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Mark Scheme (Results)

Summer 2018

Pearson Edexcel International GCSE
In Mathematics A (4MA0) Paper 4HR

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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
    - eeoo – each error or omission

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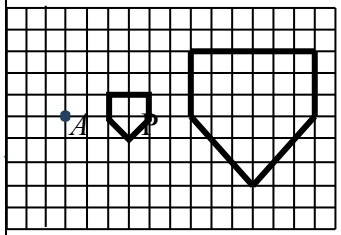
- **No working**
  If no working is shown then correct answers normally score full marks
  If no working is shown then incorrect (even though nearly correct) answers score no marks.
- **With working**
  If there is a wrong answer indicated on the answer line always check the working in the body of the 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.
  Any case of suspected misread loses A (and B) marks on that part, but can gain the M marks.
  If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.
  If there is a choice of methods shown, then no marks should be awarded, unless the answer on the answer line makes clear the method that has been used.
  If there is no answer on the answer line then check the working for an obvious answer.
- **Ignoring subsequent work**
  It is appropriate to ignore subsequent work when the additional work does not change the answer in a way that is inappropriate for the question: eg. Incorrect cancelling of a fraction that would otherwise be correct.
  It is not appropriate to ignore subsequent work when the additional work essentially makes the answer incorrect eg algebra.
  Transcription errors occur when candidates present a correct answer in working, and write it incorrectly on the answer line; mark the correct answer.
- **Parts of questions**
  Unless allowed by the mark scheme, the marks allocated to one part of the question CANNOT be awarded in another.

International GCSE Maths

Apart from questions 2(a)(ii), 7, 10(a), 12, 15(c), 19, 20, 22 and 25 (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		2 , 20, 29	3	M2	for 3 number selected with at least two of the properties: mean = 17, median = 20, range = 27 else M1 with one of these properties
				A1	in any order
Alternative					
1	17 × 3 (= 51)	2 , 20, 29	3	M1	method to find sum of 3 numbers
	17 × 3 – 20 (=31)			M1	method to find sum of smallest and largest numbers
				A1	in any order
Alternative					
1	x, 20, z or x, y , z and $y = 20$	2 , 20, 29	3	M1	use of different letters with 20 shown as the middle value
	$x + z = 31$ or $\frac{x+20+z}{3} = 17$ oe or $z - x = 27$ or $x - z = 27$			M1	an equation for the sum or for the difference of the two unknown numbers
				A1	in any order
					Total 3 marks

Question		Working	Answer	Mark	Notes	
2	(a)(i)		67	1	B1	
	(ii)		reason	1	B1	dep on B1or a fully correct method shown in (i) e.g. alternate angles are equal or other fully correct method
	(b)	e.g. 180 – (67 + 60) or 120 – 67 or (180 – 67) – (180 – 120) or 113 – 60 or 180 – 67 = 60 + y or 113 = 60 + y or 120 – y = 67	53	2	M1	Correct calculation for y or correct equation in y, or $BFC = 60°$ and $BCF = 67°$ or $ABF = 60°$ and $BCF = 67°$ or $ABF = 60°$ and $ABC = 113°$
					A1	
						Total 4 marks
3	(a)	(0 × 2) + 1 × 7 + 2 × 3 + 3 × 4 + 4 × 3 + 5 × 1 (0 +) 7 + 6 + 12 + 12 + 5	42	2	M1	For at least 4 correct products with the intention to add.
					A1	SC B1 for 2.1
	(b)		2	1	B1	
						Total 3 marks
4		$\frac{6}{100}$ × 8.50 or 0.06 × 8.50 or 0.51 or 51p	9.01	3	M1	M2 for 1.06 × 8.50 oe
		8.50 + "0.51"			M1 dep	
					A1	
						Total 3 marks

Question	Working	Answer	Mark	Notes		
5 (a)		A correct enlargement in the correct position	2	M1 A1	Enlargment of given shape by SF 3 anywhere on grid or completely correct enlargement by SF 2 Fully correct	
(b)		Rotation (Centre) (0,0) 90° clockwise oe	3	B1 B1 B1	 *O* or origin −90°, 270°	If more than one transformation mentioned then no marks
						Total 5 marks
6	2240 ÷ 805 (=2.78(26).....) "0.7826..." × 60 (= 46.95...) or "2.7826..." × 60 (= 166.95…)	2 hrs 47 mins	3	M1 M1 A1	 Method to change "0.7826…" to minutes or "2.7826…" to minutes cao	
						Total 3 marks
7	e.g. $7x = 4x - 13.5$ or $7x - 4x = -13.5$ or $7x + 13.5 = 4x$ or $4y - 7y = 54$ e.g. $y = 4 \times$ "−4.5" or $4x =$ "−18" or $7 \times$ "−4.5" $- y = -13.5$	$x = -4.5$ $y = -18$	3	M1 M1 A1	For correctly eliminating y or x dep on first M1 For method to find second variable dep on first M1 for both answers	
						Total 3 marks

Question	Working	Answer	Mark	Notes
8	$\cos A = \frac{43}{70}$ (=0.6142) or $\sin B = \frac{43}{70}$ (=0.6142)	142	4	M1 $\cos B = \frac{55.23...}{70}$, $\sin A = \frac{55.23...}{70}$
	$A = \cos^{-1}\left(\frac{43}{70}\right)$ or $B = \sin^{-1}\left(\frac{43}{70}\right)$			M1 $A = \sin^{-1}(0.7890...)$ $B = \cos^{-1}(0.7890...)$
	$A = 52.1°$ or $B = 37.9°$			A1 52° - 52.1° or 37.9° - 38° **SC B1** If M0 M0 A0 award B1 for 52.1° or 37.9° not identified as *A* or as *B*
				B1 ft for an angle identified as *A* or *B* Correct bearing (142 – 142.1)
				Total 4 marks

Question	Working	Answer	Mark	Notes
9 (a)		$27a^6b^{12}$	2	B2 fully correct B1 for 2 of the three terms correct in a product.
(b)	$4g - 8h + 10g - 15h$	$14g - 23h$	2	M1 Expanding brackets with 3 of 4 terms correct. A1 Fully correct
(c)	$y^2 - 7y + 5y - 35$	$y^2 - 2y - 35$	2	M1 Any 3 terms correct or 4 correct terms ignoring signs or $y^2 - 2y$ +/−... or ...−2y −35 A1
(d)	$-5 - 3 \leqslant 2p < 13 - 3$ or $-5 - 3 \leqslant 2p$ **and** $2p < 13 - 3$ or $-\frac{5}{2} \leqslant \frac{2p+3}{2} < \frac{13}{2}$ or $-\frac{5}{2} \leqslant \frac{2p+3}{2}$ **and** $p + \frac{3}{2} < \frac{13}{2}$	$-4 \leqslant p < 5$	3	M2 Correctly subtracting 3 from each part of the inequality or dividing each term by 2 or (p =) −4 **and** (p =) 5 M1 for one end correct e.g. $2p \geqslant -5 - 3$ **or** $\frac{2p+3}{2} < \frac{13}{2}$ or (p =) −4 **or** (p =) 5 A1 accept $p \geq -4$ and $p < 5$
				Total 9 marks

Question		Working	Answer	Mark	Notes	
10	(a)	eg $280 = 2 \times 140 = 2 \times 2 \times 70$ $(= 2 \times 2 \times 2 \times 35 = 2 \times 2 \times 2 \times 5 \times 7)$ eg $280 = 10 \times 28 = 2 \times 5 \times 28$ $(= 2 \times 5 \times 2 \times 14 = 2 \times 5 \times 2 \times 2 \times 7)$	$2 \times 2 \times 2 \times 5 \times 7$	3	M1	for at least first 2 correct steps in repeated factorisation (may be seen in a tree diagram)
		2, 2, 2, 5, 7			A1dep	For all correct factors, may include 1
					A1dep	Must see correct method Accept $2^3 \times 5 \times 7$
	(b)	2, 3, 3, 5, 7 or 2, 5, 7, 9 or $280 = 2 \times 2 \times 70$ and $630 = 3 \times 3 \times 70$	70	2	M1	For prime factors of 630 (which may be shown in part (a)) or factors 2, 5, 7, 9 of 630 or common prime factors 2, 5, 7 or $280 = 2 \times 2 \times 70$ and $630 = 3 \times 3 \times 70$ or an answer of 10, 14 or 35
					A1	Accept $2 \times 5 \times 7 (\times 1)$
						Total 5 marks
11		$10 - 3$	7	2	M1	10 and 3 identified
					A1	
						Total 2 marks

Question	Working	Answer	Mark	Notes
12	e.g. $4(5x-2)+3(3-5x)=2\times12$ or $\frac{4(5x-2)}{12}+\frac{3(3-5x)}{12}$ or $\frac{4(5x-2)+3(3-5x)}{12}$	4.6	4	M1 For clear intention to multiply all terms by 12 or a multiple of 12 or to express LHS as a single fraction or as the sum of a pair of fractions with a common denominator of 12 or a multiple of 12
	$20x-8+9-15x=2\times12$ or $\frac{20x-8+9-15x}{12}=2$ or $\frac{20x-8}{12}+\frac{9-15x}{12}=2$			M1 Expanding brackets correctly in a correct equation.
	$5x = 23$ or $20x - 15x = 24 + 8 - 9$ or $20x - 15x = 24 - 1$ oe			M1 For correct rearrangement of a correct equation with fractions cleared and terms in x isolated. A1oe dep on at least M1
				Total 4 marks
13 (a)		3.7×10^{-5}	1	B1
(b)		2.34×10^{9}	1	B1
(c)	$(1.4 \times 10^{9}) \div (3.5 \times 10^{7})$ or $\frac{1\,400\,000\,000}{35\,000\,000}$	40	2	M1 or for an answer equivalent to 4×10^{n} where n is an integer, e.g. 4, 4×10^{-2}, 4000, 0.4×10^{3} A1 Accept 4×10^{1} or 4×10
				Total 4 marks

Question		Working	Answer	Mark	Notes	
14	(a)		$\frac{4}{7}$	2	B1	For left branch correct 0.57(142…)
			$\frac{4}{9}, \frac{5}{9}, \frac{4}{9}, \frac{5}{9}$		B1	For right branches correct 0.44(4…), 0.55(5…)
	(b)	$\frac{3}{7} \times \frac{4}{9}$	$\frac{4}{21}$	2	M1	ft their tree
					A1	ft their tree for fractions less than 1 oe $\frac{12}{63}$, 0.19(0476...)
						Total 4 marks
15	(a)		−18, 2, 24	2	B2	For 3 correct values or B1 for 2 correct values
	(b)		Correct curve	2	M1ft	if at least B1 scored in (a) At least 5 points plotted correctly Plotting tolerance ± ½ sq
					A1	Through 7 correct points
	(c)	$x^3 - 2x + 3 = 3x + 2$ $y = 3x + 2$	−2.3 0.2 2.1	3	M1	For identifying (y =) $3x + 2$
					M1	For drawing correct line
					A1	dep on correct line drawn 3 correct x values in intervals: [−2.5, −2.2] [0.1, 0.3] [2.0, 2.2] ft dep on M1 in (b), correct line drawn and 3 points of intersection
						Total 7 marks

Question	Working	Answer	Mark	Notes
16	$p^2 = \frac{w+4}{w-2}$	$w = \frac{2p^2+4}{p^2-1}$	4	M1 For squaring both sides
	$p^2(w-2) = w+4$			M1 For multiplying both sides by $(w-2)$
	$p^2w - w = 4 + 2p^2$ or $-4 - 2p^2 = w - p^2w$			M1 For isolating terms in w in a correct equation.
				A1 oe $w = \frac{-2p^2-4}{1-p^2}$
				Total 4 marks
17	$AP \times 4.4 = 5.5 \times 2.4$ or $\frac{AP}{5.5} = \frac{2.4}{4.4}$ oe	3	2	M1
				A1
				Total 2 marks

Question	Working	Answer	Mark	Notes
18 (a)	15 ÷ (80 – 50) (= 0.5)	28, 18	2	M1 correct method to find fd for interval $50 < t \leqslant 80$ or one correct frequency for $80 < t \leqslant 120$ or $120 < t \leqslant 180$ or 0.5 shown correctly on fd axis (1cm = 0.1) or 10 small squares = 1 person oe
				A1 Both values correct
(b)	$\frac{10}{50-0}(=0.2)$, $\frac{12}{240-180}(=0.2)$, $\frac{8}{320-240}(=0.1)$	Correct bars drawn	2	M1 For method to find one correct frequency density. Accept one bar drawn with correct height Accept 10 × 10 = 100 or 12 × 10 = 120 or 8 × 10 = 80 small squares.
	$0 < t \leqslant 50$ fd = 0.2 (height 2 cm) $180 < t \leqslant 240$ fd = 0.2 (height 2 cm) $240 < t \leqslant 320$ fd = 0.1 (height 1 cm)			A1 Three bars with correct widths and heights
				Total 4 marks

Question	Working	Answer	Mark	Notes
19 (a)	$(2x + 1)(x + 3) – 2 \times 3$ (= 45) or $(2x + 1)(x + 3) – 6$ (= 45) $2x^2 + 6x + x + 3 – 6 = 45$	$2x^2 + 7x – 48 = 0$ obtained correctly.	2	M1 A correct unsimplified expression or equation for shaded area A1dep Convincingly arriving at given equation. Expansion of brackets must be shown (3 or 4 terms).
(b)	$(x =) \dfrac{-7 \pm \sqrt{7^2 - 4 \times 2 \times -48}}{2 \times 2} \left(= \dfrac{-7 \pm \sqrt{49 + 384}}{4} \right)$	3.45	3	M1 Correct substitution into the quadratic formula, allow one sign error in numbers and + instead of ± ; discriminant must not be simplified as far as 433 M1 dep on first M1 for simplification of discriminant to $\sqrt{433}$ or $\sqrt{49+384}$ A1 dep on first M1 3.45(216…) Award A0 if negative root is not excluded.
				Total 5 marks
20	$1000x = 278.7878...$ $10x = 2.7878....$ $990x = 276$ $x = \dfrac{276}{990}$	$100x = 27.8787…$ $x = 0.2787…$ $99x = 27.6$ $x = \dfrac{27.6}{99} \left(= \dfrac{276}{990} \right)$	$\dfrac{46}{165}$ correctly shown	2 M1 Two appropriate equations selected for use. e.g. $1000x = 278.7878...$ and $10x = 2.7878...$ A1 e.g. $\dfrac{276}{990} = \dfrac{46}{165}$ or $\dfrac{27.6}{99} = \dfrac{46}{165}$ must be shown
				Total 2 marks

Question	Working	Answer	Mark	Notes
21	$\frac{(x+3)(x-3)-(x+4)(x-4)}{(x-3)(x-4)}$ or $\frac{(x+3)(x-3)}{(x-3)(x-4)}-\frac{(x+4)(x-4)}{(x-3)(x-4)}$ oe	$\frac{7}{(x-3)(x-4)}$	3	M1 For a correct expression as one fraction or as two fractions with a common denominator
	$\frac{(x^2-3x+3x-9)-(x^2-4x+4x-16)}{(x-3)(x-4)}$ or $\frac{(x^2-9)-(x^2-16)}{(x-3)(x-4)}$ or $\frac{x^2-9-x^2+16}{(x-3)(x-4)}$ oe			M1 Correct expansion of $(x-3)(x+3)$ and $(x-4)(x+4)$ in a single correct fraction
				A1 Accept $\frac{7}{x^2-7x+12}$
				Total 3 marks
22	$\frac{5^{n^2+n^2-5n}}{5^{6+3}}(=125)$ or $5^{n^2-6}\times 5^{n^2-5n-3}(=125)$ or $5^{n^2+n^2-5n-9}(=125)$ or $5^{n^2+n^2-5n}=125\times 5^9$	4	5	M1 For simplifying the LHS to a product or quotient of two single powers of 5 or for an equation with 125 and at most a single power of 5 on each side.
	$5^{n^2+n^2-5n}=5^{12}$ or $5^{n^2+n^2-5n-9}=5^3$ or $5^{n^2+n^2-5n-9-3}=5^0$			M1 For simplifying both sides to a single power of 5
	e.g. $2n^2-5n-12\ (=0)$ or $2n^2-5n=12$			A1 A correct quadratic equation in n, simplified to three terms in any position.
	$(2n+3)(n-4)\ (=0)$ or $n=\frac{5\pm\sqrt{(-5)^2-4\times 2\times -12}}{2\times 2}=\ (=\frac{5\pm\sqrt{25+96}}{4})$			M1 A correct factorisation or correct substitution into the quadratic formula or correctly completing the square.
				A1 dep on correct quadratic equation Award A0 if negative root is not excluded.
				Total 5 marks

Question	Working	Answer	Mark	Notes
23	**½ side of square** = 11cos72 (= **3.3991**...) or 11sin18 **side of square** = $\frac{11\sin 36}{\sin 72}$ (= **6.7983**…) or $\sqrt{11^2+11^2-2\times11\times11\times\cos(36)}$ or $2\times11\cos 72$	9.89	4	M1 For a complete correct method to find a length identified as side of square or ½ side of square.
	ht of triangular face = 11sin72 (= **10.4616**…) or 11cos18 or $\sqrt{11^2-("3.3991...")^2}$ **diagonal of base** = $\frac{"6.7983..."}{\cos 45}$ (= **9.6143**…) or $\frac{"6.7983..."}{\sin 45}$ or $\sqrt{("6.7983...")^2+("6.7983...")^2}$ **½ diagonal of base** = $\frac{"3.3991..."}{\cos 45}$ (= **4.8071**…) or $\frac{"3.3991..."}{\sin 45}$ or $\sqrt{("3.3991...")^2+("3.3991...")^2}$ or $"6.7983..."\cos 45$ or $"6.7983..."\sin 45$			M1 For complete correct method to find a length identified as height of triangular face, or diagonal of base or ½ diagonal of base
	$OP=\sqrt{("10.4616...")^2-("3.3991...")^2}$ or $\sqrt{11^2-(\frac{1}{2}\times"9.6143...")^2}$ or $\sqrt{11^2-("4.8071...")^2}$			M1 A correct method to find *OP* A1 Allow 9.8 – 9.95 **SC B1** If no other marks are scored, award B1 for 11sin72 seen.
				Total 4 marks

Question	Working	Answer	Mark	Notes	
24	$\frac{360}{5}(=72)$ oe or $\frac{1}{2}\times\frac{(5-2)180}{5}(=54)$ oe	16.5	4	M1	A correct method to find an angle in a triangle formed by two radii and a side of the pentagon.
	$\frac{72}{360}\times 2\times\pi\times 6.8$ $(=\frac{68\pi}{25}=8.54(5)...)$ oe			M1	A correct method to find arc length
	$2\times 6.8\times\sin 36°$ or $2\times 6.8\times\cos 54°$ or $\sqrt{6.8^2+6.8^2-2\times 6.8\times 6.8\times\cos 72^o}$ or $\frac{6.8}{\sin 54^o}\times\sin 72^o$ (=7.99(3)...)			M1	indep A correct method to find length of chord
				A1	Allow 16.5 – 16.6
					Total 4 marks
25	11.45, 11.55, 5.05, 5.15	1001	4	M1	For a correct upper or lower bound for either number
	11.55^3 (=1540 (.798875…))			M1	Correct method to find upper bound for volume of box
	$\frac{4}{3}\times\pi\times 5.05^3$ (=539 (.53429…))			M1	Correct method to find lower bound for volume of ball
				A1	dep on correct working Accept 1001 or answer in range [1001.26, 1001.34]
					Total 4 marks