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Mark Scheme (Results)

Summer 2014

Pearson Edexcel International GCSE Mathematics A (4MA0/3HR) 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**
    - awrt – answer which rounds to
    - 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.

Apart from questions 1b, 6, 13, 16a, 20, (where the mark scheme states otherwise) the correct answer, unless obtained from an incorrect method, should be taken to imply a correct method.

Question	Working	Answer	Mark	Notes
1. (a)		40, 60, 20	2	B2 Award B1 for any one correct. Allow standard form, but not trailing zeros (40.0/40.00 etc)
(b)	$\frac{"40"+"60"}{"20"}=\frac{100}{20}$		2	M1 For adding their 40 and 60 correctly (not 42.37 and 58.92) or for correct working with rounded figures.
		5		A1cao dep on M mark awarded above.
				Total 4 marks

Question	Working	Answer	Mark	Notes
2. (a)	e.g. "There are no numbers which are in both *A* and *B"*. e.g. "*A* is odd, *B* is even".		1	B1 For a statement which indicates correct meanings of intersection and empty set.
(b)		9	1	B1
(c)		3, 7, 8, 9	2	B2 Award B1 for any three correct with no extras or all four correct with only one extra. Allow in any order, with or without brackets, ignore repeats.
				Total 4 marks

Question	Working	Answer	Mark	Notes
3. (a)	$\frac{1}{2}\times 8\times 9$ or $\frac{1}{2}\times 5\times 14$ or 36 or 35			M1 Correct expression for area of *RQB* or *PQA*.
	$\frac{1}{2}\times 4\times 6$ or 12			M1 Correct expression for area of *ABS*.
	$9\times 14-\frac{1}{2}\times 4\times 6-\frac{1}{2}\times 8\times 9-\frac{1}{2}\times 5\times 14$ or $126-12-36-35$			M1 Area of rectangle — their three triangles (obtained by using the correct formula for area of triangle)
		43		A1
	Alternative (i):			
	$AB=\sqrt{52},(7.2\ldots),BQ=\sqrt{145}$ (12.0…) AQ $=\sqrt{221}$ (14.8… or 14.9)		4	M1 A correct method to find all 3 sides of triangle ABQ
	ABQ = 97.9434… or BQA = 28.7126… or BAQ = 53.3438…			M1 A correct method to find an angle in ABQ (cosine rule or 180 — use of trig in 2 smaller triangles)
	$\frac{1}{2}(\sqrt{52})(\sqrt{145})\sin(97.9..)$ or $\frac{1}{2}(\sqrt{145})(\sqrt{221})\sin(28.7..)$ or $\frac{1}{2}(\sqrt{52})(\sqrt{221})\sin(53.3..)$ oe			M1 Correct use of formula $\frac{1}{2}$absinC to find area of ABQ
		43		A1 Must be exact answer – not from rounding.
	Alternative (ii):			
				M2 For a correct method to find 2 sides and the correct included angle (by use of trig and angles on a straight line).
				M1 Correct use of formula $\frac{1}{2}$absinC to find area of ABQ (see above)
		43		A1 Must be exact answer – not from rounding.
(b)	5^2+14^2 or $25+196$ or 221		3	M1 For squaring and adding
	$\sqrt{5^2+14^2}$ or $\sqrt{25+196}$ or $\sqrt{221}$			M1 (dep on M1 above) for square root
		14.9		A1 For answer rounding to 14.9
				Total 7 marks

Question	Working	Answer	Mark	Notes
4. (a)		10 to 14	1	B1
(b)	$2\times2+6\times7+20\times12+13\times17+8\times22+3\times27$ or 4 + 42 + 240 + 221 + 176 + 81 or 764		4	M2 Freq x all correct midpoint values stated or evaluated with intention to add (condone any one error). If not M2 then award M1 for all products *t* x *f* (and *t* is consistently within the interval, including end values) and intention to add (condone any one error)
	"764" ÷ 52			M1 (dep on at least M1) for division by 52. Accept their 52 if addition shown.
		14.7		A1 for answer rounding to 14.7 Accept 15 with working (15 without working gains M0A0)
(c)	$\frac{13+8+3}{52}$		2	M1 for 13 + 8 + 3 or 24 or $\frac{a}{52}$ where a<52
	$\frac{24}{52}$	$\frac{6}{13}$ oe		A1 Accept a decimal/percentage answer 0.461538…(46.15…%) truncated or rounded to 3 or more sig figs. Only accept 0.46(46%) if preceded by a more accurate answer or M1(above) awarded.
				Total 7 marks

Question	Working	Answer	Mark	Notes
5. (a)		$d(7g-9e)$	2	B2 Award B1 for *d*(sum or difference of any other two terms which when multiplied out would give one term correct).
(b)	$x^2+2x+5x+10$		2	M1 For 3 correct terms out of a maximum of 4 Or for 4 correct terms ignoring signs Or for $x^2 + 7x + k$ for any non-zero value of k Or for …+ 7x + 10
		$x^2+7x+10$		A1 cao
				Total 4 marks

Question	Working	Answer	Mark	Notes
6.	$6z-15=4z+11$		3	M1 for $6z-15$
	$6z-4z=11+15$ or $2z=11+15$ or $6z-4z=26$ or $2z=26$ or –11–15 = 4z–6z or –26 = –2z			M1 For a correct equation with terms in z on one side and numbers on the other.
		13		A1 dep on at least one M mark awarded
				Total 3 marks

Question	Working	Answer	Mark	Notes
7. (a)	$133.3-87.3$ or 46 or $\frac{133.3}{87.3}(\times 100)$		3	M1 Difference for two given years
	$\frac{133.3-87.3}{87.3}(\times 100)$ or $\frac{46}{87.3}(\times 100)$ or $\left[\frac{133.3}{87.3}-1\right](\times 100)$ or 0.527			M1 for difference divided by 87.3 oe
		52.7		A1 for answer rounding to 52.7
(b)	$1.2x=133.3$ or $120\%x=133.3$		3	M1 also allow 120% = 133.3 or $\frac{133.3}{120}$ or $\frac{133.3}{x}=1.2$ or 1.11 …
	$x=\frac{133.3}{1.2}$ or $x=\frac{133.3}{120}\times 100$			M1 oe
		111.1		A1 for answer rounding to 111.1
				Total 6 marks

Question	Working	Answer	Mark	Notes
8. (a)		4, 0, (−2), −2, 0,(4)	2	B2 Award B1 for any 2 correct.
(b)	(0, 4), (1, 0), (2, −2), (3, −2), (4, 0), (5, 4)	Correct curve	2	B2 For the correct smooth curve. B1 for at least 5 points from table plotted correctly provided at least B1 scored in (a).
				Total 4 marks

Question	Working	Answer	Mark	Notes
9.	12π		3	M1 for circumference accept value which rounds to 37.7
	$30\times 12\pi$ or 360π			M1 correct expression for surface area
		1130		A1 accept awrt 1130 (3SF) e.g 1131 If full Surface Area given, then award 2 marks as long as you see 360π oe in working (M1 for 12π oe) Do not isw.
				Total 3 marks

Question	Working	Answer	Mark	Notes
10. (a)		10	1	B1 Allow values from 8-12
(b)		90	1	B1 Allow values in range 88-92
(c)	$Q_1 \approx 68$ at CF = 30 or 30.25 $Q_3 \approx 118$ at CF = 90 or 90.75		2	M1 for 30 and 90, or 30.25 and 90.75, or 68 (64 - 68) and 118 (115-119) stated or indicated on graph.
		50		A1 Ft their values for Lower Quartile and Upper Quartile as long as in given range
				Total 4 marks

Question	Working	Answer	Mark	Notes
11. (a)		7	1	B1 cao
(b)	$g(-3) = \frac{2\times -3}{-3+1}\left(=\frac{-6}{-2}=3\right)$		2	M1 for correct expression for $g(-3)$
		$5\frac{1}{2}$		A1 or 5.5 or 11/2
(c)	$-2(a+1)=2a$ or $-2a-2=2a$ or $4a=-2$		2	M1 for correct equation with fraction cleared (allow x)
		$-\frac{1}{2}$		A1 Accept -0.5
(d)	$y=\frac{1}{2}x+4$ or $x=\frac{1}{2}y+4$ (any two different variables) or flow diagram $\div 2 \rightarrow +4$		3	M1
	$x=2(y-4)$ or $x=2y-8$ Or $y=2x-8$ or $y=2(x-4)$ or $x=\frac{y-4}{0.5}$ or $y=\frac{x-4}{0.5}$			M1 For full method to correctly change the subject.
		$2(x-4)$		A1 or $2x-8$ or $\frac{x-4}{0.5}$ oe Do not allow other variables. **SC**: Award B2 for $f^{-1}(x) = 2y - 8$ if no working shown.
				Total 8 marks

Question	Working	Answer	Mark	Notes
12. (a)	$\frac{27.5}{11}$ or $\frac{11}{27.5}$		2	M1
		2.5		A1 oe
(b)	$5 \times$ "2.5" or $5 \times \frac{27.5}{11}$ or $\frac{RQ}{5} = \frac{27.5}{11}$ oe or $\frac{5}{11} = \frac{RQ}{27.5}$ oe		2	M1 Correct expression for *RQ* or correct equation to give *RQ*. ft their answer to (a)
		12.5		A1
(c)	$42.5 \div$ "2.5" or $42.5 \times \frac{11}{27.5}$ or $42.5 \times \frac{5}{"12.5"}$ or $\frac{CD}{42.5} = \frac{11}{27.5}$ or $\frac{CD}{42.5} = \frac{5}{"12.5"}$ oe		2	M1 Correct expression for *CD* or correct equation to give *CD*. ft their *RQ*, if used. ft their answer to (a)
		17		A1
(d)	$54 \times ("2.5")^2$ oe or $\frac{\text{Area}}{54} = \left(\frac{27.5}{11}\right)^2$ oe		2	M1 Correct expression for area or correct equation to give area. ft ratio from (a), if used.
		337.5		A1
				Total 8 marks

Question	Working	Answer	Mark	Notes
13.	Eg. $\begin{matrix}15x+20y=30\\15x+18y=33\end{matrix}$ or $\begin{matrix}18x+24y=36\\20x+24y=44\end{matrix}$ oe or $3x + 4\left(\frac{11-5x}{6}\right) = 6$ oe or $3\left(\frac{11-6y}{5}\right) + 4y = 6$ oe		4	M1 For coefficient of *x* or *y* the same **and** correct operation to eliminate selected one(condone any one arithmetic error in multiplication) **or** For correct rearrangement of one equation followed by correct substitution in the other.
	$y = -1\frac{1}{2}$ or $x = 4$			A1 Cao dep on M1
	Eg. $3x + 4(-1.5) = 6$ oe			M1 (dep on 1st M1) for substituting the other variable
		$x = 4, y = -1\frac{1}{2}$		A1 Award 4 marks for correct values if at least first M1 scored
				Total 4 marks

Question	Working	Answer	Mark	Notes
14. (a)		$6x^2+6x$	2	B2 Award B1 for any two terms differentiated correctly (remember $\frac{d}{dx}(2) = 0$ is a term)
(b)	$"6x^2+6x" = -\frac{3}{2}$		5	M1 Their derivative = -1.5 oe dep on at least B1 in (a)
	$6x^2+6x+1\frac{1}{2}(=0)$ or $4x^2+4x+1=(0)$ oe			M1 Correct three terms of quadratic equation on one side.
	$(2x+1)^2=0$ or $(x=)\frac{-4\pm\sqrt{4^2-4\times4\times1}}{2\times4}$ or $\frac{-4\pm\sqrt{16-16}}{8}$ or $\frac{-4\pm0}{8}$ or $6((x+\frac{1}{2})^2-\frac{1}{4}+\frac{3}{12})$ (=0) oe			M1 Correct factors or correct use of quadratic formula or completing the square.
	$x=-\frac{1}{2}$			A1 For correctly calculating x
		$\left(-\frac{1}{2}, 2\frac{1}{2}\right)$		A1 For completely correct coordinates.
				Total 7 marks

Question	Working	Answer	Mark	Notes
15.	(3.1 x 10) + (2.2 x 20) + (0.9 x 30) + (0.3 x 60) or 31 + 44 + 27 + 18 (=120) or 120 or 12 or 1200 or 600 or 24 oe Or (3.1 x 10) + (2.2 x 20) + (0.9 x 10) or 31 + 44 + 9(=84) or 84 or 8.4 or 840 or 420 or 16.8 oe			M1 For a correct method to work out the total area (by using freq density, counting squares, oe) or for a correct method to work out the total area less than 40 calls (by using freq density, counting squares, oe). Allow one error
	$\frac{84}{120}$ or $\frac{8.4}{12}$ or $\frac{840}{1200}$ or $\frac{8}{24}$ or $\frac{420}{600}$ or $\frac{16.8}{24}$ oe			M1ft For a correct fraction $\frac{a}{120}$ oe, or $\frac{84}{b}$ oe where $a < 120$ *oe and* $b > 84$ oe
		70		A1 cao
				Total 3 marks

Question	Working	Answer	Mark	Notes		
16. (a)	$25+15\sqrt{2}+15\sqrt{2}+9\times 2$ or $25 + 15\sqrt{2} + 15\sqrt{2} + 18$ or $25+30\sqrt{2}+9\times 2$ or $25 + 30\sqrt{2} + 18$		2	M1	Expand to give four terms – (must have surds not decimals), at least three correct, or three terms with irrational term and one other correct. Accept $\left(\sqrt{2}\right)^2$ for 2	
		$43+30\sqrt{2}$		A1	dep on M1 awarded	
(b)	$\sqrt{8}=2\sqrt{2}$ or $(q=)\sqrt{8}\times"30\sqrt{2}"$		3	M1	Award M marks independently for simplifying $\sqrt{8}$ and rationalising the denominator, seen at any points in the solution.	
	$\frac{1}{\sqrt{2}}=\frac{\sqrt{2}}{2}$ or $\frac{1}{\sqrt{8}}=\frac{\sqrt{8}}{8}$ or $(q=)30\sqrt{16}$ or (q =) $60\sqrt{4}$ or (q =) $30\sqrt{2}$ x $2\sqrt{2}$			M1		ft from (a) for $30\sqrt{16}$
		120		A1	ft 4 × "30" from (a)	
						Total 5 marks

Question	Working	Answer	Mark	Notes
17. (a)	$\frac{26}{40}\times\frac{25}{39}$		2	M1
	$\frac{650}{1560}=\frac{65}{156}=0.41\dot{6}$	$\frac{5}{12}$		A1 Allow answer as decimal (0.4166..) or percentage (41.66..%) rounded or truncated to 3 or more sig figs; only accept 0.42 (42%) if preceded by more accurate answer or M1 awarded.
(b)	$\frac{4}{40}\times\frac{13}{39}+\frac{3}{40}\times\frac{4}{39}+\frac{7}{40}\times\frac{4}{39}$ or $\frac{4}{40}\times\frac{13}{39}+\frac{10}{40}\times\frac{4}{39}$ or $2\times\frac{4}{40}\times\frac{10}{39}+\frac{4}{40}\times\frac{3}{39}$ or $\frac{4}{40}\times\frac{7}{39}+\frac{4}{40}\times\frac{3}{39}+\frac{4}{40}\times\frac{3}{39}+\frac{3}{40}\times\frac{4}{39}+\frac{7}{40}\times\frac{4}{39}$		3	M2 Award M1 for any one correct product (shown or worked out). SC Award M2 for $\frac{4}{40}\times\frac{14}{40}+\frac{3}{40}\times\frac{4}{40}+\frac{7}{40}\times\frac{4}{50}$ or $\frac{4}{40}\times\frac{14}{40}+\frac{10}{40}\times\frac{4}{40}$ or $\frac{4}{40}\times\frac{7}{40}+\frac{4}{40}\times\frac{3}{40}+\frac{4}{40}\times\frac{4}{50}+\frac{3}{40}\times\frac{4}{40}+\frac{7}{40}\times\frac{4}{50}$ or $\frac{96}{1600}$ or $\frac{6}{100}$ or 0.06 M1 for one product
	$\frac{92}{1560}=\frac{46}{780}=0.05897\cdots$	$\frac{23}{390}$		A1 Allow answer as decimal (0.05897..) or percentage (5.897..%) rounded or truncated to 3 or more sig figs; only accept 0.059 (5.9%) if preceded by more accurate answer or M2 awarded.
				Total 5 marks

Question	Working	Answer	Mark	Notes
18. (a)	$6^2 + 8^2 + BC^2 = 16^2$ or $BC^2 = 16^2 - 6^2 - 8^2$ or $36 + 64 + BC^2 = 256$ or $BC^2 = 256 - 36 - 64$ or $FB^2 = 100$ oe or $FB = \sqrt{100}$ oe or AC² = 220 oe or AC = $\sqrt{220}$ oe or GC² = 192 oe or GC = $\sqrt{192}$ oe		3	M1 for use of Pythagoras in 3D shape or a correct value for FB or FB^2 or AC or AC²
	$BC = \sqrt{16^2 - 6^2 - 8^2}$ or $BC = \sqrt{256 - 36 - 64}$ or $BC = \sqrt{156}$ or $BC = \sqrt{16^2 - 10^2}$ or $BC = \sqrt{256 - 100}$ or BC = $\sqrt{220 - 8^2}$ oe or BC = $\sqrt{192 - 6^2}$ oe			M1 For a correct method to find BC. (Condone $2\sqrt{55^2}$ rather than $(2\sqrt{55})^2$ for 220 for method mark)
	12.4899…	12.5		A1 for answer which rounds to 12.5
(b)	$\cos BFC = \frac{10}{16}$ or $\sin BFC = \frac{"12.5"}{16}$ or $\tan BFC = \frac{"12.5"}{10}$		2	M1 A correct equation for the correct angle.
		51.3		A1 for awrt 51.3 or 51.4
				Total 5 marks

Question	Working	Answer	Mark	Notes
19.	$x^2 < \frac{53-5}{3}$ or $x^2 < \frac{48}{3}$ or 3(x² – 16) < 0		3	M1 Allow x² = 16 oe. 3(x² – 16) = 0
				M1 For – 4 and 4
		$-4 < x < 4$		A1 for correct inequality accept $-4 < x$ and $x < 4$
				Total 3 marks

Question	Working	Answer	Mark	Notes
20.	$n^2 - n - 6 = 0$ or n² = n + 6 oe		3	M1 For correct quadratic equation.
	(n + 2)(n – 3) (=0) or $(n=)\frac{-(-1)\pm\sqrt{(-1)^2-4\times1\times(-6)}}{2\times1}$ or $(n=)\frac{1\pm\sqrt{1+24}}{2}$ or $(n=)\frac{1\pm5}{2}$			M1 For correct factorisation or correct use of quadratic formula.
		$(n=)-2,\ (n=)3$		A1 Both correct - dep on at least M1 scored.
				Total 3 marks

Question	Working	Answer	Mark	Notes
21.	$(\overrightarrow{PQ}=)-\frac{1}{4}\mathbf{c}-\mathbf{a}+\frac{2}{3}\mathbf{c}$ or $(\overrightarrow{PQ}=)\frac{3}{4}\mathbf{c}-\mathbf{a}-\frac{1}{3}\mathbf{c}$		3	M2 Award M1, ignoring signs, for $\frac{1}{4}\mathbf{c}$ or $\frac{3}{4}\mathbf{c}$ or $\frac{1}{3}\mathbf{c}$ or $\frac{2}{3}\mathbf{c}$ or $\overrightarrow{PQ}=\overrightarrow{PA}+\overrightarrow{AO}+\overrightarrow{OQ}$ oe or $\overrightarrow{PQ}=\overrightarrow{PB}+\overrightarrow{BC}+\overrightarrow{CQ}$ oe
		$\frac{5}{12}\mathbf{c}-\mathbf{a}$		A1 **SC**: B2 for $\mathbf{a}-\frac{5}{12}\mathbf{c}$
				Total 3 marks

TOTAL FOR PAPER: 100 MARKS

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