Pearson Edexcel

Mark Scheme (Results)

Summer 2025

Pearson Edexcel International GCSE
In Mathematics B (4MB1) Paper 01R

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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 – can only be awarded when relevant M marks have been gained
  - B marks: unconditional accuracy marks (independent of M marks)

- **Abbreviations**
  - cao – correct answer only
  - cso – correct solution 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 may score full marks
  If no working is shown, then incorrect (even though nearly correct) answers score no marks.

- **With working**
  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: e.g. uses 252 instead of 255; follow through their working and deduct 2A marks from any gained provided the work has not been simplified. (Do not deduct any M marks gained.)

  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

  Examiners should send any instance of a suspected misread to review (but see above for simple misreads).

- **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: e.g. 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 e.g. algebra.

- **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			$3x(3+4xy)$	2	B2 fully correct answer as their final answer (B1 for partial factorisation $3(3x+4x^2y)$ or $x(9+12xy)$ or for correctly identifying the HCF in the factorisation of the form $3x(3+...)$ or $3x(...+axy)$ where *a* is an integer or a correct answer (that is not their final answer) seen within the working) condone missing closed bracket
		cas			***Total 2 marks***

Question		Working	Answer	Mark	Notes
2		360 – 214 [= 146] oe or 270 – 214 [= 56] oe eg 360 – 90 – 214 [= 56] oe 214 – 180 oe		2	M1 for a correct method to find an appropriate angle at *K* or a correct method to find the bearing. may be seen on diagram
			034		A1 Allow 34 Do **not** ISW ie if 34 is not on the answer line it must be their final answer may be seen on diagram provided it is the only angle at *J*
		cas			***Total 2 marks***

Question		Working	Answer	Mark	Notes
3		eg $t-24=6x$ or $\frac{t}{6}=x+4$		2	M1 for start by multiplying out brackets and isolating the term in x correctly **or** dividing throughout by 6 **or** correct expression for x without $x =$ …
			$x=\frac{t}{6}-4$		A1 oe eg $x=\frac{t-24}{6}$ or $x=\frac{24-t}{-6}$ must see $x=...$ but allow if correct answer is in working but omitted on the answer line. Do not ISW for incorrect subsequent cancelling SCB1 for a final answer of $x=\frac{t+24}{6}$ or $x=\frac{24-t}{6}$ or $x=\frac{t-4}{6}$ oe must see $x=...$ but allow if written in working but omitted on the answer line.
		cas			***Total 2 marks***

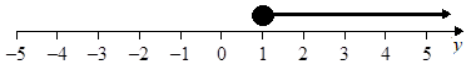
Question		Working	Answer	Mark	Notes
4		$\frac{1012}{0.92}$ or $\frac{92}{100}\times x=1012$ or 92% = 1012 oe		2	M1 for realising that 1012 is 92%
			1100		A1
		cas			***Total 2 marks***

Question		Working	Answer	Mark	Notes
5			$32x^2y^{14}$	2	B2 (B1 for a product with 2 parts correct and no more than 3 parts in total) Condone inclusion of multiplication signs for B1
		cas			***Total 2 marks***

Question		Working	Answer	Mark	Notes
6				2	M1 for $(x+3)^2 -$ .... (condone $(x+3) -$ ....) or ... $-$ 24 is seen in working Implied by $a = 3$ and $b = 24$ **or** $a = 3$ and $b = -24$ or $x^2 + 2ax + a^2 - ...$ **and** $2a = 6$ or $a^2 - b = -15$ oe
			$a = 3$ and $b = 24$		A1 for $a = 3$ and $b = 24$ Allow if $(x+3)^2 - 24$ is seen in working even if $a = 3$ and $b = -24$ is seen on the answer line NB When + 6x is misread as – 6x award M1 for $a = -3$ and b = 24
		cas			***Total 2 marks***

Question		Working	Answer	Mark	Notes
7		$\angle ABE = 56$ or $\angle BFE = 72$ or $\angle BED = 180 - 56 [= 124]$ or $\angle EBC = 180 - 56 [= 124]$ or $\angle ABF = 180 - 72 [= 108]$ or $\angle BFG = 180 - 72 [= 108]$ or $56 + 72 + x = 180$ oe eg [x =]$180 - (56 + 72)$ oe		3	M1 may be seen on diagram Angles must be unambiguously identified eg Angle F = 72 is too ambiguous For the equation $56 + 72 + x = 180$ x can be any letter and does not need to be identified
			52		A1 cas may be on the diagram If 52 is on the answer line or their final answer in their working or identified as $\angle EBF$ on the diagram then award M1A1 ignoring any contradiction
		Alternate angles **Angle**(s) on a straight **line** **Angle(**s) in a **triangle** add to 180° **Co-interior** angles or/ **allied** angles add up to 180°			B1 dep the method mark being awarded For a correct reason relevant to their method with the words in bold. Allow Alt and $\triangle$ for 'triangle' and $\angle$ for 'angle'
					Total 3 marks

Question		Working	Answer	Mark	Notes
8	(a)		11	1	B1
	(b)	4 6 10 11 11 15 19 24 25 28 or $\frac{11+15}{2}$		2	M1 for arranging all 10 numbers in order (this may be seen anywhere in the question) or for identifying 11 and 15 or for a correct calculation
			13		A1
		cas			***Total 3 marks***

Question		Working	Answer	Mark	**Notes**
9	(a)	$5y-3y<20$ or $2y<20$ oe		2	M1 for correctly isolating y terms and constant terms. May be the wrong inequality sign or an = sign Also allow for a critical value of 10 oe eg 20/2 with incorrect sign
			$y<10$		A1 cas condone use of x Allow for $y < 10$ or $y < 20/2$ even if a final answer of 10 is given Allow $[-\infty,10)$ or $(-\infty,10)$
	(b)			1	B1 filled in circle with single horizontal line going to 5 or if it doesn't reach 5 it must have an arrow on.
		cas			***Total 3 marks***

Question		Working	Answer	Mark	Notes
10		$624\times1.28\left[=798.72\right]$ **or** $224\times1.28\left[=286.72\right]$ **or** $\frac{448}{1.28}\left[=350\right]$		3	M1 A correct method used to change currency Allow embedded if all amounts that are being multiplied or divided by 1.28 are in the same currency eg $(624-224)\times1.28\left[=512\right]$ or $(624+224)\times1.28\left[=1085.44\right]$ Implied by the values 798.72 or 800 or 799 or 286.72 or 290 or 287 or 512 or 350
		In American Dollars: $448+d=\text{"798.72"}-\text{"286.72"}$ oe eg $448+d=1.28\times624-1.28\times224$ or $\left[d=\right]\text{"798.72"}-\text{"286.72"}-448$ **or** In GBP $\text{"350"}+d=624-224$ oe			M1 dep on previous M1 mark awarded. An equation or method to find the delivery cost in $ or £ (the equation must have all values in the same currency) Allow use of their values rounded to minimum of 2 sf eg 800, 799, 290, 287. Implied by (£)50 or ($)64
			64		A1 cao
		cas			***Total 3 marks***

Question		Working	Answer	Mark	Notes
11		$\tan(6)=\frac{h}{1500}$ or $\tan(6)=\frac{h}{1.5}$ oe $\tan(84)=\frac{1500}{h}$ or $\tan(84)=\frac{1.5}{h}$ oe $\frac{\sin(6)}{h}=\frac{\sin(84)}{1.5}$ or $\frac{\sin(6)}{h}=\frac{\sin(84)}{1500}$ oe		3	M1 for a correct equation to find the height in m or km Condone an incorrect conversion from 1.5 km to 1500 m
		$[h=]1500\tan(6)[=157.656...]$ or or $[h=]1.5\tan(6)$ [= 0.1576…] oe or $[h=]\frac{1.5}{\tan(84)}$ [= 0.1576...] oe or $[h=]\frac{1500}{\tan(84)}$ [=157.656..] oe or $[h=]\frac{1.5\times\sin(6)}{\sin(84)}$ oe or $[h=]\frac{1500\times\sin(6)}{\sin(84)}$ oe			M1 for a correct expression for the height in metres or km or awrt 160 or awrt 0.16 provided it is not from an incorrect working Allow use of tan6 = 0.105 or 0.11 or more accurate Allow use of tan84 = 9.5(1…) or more accurate Allow use of sin6 = 0.104(5…) or more accurate Allow use of sin84 = 0.99(4…) or more accurate Condone an incorrect conversion from 1.5 km to 1500 m
			158		A1 awrt 158 or awrt 157 provided it is not from incorrect working NB 1500sin6 = 156.(7…) is from incorrect working and worth 0 marks NB: When 6 is misread as 60 award M2 for awrt 2600 or awrt 2.6 provided they are not from incorrect working
		cas			***Total 3 marks***

Question		Working	Answer	Mark	Notes
12		$\sqrt{\frac{900}{25}}\left[=6\right]$ or $\sqrt{\frac{25}{900}}\left[=\frac{1}{6}\right]$ or $25\times x^2=900$ or $\sqrt{900}:\sqrt{25}$ oe or $\left(\frac{900}{25}\right)^3=\left(\frac{V}{50}\right)^2$		3	M1 for a correct expression to find a linear SF or a correct equation in x^2 or allow sf written as a correct ratio or for a correct equation in terms of V
		$50\times(\text{"6"})^3$ or $\frac{50}{\left(\text{"}\frac{1}{6}\text{"}\right)^3}$ or $\sqrt{\left(\frac{900}{25}\right)^3\times 50^2}$ oe			M1 dep on previous method mark awarded for a correct method to find the volume. ft their SF if it comes from correct working
			10 800		A1 cao do not isw
		cas			***Total 3 marks***

Question		Working	Answer	Mark	Notes	
13		$40\times1.3\left[=52\right]$ or $22\times0.5\left[=11\right]$ oe		4	M1 correct method to find the distance travelled for one part of the trip eg $\frac{40}{60}\times78\left[=52\right]$ or $\frac{22}{60}\times30\left[=11\right]$	M3 for $\frac{40\times78+22\times30}{78+30}$
		$40\times1.3+22\times0.5\left[=63\right]$ oe			M1 dep on previous method mark awarded correct method to find total distance travelled eg $\frac{40}{60}\times78+\frac{22}{60}\times30\left[=63\right]$ Allow $40\times m+22\times0.5$ where $1<m<1.5$	
		$\frac{"63"}{1.3+0.5}$ or $\frac{"63"}{78+30}\times60$ oe			M1 dep on the previous method mark awarded correct method to find speed Allow $\frac{"63"}{m+0.5}$ where $1<m<1.5$ and m is the same value for total distance and speed	
			35		A1 cao NB: Accept 60 + 18 for 78 throughout	
		cas				***Total 4 marks***

Question		Working	Answer	Mark	Notes
14		$1\times7+3\times8+5\times6+7\times5+9\times4$ $[=132]$		4	M2 for at least 3 correct products using midpoints (need not be evaluated but must be added) Allow 7 + 24 + 30 + 35 + 36 or seeing 132 If not M2 then award: M1 for at least 3 products using frequency and a value within the interval with intention to add. Condone use of the lower class bound and upper class bound **or** at least 3 correct products using midpoints without adding. [lower bound products are 0, 16, 24, 30, 32 upper bound products are 14, 32, 36, 40, 40]
		$\frac{"132"}{30}$			M1 dep on M1 for dividing by 30 Allow 7 + 8 + 6 + 5 + 4 for 30
			4.4		A1 oe
		cas			***Total 4 marks***

Question		Working	Answer	Mark	Notes. Condone missing arrows throughout
15		$\left[\ \left\|OB\right\| = \right]\sqrt{(-4)^2+2^2}\left[=\sqrt{20}\right]$ or $\left[\ \left\|AC\right\| = \right]\sqrt{(-4k)^2+(2k)^2}\left[=\sqrt{20}k\right]$ oe eg $\left[\ \left\|AC\right\| = \right]\sqrt{16k^2+4k^2}\left[=\sqrt{20}k\right]$		4	M1 correct method to find $\left\|OB\right\|$ or $\left\|AC\right\|$ or OB^2 or AC^2 Condone missing brackets around the –4 or – 4k Implied by $\overrightarrow{AC}=\begin{pmatrix}-10\\5\end{pmatrix}$ or $\overrightarrow{OC}=\begin{pmatrix}-11\\10\end{pmatrix}$
		$\sqrt{125}=k"\sqrt{20}"$oe eg $125=\lambda"20"$oe			M1 for using $\overrightarrow{AC}=k\overrightarrow{OB}$ or $\|\overrightarrow{AC}\|=k\|\overrightarrow{OB}\|$ ft $\|\overrightarrow{OB}\|$ if clearly labelled or comes from $\sqrt{(-4)^2+2^2}$ Allow for $\overrightarrow{AC}=k\begin{pmatrix}-4\\2\end{pmatrix}$ or $\sqrt{125}=k\begin{pmatrix}-4\\2\end{pmatrix}$ Implied by 2.5 oe or 0.4 oe or 6.25 oe or 0.16 oe or $\overrightarrow{AC}=\begin{pmatrix}-10\\5\end{pmatrix}$ or $\overrightarrow{OC}=\begin{pmatrix}-11\\10\end{pmatrix}$
		$\overrightarrow{BC}=\begin{pmatrix}4\\-2\end{pmatrix}+\begin{pmatrix}-1\\5\end{pmatrix}\pm\frac{\sqrt{125}}{"\sqrt{20}"}\begin{pmatrix}-4\\2\end{pmatrix}$ or $\overrightarrow{BC}=\begin{pmatrix}4\\-2\end{pmatrix}+\begin{pmatrix}-1\\5\end{pmatrix}\pm"\begin{pmatrix}-10\\5\end{pmatrix}"$			M1 dep on both previous marks for a correct method to find $\overrightarrow{BC}$ If working shown allow $\overrightarrow{BC}=\begin{pmatrix}4\\-2\end{pmatrix}+\begin{pmatrix}-1\\5\end{pmatrix}\pm"k"\begin{pmatrix}-4\\2\end{pmatrix}$ or $\overrightarrow{BC}=\begin{pmatrix}3\\3\end{pmatrix}\pm"k"\begin{pmatrix}-4\\2\end{pmatrix}$ $\overrightarrow{BC}=\begin{pmatrix}4\\-2\end{pmatrix}+\begin{pmatrix}-1\\5\end{pmatrix}\pm"\sqrt{\lambda}"\begin{pmatrix}-4\\2\end{pmatrix}$ or $\overrightarrow{BC}=\begin{pmatrix}3\\3\end{pmatrix}\pm"\sqrt{\lambda}"\begin{pmatrix}-4\\2\end{pmatrix}$ Do not allow misreads of signs $\overrightarrow{BO}$ and $\overrightarrow{OA}$ Implied by $\begin{pmatrix}13\\-2\end{pmatrix}$ or $\begin{pmatrix}-7\\8\end{pmatrix}$

			$\begin{pmatrix}-7\\8\end{pmatrix}$		A1 dep on at least 2 previous marks awarded. condone $\begin{pmatrix}13\\-2\end{pmatrix}$ (from $k = -2.5$) not being eliminated.
		cas			***Total 4 marks***
		ALT			
		$\left[\lvert AC\rvert^2 =\right](c-3)^2+(d-3)^2=125$ oe $(x+1)^2+(y-5)^2=125$ oe			M1 correct method to find $\lvert AC\rvert$ or AC^2 in terms of c and d or correct method to find the equation of a circle with centre A and radius $\sqrt{125}$ where $\overrightarrow{OC}=\begin{pmatrix}x\\y\end{pmatrix}$ (allow any letter for x and y including c and d and allow any letter for c and d)
		eg $\frac{d-3}{c-3}=-\frac{2}{4}$ oe or $\frac{y-5}{x+1}=-\frac{2}{4}$ oe			M1 for correct method to find the equation of the line CD This mark and the previous may be awarded in either order
		eg $(6-2d)^2+(d-3)^2=125$ oe $(c-3)^2+\left(-\frac{1}{2}c+\frac{9}{2}-3\right)^2=125$ oe or $(10-2y)^2+(y-5)^2=125$ oe $(x+1)^2+\left(-\frac{1}{2}x+\frac{9}{2}-5\right)^2=125$ oe			M1 dep on both previous marks for correctly substituting their rearranged linear equation into the non linear equation to form an equation in one variable
			$\begin{pmatrix}-7\\8\end{pmatrix}$		A1 dep on at least 2 previous marks awarded. condone $\begin{pmatrix}13\\-2\end{pmatrix}$ not being eliminated.

Question		Working	Answer	Mark	Notes
16		$\frac{120}{360}\times 2\pi r = 17.2$ oe eg $\frac{2\pi r}{3} = 17.2$		4	M1 setting up a correct equation to find r Allow π to be 3 or better for this mark
		$[r =]\frac{17.2}{\frac{120}{360}\times 2\pi}[= 8.2123...]$ oe eg $[r =]\frac{17.2}{\frac{2\pi}{3}}[= 8.2123...]$ or $[2r =]\frac{17.2}{\frac{120}{360}\times \pi}[= 16.4247...]$ oe			M1 fully correct method to find r or $2r$ Implies the previous method mark Implied by r = 8(.2123…) rounded or truncated to 1sf or $r = \frac{25.8}{\pi}$ or $2r$ = 16(.4247…) rounded or truncated to 2sf unless from obvious incorrect working Allow π to be 3 or better for this mark
		Area = $\frac{120}{360}\times\pi\times"8.2123..."^2$ oe eg Area = $\frac{1}{3}\pi\times\left(\frac{17.2}{2\pi/3}\right)^2$			M1 (indep) Accept any value of r except 17.2 used correctly in the area formula for the sector (must show substitution into correct formula if r is incorrect) Allow π to be 3 or better for this mark
			70.6		A1 awrt 69 or awrt 70 or awrt 71
		cas			***Total 4 marks***

Question		Working	Answer	Mark	Notes
17				4	B1 for an answer of $13+\sqrt{175}$
		$\frac{4+2\sqrt{7}}{3-\sqrt{7}}\times\frac{3+\sqrt{7}}{3+\sqrt{7}}$			M1 For multiplying the numerator and denominator by $3+\sqrt{7}$
		$\frac{12+6\sqrt{7}+4\sqrt{7}+14}{9-7}$			M1 dep on the previous mark being awarded. For expanding numerator (2, 3 or 4 terms) and/or denominator (1 or 2 or 4 terms) where either or both are correct (the numerator terms and the denominator terms do not need to be seen in a fraction)
			$13+\sqrt{175}$		A1 dependent on both previous method marks and no errors seen when expanding numerator and denominator for $13+5\sqrt{7}$ or $13+\sqrt{175}$
		wr			***Total 4 marks***
					No marks for $\left[\frac{4+2\sqrt{7}}{3-\sqrt{7}}=\right]13+5\sqrt{7}$ B1 only for $\left[\frac{4+2\sqrt{7}}{3-\sqrt{7}}=13+5\sqrt{7}=\right]13+\sqrt{175}$ M1 only for $\frac{4+2\sqrt{7}}{3-\sqrt{7}}\times\frac{3+\sqrt{7}}{3+\sqrt{7}}=13+5\sqrt{7}$ B1M1 only for $\frac{4+2\sqrt{7}}{3-\sqrt{7}}\times\frac{3+\sqrt{7}}{3+\sqrt{7}}=\left[13+5\sqrt{7}=\right]13+\sqrt{175}$ B0M2A1 for $\frac{4+2\sqrt{7}}{3-\sqrt{7}}\times\frac{3+\sqrt{7}}{3+\sqrt{7}}=\frac{26+10\sqrt{7}}{2}=13+5\sqrt{7}$ B1M2A1 for $\frac{4+2\sqrt{7}}{3-\sqrt{7}}\times\frac{3+\sqrt{7}}{3+\sqrt{7}}=\frac{26+10\sqrt{7}}{2}=\left[13+5\sqrt{7}=\right]13+\sqrt{175}$

Question		Working	Answer	Mark	Notes
18	(a)		128	2	B1 may be on the diagram If 128 is on the answer line or identified as $\angle ADC$ in the working or on the diagram then award B1 ignoring any contradiction
		Opposite angles of a **cyclic quad**rilateral add to 180 º **or** if $\angle AOC$ has been found at any point (including in part b) **Angle** at the **centre** is **2 ×** (double) angle at **circumference / angle** at **circumference** is ½ angle at **centre** **AND** **Angle**s around a **point** add up to 360°			B1 dep on previous B mark being awarded for all reasons related to their method Require the words in bold Condone **opposite** sides / vertices of **cyclic quad**rilateral Allow ∠ for 'angle'
	(b)	$[\angle AOC =]2\times 52[=104]$ **and** 360 – 104 **or** "128"× 2		3	M1 follow through their answer to part (a)
			256		A1 follow through their answer to part (a) may be on the diagram If 256 is on the answer line or identified as the reflex $\angle AOC$ or identified as x in the working or on the diagram then award M1A1 ignoring any contradiction
		Angle at the **centre** is **2 ×** (double) angle at **circumference / angle** at **circumference** is ½ angle at **centre** **or** **Angle**s around a **point** add up to 360°			B1 dep on M1 for one reason related to their method Require the words in bold Allow ∠ for 'angle'
		cas			***Total 5 marks***

Question		Working	Answer	Mark	Notes
19	(a)	eg 27×10^{204}		2	M1 For a correct answer in the form $a\times10^{n}$ or $3.6\times7.5\times10^{103+101}$ or $27\times10^{103+101}$ (isw)
			2.7×10^{205}		A1 cas
	(b)	$\frac{1}{\left(4\times10^{-8n}\right)^{1/2}}$ or $\frac{1}{\sqrt{4\times10^{-8n}}}$ or $\frac{1}{2\times10^{-4n}}$ **or** 10^{4n} or $10^{8n/2}$ or $\frac{1}{\left(10^{-8n}\right)^{\frac{1}{2}}}$ or $10^{-8n\times-\frac{1}{2}}$		3	M1 for $\frac{1}{\left(4\times10^{-8n}\right)^{1/2}}$ or $\frac{1}{\sqrt{4\times10^{-8n}}}$ or $\frac{1}{2\times10^{-4n}}$ **or** 10^{4n} or $10^{8n/2}$ or $\frac{1}{\left(10^{-8n}\right)^{\frac{1}{2}}}$ or $10^{-8n\times-\frac{1}{2}}$ may be seen embedded This mark is not awarded simply for $4^{-\frac{1}{2}}$ or 0.5 oe
		Eg 0.5×10^{4n} or $\frac{10^{4n}}{2}$			A1 Allow for a correct answer written in any form provided we have 10^{4n} or $10^{8n/2}$ Allow 2^{-1} for 0.5 or $\frac{1}{2}$ but do not allow $4^{-0.5}$
			$5\times10^{4n-1}$		A1 both correct Accept $5\times10^{\frac{8n}{2}-1}$
		cas			***Total 5 marks***

Question		Working	Answer	Mark	Notes
20	(a)	$x+x+(x+8)+(x+8)$		2	M1 for $4x + 16$ oe Allow for a correct answer (that is not their final answer) seen within the working
			$4x+16$		A1 Allow factorised forms eg $4(x+4)$ or $2(2x+8)$ Do not ISW
	(b)	$(x+10)(x-2)$		2	M1 Must be in the form $(x + a)(x + b)$ and multiply out to give at least 2 correct terms
			$(x+10)(x-2)$		A1 ignore any subsequent solving
	(c)		$x>"2"$	1	B1 for $x>2$ or follow through their part (b) but factorised form must have only one positive critical value and only one region must be given Condone $x\geq"2"$
		cas			***Total 5 marks***

Question		Working	Answer	Mark	Notes
21		**8.5**, 9.5, **6.25**, 6.75, 5075, **5085**, **10.45**,10.55		5	B1 for one correct LB or UB seen or used.
		$V=\frac{1}{3}xyh$ where $8.5 \leqslant x \leqslant 9.5$ and $6.25 \leqslant y \leqslant 6.75$ eg $[V=]\frac{1}{3}\times 8.5\times 6.25\times h\left[=\frac{425}{24}h\right]$ **or** $V=\frac{m}{d}$ where $5075 \leqslant m \leqslant 5085$ and $10.45 \leqslant d \leqslant 10.55$ eg $[V=]\frac{5085}{10.45}[=486.6028708]$ May be embedded eg $10.45=\frac{5085}{\frac{1}{3}\times 8.5\times 6.25\times h}$			M1 for correct method to find an expression for the volume (will be in terms of h) using the formula $V=\frac{1}{3}xyh$ or for a correct method to find the volume using $V=\frac{m}{d}$
		$[h=]\frac{m}{\frac{1}{3}xyd}$ or $d=\frac{m}{\frac{1}{3}xyh}$ where $5080 < m \leqslant 5085$ and $8.5 \leqslant x < 9$ and $6.25 \leqslant y < 6.5$ and $10.45 \leqslant d < 10.5$ eg $[h=]\frac{5085}{\frac{1}{3}\times 8.5\times 6.25\times 10.45}$ or $10.45=\frac{5085}{\frac{1}{3}\times 8.5\times 6.25\times h}$			M1 dep on the previous mark being awarded correct expression for h or a correct formula used and knowing where to use an upper bound and where to use a lower bound
		eg $[h=]\frac{5085}{\frac{1}{3}\times 8.5\times 6.25\times 10.45}$			M1 dep on the previous mark being awarded. For a correct formula for h with at least two correct bounds used in the right place

			$\frac{5085}{\frac{1}{3}\times 8.5\times 6.25\times 10.45} = 27.478...$		A1 dep on all previous marks being awarded for a correct calculation with the correct figures seen leading to awrt 27.5
	wr				***Total 5 marks***

Question		Working	Answer	Mark	Notes
22	(a)	fd = 4.8 or 4 or 6 or 2 oe seen by the table or in working or on the graph **or** for a correct frequency density on the FD axis where the height of one large square is 2 eg height of 10-15 bar is 4.8 **or** height of 15-25 bar is 4 **or** height of 25-35 bar is 6 **or** height of 35-55 bar is 0.8 **or** height of 55-65 bar is 2, (may be seen besides the table) **or** 1 small square = 0.2 oe **or** 1 medium square = 5 oe **or** 1 large square = 20 oe		2	M1 for use of area to work out frequency density. May be implied by a correct fd or a correct frequency per square(s) or a correct scale on the *y*-axis. Allow multiple of squares eg 2 large squares = 40
		$20\times0.8=16$			A1 shows that $y = 16$ eg $80\times0.2=16$ or $4\times0.8\times5=16$ or $2\times0.4\times20=16$ Allow verification eg 16 ÷ 20 = 0.8 **and** fd = 0.8 for the 35-55 group **OR** $0.8=\frac{y}{20}$ **and** $y = 16$ **and** fd = 0.8 for the 35-55 group
	(b)	$\frac{x+24}{x+24+40+60}=\frac{3}{8}$ oe eg $\frac{x+24}{x+124}=\frac{3}{8}$ or $\frac{40+60}{x+24+40+60}=\frac{5}{8}$ oe eg $\frac{100}{x+124}=\frac{5}{8}$		4	M1 Allow $\frac{x+24}{x+a}=\frac{3}{8}$ or $\frac{40+60}{x+a}=\frac{5}{8}$ where *a* is a positive integer eg $\frac{x+24}{x+160}=\frac{3}{8}$ or $\frac{40+60}{x+160}=\frac{5}{8}$ The denominator must be an expression with an unknown
		eg $8(x+24)=3(x+124)$ or $8x+192=3x+372$ or $800=5(x+124)$ or $800=5x+620$			M1 Allow any correct equation eg $\frac{x+24}{x+24+40+60}=\frac{3}{8}$ oe

					Can be implied by 36 provided not from an incorrect equation or incorrect working
		$x = 36$			A1 can be implied by a bar of height 18 small squares provided not from incorrect working
			Bar 18 small squares high		B1ft their x value provided x is an integer NB A bar of height 18 small squares and width 10 small squares is to be awarded all 4 marks if no working is seen or no incorrect working seen
		(a) wr (b) cas			***Total 6 marks***

Qu		Working	Ans	Mark	Notes
23		$[\mathbf{B}=]\begin{pmatrix} x & -8 \\ 1 & x \end{pmatrix}\begin{pmatrix} -\frac{1}{2} & -2 \\ 0 & 1 \end{pmatrix}$		5	M1 $\mathbf{BA}^{-1}$ and $\mathbf{A}$ matrices to be multiplied in correct order This may be implied by the second M1 Condone incorrect labelling
		$[\mathbf{B}=]\begin{pmatrix} -\frac{1}{2}x & -2x-8 \\ -\frac{1}{2} & -2+x \end{pmatrix}$ or $\left[\mathbf{B}^{-1}\right]=\begin{pmatrix} \frac{1}{-\frac{1}{2}x(-2+x)-\frac{1}{2}(2x+8)} \end{pmatrix}\times\begin{pmatrix} -2+x & 2x+8 \\ \frac{1}{2} & -\frac{1}{2}x \end{pmatrix}$			M1 correct method to multiply out the matrices with at least 2 elements correct. Condone incorrect labelling Condone missing brackets – mark clear intention (even if not recovered)
		eg $-\frac{1}{2}x(-2+x)-\frac{1}{2}(2x+8)=-6$ or $-\frac{1}{2}x(-2+x)--\frac{1}{2}(-2x-8)=-6$ or $-0.5x^2-4=-6$ or $\frac{1}{-\frac{1}{2}x(-2+x)-\frac{1}{2}(2x+8)}=-\frac{1}{6}$ oe			M1 for a correct equation in terms of x Condone missing brackets – mark clear intention (even if not recovered) NB Allow for $x=2$ and /or $x=-2$
		$\left[\mathbf{B}^{-1}=\right]-\frac{1}{6}\begin{pmatrix} -2+"2" & 2\times"2"+8 \\ \frac{1}{2} & -\frac{1}{2}\times"2" \end{pmatrix}$			M1ft dep on previous 3 M marks being awarded. Correct method to find 3 or 4 elements x -value subst into $\mathbf{B}$ or $\mathbf{B}^{-1}$ ft their x value Implied by a correct matrix NB For $x=-2$ $\left[\mathbf{B}^{-1}=\right]-\frac{1}{6}\begin{pmatrix} -2+"-2" & 2\times"-2"+8 \\ \frac{1}{2} & -\frac{1}{2}\times"-2" \end{pmatrix}\left[=-\frac{1}{6}\begin{pmatrix} -4 & 4 \\ \frac{1}{2} & 1 \end{pmatrix}\right]$
		$-\frac{1}{6}\begin{pmatrix} 0 & 12 \\ \frac{1}{2} & -1 \end{pmatrix}$			A1 oe dep on at least first 2 method marks awarded ignore any second matrix given.
		cas			***Total 5 marks***

Question		Working	Answer	Mark	Notes
24		$(4y-11)^2 = 9-(4y-11)y$ or $x^2 = 9 - x\left(\frac{11+x}{4}\right)$ $4\left(\frac{9-x^2}{x}\right) - x = 11$		6	M1 for substituting a rearranged linear equation into the correct non linear equation (or a rearranged non linear equation into the correct linear equation) to form an un-simplified equation in one variable – allow one sign error only in the rearranged equation. This mark can be implied by a correct equation (simplified or unsimplified) in terms of x or y eg $16y^2 - 88y + 121 = 9 - 4y^2 + 11y$
		$5x^2 + 11x - 36[=0]$ **or** $20y^2 - 99y + 112[=0]$			M1 dep on first M awarded for simplifying to a 3 term quadratic with least 2 terms correct (oe so look for signs reversed, does not need to equal zero eg allow $5x^2 + 11x = 36$ or $20y^2 = 99y - 112$)
		$(5x-9)(x+4)[=0]$ **or** $(5y-16)(4y-7)[=0]$			M1 dep on first M awarded for correct method to solve their three term quadratic. If the quadratic is correct then the method is implied by $x = 1.8$ and $x = -4$ or $y = 3.2$ and $y = 1.75$ (condone incorrect labelling) Working must be shown if their quadratic is incorrect to gain this method mark. If factorising must multiply out to give 2 correct terms. Allow use of formula with one sign error $[x=]\ \frac{-27 \pm \sqrt{27^2 - 4\times 3\times(-188)}}{2\times 3}$. Allow completing the square with one sign error only
		$x = \frac{9}{5}$ or $x = -4$ or $y = \frac{16}{5}$ or $y = \frac{7}{4}$			A1 oe dep on a correct quadratic Correct values for x or for y (condone incorrect labelling)
		eg $4\times 3.2 - x = 11$ or $4(1.75) - x = 11$ or $4y - 1.8 = 11$ or $4y + 4 = 11$			M1 dep on first M mark awarded Subst at least one of their values of x or y into a correct equation or their rearranged equation (condoning one sign error) or starting again and giving a correct unsimplified equation for the relevant variable. If values of x or y are incorrect then working must be shown

					Implied by a correct pair of values Condone substitution of y values for x provided these have been labelled as x	
			$x=\frac{9}{5}$ $y=\frac{16}{5}$ and $x=-4$ $y=\frac{7}{4}$		A1 oe dependent on 2 M marks awarded. For both pairs correct. Must be clearly paired up eg $x=\frac{9}{5}$ and $x=-4$ and $y=\frac{16}{5}$ and $y=\frac{7}{4}$	$\left(\frac{9}{5},\frac{16}{5}\right)\left(-4,\frac{7}{4}\right)$
		wr				***Total 6 marks***

Question		Working	Ans	Mark	Notes
25		$[AC =]\sqrt{6^2+6^2}\left[=\sqrt{72}=6\sqrt{2}=8.4852...\right]$ oe or $\left[\frac{1}{2}AC=\right]\frac{1}{2}\sqrt{6^2+6^2}\left[=3\sqrt{2}=4.2426...\right]$		5	M1 A correct method to find AC or $\frac{1}{2}AC$ May be seen embedded when finding another length eg $[XA=]"7\sqrt{2}"-6\sqrt{2}$ where $"7\sqrt{2}"$ is the candidate's value for XC **This mark and the following mark can be awarded in either order**
		$[XC =]\sqrt{134-6^2}$ $\left[=\sqrt{98}=7\sqrt{2}=9.8994....\right]$ oe or $\left[\frac{1}{2}XC=\right]\frac{1}{2}\sqrt{134-6^2}$ $\left[=\frac{1}{2}\sqrt{98}=\frac{7\sqrt{2}}{2}=4.9497...\right]$ oe			M1 A correct method to find XC or $\frac{1}{2}XC$ May do in two steps using trigonometry eg $\sin\theta=\frac{6}{\sqrt{134}}\rightarrow\theta=31.21...$ and $\sqrt{134}\cos 31.21=9.8994...$ oe or $\cos\theta=\frac{6}{\sqrt{134}}\rightarrow\theta=58.78...$ and $\sqrt{134}\cos 58.78=9.8994...$ oe May be seen embedded when finding another length eg $[XA=]7\sqrt{2}-"6\sqrt{2}"$ where $"6\sqrt{2}"$ is the candidate's value for AC **This mark and the previous mark can be awarded in either order**
		$[XA=]"7\sqrt{2}"-"6\sqrt{2}"\left[=\sqrt{2}=1.414...\right]$ oe or $[XY=]"6\sqrt{2}"+2\times\left("7\sqrt{2}"-"6\sqrt{2}"\right)$ $\left[=8\sqrt{2}=11.3137...\right]$ oe or $\left[\frac{1}{2}XY=\right]\frac{1}{2}"6\sqrt{2}"+\left("7\sqrt{2}"-"6\sqrt{2}"\right)$ $\left[=4\sqrt{2}=5.6568...\right]$ oe			M1 A correct method to find XA or XY or $\frac{1}{2}XY$ ft their AC and XC provided they are clearly labelled or from correct working If XA or XY or $\frac{1}{2}XY$ are correct then this implies the previous method marks

		eg $\frac{6}{\sqrt{2}}=\frac{h-6}{3\sqrt{2}}$ oe eg $\frac{6}{1.4(1...)}=\frac{h-6}{4.2(4...)}$ oe or $\frac{h-6}{6\sqrt{2}}=\frac{h}{8\sqrt{2}}$ oe eg $\frac{h-6}{8.4(5...)}=\frac{h}{11.3(1...)}$ oe or $\frac{h-6}{3\sqrt{2}}=\frac{h}{4\sqrt{2}}$ oe eg $\frac{h-6}{4.2(4...)}=\frac{h}{5.6(5...)}$ oe or $\frac{h}{4\sqrt{2}}=\frac{6}{\sqrt{2}}$ oe eg $\frac{h}{5.6(5...)}=\frac{6}{1.4(1...)}$ oe			M1 A fully correct equation set up to enable h (or $h-6$) to be found Allow x in place of $h-6$ and $x+6$ in place of h which will lead to $x = 18$ eg $\frac{6}{\sqrt{2}}=\frac{x}{3\sqrt{2}}$ or $\frac{x}{6\sqrt{2}}=\frac{x+6}{8\sqrt{2}}$ oe May do in two steps using trigonometry eg $\tan\theta=\frac{6}{\sqrt{2}}\rightarrow\theta=76.73...$ and $\tan 76.73=\frac{h}{4\sqrt{2}}$ eg $\tan\theta=\frac{\sqrt{2}}{6}\rightarrow\theta=13.26...$ and $\tan 13.26=\frac{4\sqrt{2}}{h}$ Allow decimals to at least 1 dp condone truncation eg $\frac{h-6}{4.2}=\frac{h}{5.6}$
			24		A1 dep on the first 3 method marks awrt 24
		cas			***Total 5 marks***
		ALT			
		$[AC=]\sqrt{6^2+6^2}$ or $\left[\frac{1}{2}AC=\right]\frac{1}{2}\sqrt{6^2+6^2}$			M1 A correct method to find AC or $\frac{1}{2}AC$
		$[XY=]\frac{h}{h-6}"\sqrt{6^2+6^2}"$ $\left[\frac{1}{2}XY=\right]\frac{h}{h-6}"\sqrt{3^2+3^2}"$ or			M1 a correct method to find XY or $\frac{1}{2}XY$
		$[XC=]\sqrt{"3^2+3^2"}+"\frac{h}{h-6}\sqrt{3^2+3^2}"$			M1 a correct method to find XC
		$134=6^2+\left("\sqrt{3^2+3^2}+\frac{h}{h-6}\sqrt{3^2+3^2}"\right)^2$ $13h^2-372h+1440=0$			M1 A fully correct equation set up to enable h to be found (which may be a correct 3 term quadratic)
			24		A1 dep on the first 3 method marks awrt 24 need to discard the 4.61(5…)

Question		Working	Answer	Mark	Notes	
26	(a)		5.5	1	B1 oe	
	(b)	3 or $y=3$ or $y>3$ or $y<3$ or $y\geqslant 3$ or $y\leqslant 3$		2	M1 for realising 3 is the bound. Allow no letter or any letter including x	
			$y>3$		A1 cas For y allow g or g(x) Do **not** allow $x>3$	
	(c)	$yx-3x=-5$ or $xy-3y=-5$ or $y-3=-\frac{5}{x}$ or $x-3=-\frac{5}{y}$		3	M1 multiply through by x (or y) and collect terms in x (or y) on one side or subtract 3 from both sides to isolate the terms in x (or y) look for signs reversed (Allowing x and y interchanged or use of other letters)	Condone one sign error throughout
		$x(y-3)=-5$ or $y(x-3)=-5$			M1 dep on first M awarded take x out as a common factor or multiply throughout by x (or y) look for signs reversed (Allow x and y interchanged or use of other letters) Implied by a correct answer (that is not their final answer) seen within the working)	
			$\left[g^{-1}:x\mapsto\right]\frac{-5}{x-3}$		A1oe eg $\frac{5}{3-x}$ Must be in terms of x. Do not isw	
	(d)	$\left[\text{gh}:x\mapsto\right]\ 3-\frac{5}{2/2x-3}$		2	M1 Allow $3-\frac{5(2x-3)}{2}$ oe Read $2/2x-3$ as $\frac{2}{2x-3}$	
			$\frac{-10x+21}{2}$		A1 condone the fraction line not being under the – in the $-10x$	
		cas				***Total 8 marks***

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