Pearson Edexcel

Mark Scheme (Results)

January 2023

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

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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.

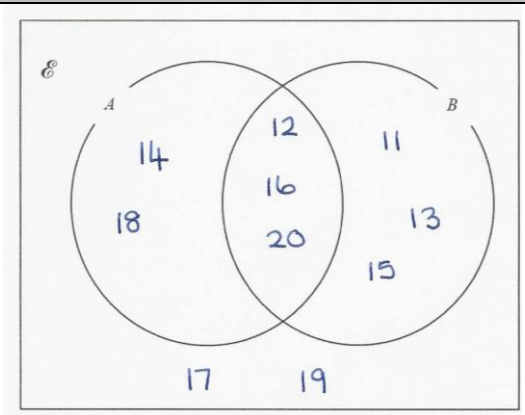
  It is not appropriate to ignore subsequent work when the additional work essentially makes the answer incorrect eg algebra.

  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 where the mark scheme states otherwise, the correct answer, unless clearly obtained from an incorrect method, should be taken to imply a correct method.				
Question	**Working**	**Answer**	**Mark**	**Notes**
1	$\frac{26}{7}, \frac{13}{8}$ oe		3	M1 both fractions expressed as improper fractions, no need for ÷ or × may be equivalent to those given eg $\frac{52}{14}, \frac{26}{16}$ etc. A student could invert $\frac{13}{8}$ and show multiplication - as shown in the 2nd M1, this mark is then implied.
	$\frac{26}{7} \times \frac{8}{13}$ oe or eg $\frac{208}{56} \div \frac{91}{56}$			M1 **or** for both fractions expressed as equivalent fractions with denominators that are a common multiple of 7 and 8 eg $\frac{208}{56} \div \frac{91}{56}$
	eg $\frac{26}{7} \times \frac{8}{13} = \frac{208}{91} = \frac{16}{7} = 2\frac{2}{7}$ **or** $\frac{26}{7} \times \frac{8}{13} = \frac{208}{91} = 2\frac{26}{91} = 2\frac{2}{7}$ **or** $\frac{\cancel{26}^{2}}{7} \times \frac{8}{\cancel{13}^{1}} = \frac{16}{7} = 2\frac{2}{7}$ **or** $\frac{208}{56} \div \frac{91}{56} = \frac{208}{91} = \frac{16}{7} = 2\frac{2}{7}$ **or** correct working to $\frac{16}{7}$ **and** writing $2\frac{2}{7} = \frac{16}{7}$ (usually on the first line of working) *working required*	shown		A1 dep on M2 **NB: use of decimals scores no marks (unless used as a check)**
				Total 3 marks

Question	Working	Answer	Mark	Notes	
2	90 × 1000 (=90 000) or $\frac{90}{60\times60}(=0.025 \text{ or } \frac{1}{40})$ **or** $\frac{1000}{60\times60}(=\frac{5}{18}=0.277...)$ **or** sight of 1500		3	M1 For one of ×1000 (eg sight of 90 000) or (÷60 ÷ 60) or ÷3600 oe ie correct conversion of distance units or of time units	M2 for 90 ÷ 3.6 **or** $90\times\frac{5}{18}$
	$\frac{90\times1000}{60\times60}$ oe eg$(1.5\times1000)\div60$			M1 For a fully correct method with correct use of brackets eg 90 000 ÷ 60 × 60 is M1 only if not recovered	
	Working required	25		A1 dep on M1	
					Total 3 marks

Question	Working	Answer	Mark	Notes
3			3	B3 Fully correct (B2 for 2 or 3 'regions' correct, B1 for one 'region' correct)
				Total 3 marks

Question	Working	Answer	Mark	Notes
4	eg $5x-1=3x+7.4$ oe **or** eg $10x-2+48$ **or** $6x+14.8+48$ **or** $24+24+5x-1+3x+7.4$ oe		4	M1 a correct equation to find x **or** a correct expression for the perimeter in terms of x
	$x=4.2$			A1 the correct value of x (implies previous mark)
	$2\times24+2(5\times$"4.2"$-1)$ oe **or** $2\times24+2(3\times$"4.2"$+7.4)$ oe **or** $2\times24+(5\times4.2-1)+(3\times4.2+7.4)$ oe eg $24+24+20+20$ oe			M1dep on a correct method to find the perimeter – use of positive x from correct working (1st M1 awarded for an equation) **and** only if used the same measurement for AD and BC
	working required	88		A1 cao dep on either M1 or $x=4.2$
				Total 4 marks

Question		Working	Answer	Mark	Notes
5	(a)		2.745	1	B1
	(b)		2.755	1	B1 allow $2.754\dot{9}$
	(c)	$(80\times60)\div2^2$		2	M1 For two of 80, 60, 2 or 4 rather than 2^2 oe
		eg $(80\times60)\div2^2=1200$ oe *working with rounded values seen required*	1200		A1 dep on M1 for answer coming from use of the 3 rounded numbers – if 1200 seen then ignore any other working and comments
					Total 4 marks

Question	Working	Answer	Mark	Notes
6	$[k =] \frac{6+17}{2}$ **or** $[k =] 6+\frac{17-6}{2}$ oe **or** $[j =]\ 4+2(15-4)$ **or** $[j =]\ 15 + (15 - 4)$ **or** $\frac{4+j}{2}=15$ oe		3	M1
	Correct answers score full marks (unless from obvious incorrect working) *1 correct answer will score M1A1 and both will score M1A1A1*	26		A1
		11.5		A1 oe eg $\frac{23}{2}$ both answers the wrong way round scores M1A1 unless the correct answers are clearly labelled in working space
				Total 3 marks

Question	Working		Answer	Mark	Notes
7	eg $5x + 4y = -2$ $+ 8x - 4y = 17.6$ $(13x = 15.6)$ eg $[x = \frac{4.4 + y}{2}]$ oe $5\left(\frac{4.4 + y}{2}\right) + 4y = -2$ oe	eg $10x + 8y = -4$ $- 10x - 5y = 22$ $(13y = -26)$ eg $[y = 2x - 4.4]$ oe $5x + 4(2x - 4.4) = -2$ oe		3	M1 multiplication of one or both equation(s) with correct operation selected (allow one arithmetic error) (if + or – is not shown then assume it is the operation that at least 2 of the 3 terms have been calculated for) **or** correct rearrangement of one equation with substitution into second
	eg $5 \times$ "1.2" $+ 4y = -2$ **or** $2 \times$ "1.2" $- y = 4.4$	eg $5x + 2 \times$ "–2" $= 4.4$ **or** $2x -$ "–2" $= 4.4$			M1 (dep on previous M1 but not on a correct first value) correct method to find second unknown – this could be a correct substitution into one of the equations given or calculated or starting again with the same style of working as for the first method mark
	Working required		$x = 1.2$ $y = -2$		A1 oe eg $x = \frac{6}{5}$ for both solutions dependent on first M1
					Total 3 marks

Question	Working		Answer	Mark	Notes	
8	$\frac{2.9}{100} \times 5000 (=145)$ oe **or** 1.029 × 5000 (=5145) oe **or** $1.029^2 \times 5000$ (= 5294….) oe **or** 0.058 × 5000 (= 290) oe **or** 1.058 × 5000 (= 5290)				M1 **Bank H**	
	5000 × 0.016 oe (= 80) oe **or** 5000 × 1.016 oe (= 5080) oe **or** 5000 × 0.032 (= 160) oe **or** 5000 × 1.032 (= 5160) oe	M2 for 5000×1.016^2 (= 5161.28)		4	M1 **Bank G**	
	(80 + 5000) × 0.016 (= 81.28) oe **or** 5080 × 1.016 (= 5161.28) oe				M1 **Bank G**	
	Correct answer scores full marks (unless from obvious incorrect working)		16.28		A1	
						Total 4 marks

Question	Working	Answer	Mark	Notes
9 (a)		1	1	B1
(b)		$27a^6b^{12}$	2	B2 (B1 for 2 of 3 parts in a product)
(c)		$7x^2y^2(2y^2+3x)$	2	B2 B1 for a correct factorisation with at least 2 factors outside (eg $7x$, x^2, xy, etc) eg $7x(2xy^4+3x^2y^2)$ eg $x^2y^2(14y^2+21x)$ or for the correct common factor with just one mistake inside the bracket eg $7x^2y^2(2y+3x)$ which is missing the squared on the y term
(d)	$y = mx + 4$ where $m \neq 0$ oe (eg $y = 2x + 4$) **or** $y = –2x + c$ or $y + 2x = c$ oe **or** $–2x + 4$ or $f(x) = –2x + 4$ oe		2	M1
	Correct answer scores full marks (unless from obvious incorrect working)	$y = –2x + 4$		A1 oe eg $y + 2x = 4$
				Total 7 marks

Question	Working	Answer	Mark	Notes
10	(54 – 24) ÷ 2 (=15) [may be marked on diagram]		5	M1
	$"15"^2-(24\div 2)^2 (=81)$			M1 ft their "15" (if > 12)
	[height =] $\sqrt{"15"^2-(24\div 2)^2}\,(=9)$			M1 ft their "15" (if > 12)
	$(24\times "9")\div 2$ oe			M1 figures must be from correct working
	Correct answer scores full marks (unless from obvious incorrect working)	108		A1 allow 107.9 – 108.1
	ALTERNATIVES BELOW			**Total 5 marks**
10	(54 – 24) ÷ 2 (=15) [may be marked on diagram]		5	M1
	or $x=\cos^{-1}\left(\frac{"12"}{"15"}\right)(=36.86...)$ **or** $y=\sin^{-1}\left(\frac{24\div 2}{"15"}\right)(=53.13...)$ **or** $A=\cos^{-1}\left(\frac{15^2+15^2-24^2}{2\times 15\times 15}\right)(=106.2...)$ **or** $B=\cos^{-1}\left(\frac{15^2+24^2-15^2}{2\times 15\times 24}\right)(=36.8....)$			M1 ft their "15" (if > 12) [using Hero's formula S = 0.5 × 54 (= 27) and] 27 × (27 – 24) × (27 – "15") × (27 – "15")
	or "12"tan"36.86…" (= 9) (allow 8.9… for these) "12" ÷ tan"53.13…" (= 9) **or** "15" × sin "36.86…" (= 9) **or** "15" × cos "53.13…" (= 9)			M1 ft their "15" (if > 12) M2 for 0.5 × 24 × "15" × sin"36.86…" or 0.5 × "15" × "15" × sin(2 × "53.13…") or $0.5\times "15"\times "15"\times \sin("106.2...")$ **or** $\sqrt{"27"("27"-24)("27"-"15")("27"-"15")}$
	$(24\times "9")\div 2$ oe			M1
	Correct answer scores full marks (unless from obvious incorrect working)	108		A1 allow 107.9 – 108.1
				Total 5 marks

Question	Working	Answer	Mark	Notes
11		**B**	3	B1
		A		B1
		F		B1
				Total 3 marks

<table>
<tr><th colspan="2">Question</th><th>Working</th><th>Answer</th><th>Mark</th><th colspan="2">Notes</th></tr>
<tr><td>12</td><td>(a)</td><td></td><td>43.5 - 44.5</td><td>1</td><td>B1</td><td>±0.5 small square</td></tr>
<tr><td></td><td>(b)</td><td>eg reading of 48 - 49</td><td></td><td>2</td><td>M1</td><td>For correct method to start the question eg a vertical line from 55 up to the line and a horizontal line from the correct point on the curve or a mark on the curve at the correct point and a mark on the vertical axis at the correct point or a correct reading of 48 to 49</td></tr>
<tr><td></td><td></td><td>Correct answer scores full marks (unless from obvious incorrect working)</td><td>11 or 12</td><td></td><td>A1</td><td>Allow an answer of 11 or 12 (ie must be whole number)</td></tr>
<tr><td></td><td>(c)</td><td><table><tr><th>Time taken to shop in the market (m minutes)</th><th>Frequency</th></tr><tr><td>$0 < m \leq 10$</td><td>3</td></tr><tr><td>$10 < m \leq 20$</td><td>5</td></tr><tr><td>$20 < m \leq 30$</td><td>7</td></tr><tr><td>$30 < m \leq 40$</td><td>10</td></tr><tr><td>$40 < m \leq 50$</td><td>15</td></tr><tr><td>$50 < m \leq 60$</td><td>15</td></tr><tr><td>$60 < m \leq 70$</td><td>5</td></tr></table></td><td></td><td>2</td><td>B2</td><td>All values correctly filled in (NB: first 2 are already completed)
(B1 for 3 or 4 correct values from 7, 10, 15, 15, 5)</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td colspan="2">Total 5 marks</td></tr>
</table>

Question	Working	Answer	Mark	Notes
13	eg $20\times\frac{x+3}{4}-20\times\frac{7-x}{5}=20\times4.3$ or eg $5(x+3)-4(7-x)=20\times4.3$ or eg $\frac{5(x+3)}{20}-\frac{4(7-x)}{20}(=4.3)$ or eg $\frac{5(x+3)-4(7-x)}{20}(=4.3)$		3	M1 For clear intention to multiply all terms by 20 (or 4 × 5) or a multiple of 20 oe or to express LHS as two fractions over 20 (or 4 × 5) or a multiple of 20 oe or as a single fraction with a denominator of 20 (or 4 × 5) or a multiple of 20 oe if expanded numerator, allow one error
	eg $5x + 15 – 28 + 4x = 4.3 \times 20$ oe eg $9x – 13 = 86$ eg $9x = 99$			M1 Expanding brackets and multiplying by denominator with no more than one error in total from multiplying out brackets [we must see 4.3 × 20 or 86 accurately]
	Working required	11		A1 dep on M1
				Total 3 marks

Question	Working	Answer	Mark	Notes
14 (a)(i)		140	1	B1
(a)(ii)		opposite angles of a cyclic quadrilateral (add to 180º) oe	1	B1 dep on B1 in (a)(i) or seeing 180 – 40 with no contradiction oe eg angle at centre is double (2 ×) angle at circumference oe **AND** angles around a point (or point 360)
(b)	*ADB* = 66 or *ABO* = 90 – 66 (=24) or *BAO* = 90 – 66 (=24) or $ODB = \frac{180-80}{2} (=50)$ or *DOB* reflex = 280		3	M1 Clearly labelled in working or shown on diagram
	For 2 of: *ADB* = 66 or *ABO* = 90 – 66 (=24) or *BAO* = 90 – 66 (=24) or $ODB = \frac{180-80}{2} (=50)$ *DOB* reflex = 280			M1 (award M2 for $360-(280+40+24)$ oe
	Correct answer scores full marks (unless from obvious incorrect working)	16		A1
				Total 5 marks

Question	Working	Answer	Mark	Notes	
15			3	M1	4 and 34 clearly indicated – either in list or in working (condone 26 also indicated in list)
				A1	For IQR for team **A** = 34 – 4 (= 30)
		The IQR for Team **B** was higher than the IQR for Team **A** oe or Team **B** had an interquartile range of "12" more than team **A** **or** The runs scored were more spread out for Team **B** than for Team **A** oe **or** The runs for Team **A** were more consistent oe		B1ft	Must ft dep on IQR stated for team **A** Either comparing the IQR correctly or for giving a comparison in context about spread as long as not contradicted by further statements as this would be choice **NOT** Team **B** scored more runs than team **A** The average score of **B** is higher than the average score of **A** The IQR of **A** was 30 while the IQR of **B** was 42 The range of **B** was more than the range of **A**
					Total 3 marks

Question	Working	Answer	Mark	Notes
16	eg $1000x = 438.38\ldots$ $10x = 4.38\ldots$ **or** $100x = 43.838\ldots$ $x = 0.438\ldots$ oe		2	M1 For **selecting** 2 correct recurring decimals that when subtracted give a whole number or terminating decimal (43.4 or 434 etc) eg $1000x = 438.38...$ and $10x = 4.38....$ **or** $100x = 43.838\ldots$ and $x = 0.438\ldots$ with intention to subtract. (if recurring dots not shown then showing at least **one** of the numbers to at least 5sf) **or** $0.4 + 0.0\dot{3}\dot{8}$ **and** eg $1000x = 38.38...$ & $10x = 0.3838...,$ with intention to subtract.
	eg $1000x - 10x = 438.38\ldots - 4.38\ldots = 434$ **and** $\frac{434}{990} = \frac{217}{495}$ **or** eg $100x - x = 43.838\ldots - 0.438\ldots = 43.4$ **and** $\frac{43.4}{99} = \frac{217}{495}$ **or** eg $1000x - 10x = 38.38\ldots - 0.3838 = 38$ and $0.4 + \frac{38}{990} = \frac{4\times99+38}{990} = \frac{434}{990} = \frac{217}{495}$ oe *working required*	Clearly shown		A1 For completion to $\frac{217}{495}$ dep on M1 and use of some algebra
				Total 2 marks

Question	Working	Answer	Mark	Notes
17 (a)		12	1	B1
(b)	$\frac{5-\sqrt{18}}{1-\sqrt{2}}\times\frac{1+\sqrt{2}}{1+\sqrt{2}}$ **or** $\frac{5-\sqrt{18}}{1-\sqrt{2}}\times\frac{-1-\sqrt{2}}{-1-\sqrt{2}}$ oe		3	M1 Multiplying numerator and denominator by $1+\sqrt{2}$
	$\frac{5-\sqrt{36}+5\sqrt{2}-\sqrt{18}}{1+\sqrt{2}-\sqrt{2}-2}$ **or** $\frac{5-6-3\sqrt{2}+5\sqrt{2}}{-1}$ **or** $\frac{-5+6+3\sqrt{2}-5\sqrt{2}}{1}$ oe NB: allow $\sqrt{18}$ or $3\sqrt{2}$ $\sqrt{36}$ or 6 or $\sqrt{6}\sqrt{6}$			M1 Showing correct expansions (not necessarily as a fraction)
	working required	$1-2\sqrt{2}$		A1 dep on M2 (ie all stages of working must be shown convincingly) or for stating $a = 1$ and $b = -2$
				Total 4 marks

Question	Working	Answer	Mark	Notes
	USE OVERLAY PROVIDED			
18 (a)	FD are: 6, 7, 5, 4, 1.8		3	M1 For at least two frequency densities correct or at least two correct bars
				M1 For at least 4 correct frequency densities or 4 correct bars
	A fully correct histogram gains full marks	Correct histogram		A1 Fully correct histogram SCB2 for all five bars of correct width with heights in the correct ratio (eg drawn at 0.6, 0.7, 0.5, 0.4, 0.18) SCB1 for three bars of correct width with heights in the correct ratio
(b)	$(9 + \frac{2}{3} \times 12)$ (= 17) oe eg 9 + 8 (= 17) or $55 - (12 + 7 + 15 + \frac{1}{3} \times 12)$		2	M1 may be seen as numerator of fraction (ft their graph dep on M1 in (a))
	Correct answer scores full marks (unless from obvious incorrect working)	$\frac{17}{55}$		A1cao Or 0.30909…or 30.909….% (to at least 2 sf) SCB1 for $\frac{38}{55}$ (0.6909…)
				Total 5 marks

Question	Working	Answer	Mark	Notes
19	eg $\sqrt{\frac{25}{64}}\left(=\frac{5}{8}=0.625\right)$ **or** $\sqrt{\frac{64}{25}}\left(=\frac{8}{5}=1.6\right)$ **or** $\sqrt{25}:\sqrt{64}\ (5:8)$ **or** $\sqrt{64}:\sqrt{25}\ (8:5)$ **or** $\frac{(\sqrt{25})^3}{(\sqrt{64})^3}=\left(\frac{125}{512}=0.244140625\right)$ oe **or** $\frac{512}{125}=4.096$ $\frac{25^3}{64^3}=\frac{(\text{vol of }\mathbf{B})^2}{(\text{vol of }\mathbf{B}+541.8)^2}$ **or** $\frac{25}{64}=\frac{(\text{vol of }\mathbf{B})^{\frac{2}{3}}}{(\text{vol of }\mathbf{B}+541.8)^{\frac{2}{3}}}$ oe		4	M1 for a correct scale factor for length – may be given as a fraction or decimal or ratio **or** a correct scale factor for volume given as a fraction or decimal or ratio **or** a correct equation for the volume of vase **B**
	eg $\mathbf{B}\left(\frac{512}{125}-1\right)=541.8$ **or** $3.096\mathbf{B}=541.8$ oe **or** eg $\mathbf{A}\left(1-\frac{125}{512}\right)=541.8$ **or** $\frac{387}{512}\mathbf{A}=541.8$ $(8^3)k-(5^3)k(=387k)=541.8$ **or** eg $(k=)\frac{541.8}{387}\left(=\frac{7}{5}\right)$			M1 For a correct equation for the volume of **B** or a correct equation for the volume of **A**
	eg (**B**) $541.8\div"\frac{387}{125}"$ **or** $541.8\div$"3.096" **or** eg $125\times"\frac{7}{5}"$ or (**A**) $541.8\div"\frac{387}{512}"(=716.8)$ oe			M1 For a completely correct method to find the volume of vase **B** or vase **A**
	Correct answer scores full marks (unless from obvious incorrect working)	175		A1 cao
				Total 4 marks

20	$x^2+(7-2x)^2=34$	$\left(\frac{7-y}{2}\right)^2+y^2=34$		5	M1	substitution of linear equation into quadratic
	$5x^2-28x+15[=0]$ oe	$5y^2-14y-87[=0]$ oe			M1	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** and all are non-zero
	$(5x-3)(x-5)$ [= 0] or $\frac{-(-28)\pm\sqrt{(-28)^2-4\times5\times15}}{2\times5}$ or $5[(x-\frac{28}{10})^2-\frac{784}{100}]+15=0$ oe or $x = 0.6$ **and** $x = 5$ (allow incorrect labels for x/y)	$(5y-29)(y+3)$ [= 0] or $\frac{-(-14)\pm\sqrt{(-14)^2-4\times5\times(-87)}}{2\times5}$ or $5[(y-\frac{14}{10})^2-\frac{196}{100}]-87=0$ oe or $y = 5.8$ **and** $y = -3$ (allow incorrect labels for x/y)			M1ft	dep on M1 for solving *their* 3 term quadratic equation using any correct method (if factorising, allow brackets which expanded give 2 out of 3 terms correct) (if using formula allow one sign error and some simplification – allow as far as $\frac{28\pm\sqrt{784-300}}{10}$ or $\frac{14\pm\sqrt{196+1740}}{10}$) (if completing the square allow as far as shown) or **correct values for x** or **correct values for y dep on correct quadratic**
	eg $y = 7 - 2 \times 5$ and $y = 7 - 2 \times 0.6$ (correct labels for x/y)	eg $5.8 = 7 - 2x$ and $-3 = 7 - 2x$ (correct labels for x/y)			M1ft	dep on previous M1 for substituting **their** 2 found values of x or y in a suitable equation **or** correct values for the other variable
	Working must be shown		$x = 0.6$, $y = 5.8$ $x = 5$, $y = -3$		A1	dep on M1 and **the correct quadratic** (allow coordinates) must be paired correctly

				Total 5 marks

Question	Working	Answer	Mark	Notes
21	$r = \sqrt{\frac{49\pi}{4\pi}}$ oe (= 3.5)		3	M1
	[volume =] $\frac{4}{3} \times \pi \times "3.5"^3$			M1
	Correct answer scores full marks (unless from obvious incorrect working)	180		A1 awrt 180
				Total 3 marks

Question	Working	Answer	Mark	Notes
22	$(6x - 5)(x + 7)(=0)$ **or** $\frac{-37 \pm \sqrt{37^2 - 4 \times 6 \times -35}}{2 \times 6}$ $6\left[\left(x + \frac{37}{12}\right)^2 - \left(\frac{37}{12}\right)^2\right]$... oe		3	M1 A correct method to solve the quadratic equation $6x^2 + 37x - 35(= 0)$ using any correct method (if factorising, allow brackets which expanded give 2 out of 3 terms correct) (if using formula allow one sign error in substitution and some simplification – allow as far as $\frac{-37 \pm \sqrt{1369 + 840}}{12}$) or completing the square as far as shown on left
	$\frac{5}{6}$ oe **and** -7			A1 dep on M1 correct critical values (allow 0.83…)
	Working must be seen for both accuracy marks as asked for in question	$-7 \le x \le \frac{5}{6}$		A1 dep on M1 oe eg $-7 \le x \le 0.83\ldots$, $\left[-7, \frac{5}{6}\right]$ Accept $x \le \frac{5}{6}$, $x \ge -7$
				Total 3 marks

Q	Working	Answer	Mark	Notes
23	$[DN =]8\sin 30$ **or** $8\cos 60$ (= 4) oe [where N is the midpoint of EC] **or** $[x =]8\cos 30$ **or** $8\sin 60 (= 4\sqrt{3} = 6.928...)$ **or** $2x = \sqrt{8^2 + 8^2 - 2\times 8\times 8\times \cos 120} (= \sqrt{192} = 8\sqrt{3} = 13.85....)$		5	M1
	$[DN =]8\sin 30$ **or** $8\cos 60$ (= 4) oe eg $\sqrt{8^2 - (4\sqrt{3})^2} (= 4)$ **And 1 of** $[x =]8\cos 30$ **or** $8\sin 60 (= 4\sqrt{3} = 6.928...)$ oe or $\sqrt{8^2 - "4"^2} (= 4\sqrt{3} = 6.928...)$ **or** $2x = \sqrt{8^2 + 8^2 - 2\times 8\times 8\times \cos 120} (= 8\sqrt{3} = 13.85....)$			M1 [$(JM =)$ 4 + $4\sqrt{3}$ implies M2]
	$[AM =]\sqrt{12^2 + ("4\sqrt{3}")^2}$ (= $\sqrt{192}$ = $8\sqrt{3}$ = 13.856…) oe [where M is the midpoint of GH]			M1 **Clear intention to be *AM* (not *EC*)**
	$\tan MAJ = \left(\frac{"4" + "4\sqrt{3}"}{"8\sqrt{3}"}\right)$ oe eg $\tan MAJ = \left(\frac{10.928...}{13.856...}\right)$ if student uses sin or cos, then AJ = 17.647… to award marks this must come from a correct method or be correct			M1
	Correct answer scores full marks (unless from obvious incorrect working)	38.3		A1 Accept 38.1 – 38.4 If no marks scored then award SCB2 for $\tan MAJ = \frac{4+x}{\sqrt{x^2+12^2}}$ or SCB1 for $AM = \sqrt{x^2+12^2}$
				Total 5 marks

Q	Working	Answer	Mark	Notes
24		3	2	B1
		0.5		B1 oe
				Total 2 marks

Q	Working	Answer	Mark	Notes	
25	$y=3\left(x^2-4x\right)+7$ **or** $y=3\left(x^2-4x+\frac{7}{3}\right)$ or $\frac{y-7}{3}=x^2-4x$ or $y=3(x-2)^2$.....		4	M1	for a correct equation for a first step to complete the square
	eg $y=3\left(\left(x-2\right)^2-2^2\right)+7$ **or** $y=3\left(\left(x-2\right)^2-2^2+\frac{7}{3}\right)$ **or** $y=3\left(x-2\right)^2-5$ oe or			M1	
	$\left(x-2\right)^2=\frac{y+5}{3}$ oe eg $(x-2)^2=\frac{y-7}{3}+4$ or $x-2=(\pm)\sqrt{\frac{y+5}{3}}$ oe			M1	
	Correct answer scores full marks (unless from obvious incorrect working)	$2-\sqrt{\frac{x+5}{3}}$		A1 oe	NB: note only negative square root. Must be in terms of x **any equivalent form**
	Note: Allow candidates to swap *x* and *y* when finding the inverse			**Total 4 marks**	
25 Alt	$3x^2-12x+(7-y)=0$		4	M1	for a correct first step
	$\left(x=\right)\frac{12\pm\sqrt{144-12(7-y)}}{6}$			M1	
	$\left(x=\right)2\pm\sqrt{\frac{60+12y}{36}}$ oe			M1	
	Correct answer scores full marks (unless from obvious incorrect working)	$2-\sqrt{\frac{x+5}{3}}$		A1 oe	NB: note only negative square root. Must be in terms of x **any equivalent form**
				Total 4 marks	

Q	Working	Answer	Mark	Notes
26	**For one of:** $10^{4n} = (5\times 2)^{4n}$ **or** $5^{4n}\times 2^{4n}$ **or** oe $20^2 = (5\times 2^2)^2$ **or** $5^2\times 2^4$ **or** $5^2\times 2^2\times 2^2$ **or** cancelling 5^2 on numerator with 20^2 to get 16 or 2^4		5	M1 for writing 10^{4n} correctly as a product of 5 and 2 to the power $4n$ oe **or** writing 20^2 correctly as a product of 5 and 2^2 to the power 2 oe **or** cancelling 5^2 on numerator with 20^2 to get 16 or 2^4
	for getting numerator to the stage (this scores M1M1) $2^{4n}\times 2^{3n^2-15n}\times 5^2$ oe eg $2^{3n^2-11n}\times 5^{-4n+4n+2}$ oe **or for two of** $10^{4n} = (5\times 2)^{4n}$ **or** $5^{4n}\times 2^{4n}$ **or** oe $20^2 = (5\times 2^2)^2$ **or** $5^2\times 2^4$ **or** $5^2\times 2^2\times 2^2$ **or** cancelling 5^2 on numerator with 20^2 to get 16 or 2^4 or getting the numerator to the stage			M1
	$\frac{2^{4n}\times 2^{3n^2}\times 2^{-15n}}{2^4}[=1$ **or** $2^0]$ *or* $2^{4n}\times 2^{3n^2}\times 2^{-15n} = 2^4$ oe			M1 For writing the equation in powers of 2 only
	$3n^2 - 11n - 4[=0]$			A1 Correct quadratic equation dep on M1
	working required	$-\frac{1}{3}$, 4		A1 Both answers required dep on M1
				Total 5 marks

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