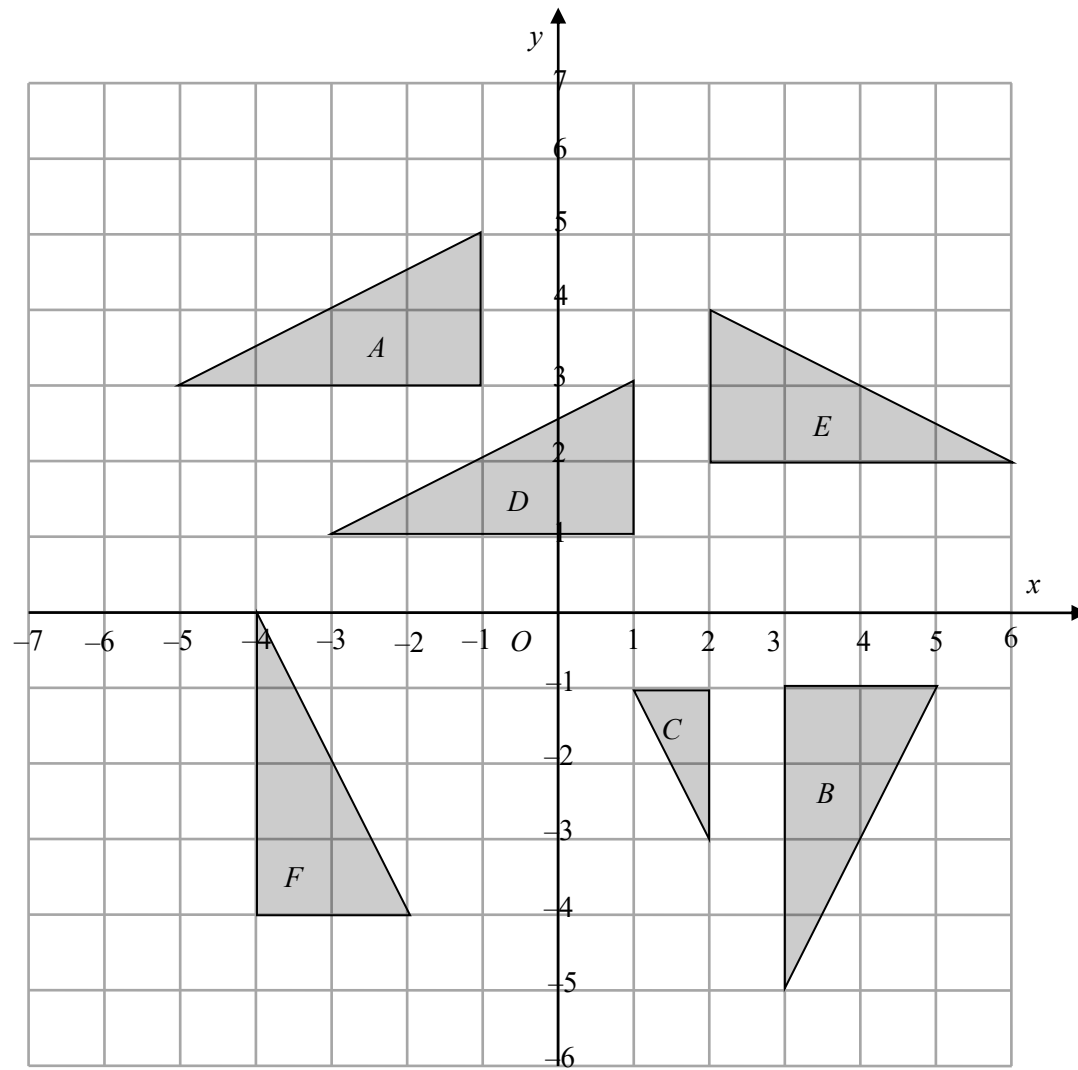
Question		Working	Answer	Mark	Notes
7	(a)	$9^{2b} \Rightarrow 3^{4b}$ and $27 \Rightarrow 3^3$ or $3^{3a} \Rightarrow 9^{\frac{3}{2}a}$ and $27 \Rightarrow 9^{\frac{3}{2}}$ or $3^{3a} \Rightarrow 27^a$ and $9^{2b} \Rightarrow 27^{\frac{4}{3}b}$		2	M1 For expressing everything as powers of 3 or a power of 9 or a power of 27 Allow e.g. $9^{2b} \Rightarrow (3^2)^{2b}$
	Wr	$\frac{3^{4b}}{3^3} = 3^{4b-3}$ or $\frac{9^{2b}}{3^{\frac{3}{2}}} = 9^{2b-\frac{3}{2}}$ or $\frac{27^{\frac{4}{3}b}}{27} = 27^{\frac{4}{3}b-1}$	$3a = 4b - 3$		A1 Must gain M1. Must see evidence of the subtraction of the indices. Allow e.g. $\frac{3^{4b}}{3^3} = 3^{2(2b)}3^{-3}$ Answer is given so no incorrect working can be seen
	(b)	$4^a \Rightarrow 2^{2a}$ and $8^{2-b} \Rightarrow 2^{3(2-b)}$ or $8^{2-b} \Rightarrow \left(4^{\frac{3}{2}}\right)^{2-b}$ or $4^a \Rightarrow \left(8^{\frac{2}{3}}\right)^a$		2	M1 for expressing everything as powers of 2 Allow e.g. $8^{2-b} \Rightarrow (2^3)^{2-b}$ or expressing 8^{2-b} as a power of 4 or expressing 4^a as a power of 8
	Wr	$\frac{1}{2^{3(2-b)}} \Rightarrow 2^{-3(2-b)}$ or $\frac{1}{\left(4^{\frac{3}{2}}\right)^{2-b}} \Rightarrow 4^{-3+\frac{3}{2}b}$ or $\frac{1}{8^{2-b}} = 8^{b-2}$	$2a = 3b - 6$		A1 Must gain M1 and see evidence of turning reciprocal into negative power. Allow e.g. $(2^3)^{(-2+b)}$ Answer is given so no incorrect working can be seen
	(c)	$6x = 9y - 18$ or $9x = 12y - 9$ $\frac{6x}{6} = \frac{9y-18}{6} (-)$ $\frac{9x}{9} = \frac{12y-9}{9} (-)$ $0 = y - 12$ $x = 15$ or $3\left(\frac{3y-6}{2}\right) = 4y-3$ or $3x = 4\left(\frac{2x+6}{3}\right) - 3$ or $2\left(\frac{4y-3}{3}\right) = 3y-6$ or $2x = 3\left(\frac{3x+3}{4}\right) - 6$		4	M1 For a correct method to eliminate x or y : coefficients of x or y the same and correct operation to eliminate selected variable (condone any one arithmetic error) or writing x or y in terms of the other variable and correctly substituting must gain an equation in one variable
			$x = 15$ or $y = 12$		A1 oe one correct value dep on M1
		$3x = 4 \times "12" - 3$ or $3 \times "15" = 4y - 3$ or $2x = 3 \times "12" - 6$ or $2 \times "15" = 3y - 6$			M1 dep on M1. For a correct method to find second variable – could start process again or use substitution
	Wr		$x = 15$ and $y = 12$		A1 oe for both correct values dep on both M marks
	(d)		$a = 15$ and $b = 12$	1	B1 ft their part c
					Total 9 marks

Question		Working	Answer	Mark	Notes
8	(a)	$15 - 5 - 3 [= 7]$ or $\frac{5}{15} + \frac{3}{15} [= \frac{8}{15}]$		2	M1 For a correct method to find number of green counters or the probability the counter is red or blue
	<i>Wr</i>		$\frac{7}{15}$		A1 dep on a fully correct method seen, must see either the total probability is 1 or the total number of counters is 15 used and a correct conversion between probability and number of counters
	(b)			3	<p>B1 $\frac{7}{15}$ placed correctly allow 0.467 or better.</p> <p>B1 any group of $\frac{4}{14} \frac{3}{14} \frac{7}{14}$, $\frac{5}{14} \frac{2}{14} \frac{7}{14}$ or $\frac{5}{14} \frac{3}{14} \frac{6}{14}$</p> <p>Allow equivalent fractions or decimal to at least 3dp (0.286, 0.214, 0.5, 0.357, 0.143, 0.5, 0.357, 0.214, 0.429)</p> <p>B1 all groups of $\frac{4}{14} \frac{3}{14} \frac{7}{14}$, $\frac{5}{14} \frac{2}{14} \frac{7}{14}$ and $\frac{5}{14} \frac{3}{14} \frac{6}{14}$</p> <p>Allow equivalent fractions or decimal to at least 3dp</p>

	(c)	$\frac{5}{15} \times \frac{4}{14}$ " or $\frac{5}{15} \times \frac{3}{14}$ " or $\frac{5}{15} \times \frac{7}{14}$ " or $\frac{3}{15} \times \frac{5}{14}$ " or $\frac{3}{15} \times \frac{2}{14}$ " or $\frac{3}{15} \times \frac{7}{14}$ " or $\frac{7}{15} \times \frac{5}{14}$ " or $\frac{7}{15} \times \frac{3}{14}$ " or $\frac{7}{15} \times \frac{6}{14}$ "		3	M1 ft their tree diagram, any product of probabilities do not ft probabilities above 1 or below 0
		$\frac{5}{15} \times \frac{7}{14}$ " + $\frac{3}{15} \times \frac{7}{14}$ " + $\frac{7}{15}$ oe or $1 - \left(\frac{5}{15} \times \frac{4}{14} \right) - \left(\frac{5}{15} \times \frac{3}{14} \right) - \left(\frac{3}{15} \times \frac{5}{14} \right) - \left(\frac{3}{15} \times \frac{2}{14} \right)$ oe			M1 ft their tree diagram, correct expression for the probability at least one is green do not ft probabilities above 1 or below 0 May be implied by a correct probability
	<i>cas</i>		$\frac{11}{15}$		A1 oe e.g. $\frac{154}{210}$ Allow 0.733 or better
Total 8 marks					

Question		Working	Answer	Mark	Notes
9	(a)(i)		$2\mathbf{a} + \mathbf{b}$	1	B1
	(ii)	$\overrightarrow{CD} = \overrightarrow{CB} + \overrightarrow{BA} + \overrightarrow{AD} \quad [= -(4\mathbf{a} + 2\mathbf{b}) - 5\mathbf{b} + 7\mathbf{a}]$		2	M1 For a correct vector expression for $\overrightarrow{CD}$ in terms of $\overrightarrow{CB}$, $\overrightarrow{BA}$ and $\overrightarrow{AD}$ oe
	Cas		$3\mathbf{a} - 7\mathbf{b}$		A1 oe
	(iii)	$\overrightarrow{MN} = \overrightarrow{MC} + \frac{1}{2}\overrightarrow{CD} \quad [= ("2\mathbf{a} + \mathbf{b}") + \frac{1}{2}("3\mathbf{a} - 7\mathbf{b}")]$		2	M1 For a correct vector expression for $\overrightarrow{MN}$ in terms of their $\overrightarrow{MC}$ and their $\overrightarrow{CD}$
	Cas		$\frac{7}{2}\mathbf{a} - \frac{5}{2}\mathbf{b}$		A1 oe
	(b)	$[\overrightarrow{BE} =] \quad 2\mathbf{a} + \mathbf{b} + \lambda \left(\frac{7}{2}\mathbf{a} - \frac{5}{2}\mathbf{b} \right) \text{ or}$ $[\overrightarrow{BE} =] \quad 5.5\mathbf{a} - 1.5\mathbf{b} + \alpha \left(\frac{7}{2}\mathbf{a} - \frac{5}{2}\mathbf{b} \right) \text{ or}$ $[\overrightarrow{ME} =] \lambda \left(\frac{7}{2}\mathbf{a} - \frac{5}{2}\mathbf{b} \right) \text{ or } [\overrightarrow{NE} =] \alpha \left(\frac{7}{2}\mathbf{a} - \frac{5}{2}\mathbf{b} \right)$		4	M1 For a correct expression for $\overrightarrow{BE}$ or $\overrightarrow{ME}$ or $\overrightarrow{NE}$ in terms of $\mathbf{a}$, $\mathbf{b}$ and a scalar multiple of $\overrightarrow{MN}$ ft their $\overrightarrow{MN}$
		$[\overrightarrow{BE} = \overrightarrow{BA} + \overrightarrow{AE} =] -5\mathbf{b} + k\mathbf{a} \text{ or}$ $[\overrightarrow{BE} = \overrightarrow{BD} + \overrightarrow{DE} =] 7\mathbf{a} - 5\mathbf{b} + m\mathbf{a} \text{ or}$ $[\overrightarrow{ME} =] -2\mathbf{a} - 6\mathbf{b} + m\mathbf{a} \text{ or } [\overrightarrow{ME} =] 5\mathbf{a} - 6\mathbf{b} + m\mathbf{a} \text{ or}$ $[\overrightarrow{NE} = \overrightarrow{ND} + \overrightarrow{DE} =] \frac{3}{2}\mathbf{a} - \frac{7}{2}\mathbf{b} + m\mathbf{a}$			M1 For a correct expression for $\overrightarrow{BE}$ or $\overrightarrow{ME}$ or $\overrightarrow{NE}$ in terms of $\mathbf{a}$, $\mathbf{b}$ and a scalar multiple of $\mathbf{a}$. Allow $7m\mathbf{a}$ for a multiple of $\mathbf{a}$
		e.g. $\left(1 - \frac{5}{2}\lambda\right)[\mathbf{b}] = -5[\mathbf{b}]$ or $\left(-1.5 - \frac{5}{2}\alpha\right)[\mathbf{b}] = -5[\mathbf{b}]$ or $-\frac{5}{2}\lambda[\mathbf{b}] = -6[\mathbf{b}]$ or $-\frac{5}{2}\alpha[\mathbf{b}] = -\frac{7}{2}[\mathbf{b}]$			M1 Dep on both previous M marks For comparing the coefficients of $\mathbf{b}$ Can be implied by $\lambda = \frac{12}{5}$, $\alpha = \frac{7}{5}$, $k = \frac{52}{5}$ or $m = \frac{17}{5}$ or correct answer
	Cas		$\frac{52}{5}\mathbf{a} - 5\mathbf{b}$		A1 oe
					Total 9 marks

Question		Working	Answer	Mark	Notes
10	(a)		Correctly plotted triangle	1	B1 cao (1, -1), (2, -1) and (2, -3)
	(b)		Correctly plotted triangle (-3, 1), (1, 1) and (1, 3)	2	B2 fully correct triangle plotted (B1 for triangle translated by $\begin{pmatrix} 2 \\ n \end{pmatrix}$ or $\begin{pmatrix} n \\ -2 \end{pmatrix}$)
	(c)		Correctly plotted triangle (2, 2), (2, 4) and (6, 2)	2	B2 fully correct triangle plotted (B1 2 points plotted correctly or triangle rotated by 90° anticlockwise about any centre)
	(d)		Reflection in line $y = x$	2	B1 For reflection/reflect. Do not allow mirrored. (B0 if multiple transformations stated. Multiple transformations are when more than one of reflection (mirrored), rotation (turn), translation (move) is stated e.g. a vector or SF or equation of a line do not imply multiple transformations) B1 $y = x$
	(e)		Correctly plotted triangle (-4, 0), (-4, -4) and (-2, -4)	2	B2 fully correct triangle plotted (B1 2 points plotted correctly or triangle enlarged by scale factor -2 about any centre)
					Total 9 marks



Question		Working	Answer	Mark	Notes
11	(a)		9	1	B1 cao
	(b)	$(2x+5)(2x-3)$ $\left[= 0 \Rightarrow x = -\frac{5}{2}, x = \frac{3}{2} \right]$		2	<p>M1 for a correct method to solve the quadratic equation. If factorising, allow brackets which when expanded give 2 out of 3 terms correct</p> <p>If using formula must use a fully correct formula allow one sign error when substituting in $\frac{-4 \pm \sqrt{4^2 - 4 \times 4 \times (-15)}}{2 \times 4}$ oe</p> <p>If completing the square need to see $4\left(x + \frac{1}{2}\right)^2 + c [= 0]$ or $(2x+1)^2 + c [= 0]$ oe where c is a numerical expression that does not equal -15 or to see $x^2 + x - 3.75 = 0$ leading to $\left(x + \frac{1}{2}\right)^2 + k [= 0]$ oe where k does not equal -3.75</p> <p>May be implied by $x = -\frac{5}{2}$ or $x = \frac{3}{2}$</p>
	Cas		$\frac{3}{2}$		A1oe do not condone inclusion of second solution
	(c)	$\frac{x+2}{x+1} + 2$ $\frac{x+2}{x+1} + 1$		3	M1 for substituting h into h
		$\frac{\frac{x+2+2(x+1)}{x+1}}{\frac{x+2+x+1}{x+1}}$ oe or $\frac{x+2+2(x+1)}{x+2+x+1}$ oe			M1 dep on M1 for getting the numerator and denominator over $x+1$ or multiplying each term by $x+1$
	Cas		$\frac{3x+4}{2x+3}$		A1 oe

	(d)	$4(x+\dots)^2$ or $(2x+\dots)^2$ or $x^2 + x - \frac{15}{4} = \frac{y}{4}$		4	M1 start to complete the square, correctly dealing with $4x^2$ NB may be in terms of y rather than x
		$4\left(x + \frac{1}{2}\right)^2 + \dots$ or $(2x+1)^2 + \dots$ or $\left(x + \frac{1}{2}\right)^2 + \dots = \frac{\dots}{4}$			M1 dep on previous M mark. Completing square, correctly dealing with $4x^2 + 4x$ NB may be in terms of y rather than x
		$x + \frac{1}{2} = \sqrt{\frac{y+16}{4}}$ or $2x+1 = \sqrt{y+16}$ oe			M1 dep on previous M mark. A correct rearrangement to a form involving a square root e.g. $x + \frac{1}{2} = \sqrt{\frac{y+\dots}{4}}$ or $2x+1 = \sqrt{y+\dots}$ Allow for x and y interchanged
	Cas		$\sqrt{\frac{x+16}{4}} - \frac{1}{2}$		A1 oe accept equivalent forms eg $\frac{\sqrt{x+16}-1}{2}$ must be in terms of x Do not allow $\pm \sqrt{\frac{x+16}{4}} - \frac{1}{2}$
	(d) ALT	$4x^2 + 4x + (-15 - y) = 0$		4	M1 Writing as a 3 term quadratic equation Allow for x and y interchanged
		$x = \frac{-4 + \sqrt{4^2 - 4 \times 4(-15 - y)}}{2 \times 4}$ oe			M1 dep on previous M mark. Substitution into a correct quadratic formula, allow one sign error in the substitution could be $\pm$ at this stage. Allow for x and y interchanged
		$x = \frac{-4 + \sqrt{256 + 16y}}{8}$			M1 dep on previous M mark. Expand and combine terms in the square root could be $\pm$ at this stage. Allow for x and y interchanged
	Cas		$\frac{-4 + \sqrt{256 + 16x}}{8}$		A1 oe eg $-\frac{1}{2} + \sqrt{\frac{256 + 16x}{64}}$ but must have only + before the square root and must be in terms of x . Do not ISW Do not allow $-\frac{1}{2} \pm \sqrt{\frac{256 + 16x}{64}}$
	(e)	$x > 1 \Rightarrow f(x) > 4 \times 1^2 + 4 \times 1 - 15$		2	M1 calculating range of $f(x)$ may be as an equation for this mark.
	Cas		$x > -7$		A1 cao
					Total 12 marks

Question		Working	Answer	Mark	Notes
12	(a)		-6.02, -2.45	2	B2 Both values correct (B1 One value which rounds to -6.0 or -2.5)
	(b)		Fully correct graph	3	B3 Fully correct graph (B2 for 6 or 7 points correct and joined with a smooth curve) (B1 for 4 or 5 points plotted correctly)
	(c)	$5x^2 - 10 + \frac{1}{2x^2} = 3 - 9x$		4	M1 Rearrange to isolate $5x^2 - 10 + \frac{1}{2x^2}$ allow if $y = 3 - 9x$ seen or implied
					M1 Line drawn with a gradient of -9 or which would intersect y axis at 3
					A1 Correct line drawn which crosses the curve in 2 places
	<i>Wr</i>		0.21, 0.91		A1 Dep on both M marks. Allow ft their curve and line (Allow answers correct to 1dp)
					Total 9 marks