Mark Scheme (Results)

January 2023

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
  - eeoo – each error or omission
- **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 the final answer is wrong 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 award the lowest mark, unless the subsequent working makes clear the method that has been used.

  If there is no answer achieved then check the working for any marks appropriate from the mark scheme.

- **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**

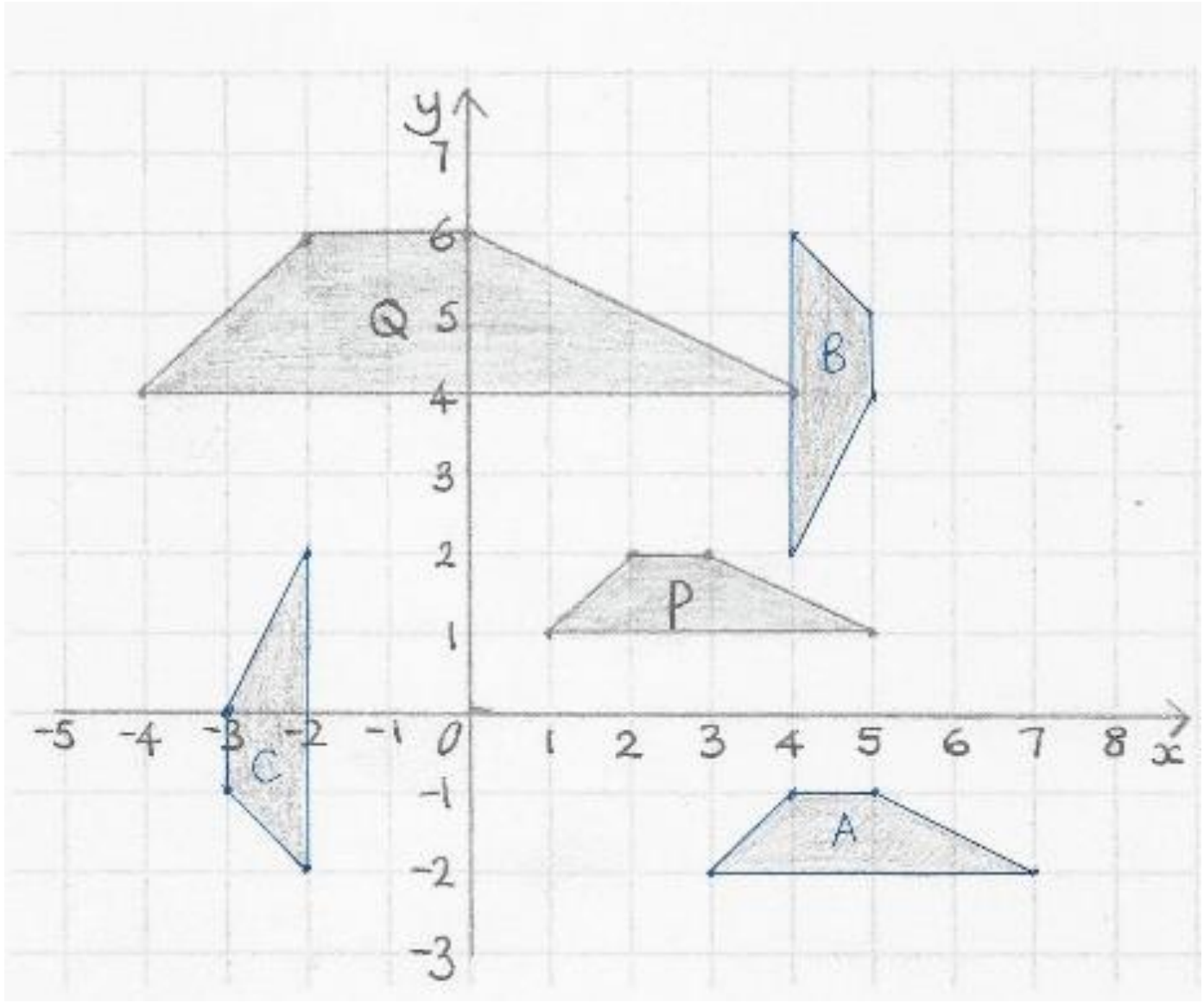
  Unless allowed by the mark scheme, the marks allocated to one part of the question CANNOT be awarded to another.

Question		Working	Answer	Mark	Notes
1	(a)	$\frac{230-180}{180}\times 100$ or $\frac{230}{180}\times 100-100$ oe		2	M1 Correct method to find percentage profit award for 28% with no incorrect working seen the $\times 100$ or -100 may be inferred eg $127.8\% \Rightarrow 27.8\%$ implies -100
			27.8(%)		A1 accept awrt 27.8
	(b)	$203 \div 1.16$ or $203 \div 116 \times 100$ oe		2	M1 Fully correct method to find the cost price allow for $\frac{203-x}{x} = 0.16$ oe do not allow $203 \div (1+16\%)$ or $203 \div 116\%$ without further correct working or a correct answer.
			($)175		A1 cao
	(c)	Use of 12 hrs 48 mins = 12.8 hrs or 768 mins		3	B1 Convert time to hours or minutes only, accept $\frac{64}{5}$
		860 × "12.8" or $\frac{860}{60}\times$"768"			M1 for use of time × distance (allow use of their time eg 12.48)
			11 008 (km)		A1 allow an answer of 11 000 from correct working
	(d)	91 750 ÷ 3.67		2	M1 Correct method to find cost in dollars
			($)25 000		A1 cao
		Correct answers scores full marks (unless from obviously incorrect working)			**Total 9 marks**

2	(a)		7.6×10^7	1	B1 cao
	(b)		0.000 83	1	B1 cao do not accept $\frac{83}{100\,000}$
	(c)	0.5×10^{25} oe		2	M1 also accept 5×10^n or $x\times10^{24}$ where n is an integer and $1\le x<10$ or $10^{25}\div 2$ or 5 000 000 000 000 000 000 000 000 oe
			5×10^{24}		A1
	(d)	$[1.6\times10^{41} =] 16 \times 10^{40}$ **or** $16 = 2^4$ or $1.6 = 2^3\times5^{-1}$ oe **or** $10^{40} = (2\times5)^{40}$ or $10^{41} = (2\times5)^{41}$ oe		3	M1 For any one of: 1.6×10^{41} expressed as the product of an integer and a power of 10 eg 160×10^{39} or Express 1.6, 16, 160 etc as a product of prime factors, Condone $1.6 = \frac{1}{5}\times2^3$ or $1.6 = 2^3\times0.2$ or Express $10^n = (2\times5)^n$
		For any two of: $[1.6\times10^{41} =] 16 \times 10^{40}$ **or** $16 = 2^4$ or $1.6 = 2^3\times5^{-1}$ oe **or** $10^{40} = (2\times5)^{40}$ or $10^{41} = 2^{41}\times5^{41}$ oe			M1 dep on M1 For any two of: 1.6×10^{41} expressed as the product of an integer and a power of 10 or Express 1.6, 16, 160 etc as a product of prime factors or Express $10^n = (2\times5)^n$
			$2^{44} \times 5^{40}$		A1 dependent on both method marks gained
		(c) Correct answers scores full marks (unless from obviously incorrect working) *(d) Working required*			**Total 7 marks**

3		$\frac{1}{3}\times\pi\times8^2\times h=320\pi$ oe		5	M1 for a correct equation to find the height of the cone allow an equation with π cancelled eg $\frac{64h}{3}=320$
		$[h=]\frac{320\times3}{8^2}[=15]$			M1 dep on previous M mark for a correct calculation to find the height of the cone
		$[l=]\sqrt{"15"^2+8^2}[=17]$			M1 for a correct calculation for the slant height, l
		$\pi\times8^2+\pi\times8\times"17"$ oe			M1 for a correct total area follow through their l. May use their slant height which must be distinct from their height (or for an answer of 628 – 629 without 200π seen) (NB: an answer of 628 – 629 with no obvious incorrect working seen gains 4 marks) Condone $[k=]8^2+8\times"17"$ without π
			200		A1 allow 200π
		Correct answers scores full marks (unless from obviously incorrect working)			**Total 5 marks**

4	(a)		Enlargement	3	B1 with no mention of any other transformation
			Scale factor 2		B1
			Centre (6, –2)		B1
	(b)	(3, –2), (4, –1), (5, –1), (7, –2)	*A* correctly shown	2	B2 for *A* shown in the correct position. (B1 for 2 points plotted correctly or 3 points listed correctly or for the correct translation for one direction only) SC For a correct transformation applied to *Q* (vertices (–2, 1), (0, 3), (2, 3) and (6, 1) drawn) Award B1
	(c)	(4, 6), (5, 5), (5, 4), (4, 2)	*B* correctly shown	2	B2 for *B* shown in the correct position (B1 for 2 points plotted correctly or 3 points listed correctly or a shape the correct size and shape with the correct orientation or shape with vertices (5, –1), (5, 0), (6, 2) and (6, –2) drawn)
	(d)	$\begin{pmatrix} 0 & -\frac{1}{2} \\ \frac{1}{2} & 0 \end{pmatrix}\begin{pmatrix} -4 & -2 & 0 & 4 \\ 4 & 6 & 6 & 4 \end{pmatrix}$		3	M1 for the transformation matrix followed by a either correct coordinate matrix or 4 correct position vectors of object (NB: any order of coordinates) or 3 correct points of image listed or 2 correct points of image plotted For this mark allow transformation of *P* by matrix eg. $\begin{pmatrix} 0 & -0.5 \\ 0.5 & 0 \end{pmatrix}\begin{pmatrix} 1 & 2 & 3 & 5 \\ 1 & 2 & 2 & 1 \end{pmatrix}$
		$\begin{pmatrix} -2 & -3 & -3 & -2 \\ -2 & -1 & 0 & 2 \end{pmatrix}$			M1 dep on M1 awarded, at least 3 correct points of image listed (may be seen in a single matrix) or 3 correct points of image plotted For this mark allow $\begin{pmatrix} -0.5 & -1 & -1 & -0.5 \\ 0.5 & 1 & 1.5 & 2.5 \end{pmatrix}$
		(–2, –2), (–3, –1), (–3, 0), (–2, 2)	*C* correctly shown		A1 for a fully correct shape drawn on the grid
		Correct answers scores full marks (unless from obviously incorrect working)			**Total 10 marks**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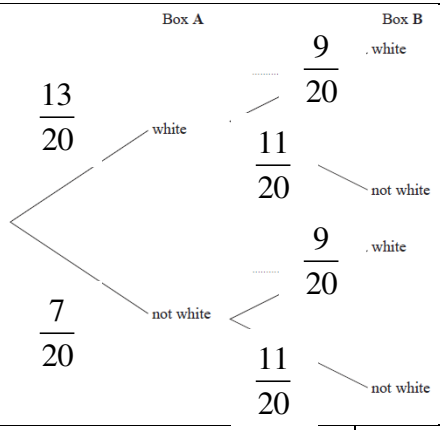
5	(a)	$8^2 - 5^2 [= 39]$ or $[\angle BAC =] \cos^{-1}\left(\frac{5}{8}\right) [= 51.3...]$ and $8 \times \sin("51.3")$		4	M1 Correct use of Pythagoras' theorem or other method to find *BC* oe Allow $8^2 = x^2 + 5^2$ oe
		$\sqrt{8^2 - 5^2} [= \sqrt{39} = 6.24...]$			M1 Correct method to find *BC* oe
		$\frac{1}{2} \times 5 \times "6.24..." \times 7$			M1 Must use a length which is their *BC* or *DE*, may be on diagram if not labelled must be correct. Correct formula for volume of prism.
			109 [cm^3]		A1 109 – 109.3 (if no marks awarded, SCB1 for $\frac{1}{2} \times 5 \times 8 \times 7 [= 140]$ or $\frac{1}{2} \times 5 \times \sqrt{5^2 + 8^2} \times 7 [= 165...]$)
	(b)	$QT = 25\cos 70 [= 8.55...]$ or $QT = 25\sin 20 [= 8.55...]$ or $PT = 25\sin 70 [= 23.49...]$ or $PT = 25\cos 20 [= 23.49...]$ or $PT = \frac{25\sin 70}{\sin 90}$ oe		4	M1 for a correct method to find *QT* or *PT*
		$QT = 25\cos 70 [= 8.55...]$ and $PT = \sqrt{25^2 - "8.55"^2}$ [=23.49…] oe			M1 for a correct method to find *QT* and *PT*
		"8.55…" + "23.49…" + 12 + 12 + 25			M1 for a fully correct method to find the perimeter
			81[cm]		A1 awrt 81
		Correct answers scores full marks (unless from obviously incorrect working)			**Total 8 marks**

6	(a)			2	B1 For Box A correct, $\frac{13}{20}$ and $\frac{7}{20}$ B1 For Box B correct, $\frac{9}{20}$ and $\frac{11}{20}$ Ignore any additions to the right of the diagram
	(b)	$"\left(\frac{13}{20}\right)"\times"\left(\frac{9}{20}\right)"\left[=\frac{117}{400}\right]$ or $"\left(\frac{13}{20}\right)"\times"\left(\frac{11}{20}\right)"\left[=\frac{143}{400}\right]$ or $"\left(\frac{7}{20}\right)"\times"\left(\frac{9}{20}\right)"\left[=\frac{63}{400}\right]$ or $"\left(\frac{7}{20}\right)"\times"\left(\frac{11}{20}\right)"\left[=\frac{77}{400}\right]$		3	M1Correct product of probabilities ft their tree diagram Do not ft any probability greater than 1
		$"\frac{117}{400}"+"\frac{143}{400}"+"\frac{63}{400}"$ or $"\frac{13}{20}"+"\frac{63}{400}"$ or $"\frac{9}{20}"+"\frac{143}{400}"$ or $1-"\frac{77}{400}"$			M1 fully correct method to find P(at least one W) ft their tree diagram Do not ft any probability greater than 1 dep on previous M mark
			$\frac{323}{400}$		A1 Allow awrt 0.81 oe

	(c)	$"\left(\frac{13}{20}\right)"\times"\left(\frac{9}{20}\right)"\times\frac{30-x}{30}\left[=\frac{39(30-x)}{4000}=\frac{1170-39x}{4000}\right]$ or $"\left(\frac{13}{20}\right)"\times"\left(\frac{11}{20}\right)"\times\frac{x}{30}\left[=\frac{143x}{12000}\right]$ or $"\left(\frac{7}{20}\right)"\times"\left(\frac{9}{20}\right)"\times\frac{x}{30}\left[=\frac{21x}{4000}\right]$ oe		4	M1for a correct product of 3 probabilities ft their tree diagram If total in bag is incorrect but consistent allow this mark. Eg $"\left(\frac{13}{20}\right)"\times"\left(\frac{9}{20}\right)"\times\frac{20-x}{20}$ Do not ft any probability greater than 1 If using x rather than $\frac{x}{30}$ do not award until attempting to find number of counters rather than probability
		$"\left(\frac{1170-39x}{4000}\right)"+"\left(\frac{143x}{12000}\right)"+"\left(\frac{21x}{4000}\right)"$ oe			M1for a fully correct probability ft their tree diagram If total in bag is incorrect but consistent allow this mark. Do not ft any probability greater than 1 Need not be simplified dep on previous M mark
		$\frac{3\times"1170"-3\times"39"x+"143"x+3\times"21"x}{12000}=\frac{337}{1000}$ or $\frac{89}{12000}x+\frac{1170}{4000}=\frac{337}{1000}$ or $3\times"1170"-3\times"39"x+"143"x+3\times"21"x=337\times12$ or $89x = 534$ oe			M1 ft their tree diagram Do not ft any probability greater than 1 for a correct equation with no brackets (but can be a fraction) dep on previous M mark
			6		A1
		Correct answers scores full marks (unless from obviously incorrect working)			**Total 9 marks**

7	(a)		$\frac{3}{2}$	1	B1 oe accept 1.5 allow $x \neq \frac{3}{2}$
	(b)	$5(2x-3)=10$ oe		3	M1 Setting g(x) = 5 and gaining a correct equation with no fractions
		$10x=10+15$ **or** $2x-3=\frac{10}{5}$			M1dep on previous M mark For removing any brackets, allow a maximum of 1 numerical error
			2.5		A1 oe
	(c)	$3\left(-\frac{1}{2}\right)^2+9\times-\frac{1}{2}-7$ oe		2	M1
			$-\frac{43}{4}$		A1 oe accept –10.75
	(d)	$y=3\left(\left(x+\frac{3}{2}\right)^2-\frac{9}{4}\right)-7$ or $y=3\left(x+\frac{3}{2}\right)^2-\frac{27}{4}-7$		4	M1 for a start to completing the square As a minimum must see $y=3\left(x+\frac{3}{2}\right)^2+c$ where c is a number or numerical expression not equal to –7
		$(x+\frac{3}{2})^2=\frac{y}{3}+\frac{55}{12}$			M1dep on previous M mark isolating $\left(x+\frac{3}{2}\right)^2$
		$x=-\frac{3}{2}+\sqrt{\frac{y}{3}+\frac{55}{12}}$			M1 dep on previous M mark removing square and isolating x could be +/– at this stage
			$-\frac{3}{2}+\sqrt{\frac{x}{3}+\frac{55}{12}}$		A1oe eg $-\frac{3}{2}+\sqrt{\frac{\left(x+\frac{55}{4}\right)}{3}}$ but must have only + before square root and must be in terms of x

	(d)	***alternative***			
		eg $3x^2+9x+(-7-y)=0$		4	M1 Writing as a 3 term quadratic equation in terms of x
		$(x=)\dfrac{-9+\sqrt{9^2-4\times3(-7-y)}}{2\times3}$ oe			M1 dep on previous M mark. Substitution into a correct quadratic formula, allow one sign error in the substitution could be +/–at this stage
		$x=\dfrac{-9+\sqrt{165+12y}}{6}$			M1 dep on previous M mark. Expand and combine terms in the square root could be +/–at this stage
			$\dfrac{-9+\sqrt{165+12x}}{6}$		A1 oe eg $-\dfrac{3}{2}+\sqrt{\dfrac{165+12x}{36}}$ oe but must have only + before square root and must be in terms of x Do not ISW
		Correct answers scores full marks (unless from obviously incorrect working)			**Total 10 marks**

8	(a)		3, 1.5, –3, –9, –4.5	3	B3 for all 5 correct (B2 for 3 or 4 correct, B1 for 1 or 2 correct)
	(b)			3	M1 Attempts to plot at least 7 of their points with at least 5 correct ±1 small square. (Allow if curve goes through the points) ft their values from (a) M1 drawing a smooth curve through at least 5 of their plotted points. Do not allow if straight lines used. Allow ±1 small square from their point. A1ft A fully correct curve ft their values from (a). All Points plotted correctly, ± 1 small square, with a smooth curve through all the points ±1 small square. Penalise a curve for which there are clearly multiple y values for any x in a range of size at least 0.2
	(c)	$y = 1 - \frac{1}{2}x$ drawn		3	M1 for the correct line drawn (If extended must go through (–4, 3) and (4, –1) ±1 small square
			–2.4, –1, 3.4		A2ft for all 3 correct solutions do not allow coordinates (A1ft for 2 correct solutions, condone coordinates) tolerance of 1 small square Dep on M1 in this part and at least M1 scored in (b) and a "curve" drawn condone straight line segments for this. Values given must follow through their graph, do not allow values listed if they do not match up with their graph Be particularly careful if $\frac{1}{2}x^3 - \frac{9}{2}x - 4 = 0$ followed by results is seen. Penalise any value given to more than 2 dp.
		(c) Working required			**Total 9 marks**

9	(a)(i)	$5y - 2y > -13 + 7$ oe		2	M1 or for an answer of –2 or y and incorrect inequality sign with –2
			$y > -2$		A1 oe eg $(-2, \infty)$
	(ii)		Correct inequality shown	1	B1 for an open circle at –2 with a line to the right as far as 5 if no arrow, or any length with an arrow. Allow alternative notation. Condone two or three inequalities seen on number line, give bod if this is seen.
	(b)(i)	$(2x+7)(2x-5)$		3	M1 for a correct method to solve the quadratic equation If factorising, allow brackets which when expanded give 2 out of 3 terms correct If using formula must use a fully correct formula allow one sign error when substituting in $\frac{-4 \pm \sqrt{4^2 - 4 \times 4 \times (-35)}}{2 \times 4}$ oe 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 –35 or to see $x^2 + x - 8.75 < 0$ leading to $\left(x+\frac{1}{2}\right)^2 + k[<0]$ oe where k does not equal –8.75
			2.5, –3.5		A1 correct critical values or an inequality of the form $a < x < b$ where $a < b$
			$-3.5 < x < 2.5$		A1 oe Do not penalise incorrect inequalities if replaced with the correct inequality isw if the correct answer is followed by a list of integers
	(ii)		$-2 < x < 2.5$	1	B1oe ft from (a)(i) and (b)(i) Correct answer scores full marks regardless of previous answers ft dep on overlap between the results from (a)(i) and (b)(i) and the inequality in (b)(i) being of the form $a < x < b$ or $x < a, x > b$ where $a < b$ Condone y rather than x Do not isw if the correct answer is followed by a list of integers
		Correct answers scores full marks (unless from obviously incorrect working)			
					Total 7 marks

10	(a)	$\sqrt{98}+\sqrt{18}=7\sqrt{2}+3\sqrt{2}\left[=10\sqrt{2}\right]$ or $\dfrac{\sqrt{98}+\sqrt{18}}{\sqrt{5}}\times\dfrac{\sqrt{5}}{\sqrt{5}}$		3	M1 Expressing $\sqrt{98}$ and $\sqrt{18}$ in terms of $\sqrt{2}$ or rationalising the denominator may imply $\times\dfrac{\sqrt{5}}{\sqrt{5}}$ by eg $\dfrac{\sqrt{490}+\sqrt{90}}{5}$
		$\dfrac{"10\sqrt{2}"}{\sqrt{5}}\times\dfrac{\sqrt{5}}{\sqrt{5}}$ or $\dfrac{\sqrt{200}}{\sqrt{5}}=\sqrt{40}$ or $\dfrac{\sqrt{98}+\sqrt{18}}{\sqrt{5}}\times\dfrac{\sqrt{5}}{\sqrt{5}}=\dfrac{7\sqrt{10}+3\sqrt{10}}{5}$			M1 dep on previous M mark, expressing surds in appropriate form to add and rationalising the denominator or dividing two square roots may imply $\times\dfrac{\sqrt{5}}{\sqrt{5}}$ by eg $\dfrac{10\sqrt{2}}{\sqrt{5}}=\dfrac{10\sqrt{10}}{5}$
			$\sqrt{40}$		A1 dep on M2
	(b)	$\sqrt{27}=3^{\frac{3}{2}}$ or $\sqrt{27}\times\sqrt{3}=9=3^2$ or $\sqrt{27}=3\sqrt{3}$ and $3\sqrt{3}\times\sqrt{3}=3^2$ or $\sqrt{27}\times\sqrt{3}=\sqrt{81}$ and $\dfrac{\sqrt{81}}{81^{\frac{4}{3}}}=81^{-\frac{5}{6}}$ oe		3	M1 dealing with the $\sqrt{27}$
		$(\sqrt[3]{81})^4=3^{\frac{16}{3}}$			M1 dealing with $81^{\frac{4}{3}}$ allow for $81^a=3^{4a}$ where $a\neq 1$
			$-\dfrac{10}{3}$		A1 condone $3^{-\frac{10}{3}}$ dep on M2 isw if the correct answer is then given as a decimal
		Working required			**Total 6 marks**

11	(a)	$7-5x=5x^2-16x-5$ or $y=5\left(\frac{7-y}{5}\right)^2-16\left(\frac{7-y}{5}\right)-5$		5	M1 for a correct substitution to gain an equation in one variable
		$5x^2-11x-12[=0]$ or $y^2-3y-88[=0]$ oe			M1 dep on previous M mark for writing as 3 term quadratic in one variable, allow one sign error
		$(5x+4)(x-3)$ or $(y-11)(y+8)$ $\frac{-(-11)\pm\sqrt{([-]11)^2-4\times5\times(-12)}}{2\times5}$ or $\frac{-(-3)\pm\sqrt{([-]3)^2-4\times1\times(-88)}}{2\times1}$ oe			M1 for a correct method to solve their quadratic equation dep on having a three term quadratic in one variable, do not allow $5x^2-16x-5=0$ If factorising, allow brackets which when expanded give 2 out of 3 terms correct If using formula must use a fully correct formula allow one sign error when substituting If completing the square need to see $5\left(x-\frac{11}{10}\right)^2+a[=0]$ oe where a is a numerical expression that does not equal –12 or $\left(y-\frac{3}{2}\right)^2+b[=0]$ oe where b is a numerical expression that does not equal –88 or to see $x^2-2.2x-2.4=0$ leading to $(x-1.1)^2+c[=0]$ oe where c does not equal –2.4
			x= –0.8, x = 3 or y = 11, y = –8		A1 oe both x values or both y values or one correct pair of x and y dep on at least first 2 M marks gained NB M1M1M0A1 may be awarded
			(3, –8), (–0.8, 11)		A1 oe both coordinates, dep on M3. Allow written as x = 3, y = –8 x = –0.8, y = 11 as long as correctly paired

	(b)	$\frac{dy}{dx} = 10x - 16$		5	M1 for differentiating with at least one nonzero term correct
		$10 \times 2 - 16$ [= 4]			M1 for substituting 2 into their $\frac{dy}{dx}$ for gradient of tangent dep on M1
		$y = 5 \times 2^2 - 16 \times 2 - 5$ [= –17]			M1 indep for y coordinate of P
		$"-17" = "4" \times 2 + c$ or $c = -25$ oe $y - "(-17)" = "4"(x - 2)$ or a correct equation eg $y - 4x + 25 = 0$			M1 correctly substituting into formula for equation of straight line parallel to curve at P – ft correct use of their gradient and y value dep on first M1 Both must be numerical If 2nd M1 awarded do not allow use of perpendicular gradient.
			$\left(\frac{25}{8}, -\frac{25}{2}\right)$		A1 oe eg(3.125, –12.5)
		(a) Working required *(b) Correct answers scores full marks (unless from obviously incorrect working)*			**Total 10 marks**

12	(a)	$\frac{1}{2}\times x\times x\times\sin 60$ or $\frac{1}{2}\times x\times\frac{\sqrt{3}}{2}x$ or $\frac{3\sqrt{3}d^2}{2}$ or $\frac{1}{2}(d+2d)\times\frac{\sqrt{3}}{2}d$ or $\frac{1}{2}\times y\times\sqrt{3}y$ or $\frac{1}{2}\times 4y\times y\times\sin 30$ oe		4	M1 for area of one triangle or trapezium or the whole hexagon (allow use of their "60" from a correct method for method marks) *d* represents a length of the edge *x* represents either the length of an edge or a diagonal such as *AC* *y* represents a length of half an edge. If unsure of a variables meaning give bod
		eg $\frac{150\sqrt{3}}{6}=\frac{1}{2}\times x^2\times\sin 60$ or $\frac{150\sqrt{3}}{2}=\frac{1}{2}\times x^2\times\sin 60$ or $150\sqrt{3}=\frac{3\sqrt{3}d^2}{2}$ or $\frac{150\sqrt{3}}{2}=\frac{1}{2}(d+2d)\times\frac{\sqrt{3}}{2}d$ or $150\sqrt{3}=12\times\frac{\sqrt{3}}{2}y^2$ or oe			M1 for a correct equation for the area of the whole hexagon or for a trapezium or triangle within the hexagon.
		$d^2=100$ or $x^2=300$ or $y^2=25$ oe			M1 for a correct method to find a length or its square
			60(cm)		A1 accept awrt 60.0
	(b)	Hexagon int $\angle$ = 120 or ext $\angle$ = 60, Octagon int $\angle$ = 135 or ext $\angle$ = 45		6	B1 For sight of int or ext $\angle$ of either shape May be seen on diagram and allow sight of 120 in working of part(a)
		Horizontal or vertical distance of *L* from *B* = "10" sin"45" or $[KA=]"10"+2\times"10"\sin"45"\left[=10+10\sqrt{2}=24.14...\right]$ or $[KB=]2\times"10"\cos\frac{"45"}{2}[=18.47...]$ or $[KG=]\frac{10}{\cos\left(\frac{"135"}{2}\right)}[=26.13]$			M1 One of the horizontal or vertical displacement of *L* from *B* or length *KA* or *KB* or *KG* Use of their "60" ÷ 6 for all method marks. (allow use of their angles in a hexagon or octagon from a correct method for method marks)

		Height of A above F = "10"sin30 or "10"cos60 or Horizontal distance of A from F = "10"cos30 or "10"sin60 or [Angle KAF =] "120" + "45" $[=165]$ or $[FB=]2\times"10"\times\cos\frac{"60"}{2}\left[=10\sqrt{3}=17.32...\right]$ or $[FG=]2\times"10"\times\cos\left(\frac{180-"60"-"45}{2}\right)[=15.86...]$			M1 One of the vertical or horizontal displacements of A from F or angle KAF or length FB or FG
		Height of K above F = "10"sin45 + "10" + "10"sin30 $[=15+5\sqrt{2}=22.07\ldots]$ and Horizontal distance of K from F = "10" + "10"sin45+"10"sin60 $\left[=10+5\sqrt{2}+5\sqrt{3}=25.73...\right]$ or $KF^2="24.14"^2+"10"^2-2\times"24.14"\times"10"\times\cos"165"$ or $KF^2="18.47"^2+"17.32"^2-2\times"18.47"\times"17.32"\times\cos(142.5)$ or $KF^2="26.13"^2+"15.86"^2-2\times"26.13"\times"15.86"\times\cos(105)$			M1 dep on previous two M marks Both of the vertical or horizontal displacements of A from F or equation involving KF
		$[KF=]\sqrt{"22.07..."^2+"25.73..."^2}$ or $[KF=]\sqrt{"24.14"^2+"10"^2-2\times"24.14"\times"10"\times\cos"165"}$ or $[KF=]\sqrt{"18.47"^2+"17.32"^2-2\times"18.47"\times"17.32"\times\cos(142.5)}$ or $[KF=]\sqrt{"26.13"^2+"15.86"^2-2\times"26.13"\times"15.86"\times\cos(105)}$			M1 Expression to find KF dep on previous 3 M marks.
			33.9(cm)		A1 awrt 33.9
		Correct answers scores full marks (unless from obviously incorrect working)			**Total 10 marks**

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