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Mark Scheme (Results)

Summer 2015

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 4, 14, 19b, 20c and 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				
Question	**Working**	**Answer**	**Mark**	**Notes**
1 (a)	[2 × 0] + 12 × 1 + 15× 2 + 8 ×3 + 2 ×5 + 1× 8 (= 84) **or** [0] + 12 + 30 + 24 + 10 + 8		3	M1 (2 × 0) may be omitted; allow one error
	"84" ÷ 40			M1 dep **NB: Products do not have to be evaluated**
		2.1		A1
(b)	$\frac{14}{40}\times 100$ oe		2	M1 allow $\frac{26}{40}\times 100$ **or** $\frac{29}{40}\times 100$
		35		A1
				Total 5 marks

2 (a)	360 ÷ 15 **or** $\frac{(n-2)180}{n}=180-15$ oe		2	M1
		24		A1
(b)	3 × 180/5 or (180 – 360 ÷ 5) (=108)		3	M1 must be no contradiction on diagram or in working
	360 – 3 × "108"			M1 dep
		36		A1
	Alternative for (b): 360/5 (=72)			M1 must be no contradiction on diagram or in working
	(180 – "72"×2)			M1 dep
		36		A1
				Total 5 marks

3	56.25 ÷ 15			M1 M1 for 56.25 or 15
		3.75	2	A1 accept $\frac{15}{4}$, $3\frac{3}{4}$
				Total 2 marks

4	Eg. $7x + 3x = 1 + 2$		3	M1 for correct rearrangement with x terms on one side and numbers on the other **or** for correct simplification of either x terms or numbers on one side in a correct equation eg. $10x - 2 = 1$; $7x = 3 - 3x$
	$10x = 3$			M1 award also for $-10x = -3$
		$\frac{3}{10}$ oe		A1 depends on the award of at least M1 ; If no correct algebraic working then award no marks
				Total 3 marks

5 (a)		Reflection (in the line) $x = 2$	2	B1 for reflection, reflect, reflected B1 for $x = 2$ **NB: If more than one transformation then no marks can be awarded**
(b)		Vertices at (1, –1) (4, –1) (4, –3) (3, –3)	2	B2 Shape in correct position If not B2 then B1 for correct orientation of R but wrong position **or** 3 out of 4 vertices correct
(c)		Vertices at (3, 2) (3, 4) (4, 4) (4, 3)	2	B2 If not B2 then B1 for shape of correct size and orientation **OR** a correct enlargement scale factor $-\frac{1}{2}$, centre (1, 3)
				Total 6 marks

6	6×165 (= 990)		3	M1
	("990" – 155) ÷ 5			M1 dep condone missing brackets
		167		A1
				Total 3 marks

7	$5.4^2 + 12.8^2$ (= 193)		3	M1
	$\sqrt{5.4^2 + 12.8^2}$ **or** $\sqrt{"193"}$ (= 13.89244399)			M1 dep
		13.9		A1 awrt 13.9
				Total 3 marks

8 (a)		$g(g + 4)$	2	Award B2 also for $(g \pm 0)(g + 4)$ oe B1 for factors which, when expanded and simplified, give two terms, one of which is correct **except B0 for $(g + 2)(g - 2)$**
(b)			2	M1 for $(e \pm 6)(e \pm 4)$
		$(e - 6)(e + 4)$		A1
				Total 4 marks

9	$\frac{A}{4\pi} = r^2$		2	M1
		$\sqrt{\frac{A}{4\pi}}$		A1 accept equivalents eg. $\frac{\sqrt{A\pi}}{2\pi}$, $\frac{1}{2}\sqrt{\frac{A}{\pi}}$
				Total 2 marks

10 (a) (i)		$2^2 \times 5$	3	B1 for $2^2 \times 5$ oe or 20
(ii)		$2^3 \times 3 \times 5^2$		B2 for $2^3 \times 3 \times 5^2$ oe or 600 (B1 for any product using powers of 2 and 3 and 5 **or** at least 300, 600… **and** 40, 80, 120 …)
(b)	8 $(= 2^n)$ **or** 2^3		2	M1 for one correct use of index laws eg. $8^5 \div 8^4$
		3		A1
				Total 5 marks

11 (i)			2	M1 for $0.5 \times 9 \times (8x + 4)$ oe or $7 \times (10 - x)$ oe (may be seen as part of an equation)
		eg. $9(8x + 4) = 28(10 - x)$		A1 for any correct equation
(ii)	$36x + 18 = 140 - 14x$		5	M1 for correct removal of either bracket in an equation (ft providing equation is of form $a(x + b) = c(x + d)$) **NB: This mark can be implied**
	$50x = 122$			M1 dep ft for getting to $mx = k$ oe
	$x = 2.44$ or $\frac{61}{25}$ oe			A1 ft (at least 3 sig figs or a fraction)
	$7 \times (10 - \text{“2.44”})$			M1 ft their value substituted (must be positive)
		52.92		A1 cao **NB: Working for part (ii) may be seen in part (i)**
				Total 7 marks

12 (a)		1, 4, 11, 17, 19, 20	1	B1
(b)		correct cf graph	2	B2 Points at end of intervals and joined with curve or line segments If not B2 then B1(ft from a table with only one arithmetic error) for 4 or 5 of their points from table plotted consistently within each interval at their correct heights and joined with smooth curve or line segments
(c)			2	M1 ft for a cf graph horizontal line or mark drawn at 10 or 10.5 or vertical line or mark drawn at 238.5 – 239.5 incl
		238.5 – 239.5		A1 ft from their cf graph
				Total 5 marks

13 (a)		Russia	1	B1
(b)	$(2.63 \times 10^6) - (8.97 \times 10^5)$ **or** 1733(000) oe		2	M1 condone missing brackets
		1.733×10^6		A1 Accept 1.73×10^6
(c)	$(6.3 \times 10^5) \div (8.4 \times 10^6)$		2	M1
		7.5% oe		A1accept percentage, fraction, decimal or ratio eg. $\frac{3}{40}$ **or** 0.075 **or** 3 : 37 SC: B1 FOR A RATIO OF 3 : 40 OE
				Total 5 marks

14	$16x - 8y = 14$ $12x - 8y = 6$ $4x = 8$			M1 for appropriate multiplication to get coefficients of x or y the same (condone one arithmetic error) with the correct operation to eliminate one variable **or** for correct rearrangement of one equation followed by substitution in the other (condone one arithmetic error).
			3	M1(dep) to find value of second variable ft from value of their first variable
		$x = 2$ $y = 2.25$oe		A1 Award 3 marks for correct values if at least first M1 scored
				Total 3 marks

15	$x = 0.417417$ …. $1000x = 417.417$ … $999x = 417$			M1 for $1000x = 417.417\ldots$ **and** $x = 0.417417\ldots$ accept $x = 0.\dot{4}1\dot{7}$ selected for use oe
		show	2	A1for $\frac{417}{999}$ cso
				Total 2 marks

16	$0.5 \times 3 \times 8 \times \sin 110$ (= 11.2…) oe **or** 11.3			M1	M2 for $2 \times 0.5 \times 3 \times 8 \times \sin 110$ **or** $3 \times 8 \times \sin 110$
	$2 \times 0.5 \times 3 \times 8 \times \sin 110$ oe **or** $2 \times$ "11.2.."		3	M1 dep	
		22.6		A1 awrt 22.6	
					Total 3 marks

17 (i)	$\frac{5}{12}\times\frac{n}{25}\left(=\frac{2}{15}\right)$ oe **or** $\frac{2}{15}\div\frac{5}{12}$ oe		2	M1
		8		A1 *SC: B1 for an answer of* $\frac{8}{25}$
(ii)	$\frac{6}{12}\times\frac{25-"8"}{25}\left(=\frac{17}{50}\right)$		3	M1 ft from (a) for one correct branch from (R, B) or (B,R) or (W,R) or (W,B) $\frac{5}{12}\times\frac{25-"8"}{25}\left(=\frac{17}{60}\right)$ **or** $\frac{6}{12}\times\frac{"8"}{25}\left(=\frac{4}{25}\right)$ **or** $\frac{1}{12}\times\frac{"8"}{25}\left(=\frac{2}{75}\right)$ **or** $\frac{1}{12}\times\frac{25-"8"}{25}\left(=\frac{17}{300}\right)$ **NB:** $\frac{7}{12}\times\frac{"8"}{25}$ implies BR + WR; $\frac{6}{12}\times\frac{25-"8"}{25}$ implies RB and WB $\frac{1}{12}$ implies WB + WR
	$1-"\frac{17}{50}"-\frac{2}{15}$			M1 ft from (a) for all products with the intention to add
		$\frac{79}{150}$ oe		A1cao accept 0.527 **or** 0.526…. **or** 52.7% **or** 52.6..%
				Total 5 marks

18 (a) (i)		$\mathbf{b} - 2\mathbf{a}$	3	B1
(ii)		$\frac{2}{3}\mathbf{b} - \frac{4}{3}\mathbf{a}$		B1 oe eg. $\frac{2}{3}(-2\mathbf{a} + \mathbf{b})$ Allow ft from (i)
(iii)		$\frac{2}{3}\mathbf{b} - \frac{1}{3}\mathbf{a}$		B1 oe. eg. $a + \frac{2}{3}(-2\mathbf{a} + \mathbf{b})$ Allow ft from (ii)
(b)			2	M1 for $\overrightarrow{WY} = -\mathbf{a} + 2\mathbf{b}$ oe **or** $\overrightarrow{XY} = \frac{2}{3}(-\mathbf{a} + 2\mathbf{b})$ oe Allow ft from (a)
		shown		A1 for conclusion using correct vectors eg. $\overrightarrow{WY} = 2\mathbf{b} - \mathbf{a}$ $\overrightarrow{XY} = \frac{2}{3}(-\mathbf{a} + 2\mathbf{b})$ $\overrightarrow{XY} = \frac{2}{3}\overrightarrow{WY}$
				Total 5 marks

19 (a)	$\pi(r + 1.5)^2 - \pi r^2$ (= 0.1 x πr^2)		3	M1 Correct expression for area of path (may be seen as part of an equation)
	$r^2 + 3r + 2.25 - r^2 = 0.1r^2$			M1 ind. $r^2 + 3r + 2.25$ **or** $r^2 + 3r + 1.5^2$ (i.e. correct expansion of brackets with or without π)
		$2r^2 - 60r - 45 = 0$		A1 Correct algebraic steps to $2r^2 - 60r - 45 = 0$
(b)	$\frac{--60 \pm \sqrt{(-60)^2 - 4 \times 2 \times -45}}{2 \times 2}$		5	M1 Condone 1 sign error; condone missing brackets around −60 ; accept 60^2; some evaluation may be seen **NB: allow + instead of ±**
	$\frac{60 \pm \sqrt{3600 + 360}}{4}$			M1 for $\sqrt{3600 + 360}$ **or** $\sqrt{3960}$
	30.7(32 ..) **or** $\frac{30 \pm 3\sqrt{110}}{2}$			A1 dep on at least M1 awarded **NB: Ignore −0.73…**
	(Area =) π x "30.732.."^{2} (= 2967.12..)			M1 ind (ft for r (at least 3 sf)) do not award for substitution of $r = 1.5$
		2970		A1 for 2960 – 2970
				Total 8 marks

20 (a)		2	1	B1
(b)	f(–1) = 8		2	M1 may see on graph
		– 2		A1
(c)	Line drawn with negative gradient at (3, –4)		3	M1
				M1 correct method to find gradient (vertical / horizontal ignore sign at this stage – **must use scale on graph**)
		–1		A1 accept –0.7 to –1.4 inc dep on method seen
				Total 6 marks

21	58.5 **or** 57.5 **or** 27.5 **or** 28.5 **or** 18.5 **or** 17.5		3	B1 for any one
	$\frac{58.5}{27.5-18.5}$			M1
		6.5		A1from correct working
				Total 3 marks

22	$(2x \pm 3)(3x \pm 5)$		4	M1
	$3(2x-3)(2x+3)$ **or** $(2x-3)(6x+9)$			M2 (M1 for $3(4x^2-9)$ **or** $(6x-9)(2x+3)$)
		$\frac{3x+5}{3(2x+3)}$		A1 accept $\frac{3x+5}{6x+9}$
				Total 4 marks

23	$\tan ABC = \frac{25}{14}$ **or** $\tan ACB = \frac{14}{25}$		6	M1 accept use of cos or sin or Sine rule or Cosine rule with $BC = \sqrt{821}$ (=28.6… or 29.7)
	$ABC = 60.75....$ **or** $ACB = 29.24..$			A1 for ABC 60.7 – 60.8 **or** ACB = 29.2 – 29.3
	$AX = 14 \times \sin$ "60.7.." **or** $AX = 25 \times \sin$ "29.24.."			M1 dep on M1 accept fully correct alternative methods
	$AX = 12.2..$			A1 for 12 – 12.2
	$\tan(TAX) = \frac{10}{"12.2"}$			M1 dep on first M1 ft from "AX" accept fully correct alternative methods
		39.3		A1 for 39.3 – 39.4
				Total 6 marks

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