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Mark Scheme (Results)

January 2018

Pearson Edexcel International GCSE
Mathematics A (4MA0)
Foundation 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.
- 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

- **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  If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.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 Questions16b, 17b, 18 and 19, 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)	$36 \times \frac{12}{100}$ oe (= 4.32) 36 – "4.32"	31.68	3	M1 M1 M2 for a complete method Eg 0.88 × 36 oe A1
	(b)	$\frac{81}{180} \times 100$ (%)	45	2	M1 For $\frac{81}{180}$ oe A1
					Total 5 marks

2	(a)	Eg 3 × 6 or 18 or 3 × 4 or 12 or 8 × 2 or 16 or 5 × 2 or 10 or 8 × 6 or 48 or 4 × 5 or 20 Eg 3 × 6 + 5 × 2 or 3 × 4 + 8 × 2 or 8 × 6 – 4 × 5	28	3	M1 For method to find the area of a rectangle M1 Complete method A1
	(b)	$\frac{350}{"28"}$ or "28" × h = 350	12.5	2	M1ft A1ft
					Total 5 marks

3	$\frac{1+7}{2}$ or $\frac{3+8}{2}$	(4, 5.5)	2	M1 A1	Or for correct *x* coordinate of 4 or for correct *y* coordinate of 5.5 oe or (5.5, 4) oe
					Total 2 marks

4	$\frac{400}{5+3}$ or 50 or $\frac{400}{5+3} \times 5$ (=250) or $\frac{400}{5+3} \times 3$ (=150) "50" × 2	100	3	M1 M1 A1	For $\frac{400}{5+3} \times 5$ (=250) **and** $\frac{400}{5+3} \times 3$ (=150)
Alternative Method					
		100	3	M2 A1	For $\frac{2}{8} \times 400$
					Total 3 mark

5	(a)		Translation 4 to the right and 1 down	2	B2 For translation and 4 to the right and 1 down B1 for translation or 4 to the right and 1 down Accept $\begin{pmatrix} 4 \\ -1 \end{pmatrix}$ NB: No marks for multiple transformations
	(b)		Triangle in correct position	2	B2 For vertices at (2, −3), (2, −2), and (0, −3) B1 for correct orientation but in wrong position or For vertices at (2, 6), (2, 7), (4, 7)
					Total 4 marks

6	(a)	0 × 1, 1 × 8, 2 × 12, 3 × 15, 4 × 4 or 0, 8, 24, 45, 16, 93 $\frac{1\times8+2\times12+3\times15+4\times4}{40}$ or $\frac{"93"}{40}$	2.325	3	M1 M1 A1	For at least 4 products (may not be evaluated. (dep) for division by 40 NB. If division is by something other than 40 this must clearly come from adding the frequencies. Accept 2.33 or 2 if 2.325 or $\frac{93}{40}$ seen Accept $2\frac{13}{40}$ SCB2 for 2.35
	(b)		1	2	M1 A1	For Lower Quartile (Q1) = 2 AND Upper Quartile (Q3) = 3 Accept a correct ordered list of the 40 numbers with both quartiles clearly identified in the correct position.
	(c)	$\frac{15}{40}+\frac{4}{40}$ oe	$\frac{19}{40}$	2	M1 A1	 oe Eg 0.475 SCB1 for $\frac{31}{40}$ or 0.775
						Total 7 marks

7	(a)		$a(4b + 7a - 1)$	2	B2	B1 for factors which, when expanded and simplified, give three terms, at least one of which is correct.
	(b)	$4 > 11 + 8p$ or $-8p > 11 - 4$ or $-8p > 7$ or $8p < 4 - 11$ or $8p < -7$	$p < \frac{-7}{8}$	2	M1 A1	Accept $4 = 11 + 8p$ or $-8p = 11 - 4$ or $\frac{-7}{8}$ or $8p = 4 - 11$ Condone $p < -0.875$ Mark the final answer
	(c)	$x^2 + 3x - 6x - 18$	$x^2 - 3x - 18$	2	M1 A1	For 3 correct terms or For 4 correct terms ignoring signs or For $x^2 - 3x + c$ for any non-zero value of c or For ... $- 3x - 18$
	(d)		y^8	1	B1	
	(e)		$9e^2$	2	B2	B1 for 9 or e^2 as part of a product or for $3^2 \times e^2$
						Total 9 marks

8	Eg $\sin 20 = \frac{BC}{8.4}$ or $\frac{BC}{\sin 20} = \frac{8.4}{\sin 90}$ or $\frac{\sin 20}{BC} = \frac{\sin 90}{8.4}$			M1	Or for *AC* or angle *B* evaluated correctly **AND** then used in a correct method to find *BC* Eg $BC^2 + (7.89(34...))^2 = 8.4^2$ or Eg $\tan 20 = \frac{BC}{7.89(34...)}$
	$8.4\sin 20$ or $\frac{8.4}{\sin 90} \times \sin 20$ or $8.4\cos 70$	2.87	3	M1 A1	For a complete method Accept 2.87(296...) rounded or truncated to at least 3 SF
					Total 3 marks

9 (i)		1, 2, 23, 31, 46, 62, 713, 1426	3	B3	Accept factor written as products. If not B3 then B2 for three of 1, 46, 62, 713, 1426 If not B2 then B1 for one of 46, 62, 713 or four of 1, 2, 23, 31, 1426
(ii)		23 × 31	1	B1	
					Total 4 marks

10	(a)		324 000 000	1	B1	
	(b)		United Kingdom	1	B1	
	(c)		3.089×10^9	2	M1 A1	Sight of digits 3089 Accept 3.09×10^9
	(d)	Eg $1.87 \times 10^7 : 1.32 \times 10^9$ or 1.87 : 132 or 187 : 13200 or 1 : $\frac{1200}{17}$ or 1 : 70.5(882...)	71	2	M1 A1	For a correct ratio or $\frac{1.32 \times 10^9}{1.87 \times 10^7}$ oe oe eg 7.1×10^1 Accept 1 : 71 M1A0 for answer of 70.5(882...)
						Total 6 marks

11	(a)		$8a^5b^9$	2	M1 A1	For two correct from 8, a^5 or b^9 written as a product.
	(b)	Eg $\frac{1}{c^{2/4}}$ or $c^{2/4}$ or $\left(c^k\right)^4 = \frac{1}{c^2}$ or $c^{4k} = \frac{1}{c^2}$ or $4k = -2$	$-\frac{1}{2}$ oe	2	M1 A1	For a correct first step Eg $-\frac{2}{4}$
	(c)		$\frac{2(x+2)}{3}$	2	M1 A1	For $\frac{4(x+2)}{6}$ or $\frac{4x+8}{6}$ or $\frac{2(x+2)^2}{3(x+2)}$ Accept $\frac{2x+4}{3}$ or $\frac{2}{3}(x+2)$ or $\frac{2}{3}x+\frac{4}{3}$
	(d)	$3(x^2 - 25y^2)$	$3(x+5y)(x-5y)$	2	M1 A1	For $3(x^2 - 25y^2)$ or $(3x - 15y)(x + 5y)$ or $(x - 5y)(3x + 15y)$ or $(\sqrt{3}x + \sqrt{75}y)(\sqrt{3}x - \sqrt{75}y)$ oe
						Total 8 marks

12	(a)		Fully correct tree diagram	3	B1 For $\frac{7}{20}$ on lower LH branch B1 Correct binary structure with 4 branches needed on RHS B1 For fully correct tree diagram with all probabilities ($\frac{7}{20}$, $\frac{12}{19}$, $\frac{7}{19}$, $\frac{13}{19}$ and $\frac{6}{19}$) and labels.
	(b)	$\frac{13}{20}\times\frac{12}{19}$	$\frac{156}{380}$	2	M1 ft from their tree diagram in (a) A1 oe eg $\frac{78}{190}$ or $\frac{39}{95}$ Accept 0.41(0526….) rounded or truncated to at least 2dp.
	(c)	$\frac{13}{20}\times\frac{12}{19}\times\frac{7}{18}$ or $\frac{91}{570}$ or 0.15(9649...) oe $\frac{13}{20}\times\frac{12}{19}\times\frac{7}{18}+\frac{13}{20}\times\frac{7}{19}\times\frac{12}{18}+\frac{7}{20}\times\frac{13}{19}\times\frac{12}{18}$ or $3\times\frac{13}{20}\times\frac{12}{19}\times\frac{7}{18}$	$\frac{91}{190}$	3	M1 Ft from (a) M1 Ft from (a) Dep. For full correct method A1 oe Accept 0.47(894...) rounded or truncated to at least 2dp. ft method marks if probabilities <1

	With Replacement $\frac{13}{20}\times\frac{13}{20}\times\frac{7}{20}$ or $\frac{1183}{8000}$ or 0.14(7875) $3\times\frac{13}{20}\times\frac{13}{20}\times\frac{7}{20}$ or $\frac{3549}{8000}$ or 0.44(3625)			M1 M1
				Total 8 marks

13	(a)		4.06	1	B1	Accept 4 – 4.1
	(b)		1 or $k = -8.5$ (1d.p.)	2	B1 B1	For $k = 1$ $k = -8.5$ (accept $k = -8.6$ to -8.4)
	(c)	$y = ax + 3$ or $y = -x + b$ or for $3 - x$ oe	$y = 3 - x$	2	M1 A1	For $y = ax + 3$ or $y = -x + b$ or for $3 - x$
						Total 5 marks

14	(a)	$P = kQ^2$ or $P \propto kQ^2$ Eg $180 = k \times 12^2$ or $180 \propto k \times 12^2$	$P = 1.25Q^2$	3	M1 M1 A1	Allow $Q^2 = kP$ or $Q^2 \propto kP$ For a correct substitution into a correct equation Implies first M1 Award M2 if $k = 1.25$ oe stated unambiguously in (a) or (b) oe Only award if P is the subject. M2A1 for $P = kQ^2$ on answer line if $k = 1.25$ oe seen in part (a) or (b)
	(b)		1125	1	B1	Ft if (a) in form $P = kQ^2$
						Total 4 marks

15	(a)	$(BD^2 =)\ 8^2 + (6 + 5)^2 - 2 \times 8 \times (6 + 5) \times \cos 25$ $(BD^2 =)\ 64+121-159(.510...)$ or $25.4(898...)$ or $(BD =)\ \sqrt{64+121-159(.510...)}$	5.05	3	M1 M1 A1	For the correct use of Cosine rule For correct order of operations Accept 5.04(8745...) rounded or truncated to at least 3SF
	(b)	Eg $AC \times 8 = (6 + 5) \times 6$ or $(AC =)\ \frac{(6+5)\times 6}{8}$ or $\frac{11 \times 6}{8}$ oe $(8 + BC) \times 8 = (6 + 5) \times 6$ oe	8.25 oe	2	M1 A1	For a correct equation involving AC or BC Eg $\frac{66}{8}$ or $\frac{33}{4}$
						Total 5 marks

16	(a)		$6x^2 - 18x$	2	M1 For $6x^2$ or $2\times3\times x^2$ oe or $-18x$ or $-2\times9\times x$ oe A1
	(b)	$6x^2 - 18x = 0$ $6x(x - 3) = 0$ $x = 3$ (or $x = 0$) (y =) $2 \times 3^3 - 9 \times 3^2 + 31$ or 4 Gradient = $\frac{4}{3}$	$\frac{4}{3}$ oe	4	M1 ft their part (a) = 0 if quadratic A1 For $x = 3$ Dep on M1 M1 For substituting 3 in $2x^3 - 9x^2 + 31$ A1
					Total 6 marks

17	(a)(i)		$6\mathbf{a} + 4\mathbf{b} + 2\mathbf{c}$	1	B1	oe
	(a)(ii)		$3\mathbf{a} + 2\mathbf{b}$	1	B1	oe
	(b)	Eg $(\overrightarrow{UX} =) -\frac{3}{4}(6\mathbf{a} + 4\mathbf{b} + 2\mathbf{c}) + 6\mathbf{a} + 4\mathbf{b} + 1.5\mathbf{c}$ or $(\overrightarrow{UX} =) -4.5\mathbf{a} - 3\mathbf{b} - 1.5\mathbf{c} + 6\mathbf{a} + 4\mathbf{b} + 1.5\mathbf{c}$ or $(\overrightarrow{UX} =) \frac{1}{4}(6\mathbf{a} + 4\mathbf{b} + 2\mathbf{c} - 2\mathbf{c})$ $(\overrightarrow{UX} =) 1.5\mathbf{a} + \mathbf{b}$	$\overrightarrow{UX} = \frac{1}{2}\overrightarrow{VW}$ oe and conclusion	3	M1 A1 A1	For a correct expression for $\overrightarrow{UX}$ For $(\overrightarrow{UX} =) 1.5\mathbf{a} + \mathbf{b}$ NB: A correct simplified expression for $\overrightarrow{UX}$ and $\overrightarrow{VW}$ must be given.
	(c)	$6^2 + (-5)^2$ or $6^2 + 5^2$ or 61	$\sqrt{61}$	2	M1 A1	Note: M1A0 for 7.81(024…) rounded or truncated to at least 3SF
						Total 7 marks

18	17.5, 17.4$\dot{9}$, 16.5, 63.5 or 64.5 or 64.4$\dot{9}$ $\frac{\text{LB} - 2 \times \text{UB}}{2}$	14.25 oe	3	B1 M1 A1	For any correct LB or UB $63.5 \le \text{LB} < 64$ $17 < \text{UB} \le 17.5$ From correct working
					Total 3 marks

19	Eg $x^2 - 105 + x^2 - 65 + 470 - 30x + 510 - 30x = 360$ or $2x^2 - 60x + 810 = 360$			M1	For a correct equation
	Eg $2x^2 - 60x + 450$ (= 0) or $2x^2 - 60x = -450$ or $x^2 - 30x + 225$ (= 0)			M1	For a correct three term quadratic
	Eg $(x - 15)(x - 15)$ (= 0) or $\frac{30 \pm \sqrt{(-30)^2 - 4 \times 1 \times 225}}{2 \times 1}$			M1	For $(x - 15)(x - 15)$ (= 0) or $2(x - 15)(x - 15)$ (= 0) or $(2x - 30)(x - 15)$ (= 0) or $\frac{30 \pm \sqrt{(-30)^2 - 4 \times 1 \times 225}}{2 \times 1}$ oe (may be partially evaluated; Condone lack of brackets)
	$x = 15$			A1 M1	Dep on first 2 method marks For substitution of $x = 15$ into $x^2 - 65$ **and** $470 - 30x$ or $x^2 - 105$ **and** $510 - 30x$
		160 and 20 or 120 and 60 with conclusion	6	A1	

	Alternative Eg $x^2 - 65 + 470 - 30x = 180$ or $x^2 - 105 + 510 - 30x = 180$ $x^2 - 30x + 225 (= 0)$ or $x^2 - 30x = -225$ $(x - 15)(x - 15) (= 0)$ or $\frac{30 \pm \sqrt{(-30)^2 - 4 \times 1 \times 225}}{2 \times 1}$ $x = 15$	160 and 20 or 120 and 60 with conclusion	6	M1 For a correct equation M1 For a correct three term quadratic M1 For $(x - 15)(x - 15) (= 0)$ or $\frac{30 \pm \sqrt{(-30)^2 - 4 \times 1 \times 225}}{2 \times 1}$ oe (may be partially evaluated; Condone lack of brackets) A1 Dep on first 2 method marks M1 For a substitution of $x = 15$ into the other pairs of co-interior angles. A1 cso
				Total 6 marks

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