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Mark Scheme (Results)

June 2016

Pearson Edexcel International GCSE
Mathematics A (4MA0)
Paper 3HR

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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
    - awrt –answer which rounds to

- **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.

Apart from Questions 7, 18d and 20a, 20b & 21 where the mark scheme states otherwise, the correct answer, unless clearly obtained by an incorrect method, should be taken to imply a correct method.				
Q	**Working**	**Answer**	**Mark**	**Notes**
1. (a)	$\frac{7}{10}\times 30$ oe (eg 30 ÷ (7 + 3) = 3, 7 × '3') or $\frac{3}{10}\times 30$ (= 9)	21	2	M1 A Complete method to find either share A1
(b)	$\frac{75}{3}\times 4$ oe	100	2	M1 Complete method A1
				Total 4 marks

Q	Working	Answer	Mark	Notes
2. (a)		$2x(x-2)$	2	B2 Also award B2 for $(2x + 0)(x – 2)$ B1 for incomplete factorisation $2(x^2 - 2x)$ or $x(2x – 4)$ or $2x$ taken out as a common factor.
(b)	$32 = 2p + 3 \times 7$ $2p = 32 – 3 \times 7$ or $2p = 32 – 21$ or $2p = 11$ or $p = \frac{32-21}{2}$	$\frac{11}{2}$	3	M1 Correct substitution M1 Rearranging to make $2p$ or p the subject (or $-2p$ or $–p$) A1oe
				Total 5 marks

Q	Working	Answer	Mark	Notes
3.	$\frac{35}{50} \times 300$ oe, eg 35×6, 0.7×300, etc	210	2	M1 A fully correct method A1 cao (award $\frac{210}{300}$ M1 only)
				Total 2 marks

Q	Working	Answer	Mark	Notes
4.	$\frac{360}{8}$ or $180-\frac{(8-2)\times180}{8}$	45	2	M1 For complete correct method for exterior angle A1 Answer of 135 scores M0A0
				Total 2 marks

Q		Working	Answer	Mark	Notes	
5.	(a)	$\frac{8}{100}\times28$ or 2.24 28 – "2.24"	25.76	3	M1 M1 dep A1	M2 for $\frac{92}{100}\times28$
	(b)	$\frac{3}{0.08}$ or $\frac{3}{8}\times100$ oe	37.50	3	M2 M1 for $\frac{3}{8}$ or 0.375 or 3 = 8% A1 Accept 37.5	
					Total 6 marks	

Q	Working	Answer	Mark	Notes
6. (a)	$-9 < 3x \leq 6$ or $3x > -9$ and $3x \leq 6$ or $-\frac{4}{3} < x + \frac{5}{3} \leq \frac{11}{3}$ or $x + \frac{5}{3} > -\frac{4}{3}$ and $x + \frac{5}{3} \leq \frac{11}{3}$ or $x > -3$ or $x \leq 2$		3	M2 For both ends correct for $3x$ or $x + \frac{5}{3}$ or one end correct for x M1 for one end correct for 3x or $x + \frac{5}{3}$, eg $3x > -9$ or $3x \leq 6$ or answers of $x = -3$ & $x = 2$
		$-3 < x \leq 2$		A1 Accept $x > -3$, $x \leq 2$
(b)		$-2, -1, 0, 1, 2$	2	B2ft B1 for five correct values and one incorrect value or four correct values with no incorrect value Only ft from an inequality in the form $a < x \leq b$
				Total 5 marks

Q	Working	Answer	Mark	Notes
7.	$792 = 2 \times 396 = 2\times 2 \times 198$ $= 2 \times 2 \times 2 \times 99 = 2 \times 2 \times 2 \times 3 \times 33$		3	M1 For at least 2 correct steps in repeated factorisation (may be seen in a tree diagram or 'ladder')
	2, 2, 2, 3, 3, 11			A1 Condone inclusion of 1 (maybe a fully correct tree or factor ladder)
		$2 \times 2 \times 2 \times 3 \times 3 \times 11$		A1 Or $2^3 \times 3^2 \times 11$ NB: Candidates showing no working score 0 marks
				Total 3 marks

Q	Working	Answer	Mark	Notes
8. (a)		Translation 5 to the right and 4 down	2	B2 B1 for translation B1 for 5 to the right and 4 down or $\begin{pmatrix} 5 \\ -4 \end{pmatrix}$ These marks are independent but award no marks if the answer is not a single transformation.
(b)		**R** correct	2	B2 (– 2, – 1), (0, – 1), (0, – 2), (– 1, – 2), Condone omission of label B1 for 90° anticlockwise rotation about (1,0) or for Correct orientation but incorrect position.
				Total 4 marks

Q	Working	Answer	Mark	Notes
9. (a)	1 – (0.15 + 0.1 + 0.05 + 0.2 + 0.15)	0.35	2	M1 A1 oe
(b)	0.15 + 0.05 + 0.2	0.4	2	M1 A1 oe
				Total 4 marks

Q	Working	Answer	Mark	Notes
10.	3 × 13 + 10 × 10 + 17 × 16 + 24 × 7 + 31 × 4 Or 39 + 100 + 272 + 168 + 124	703	3	M1 For at least 2 products f × *x* consistently within intervals (including end points) M1 For completely correct method (condone 1 error) NB: Products do not need to be evaluated A1 cao Do not ISW to find mean SC award 2 marks for 14.06 if no other marks gained
				Total 3 marks

Q	Working	Answer	Mark	Notes
11.	gradient $= -2$		3	M1 for $m = -2$ stated or $y = k - 2x$ where $k \neq 7/2$
	$1 = 3 \times$ '(-2)' $+ c$ or $y - 1 =$ '-2'$(x - 3)$ oe			M1ft Correct substitution to find c for their gradient
		$y = -2x + 7$		A1oe (M2 for $-2x + 7$ or $\boldsymbol{L} = -2x + 7$)
				Total 3 marks

Q		Working	Answer	Mark	Notes	
12.	(a)	e.g. $\frac{a^{11}}{a^7}$ or $\frac{a^6}{a^2}$ or $\frac{a^9}{a^5}$ oe	a^4	2	M1 A1	For $\frac{a^{11}}{a^7}$ or any index law used correctly
	(b)	$4q - 5 = 3p - p$ oe eg $-2p = 5 - 4q$	$p = \frac{4q-5}{2}$	2	M1 A1	For correctly collecting terms in p one side and other terms on the other side oe, eg $p = 2q - 2.5$
	(c)	$8y^2 - 2y + 12y - 3$	$8y^2 + 10y - 3$	2	M1 A1	For any three correct terms or for 4 correct terms ignoring signs or for $8y^2 + 10y + k$ for any non-zero value of k or for ....+$10y - 3$
	(d)		$2a^2b$	2	B2	B1 for two of 2 or a^2 or b as part of a product
						Total 8 marks

Q		Working	Answer	Mark	Notes	
13.		$3.6^2 + 9.8^2$ or 109 $\sqrt{"3.6^2 + 9.8^2"}$ or $\sqrt{109}$ (=10.4…) $\sqrt{"109" - 8.4^2}$	6.2	4	M1 M1 M1 A1	A correct first step to find *DB* Accept 10.4(403065...) rounded or truncated to at least 3 SF oe
						Total 4 marks

Q	Working	Answer	Mark	Notes
14. (a)		Correct probabilities	2	B1 For 0.6 on LHS branch B1ft For all other probabilities correct
(b)	0.35 + 0.05 × 0.35 + 0.05 × 0.05 × 0.35 oe (=0.35 + 0.0175 + 0.000875)	0.368375	3	M2 ft from tree diagram M1 for 0.05 × 0.35 or 0.05² × 0.35 oe A1 oe eg $\frac{2947}{8000}$ Accept 0.36(8375) rounded or truncated to at least 2 SF
				Total 5 marks

Q	Working	Answer	Mark	Notes
15. (a)		$3x^2 - 9x - 54$	2	M1 For any two of $3x^2$, $-2\times\frac{9}{2}x$, or -54 A1
(b)	$3x^2 - 9x - 54 = 0$ Eg $3(x - 6)(x + 3)$ (= 0) or $(x =) \frac{-(-9)\pm\sqrt{(-9)^2-4\times3\times-54}}{2\times3}$	$x = -3$ and $x = 6$	3	M1ft For letting (a) = 0 M1ft For correct factors or correct substitution into the quadratic formula Only ft for a 3 term quadratic & if M1 scored in (a) A1
				Total 5 marks

Q	Working	Answer	Mark	Notes
16. (a)	1 Square = 0.5 or 2 squares = 1 oe Or fd $\left(10/5 = 2\right)$ calculated or marked at correct place on vertical axis with no contradictions $1 \times 10 + 2 \times 5 + 3 \times 5$ (=10 + 10 + 15) oe	35	3	M1 1 Square = 0.5 or 2 squares = 1 Or correct fd $\left(10/5 = 2\right)$ calculated or marked on the vertical axis with no contradictions M1 Complete method to find total number of children, eg 10, 10, and 15 frequencies assigned to correct blocks A1
(b)		Correct block	1	B1
				Total 4 marks

Q	Working	Answer	Mark	Notes
17. (a)	$\frac{9}{4}$ or $\frac{4}{9}$ oe	11.25	2	M1 For the correct SF seen or used A1oe
(b)	Eg $\frac{5}{"11.25"} = \frac{x}{x+4.5}$ or $\frac{4}{9} = \frac{x}{x+4.5}$ or $\frac{5}{4} = \frac{4.5}{x}$ or $4.5 \div \frac{"11.25"-5}{5}$ or $2.25x = x + 4.5$ oe	3.6	2	M1 A fully correct equation in x or a correct calculation for x A1oe
(c)	2.25^2 or 5.0625 or $\frac{16}{81}$ or $\frac{81}{16}$ or 81 : 16 or 16 : 81 or $\frac{16}{65}$ or $\frac{65}{16}$ or 65 : 16 or 16 : 65	$\frac{16x}{65}$	3	M1
	$5.0625y - y = x$ or $\frac{65}{16} = \frac{x}{y}$ oe			M1 For a fully correct expression in x and y that can be rearranged to give y in terms of x
				A1oe eg $\frac{x}{4.0625}$ Accept 0.246(1538....)x rounded or truncated to at least 3SF
				Total 7 marks

Q	Working		Answer	Mark	Notes
18. (a)			$\frac{1}{5}$	1	B1oe
(b)			$\frac{1}{5}$	2	M1 f(– 1) = $\frac{1}{2}$ or substitution of x = −1 into $\frac{\left(x/(3x+1)\right)}{\left(3x/(3x+1)\right)+1}$ A1oe
(c)			$-\frac{1}{3}$	1	B1
(d)	$x = \frac{y}{3y+1}$ $x(3y + 1) = y$ or $3xy + x = y$	$y = \frac{x}{3x+1}$ $y(3x + 1) = x$ or $3xy + y = x$		3	M1 For writing function in the form $x = \frac{y}{3y+1}$ or $y = \frac{x}{3x+1}$ and multiplying both sides by the denominator
	$3xy – y = – x$ or $y(3x – 1) = – x$ oe	$3xy – x = – y$ or $x(3y – 1) = –y$ oe			M1 For gathering terms in x or y (whichever is applicable) correctly
			$\frac{x}{1-3x}$ or $\frac{-x}{3x-1}$		A1 Dep on M1 must be in terms of x
					Total 7 marks

Q	Working	Answer	Mark	Notes
19.	100 × 2 360 – "100 × 2" (=160)		3	M1 Complete method to find obtuse angle *AOC* – could be seen in correct place on diagram
	360 – (90 + 90 + "160")			M1 dep for correct method to find *APC*
		20		A1
				Total 3 marks

Q	Working	Answer	Mark	Notes
20. (a)	$\frac{2(5x+2)(5x-2)}{2(5x-2)}$ or $\frac{(5x+2)(5x-2)}{5x-2}$ or $\frac{(5x-2)(10x+4)}{2(5x-2)}$ or $\frac{(10x-4)(5x+2)}{2(5x-2)}$ oe	$5x + 2$	3	M2 Factorising numerator and denominator in a correct quotient M1 for $2(25x^2 - 4)$ or a correctly factorised numerator or denominator or $\frac{25x^2-4}{5x-2}$ A1 dep on at least M1
(b)	$\sqrt{12a \times 3a} + a\sqrt{3a \times 3a}$ or better		3	M1 For correct expansion or $\sqrt{12a} = 2\sqrt{3}\sqrt{a}$ or $\sqrt{12a} = 2\sqrt{3a}$ or $6a$ or $3a^2$ from correct working
	$6a + 3a^2$			A1
	eg $3(2a + a^2)$ or $3a(2 + a)$ or $\frac{6a+3a^2}{3} = 2a + a^2$ or explanation that $6a$ and $3a^2$ are multiples of 3 so overall expression is a multiple of 3	Show		B1ft dep on at least M1
				Total 6 marks

Q	Working	Answer	Mark	Notes
21.	$(2^2)^{2k+8} = 2^3$ or $4^{\frac{3}{2}} = 8$ or $2^{4k+16} = 2^3$ or $4^{\frac{3}{2}} = 4^{2k+8}$		4	M2 M1 for $4^{2k+8} = 8$ or $3 \times 4^{\frac{3}{2}} = 24$
	$4k + 16 = 3$ or $2k + 8 = 1.5$ oe			M1 A correct equation in k or a fully correct method to find k
		$-\frac{13}{4}$		A1oe Dep on at least M2
				Total 4 marks

Q	Working	Answer	Mark	Notes
22.	$\frac{30}{360}\times\pi r^2 - 0.5r^2\sin 30 = 100$ oe $r^2\left(\frac{30\pi}{360} - 0.5\sin 30\right) = 100$ $r^2\left(\frac{\pi - 3}{12}\right) = 100$		6	M2 For a correct equation involving r^2 M1 for $\frac{30}{360}\times\pi r^2$ (or $\frac{\pi r^2}{12}$) or $0.5r^2\sin 30$ (or $0.25r^2$)
	$r^2 = \frac{1200}{\pi - 3}$			M1 For a correct equation with r^2 the subject
	$r = \sqrt{\frac{1200}{\pi - 3}}$			M1 For correctly isolating r. Accept 92.(05984992...) rounded or truncated to at least 2SF
	$2\pi \times \sqrt{\frac{1200}{\pi - 3}} \times \frac{30}{360}$ oe eg $2\pi\times 92\ldots\times\frac{1}{12}$			M1 A correct expression for the length of are PQR
		48.2		A1 Accept answers which round to 48.2
				Total 6 marks

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