Pearson Edexcel

Mark Scheme (Results)

January 2023

Pearson Edexcel International GCSE
In Mathematics A (4MA1) Paper 2HR

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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 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, mark the method that leads to the answer on the answer line; where no answer is given on the answer line, award the lowest mark from the methods shown.

  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.

International GCSE Maths

Apart from Questions 1, 11, 15a, 19, 21, 22 the correct answer, unless clearly obtained by an incorrect method, should be taken to imply a correct method

Q	Working	Answer	Mark	Notes
1	eg $\frac{14}{3}$ **and** $\frac{11}{6}$		3	M1 for both mixed numbers expressed as improper fractions
	eg $\frac{14}{3}\times\frac{6}{11}$ **or** $\frac{28}{6}\div\frac{11}{6}$ **or** $\frac{28n}{6n}\div\frac{11n}{6n}$			M1 seeing this stage gains M2
	eg $\frac{14}{3}\times\frac{6}{11}=\frac{84}{33}=\frac{28}{11}=2\frac{6}{11}$ **or** $\frac{14}{3}\times\frac{6}{11}=\frac{84}{33}=2\frac{18}{33}=2\frac{6}{11}$ **or** $\frac{14}{\cancel{3}^{1}}\times\frac{\cancel{6}^{2}}{11}=\frac{28}{11}=2\frac{6}{11}$ **or** $\frac{14}{3}\div\frac{11}{6}=\frac{28}{6}\div\frac{11}{6}=\frac{28}{11}=2\frac{6}{11}$ **or** correct working to $\frac{28}{11}$ **and** writing $2\frac{6}{11}=\frac{28}{11}$ *Working required*	Shown		A1 dep on M2 for conclusion to $2\frac{6}{11}$ from correct working – either sight of result of multiplication eg $\frac{84}{33}$ must be seen or correct cancelling to $\frac{28}{11}$ or complete method using division and common denominators
				Total 3 marks

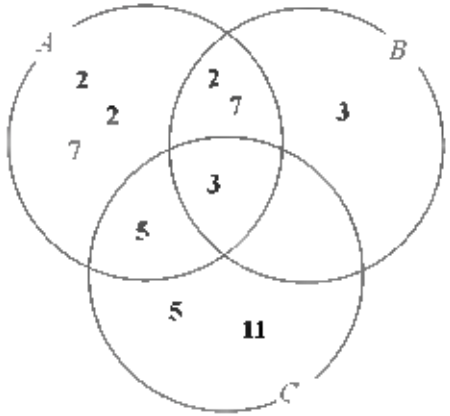
2	(a)		Triangle drawn at (−1, −3) (−1, −4) (−3, −3)	2	B2	for a correct triangle with correct orientation and position If not B2 then award B1 for a correct triangle drawn with correct orientation in wrong position or triangle drawn with 2 out of 3 correct vertices
	(b)		Triangle drawn at (−4, 4) (−4, 5) (−2, 4)	1	B1	cao
						Total 3 marks

3	(a)		−3, −2, −1, 0, 1	2	B2	for −3, −2, −1, 0, 1 If not B2 then award B1 for 4 correct values and no incorrect values (eg −3, −2, −1, 0) **or** for 6 values with no more than one incorrect value (eg −4, −3, −2, −1, 0, 1)
	(b)		$x > -1$	1	B1	accept $-1 < x$
						Total 3 marks

4		Fully correct angle bisector with all relevant arcs shown	2	B2	for a fully correct angle bisector with all relevant arcs shown If not B2 then B1 for all arcs and no angle bisector drawn or for a correct angle bisector within the guidelines but no correct arcs or insufficient correct arcs
					Total 2 marks

5	<table><tr><td>*x*</td><td>−2</td><td>−1</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>*y*</td><td>10</td><td>7.5</td><td>5</td><td>2.5</td><td>0</td><td>−2.5</td><td>−5</td></tr></table>	Correct line	3	B3	for a correct line between $x = -2$ and $x = 4$ If not B3 then award B2 for a line segment through at least 3 of (−2, 10), (−1, 7.5), (0, 5), (1, 2.5), (2, 0), (3, −2.5), (4, −5) **or** all points plotted correctly If not B2 then award B1 for at least 2 correct points plotted or stated (may be seen in a table) **or** for a line drawn with a negative gradient through (0, 5) **or** for a line with a gradient of −2.5
					Total 3 marks

6	eg $\frac{x+7}{80}=\frac{1}{4}$ **or** $4(x+7)=80$ **or** $x+7=20$		4	M1	for setting up a correct equation in terms of x only
	eg $x=80\times\frac{1}{4}-7\ (=13)$ **or** $4x+28=80$ **and** $x=\frac{80-28}{4}\ (=13)$ **or** $x = 13$			M1	for a complete method to find the value of x **or** $x = 13$. Award of this mark implies M2.
	eg $80-("13"+7+"13"-11+3\times"13")(=19)$ **or** $\frac{"13"+7+"13"-11+3\times"13"}{80}\left(=\frac{61}{80}\right)$			M1	for a method to find the number of yellow counters **or** P(R or B or G)
	Correct answer scores full marks (unless from obvious incorrect working)	$\frac{19}{80}$		A1	oe eg accept 0.2375 or 23.75% or 0.237 or 23.7% or 0.238 or 23.8% or 0.24 or 24%
					Total 4 marks

<table>
<tr><td>7 (a)</td><td>$2\times2\times2\times5\times5$ or 2, 2, 2, 5, 5 or $2\times2\times3\times5\times7$ or 2, 2, 3, 5, 7 or eg
<table>
<tr><td>2</td><td>200</td><td>420</td></tr>
<tr><td>2</td><td>100</td><td>210</td></tr>
<tr><td>5</td><td>50</td><td>105</td></tr>
<tr><td></td><td>10</td><td>21</td></tr>
</table></td><td></td><td rowspan="2">2</td><td>M1</td><td>for one number written as a product of prime factors or prime factors listed – numbers may be at end of factor trees or on ‘ladder diagrams’ or in a table or in a Venn diagram
or
at least two factors for each (excluding 1, 200, 420)</td></tr>
<tr><td></td><td>Correct answer scores full marks (unless from obvious incorrect working)</td><td>20</td><td>A1</td><td>or $2^2\times5$ oe</td></tr>
<tr><td></td><td>(b)</td><td> 
</td><td></td><td rowspan="2">2</td><td>M1</td><td>for $2^m\times3^n\times5^p\times7^q\times11^r$ with at least three of $m = 3$, $n = 2$, $p = 2$, $q = 2$, $r = 1$ (all 5 terms should be seen) or omission of one term with others fully correct
OR prime factors seen in a Venn diagram – if so must be fully correct</td></tr>
<tr><td></td><td>Correct answer scores full marks (unless from obvious incorrect working)</td><td>$2^3\times3^2\times5^2\times7^2\times11$</td><td>A1</td><td>allow 970 200 oe</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td>Total 4 marks</td></tr>
</table>

8	55×32 (= 1760) **or** 52×28 (= 1456) **or** $55 \times 32 + 52 \times 28$ (= 3216)		3	M1	for one correct product or method to find the total mark for both classes
	eg $\frac{"1760"+"1456"}{32+28}$ **or** $\frac{3216}{60}$			M1	for a complete method
	Correct answer scores full marks (unless from obvious incorrect working)	53.6		A1	
					Total 3 marks

9	(a)	for 0.04 × 2000 oe (= 80) **or** 1.04 × 2000 oe (= 2080)	**OR**		3	M1	for finding 4% **or** 104% of 2000	**OR** M2 for 2000×1.04^3 oe **or** 2000×1.04^4 oe (= 2339.72)
		1.04 × "2080" oe (= 2163.2) 1.04 × "2163.2" oe	2000×1.04^3 oe			M1	for completing method to find total amount in the account at the end of 3 years	
		Correct answer scores full marks (unless from obvious incorrect working)		2250		A1	accept 2249 – 2250	
							SC: if no other marks gained award M1 for 0.12 × 2000 oe **or** 240 **or** 1.12 × 2000 oe **or** 2240 accept (1 + 0.04) as equivalent to 1.04 throughout	
	(b)	eg 1365 ÷ (1 − 0.09) **or** 1365 ÷ 0.91			3	M2	for a complete method	
						(M1)	for 1365 ÷ (100 − 9) (= 15) **or** (100 − 9)% = 1365 **or** 91% = 1365 **or** eg (1 − 0.09)*T* = 1365 **or** eg *T* – 0.09*T* = 1365	
		Correct answer scores full marks (unless from obvious incorrect working)		1500		A1		
								Total 6 marks

10	eg $\pi \times 3^2 \times 7$ (= 63π or 197.9…)		3	M1	for method to find the volume of Solid **A**
	eg $\frac{2000}{[\text{vol A}]}$ **or** $\frac{3375}{450}$ (= 7.5 oe) **or** $\frac{2000+3375}{[\text{vol A}]+450}$			M1	(indep) for method to find the density of Solid **A**, **B** or **C,** allow use of their volume for Solids **A** and **C**
	Correct answer scores full marks (unless from obvious incorrect working)	8.3		A1	accept 8.29 – 8.31
					Total 3 marks

11	*SCD* = 128° **or** *BCS* = 32° **or** *TSC* = 180 – 128 (= 52)		4	M1	angles need to be identified or may be seen marked on the diagram	M2 for (*BCD* =) 128 + 32 (= 160) **or (***DCV* =) 52 – 32 (= 20) (may be seen marked on the diagram). To award these marks 160 or 20 must be clearly used or identified as the interior or exterior angle.
	eg (int $\angle$ =)128 + 32(= 160) **or** (ext$\angle$ =)180 – (128 + 32)(= 20) **or** (ext$\angle$ =)"52" – 32(= 20)			M1	(dep on previous M1) for method to find the size of one interior or exterior angle, may be seen marked on the diagram.	
	eg 180(n – 2) = "160"n **or** 360 ÷ "20"			M1	for setting up an equation for the sum of interior angles **or** 360 ÷ "20"	
	Working required	18		A1	dep on M2	
						Total 4 marks

12	(a)		2	1	B1	
	(b)		$8a^3$	2	B2	for $8a^3$ If not B2 then B1 for $8a^k$ where $k \neq 3$ or ka^3 where $k \neq 8$
	(c)	$5x(3x + 4) = 15x^2 + 20x$ **or** $5x(2x - 1) = 10x^2 - 5x$ **or** $(3x + 4)(2x - 1) = 6x^2 - 3x + 8x - 4$ $(= 6x^2 + 5x - 4)$		3	M1	for a correct intention to multiply all 3 factors by multiplying 2 factors only, allow one error
		$(15x^2 + 20x)(2x - 1) = 30x^3 - 15x^2 + 40x^2 - 20x$ oe $(10x^2 - 5x)(3x + 4) = 30x^3 + 40x^2 - 15x^2 - 20x$ oe $5x(6x^2 + 5x - 4) = 30x^3 + 25x^2 - 20x$ oe			M1	(dep)ft for expanding by the third factor, allow one error (some may do the expansion in one stage and will get to $30x^3 - 15x^2 + 40x^2 - 20x$ without firstly expanding two factors – this gains M2, allow one error)
		Correct answer scores full marks (unless from obvious incorrect working)	$30x^3 + 25x^2 - 20x$		A1	isw correct factorisation ($30x^3 + 25x^2 - 20x$ must be seen previously to award 3 marks) eg $5(6x^3 + 5x^2 - 4x)$ $x(30x^2 + 25x - 20)$ $5x(6x^2 + 5x - 4)$ do not isw incorrect simplification eg $30x^3 + 25x^2 - 20x = 6x^3 + 5x^2 - 4x$ gets M2A0
						Total 6 marks

13	eg 1.2 × 0.65 (= 0.78) **or** 1.2L × 0.65W (= 0.78LW) **or** 1.2 × 0.65 × 100 (= 78) **or** 1.2L × 0.65W × 100 (= 78LW)		3	M1	allow use of other variables to L and W as long as clearly labelled as length and width allow (1 + 0.2) as their 1.2 and (1 – 0.35) as their 0.65
	eg (1 **–** "0.78") × 100 **or** (LW **–** "0.78LW") × 100 (= 22LW) **or** 100 **–** "78" **or** 100LW **–** "78LW" (= 22LW)			M1	method to find the percentage reduction, allow the subtraction to be written the other way around eg "78" – 100
	Correct answer scores full marks (unless from obvious incorrect working)	22		A1	allow −22
					Total 3 marks

ALTERNATIVE Q13 mark scheme (using values for *L* and *W*)

13	eg 1.2 × x **and** 0.65 × y where x and y are positive numbers		3	M1	accept any positive values for x and y allow (1 + 0.2) as their 1.2 and (1 – 0.35) as their 0.65
	eg $\left(1-\frac{1.2x\times0.65y}{xy}\right)\times100$ **or** $\left(\frac{xy-1.2x\times0.65y}{xy}\right)\times100$			M1	method to find the percentage reduction, allow the subtraction to be written the other way around eg $\left(\frac{1.2x\times0.65y}{xy}-1\right)\times100$
	Correct answer scores full marks (unless from obvious incorrect working)	22		A1	allow −22
					Total 3 marks

14	$(\angle AOC =) 132 \times 2 (= 264)$		3	M1	for method to find angle at the centre. Do not award this mark if contradicted on the diagram eg if obtuse *AOC* is labelled as 264
	eg $\frac{"264"}{360} \times 2 \times \pi \times 8.5$ (= 39.1... or $\frac{187}{15}\pi$) **or** $2 \times \pi \times 8.5 - \frac{360 - "264"}{360} \times 2 \times \pi \times 8.5$ (= 39.1... or $\frac{187}{15}\pi$) **or** $\frac{"264"}{360} \times 2 \times \pi \times 8.5 + 2 \times 8.5$ **or** $2 \times \pi \times 8.5 - \frac{360 - "264"}{360} \times 2 \times \pi \times 8.5 + 2 \times 8.5$			M1	for a method to find the length of arc *AC* or perimeter of the sector – allow use of their *AOC* as long as clearly labelled
	Correct answer scores full marks (unless from obvious incorrect working)	56.2		A1	accept 56.1 – 56.2
					Total 3 marks

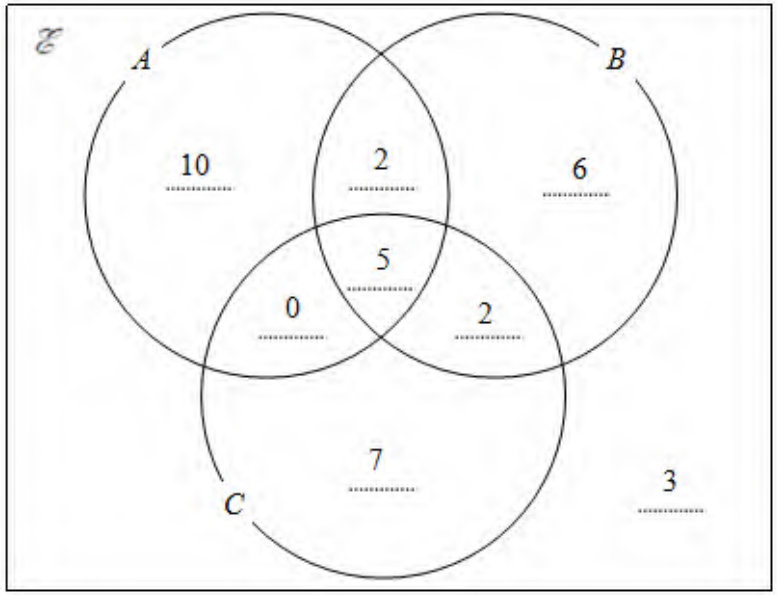
15 (a)	11 – 2		2	M1 2 and 11 clearly identified either in list or stated
	Working required	9		A1 dep on M1
(b) (i)		Kim as she has a higher median	1	B1 oe, ft their median if value given **Acceptable examples** Kim as she has a higher median Kim as/because her median is 11 and/but/whereas Rutger's is 8 Kim's median is 3 more (than Rutger's) Kim as Rutger's median is 3 less **Not acceptable examples** Kim's median is 11 and Rutger's is 8 Kim as she has a higher median and a lower IQR
(ii)		Kim as she has a smaller IQR	1	B1 oe, ft their part (a) **Acceptable examples** Kim as she has a smaller IQR Kim as/because her IQR is 5 and/but/whereas Rutger's is 9 Kim's IQR is 4 less (than Rutger's) Kim as Rutger's IQR is 4 more **Not acceptable examples** Kim's IQR is 5 and Rutger's is 9 Kim as she has a higher median and a lower IQR
				Total 4 marks

16	eg $-\begin{pmatrix}-5\\4\end{pmatrix}+\begin{pmatrix}9\\1\end{pmatrix}$ **or** $\begin{pmatrix}5\\-4\end{pmatrix}+\begin{pmatrix}9\\1\end{pmatrix}$ **or** $\begin{pmatrix}14\\a\end{pmatrix}$ $a \neq -3$ **or** $\begin{pmatrix}b\\-3\end{pmatrix}$ $b \neq 14$		2	M1 or an answer of $\begin{pmatrix}-14\\3\end{pmatrix}$
	Correct answer scores full marks (unless from obvious incorrect working)	$\begin{pmatrix}14\\-3\end{pmatrix}$		A1
				Total 2 marks

17	(a)	15 ÷ 15 (= 1) 18 ÷ 5 (= 3.6) 32 ÷ 20 (= 1.6) 4 ÷ 10 (= 0.4)	Correct histogram	3	B3	for a fully correct histogram If not B3 then B2 for 3 correct frequency densities (can be implied by heights) or 3 correct bars drawn If not B2 then B1 for 2 correctly calculated frequency densities (can be implied by heights) or 2 correct bars drawn
						SC: award B2 for all 4 bars of correct width with heights in the correct ratio (eg drawn at 0.5, 1.8, 0.8, 0.2) **SC:** award B1 for 3 bars of correct width with heights in the correct ratio
	(b)	eg $\frac{15}{20}\times 32(=24)$ **or** $\frac{5}{20}\times 32(=8)$ **or** $\frac{15}{20}\times 32+18(=42)$ **or** $32+18-\frac{5}{20}\times 32(=42)$		2	M1 ft	for a method to find an estimate for the number of students who took between 30 and 45 minutes **or** between 45 and 50 minutes **or** between 25 and 45 minutes ft incorrect histogram
		Correct answer scores full marks (unless from obvious incorrect working)	$\frac{42}{50}$		A1	oe eg $\frac{21}{25}$, 0.84, 84%
						Total 5 marks

18	$\sqrt{\frac{3600}{625}}$ **or** $\frac{12}{5}$ oe **or** 2.4 **or** 12:5 oe **or** $\sqrt{\frac{625}{3600}}$ **or** $\frac{5}{12}$ oe **or** 0.416.... **or** 5:12 oe **or** $\frac{3600^3}{625^3} = \frac{(\text{vol of statue})^2}{750^2}$ oe **or** $\frac{3600}{625} = \frac{(\text{vol of statue})^{\frac{2}{3}}}{750^{\frac{2}{3}}}$ oe		3	M1	for a correct length scale factor **or** a correct length ratio **or** setting up a correct equation involving the volume of the statue
	eg $750 \times \left("\frac{12}{5}"\right)^3$ oe **or** $750 \div \left("\frac{5}{12}"\right)^3$ oe **or** $\sqrt{\frac{3600^3 \times 750^2}{625^3}}$ oe **or** $\left(\frac{3600 \times 750^{\frac{2}{3}}}{625}\right)^{\frac{3}{2}}$ oe			M1	(dep on M1) for a correct method to work out the volume of the statue
	Correct answer scores full marks (unless from obvious incorrect working)	10 368		A1	cao
					Total 3 marks

19	eg $2n$, $2n + 2$, $2n + 4$ **or** $2n – 2$, $2n$, $2n + 2$ etc		3	M1	for 3 consecutive even numbers in algebraic form (any letter can be used)
	eg $(2n)^2 + (2n+4)^2 (= 4n^2 + 4n^2 + 16n + 16 = 8n^2 + 16n + 16)$ **or** $2(2n+2)^2$ $(= 2(4n^2 + 8n + 4) = 8n^2 + 16n + 8)$ **or** $2(2n+2)^2 + 8$ $(= 2(4n^2 + 8n + 4) + 8 = 8n^2 + 16n + 16)$			M1	for the sum of the squares of the largest and smallest even numbers and adding **or** the square of the middle even number multiplied by 2 (no need to expand or simplify for this mark)
	eg $(2n)^2 + (2n+4)^2 = 8n^2 + 16n + 16$ and $2(2n+2)^2 + 8 = 8n^2 + 16n + 16$ **or** $(2n)^2 + (2n+4)^2 = 8n^2 + 16n + 16$ and $2(2n+2)^2 = 8n^2 + 16n + 8$ and $8n^2 + 16n + 16 - (8n^2 + 16n + 8) = 8$ **or** $(2n)^2 + (2n+4)^2 = 8n^2 + 16n + 16$ and $8n^2 + 16n + 16 = 8n^2 + 16n + 8 + 8 = 2(2n+2)^2 + 8$ **or** $2(2n+2)^2 + 8 = 8n^2 + 16n + 16$ and $8n^2 + 16n + 16 = 4n^2 + 4n^2 + 16n + 16 = (2n)^2 + (2n+4)^2$ *Working required*	Correctly shown		A1	dep on M2 for use of algebra to show correct conclusion (SCB1 for eg $(p + 4)^2 + p^2$ or $2(p + 2)^2$ or $2(p + 2)^2 + 8$) (SCB2 for use of eg $(p + 4)^2 + p^2 = 2p^2 + 8p + 16$ and $2(p + 2)^2 + 8 = 2p^2 + 8p + 16$ If the student shows this and also says “it is true for all numbers, so it must be true for even numbers” oe or defines p, $p + 2$, $p + 4$ as even numbers, then this would gain M2A1
					Total 3 marks

20		Fully correct Venn diagram	4	B4 for all 8 sections correct If not B4, then award B3 for 6 or 7 sections correct B2 for 4 or 5 sections correct B1 for 2 or 3 sections correct Allow the section where 0 should be to be blank if all other sections are populated with a number.
				Total 4 marks

21			3	B1	tangent drawn at P ($x = -2$)
				M1	(dep on B1) for a method to find gradient eg $\frac{\text{difference in } y\text{-values}}{\text{difference in } x\text{-values}}$ **or** an answer in the range -0.8 to -0.2 oe
	Answer depends on tangent being drawn at P	0.5		A1	(dep on B1) oe accept answers in range 0.2 to 0.8 oe **and** from correct figures for their tangent
					Total 3 marks

22	eg $2(-3-2x)^2+x^2=-6x+42$	eg $2y^2+\left(\frac{-3-y}{2}\right)^2=-6\left(\frac{-3-y}{2}\right)+42$		5	M1	substitution of $y=\pm3\pm2x$ (or $x=\frac{\pm3\pm y}{2}$) into $2y^2+x^2=-6x+42$ to obtain an equation in x only (or y only)
	eg $9x^2+30x-24(=0)$ **or** $3x^2+10x-8(=0)$ allow eg $3x^2+10x=8$	eg $\frac{9}{4}y^2-\frac{3}{2}y-\frac{195}{4}(=0)$ **or** $9y^2-6y-195(=0)$ **or** $3y^2-2y-65(=0)$ allow eg $3y^2-2y=65$			M1 ft	(dep on previous M1) for multiplying out and collecting terms, forming a three term quadratic in any form of ax^2+bx+c (= 0) where at least 2 coefficients (a or b or c) are correct
	eg $(3x-2)(x+4)(=0)$ **or** $\frac{-10\pm\sqrt{10^2-4\times3\times-8}}{2\times3}$ **or** $3\left[\left(x+\frac{5}{3}\right)^2-\left(\frac{5}{3}\right)^2\right]=8$ oe (should give $(x=)\frac{2}{3}, -4$)	eg $(3y+13)(y-5)(=0)$ **or** $\frac{2\pm\sqrt{(-2)^2-4\times3\times-65}}{2\times3}$ **or** $3\left[\left(y-\frac{1}{3}\right)^2-\left(\frac{1}{3}\right)^2\right]=65$ oe (should give $(y=)-\frac{13}{3}, 5$)			M1 ft	(dep on M1) method to solve **their** 3 term quadratic using any correct method (allow one sign error and some simplification – allow as far as eg $\frac{-10\pm\sqrt{100+96}}{6}$ **or** $\frac{2\pm\sqrt{4+780}}{6}$) **or** if factorising allow brackets which expanded give 2 out of 3 terms correct)**or** correct values for x (allow 0.66(6…) or 0.67) **or** correct values for y (allow −4.33(3…))
	eg $2\left("\frac{2}{3}"\right)+y=-3$ **and** $2("-4")+y=-3$	eg $2x+"-\frac{13}{3}"=-3$ **and** $2x+"5"=-3$			M1	(dep on previous M1) for substituting **their** 2 found values of x or y in a suitable equation (use 2dp or better for substitution) **or** fully correct values for the other variable (correct labels for x / y)
	Working required		$x=-4$, $y=5$ and $x=\frac{2}{3}$, $y=-\frac{13}{3}$		A1	oe (dep on M1) and a correct quadratic (allow coordinates) allow $x=0.66(6\ldots)$ or 0.67, $y=-4.33(3\ldots)$, $x=-4$, $y=5$
						Total 5 marks

23	eg $(x + 5)(5x - 12) = x(x + 12)$		5	M1	for setting up a correct equation
	eg $4x^2 + x - 60\ (= 0)$ oe allow $4x^2 + x = 60$			A1	for writing the correct quadratic expression in the form $ax^2 + bx + c\ (= 0)$ allow $ax^2 + bx = c$
	eg $(4x - 15)(x + 4)(= 0)$ **or** $\dfrac{-1 \pm \sqrt{1^2 - 4 \times 4 \times -60}}{2 \times 4}$ **or** $4\left[\left(x + \dfrac{1}{8}\right)^2 - \left(\dfrac{1}{8}\right)^2\right] = 60$ oe			M1	(dep on M1) for a complete method to solve **their** 3-term quadratic (allow one sign error and some simplification – allow as far as $\dfrac{-1 \pm \sqrt{1 + 960}}{8}$) Allow + instead of ± in quadratic formula
	eg $(ADE =) \sin^{-1}\left(\dfrac{("3.75" + 5)\sin(48)}{"3.75" + 12}\right)$			M1	for a complete method for *ADE*. Allow use of $x = -4$ for this mark
	Correct answer scores full marks (unless from obvious incorrect working)	24.4		A1	accept 24.3 – 24.4
					Total 5 marks

24	eg $k \times \frac{1}{3}\pi r^2 h = \frac{4}{3}\pi r^3$ **or** $k \times \frac{1}{3}\pi r^2 h = \frac{4}{3}\pi r^3$ **or** $k \times \frac{1}{3}\pi r^2 h = \frac{4}{3}\pi r^3$ **or** $k \times h = 4r$		6	M1	for setting up an equation with volumes and some simplification (minimum of 2 terms simplified)
	$h = \frac{4r}{k}$			M1	for finding h in terms of r and k in its simplest form (may be seen at a later stage)
	eg $l^2 = r^2 + \left(\frac{4r}{k}\right)^2$ **or** $l = \sqrt{r^2 + \left(\frac{4r}{k}\right)^2}$			M1	for correct substitution into Pythagoras' theorem (accept substitution of $h = \frac{4\pi r}{\pi k}$)
	eg $l = r\sqrt{1 + \frac{16}{k^2}}$ **or** $l = r\sqrt{\frac{k^2+16}{k^2}}$ **or** $l = r\frac{\sqrt{k^2+16}}{k}$			M1	for rearranging and removing the r from the square root (may be seen at a later stage)
	eg $\pi r^2\left(\sqrt{1 + \frac{16}{k^2}} + 1\right)$			M1	for a correct expression for surface area in terms of r and k with πr^2 removed as a factor
	Correct answer scores full marks (unless from obvious incorrect working)	$\pi r^2\left(\frac{k + \sqrt{k^2+16}}{k}\right)$		A1	
					Total 6 marks

25	eg $\left(\frac{-4+2}{2}, \frac{6+3}{2}\right)$ **or** (−1, 4.5) oe		6	M1	for method to find the midpoint of *AB*
	eg $\frac{6-3}{-4-2}\left(=\frac{3}{-6}\right)$ oe **or** $-\frac{1}{2}$ oe **or** −0.5			M1	for method to find the gradient of *AB*
	eg $m \times "-0.5" = -1$ oe **or** $m = 2$			M1	for use of $m_1 m_2 = -1$ to find the gradient of the line of symmetry
	eg $y - 8 = "-0.5"(x - (-1))$ **or** 8 = "−0.5" × −1 + *c* **or** $\frac{y-8}{x-(-1)} = "-0.5"$ **or** $y - 4.5 = "2"(x - (-1))$ **or** 4.5 = "2" × −1 + *c* **or** $\frac{y-4.5}{x-(-1)} = "2"$			M1	for method to find an equation for *CD* **or** the line of symmetry
	eg $2x + 6.5 = -0.5x + 7.5$ **or** $\frac{y-6.5}{2} = \frac{y-7.5}{-0.5}$			M1	for a correct linear equation to find the *x* or *y* coordinate of *E*
	Correct answer scores full marks (unless from obvious incorrect working)	(0.4, 7.3)		A1	oe
					Total 6 marks

ALTERNATIVE (using the length of *CD*):

25	eg $\frac{6-3}{-4-2}\left(=\frac{3}{-6}\right)$ oe **or** $-\frac{1}{2}$ oe **or** −0.5		6	M1	for method to find the gradient of *AB*
	eg $y - 8 = "-0.5"(x+1)$ **or** 8 = "−0.5" × −1 + *c* **or** $\frac{y-8}{x-(-1)} = "-0.5"$			M1	for method to find an equation for *CD*
	eg $\sqrt{(-1-(-4))^2 + (8-6)^2}\ (=\sqrt{13})$			M1	for method to find the length of *AD* or AD^2
	eg $\sqrt{(x-2)^2 + (7.5-0.5x-3)^2} = "\sqrt{13}"$ **or** $\sqrt{(15-2y-2)^2 + (y-3)^2} = "\sqrt{13}"$			M1	for setting up an equation for the *x* or *y* coordinate of *C*
	(1.8, 6.6) oe			M1	for the correct coordinates for *C*
	Correct answer scores full marks (unless from obvious incorrect working)	(0.4, 7.3)		A1	oe
					Total 6 marks

26	eg $\frac{(4x+3)(x-5)}{2x-1}\times\frac{(2x-1)(x-3)}{(x+5)(x-5)}$ **or** eg $\frac{(4x+3)(x-3)}{x+5}(+(29-4x))$		4	M2	for factorising at least 2 of the quadratics correctly – could be implied by 2 factors cancelled correctly (M1 for factorising at least 1 of the 3 quadratics correctly)
	eg $\frac{(4x+3)(x-3)+(29-4x)(x+5)}{x+5}$ oe **or** eg $\frac{4x^2-9x-9+145+9x-4x^2}{x+5}$ oe			M1	for writing the correct fractions over a common denominator of $(x + 5)$ with or without brackets removed – need not be in simplest form. Could be written as 2 separate fractions.
	Correct answer scores full marks (unless from obvious incorrect working)	$\frac{136}{x+5}$		A1	
					Total 4 marks

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