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Mark Scheme (Results)

Summer 2012

International GCSE Mathematics (4MA0) Paper 3H

Level 1 / Level 2 Certificate in Mathematics (KMA0) Paper 3H

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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

- **No working**
  If no working is shown then correct answers normally score full marks – the mark scheme will make it clear when this does not apply.
  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 the lower mark should be awarded, unless it is clear which method the candidate has chosen.
  If there is no answer on the answer line then check the working for an 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.

Question Number	Working	Answer	Mark	Notes

Apart from Questions 9, 13, 18, 20 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.

1. (a)	$54 \times \frac{5}{6}$		2	M1	for 54×5 or 270 or $54 \div 6$ or 9 or $\frac{5}{6}$ oe or $\frac{6}{5}$ oe
		45		A1	cao
(b)	ratio 36 : 5400 oe inc 0.36 : 54, 36 cm : 5400 cm, 0.36 m : 54 m (condone omission of units from one side) or fraction $\frac{5400}{36}$ oe inc $\frac{54\text{ m}}{0.36\text{ m}}$ (condone omission of units from either numerator or denominator)		3	M2	M1 for ratio or fraction with no units 0.36 or 3.6 or 36 or 360 or 3600... : 0.54 or 5.4 or 54 or 540 or 5400 ... oe $\frac{0.54 \text{ or } 5.4 \text{ or } 54 \text{ or } 540 \text{ or } 5400...}{0.36 \text{ or } 3.6 \text{ or } 36 \text{ or } 360 \text{ or } 3600...}$ oe eg 36 : 54, $\frac{54}{36}$, 36 : 540, $\frac{540}{36}$, 360 : 54, $\frac{54}{360}$, 1 : 1.5, $54 \div 36$, 1 : 0.15
		150		A1	cao Do not award A1 for 150 cm, 150*n* etc
					Total 5 marks

Question Number	Working	Answer	Mark	Notes		
2. (a)	$2 \times (-3)^2 + 4 \times (-3)$ or $2 \times -3^2 + 4 \times -3$ or $2 \times 9 - 4 \times 3$ or $18 - 12$ or $18 + -12$		2	M1	for substitution or for correct evaluation of either 18 or −12	
		6		A1	cao	
(b)	$38 = 2 \times 4^2 + 4k$ or $(k) = \frac{A - 2x^2}{x}$ oe		3	M1	for correct substitution or rearrangement	*SC* M2 for $\frac{38 - 32}{4}$
	$4k = 38 - 32$ or $4k = 6$			M1	for correct rearrangement of correct substitution	
		1.5 oe		A1		
						Total 5 marks

3. (a)		2^9	1	B1	cao	
(b)		3^5	1	B1	cao	
(c)	$5^{n-4-6} = 5^3$ oe or $5^{n-10} = 5^3$ oe or $n - 4 - 6 = 3$ oe or $n - 10 = 3$ oe or $5^n = 5^3 \times 5^{10}$ oe or $5^n = 5^{3+10}$ or $5^n = 5^{13}$		2	M1		*SC* If M0, award B1 for an answer of 5^{13}
		13		A1	cao	
						Total 4 marks

Question Number	Working	Answer	Mark	Notes
4.	$5.6^2 + 3.7^2$ or 31.36 + 13.69 or 45.05		3	M1 for squaring and adding
	$\sqrt{5.6^2 + 3.7^2}$			M1 (dep) for square root
		6.71		A1 for answer rounding to 6.71
				Total 3 marks
5.		1 3 8	2	B2 for 1 3 8 in any order B1 for three positive whole numbers with either a sum of 12 or a range of 7 *SC* Award B1 for 0 5 7
				Total 2 marks
6.	Lines $x = 5$ and $y = 3$ drawn		3	B1 Lines may be full or broken
	Line $y = x$ drawn			B1 Ignore additional lines
		R shown		B1 Condone omission of label Accept shading in or shading out, if consistent Award full marks for correct region labelled **R** even if no shading
				Total 3 marks

Question Number	Working	Answer	Mark	Notes
7.	$9 \times \text{height} = 36$		4	M1
	height = 4			A1
	$36 + \frac{1}{2} \times 5 \times "4"$ or $\frac{14+9}{2} \times "4"$			M1
		46		A1 cao
				Total 4 marks

8. (a)	$\frac{1639}{3440} \times 100$		2	M1	for $\frac{1639}{3440}$ or 0.476…
		47.6		A1	for ans rounding to 47.6
(b)	$\frac{3440}{1.376}$ or $3440 \times \frac{100}{137.6}$ oe		3	M2	for $\frac{3440}{1.376}$ or $3440 \times \frac{100}{137.6}$ oe M1 for $\frac{3440}{137.6}$ or 137.6% = 3440 or $\frac{3440}{x} = 1.376$ or $3440 = 1.376x$ or 25 seen
		2500		A1	cao
					Total 5 marks

Question Number	Working	Answer	Mark	Notes
9. (a)	$6x - 3 = 6$ or $2x - 1 = 2$		3	M1 for correct expansion ($6x - 3$ seen) or correct division of both sides by 3 ($2x - 1 = 2$) May be implied by second M1
	$6x = 6 + 3$ or $6x = 9$ or $6x - 9 = 0$ or $2x = 2 + 1$ or $2x = 3$ or $2x - 3 = 0$			M1 for correct rearrangement Also award for $6x = 6 + 1$ or $6x = 7$ or $6x - 7 = 0$ if preceded by $6x - 1 = 6$
		$1\frac{1}{2}$ oe		A1 Award 3 marks if answer is correct and at least one method mark scored

Question Number	Working	Answer	Mark	Notes
9. (b)	$4(2y + 1) = 3(y - 2)$		4	M1 for clear intention to multiply both sides by 12 or by a multiple of 12 eg $4(2y + 1) = 3(y - 2)$ $2y + 1 \times 4 = y - 2 \times 3$ $12\times\frac{2y+1}{3} = 12\times\frac{y-2}{4}$ May be implied by second M1 or by $8y + 1 = 3y - 2$ or $8y + 4 = 3y - 2$ or $8y + 1 = 3y - 6$ Also award this mark for $\frac{4(2y+1)}{12} = \frac{3(y-2)}{12}$
	$8y + 4 = 3y - 6$			M1 for correct expansion of brackets or correct rearrangement of correct terms eg $8y - 3y = -6 - 4$, $\frac{8y+4}{12} = \frac{3y-6}{12}$
	$5y = -6 - 4$ or $8y - 3y = -10$ or $5y = -10$ or $-5y = 6 + 4$ or $3y - 8y = 10$ or $-5y = 10$ or $5y + 10 = 0$			M1 for correct rearrangement with y terms on one side and numbers on the other AND collection of terms on at least one side or for $5y + 10 = 0$ oe or for $\frac{5y+10}{12} = 0$ oe
		-2 oe		A1 Award 4 marks if answer is correct and at least one method mark scored
				Total 7 marks

Question Number	Working	Answer	Mark	Notes
9. (b)	Alternative method			
	$\frac{2}{3}y+\frac{1}{3}=\frac{1}{4}y-\frac{1}{2}$		4	M1 for correct expansion
	$\frac{2}{3}y-\frac{1}{4}y=-\frac{1}{2}-\frac{1}{3}$			M1 for correct rearrangement of correct terms
	$\frac{5}{12}y=-\frac{5}{6}$			M1 for correct collection of correct terms on both sides
		−2 oe		A1 Award 4 marks if answer is correct and at least one method mark scored
				Total 7 marks
10. (a)	1×3 + 2×6 + 3×5 + 4×8 + 5×2 + 6×1 or 3 + 12 + 15 + 32 + 10 + 6 or 78		3	M1 for finding at least 4 correct products and summing them
	"78" ÷ 25			M1 (dep) for division by 25 Accept division by their 25, if addition shown.
		3.12 oe inc $3\frac{3}{25}$, $\frac{78}{25}$		A1 Also accept 3 or 3.1 if both method marks scored
(b)	5 + 8 or 13 or $\frac{5}{25}+\frac{8}{25}$		2	M1
		$\frac{13}{25}$ oe		A1

Question Number	Working	Answer	Mark	Notes
10. (c)(i)	$\frac{5}{25}\times\frac{4}{24}$ oe		5	M1 for $\frac{5}{25}\times\frac{4}{24}$ oe
		$\frac{20}{600}$ oe		A1 for $\frac{20}{600}$ oe inc $\frac{1}{30}$
(ii)	$\frac{3}{25}\times\frac{5}{24}+\frac{6}{25}\times\frac{5}{24}+\frac{5}{25}\times\frac{3}{24}$ or $2\times\frac{3}{25}\times\frac{5}{24}+\frac{6}{25}\times\frac{5}{24}$			M1 for one correct product M1 for sum of all 3 correct products
		$\frac{60}{600}$ oe		A1 for $\frac{60}{600}$ oe inc $\frac{1}{10}$
				Note for (c)(ii): sample space method – award 3 marks for correct answer; otherwise no marks. *SC* M1 for $\frac{3}{25}\times\frac{5}{25}$ or $\frac{6}{25}\times\frac{6}{25}$ or $\frac{5}{25}\times\frac{3}{25}$ M1 for $\frac{3}{25}\times\frac{5}{25}+\frac{6}{25}\times\frac{6}{25}+\frac{5}{25}\times\frac{3}{25}$ or $2\times\frac{3}{25}\times\frac{5}{25}+\frac{6}{25}\times\frac{6}{25}$ *SC* Sample space method – award 2 marks for $\frac{66}{625}$; otherwise no marks.
				Total 10 marks

Question Number	Working	Answer	Mark	Notes
11. (a)	$\frac{12}{3}\times 3.5$ or $\frac{15}{3}\times 3.5 - 3.5$		2	M1 for $\frac{12}{3}$ or 4 or $\frac{15}{3}$ or 5
		14		A1 cao
(b)	scale factor = $\frac{15}{3}$ or 5 or $\frac{3}{15}$ or $\frac{1}{5}$		3	M1 for $\frac{15}{3}$ or 5 or $\frac{3}{15}$ or $\frac{1}{5}$
	$19 \div 5$ or $19\times\frac{1}{5}$			M1 Also award for $19 \div 4$ or $19\times\frac{1}{4}$ May be implied by 4.75
		3.8		A1 cao

Question Number	Working	Answer	Mark	Notes
11. (c)	"5"^{2} or "25"		2	M1 for squaring their scale factor (must be one of 5, 4, $\frac{1}{5}, \frac{1}{4}$) or for $\left(\frac{19}{3.8}\right)^2$ oe or for complete correct method of finding vert ht (h cm) of ΔABC and vert ht (H cm) of ΔPQR eg $\frac{1}{2}\times"3.8"\times h = 2$ $h = \frac{4}{"3.8"}$ (1.0526...) $H = \frac{4}{"3.8"}\times"5"$ (5.2631...)
		50		A1 for 50 or for answer which rounds to 50.0 ft only from their scale factor of 4 ie if M1 scored for 4^2 or 16, award A1 for an answer of 32
				Total 7 marks

Question Number	Working	Answer	Mark	Notes
12. (a)	l = 15 indicated on graph or 70-72 inc stated		2	M1
		9		A1 Accept 8-10 inc
(b)	20 and 60 or $20\frac{1}{4}$ and $60\frac{3}{4}$ indicated on cumulative frequency axis or stated or 6-6.5 and 11-11.5 stated		2	M1
		4.5-6 inc		A1 An answer in the range 5-6 inc with **no** indication of method scores 2 marks BUT do not award A1 if an answer in the range 5-6 inc has **clearly** been obtained by finding the difference between two values, one or both of which are outside the ranges 6-6.5 and 11-11.5 For example, if working is 12 – 7 or 12 – 6 do not award A1.
				Total 4 marks

Question Number	Working	Answer	Mark	Notes

13.	finds int angle of pentagon $\frac{(5-2)\times 180}{5}$	finds ext angle of pentagon $\frac{360}{5}$		5	M1 for $\frac{(5-2)\times 180}{5}$ or $\frac{360}{5}$	Award M1A1 for int angle of pentagon shown as 108° or ext angle shown as 72° on printed diagram or on candidate's own diagram
	108	72			A1 for 108 or 72	
	If there is *clear* evidence the candidate thinks the *interior* angle is 72° or the *exterior* angle is 108°, do not award the above two marks.					
	int angle of polygon = 144 or ext angle of polygon = 36				B1 for int angle of polygon = 144 or ext angle of polygon = 36	Award B1 for int angle of polygon shown as 144° or ext angle shown as 36° on printed diagram or candidate's own diagram
	$\frac{360}{36}$ or $\frac{180(n-2)}{n}=144$ oe				M1 for $\frac{360}{36}$ or $\frac{180(n-2)}{n}=144$ oe	
			10		A1 for 10 cao Award no marks for an answer of 10 with no working Award 5 marks for an answer of 10 if at least the first M1A1 are awarded	
						Total 5 marks

Question Number	Working	Answer	Mark	Notes
14. (a)	$3y = 2x - 6$ or $-3y = 6 - 2x$		3	M1 May be implied by second M1 or by $y = \frac{2}{3}x + c$ even if value of c is incorrect or finds coordinates of 2 points on the line eg (3, 0), (0, −2), table, sketch showing line cutting x-axis at 3 and y-axis at −2
	$y = \frac{2}{3}x - 2$ oe or $y = \frac{2x-6}{3}$ oe			M1 for correct rearrangement of $3y = 2x - 6$ with y as subject or for clear attempt to use $\frac{\text{vert difference}}{\text{horiz difference}}$ for their two points on **L**
		$\frac{2}{3}$ oe		A1 for $\frac{2}{3}$ oe inc decimal equivalent rounded or truncated to at least 2 dp Do not award A1 for $\frac{2}{3}x$

Question Number	Working	Answer	Mark	Notes	
14. (b)	$9 = "\frac{2}{3}" \times 6 + c$		2	M1 for correct substitution into $y = "\frac{2}{3}" x + c$ using their answer to (a) oe	*SC* Award B2 if $y - 9 = "\frac{2}{3}"(x - 6)$ seen; then isw
		$y = \frac{2}{3}x + 5$		A1 for $y = \frac{2}{3}x + 5$ oe inc $2x - 3y = -15$ ft from their answer to (a)	*SC* Award B1 for $2x - 3y = k$ where $k \neq -15$ and $k \neq 6$ with no working
				SC If M0 A0, award B1 for answer with '$y =$' omitted which would otherwise score M1 A1 eg $\frac{2}{3}x + 5$, $2x - 3$ if ans to (a) is 2	*SC* If M0 A0, award B1 for $y = "\frac{2}{3}" x + c$ where $c \neq 5$ or $c \neq 0$ (ie do not award this mark for $y = "\frac{2}{3}" x + 5$ or $y = "\frac{2}{3}" x$) or does not ft from (a)
					Total 5 marks

Question Number	Working	Answer	Mark	Notes
15.	$(OB =)\ 8\sin 30°$ or 4		4	M1
	$(BD =)\ 2 \times$ "4" or 8			M1
	A complete correct method eg $(BC =)$ "8" $\cos 63°$			M1
		3.63		A1 for ans rounding to 3.63 (3.63192…)
				Total 4 marks

16.	1.2×1.17 or $\frac{120}{100} \times \frac{117}{100}$ or 1.404 oe or 140.4		3	M2 M1 for 1.2 or $\frac{120}{100}$ or 1.17 or $\frac{117}{100}$
		40.4		A1 Also award for 40 if M2 scored
				Total 3 marks

17.	(a)		$81a^8b^4$	2	B2 B1 for 81 B1 for a^8b^4
	(b)		$3c^4$	2	B2 B1 for 3 B1 for c^4
					Total 4 marks

Question Number	Working	Answer	Mark	Notes			
NB The mark scheme for Q18 covers the majority of methods but there are other possible approaches. If you encounter a mathematically correct method which is not covered and (i) the answer is correct – award full marks or (ii) the answer is not correct – send the response, appropriately annotated, to Review.							
18.	$\angle COE = x$		6	B1	May be stated, marked on diagram or part of an equation		Award all 3 B marks if M1 or M2 scored.
	$\angle OCD = 2x$ or $69 - x$ or $34\frac{1}{2} + \frac{1}{2}x$	Accept $x + y = 69$ or $y - \frac{1}{2}x = 34\frac{1}{2}$ (where $\angle OCD = \angle ODC = y$)		B1		B1 for each correct expression for an angle up to a max of 2	
	$\angle ODC = 2x$ or $69 - x$ or $34\frac{1}{2} + \frac{1}{2}x$			B1			
	$\angle COD = 180 - 4x$ or $111 - x$						
	$3x = 69$			M2	M1for a correct unsimplified equation in x eg $69 + 180 - 4x + x = 180$ $69 = 2x + x$ $69 - x = 2x$ $55.5 + 55.5 + 2x + x = 180$ $111 - x + 2x + 2x = 180$ $34\frac{1}{2} + \frac{1}{2}x = 2x$		
		23		A1	cao Award 6 marks for an answer of 23 if M1 or M2 scored		
							Total 6 marks

Question Number	Working	Answer	Mark	Notes	
19.	eg $\frac{72}{360}\times\pi\times5.4^2-\frac{1}{2}\times5.4^2\times\sin72°$		5	M1	for $\frac{72}{360}$ oe inc 5
				M1	for $\pi\times5.4^2$ or value which rounds to 91.6 seen
				M1	for completely correct method of finding the area of triangle *OAB* eg $\frac{1}{2}\times5.4^2\times\sin72°$ or $5.4\times\sin36°\times5.4\times\cos36°$
	18.321… (or 18.312…) – 13.866…			A1	for either area correctly evaluated – may be rounded or truncated to 1 dp
		4.46 or 4.45		A1	for answer rounding to 4.46 ($\pi\rightarrow4.45536…$) or for answer rounding to 4.45 ($3.14\rightarrow4.44607…$) If all M1s scored, award 5 marks for an answer which rounds to 4.46 or 4.45
					Total 5 marks

Question Number	Working	Answer	Mark	Notes	
20.	42.875 seen		4	B1	Also accept 42.8749&, 42.87499... throughout
	$\sqrt[3]{42.875}$			B1	Also award for 3.5 if first B1 scored ie if 42.875 seen
	6×3.5^2			M1	dep on both B1s
		73.5		A1	cao Award 4 marks if answer is correct and both B marks scored
					Total 4 marks

Question Number	Working	Answer	Mark	Notes
21.	$2x^2 = 20 - 3x$ May be implied by second M1		5	M1 $y = 2\left(\frac{20-y}{3}\right)^2$ May be implied by second M1
	$2x^2 + 3x - 20(=0)$			M1 $2y^2 - 89y + 800(=0)$
	$(2x-5)(x+4)(=0)$ or $2x(x+4) - 5(x+4)(=0)$ or $x(2x-5) + 4(2x-5)(=0)$ or $\frac{-3 \pm \sqrt{3^2 - 4\times 2\times(-20)}}{2\times 2}$ or $\frac{-3 \pm \sqrt{9+160}}{4}$ or $\frac{-3 \pm \sqrt{169}}{4}$ or $\frac{-3 \pm 13}{4}$			M1 $(2y-25)(y-32)(=0)$ or $2y(y-32) - 25(y-32)(=0)$ or $y(2y-25) - 32(2y-25)(=0)$ or $\frac{89 \pm \sqrt{(-89)^2 - 4\times 2\times 800}}{2\times 2}$ or $\frac{89 \pm \sqrt{7921-6400}}{4}$ or $\frac{89 \pm \sqrt{1521}}{4}$ or $\frac{89 \pm 39}{4}$
		$x = \frac{5}{2},\ x = -4$		A1 $y = \frac{25}{2}, y = 32$ dep on all method marks
		$x = \frac{5}{2}, y = \frac{25}{2}$ $x = -4, y = 32$		A1 $x = \frac{5}{2}, y = \frac{25}{2}$ $x = -4, y = 32$ dep on all preceding marks Accept answers given as coordinates
				Total 5 marks

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