

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

- o M marks: method marks
- o A marks: accuracy marks
- o B marks: unconditional accuracy marks (independent of M marks)

Abbreviations

- o cao correct answer only
- o ft follow through
- o isw ignore subsequent working
- o SC special case
- o oe or equivalent (and appropriate)

- o dep dependent
- o indep independent
- o 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	Working	Answer	Mark	Notes
Number				

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 $\frac{0.36 \text{ or } 3.6 \text{ or } 36 \text{ or } 360 \text{ or } 3600}{36}$ or $\frac{54}{36}$, $\frac{54}{36}$
		150		A1	cao Do not award A1 for 150 cm, 150n etc
					Total 5 marks

Question Number	Working	Answer	Mark	Notes
Hamber				

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 ceither 18 or –12	correct evaluation of
		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 $38-32$
	4k = 38 - 32 or 4k = 6			M1	for correct rearrangement of correct substitution	4
		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 mark
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 consisten Award full marks for correct region labelled R even if no shading
					Total 3

Question Number	Working	Answer	Mark	Notes

7.	$9 \times \text{height} = 36$		4	M1	
	height = 4			A1	
	$36 + \frac{1}{2} \times 5 \times "4" \text{ or } \frac{14+9}{2} \times "4"$			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
Hamber				

9.	(a)	6x - 3 = 6 or 2x - 1 = 2		3	M1	for correct expansion $(6x - 3 \text{ seen})$ or correct division of both sides by 3 (2x - 1 = 2) May be implied by second M1
		6x = 6 + 3 or $6x = 9$ or $6x - 9 = 0or 2x = 2 + 1 or 2x = 3 or 2x - 3 = 0$			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	Working	Answer	Mark	Notes
Number				

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
						$\frac{4(2y+1)}{2} = \frac{3(y-2)}{2}$
						12 = 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 $5y = -10$			M1	for correct rearrangement with y terms on one
		or $-5y = 6 + 4$ or $3y - 8y = 10$				side and numbers on the other AND
		or $-5y = 10$ or $5y + 10 = 0$				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	Working	Answer	Mark	Notes
Number				

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)	$1 \times 3 + 2 \times 6 + 3 \times 5 + 4 \times 8 + 5 \times 2 + 6 \times 1$ 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)	$5 + 8 \text{ or } 13 \text{ or } \frac{5}{25} + \frac{8}{25}$		2	M1	
		$\frac{13}{25}$ oe		A1	

Question	Working	Answer	Mark	Notes
Number				

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)	3 5 6 5 5 3			M1	for one correct product
		$\frac{3}{25} \times \frac{5}{24} + \frac{6}{25} \times \frac{5}{24} + \frac{5}{25} \times \frac{3}{24}$			M1	for sum of all 3 correct products
		or $2 \times \frac{3}{25} \times \frac{5}{24} + \frac{6}{25} \times \frac{5}{24}$				
			$\frac{60}{600}$ 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
Number				

11.	(a)	$\frac{12}{3} \times 3.5 \text{ or } \frac{15}{3} \times 3.5 - 3.5$		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 $\frac{1}{5}$
		$19 \div 5 \text{ or } 19 \times \frac{1}{5}$			M1	Also award for $19 \div 4$ or $19 \times \frac{1}{4}$ May be implied by 4.75
			3.8		A1	cao

Question	Working	Answer	Mark	Notes
Number				

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 $(h \text{ cm})$ of $\triangle ABC$ and vert ht $(H \text{ cm})$ 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
Hamber				

12.	(a)	l = 15 indicated on graph		2	M1	
		or 70-72 inc stated				
			9		A1	Accept 8-10 inc
	(b)	20 and 60 or $20\frac{1}{4}$ and $60\frac{3}{4}$ indicated on		2	M1	
		cumulative frequency axis or stated or 6-6.5 and 11-11.5 stated				
			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	Working	Answer	Mark	Notes
Number				

13.	finds int angle of	finds ext angle of		5	M1	$(5-2)\times 180$	Award M1A1 for int
	pentagon	pentagon				for $\frac{(5-2)\times 180}{5}$	angle of pentagon
	$(5-2) \times 180$	360					shown as 108° or ext
	5	$\frac{360}{5}$				or $\frac{360}{5}$	angle shown as 72°
	108	72			A1	for 108	on printed diagram or
	108	12			AI		on candidate's own
						or 72	diagram
	If there is <i>clear</i> ev	vidence the candidate thi	nks the <i>interior</i> angle is	s 72° or the	e exterior a	ngle is 108°, do not awar	d the above two marks.
	int angle of polygon	n = 144			B1	for int angle of	Award B1 for int
	or					polygon = 144	angle of polygon
	ext angle of polygor	n = 36				or ext angle of	shown as 144° or ext
						polygon = 36	angle shown as 36°
							on printed diagram or
							candidate's own
							diagram
	360 180(n-2)	-144 00			M1	$_{60}$ 360 $_{00}$ 180($n-2$	2) _144 00
	$\frac{360}{36}$ or $\frac{180(n-2)}{n}$	= 144 0e				for $\frac{360}{36}$ or $\frac{180(n-2)}{n}$	—=144 0e
			10		A1	for 10 cao	
						Award no marks for a	an answer of 10 with no
						working	
						Award 5 marks for a	n answer of 10 if at least
						the first M1A1 are av	warded
							Total 5 marks

Question	Working	Answer	Mark	Notes
Number				

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
	$y = \frac{1}{3}x - 2$ oc or $y = \frac{1}{3}$ oc				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	Working	Answer	Mark	Notes
Number				

4. (1)				1 264 0	
14. (b)	$9 = \frac{2}{3} \times 6 + c$		2	M1 for correct	SC
	3 70 1 6			substitution	Award B2 if
				into $y = \frac{2}{3}x + c$	$y-9="\frac{2}{3}"(x-6)$
				using their answer	seen; then isw
				to (a) oe	
		2 . 5		2	SC Award B1 for
		$y = \frac{2}{3}x + 5$		A1 for $y = \frac{2}{3}x + 5$ oe	2x - 3y = k where
				inc 2x - 3y = -15	$k \neq -15$ and $k \neq 6$
				ft from their answer	with no working
				to (a)	
					SC If M0 A0, award
				SC If M0 A0, award B1 for answer with 'y =' omitted which would	B1 for $y = \frac{2}{3}x + c$
					where $c \neq 5$ or $c \neq 0$
				otherwise score M1 A1 eg $\frac{2}{3}x + 5$, (ie do not award this
				2x - 3 if ans to (a) is 2	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.	$(OB =) 8 \sin 30^{\circ} \text{ or } 4$		4	M1	
	$(BD =) 2 \times "4" \text{ or } 8$			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.	120 117				120 117
	$1.2 \times 1.17 \text{ or } \frac{120}{100} \times \frac{117}{100} \text{ or } 1.404 \text{ oe}$ 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	Working	Answer	Mark	Notes
Number				

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		
	$\angle OCD = 2x \text{ or } 69 - x \text{ or } 34\frac{1}{2} + \frac{1}{2}x$	Accept			stated,	B1 for each	Award all
		x + y = 69 or		5.4	marked on	correct	3 B marks if
	$\angle ODC = 2x \text{ or } 69 - x \text{ or } 34\frac{1}{2} + \frac{1}{2}x$	$y - \frac{1}{2}x = 34\frac{1}{2}$		B1	diagram or	expression	M1 or M2 scored.
	2 2	(where $\angle OCD$		B1	part of an	for an angle up to a max	scored.
		$= \angle ODC = y)$		D1	equation	of 2	
	$\angle COD = 180 - 4x \text{ or } 111 - x$		-				
	3x = 69			M2	M1for a correc	ct unsimplified	
					equation in x e	eg	
					69 + 180 - 4x	+ x = 180	
					69 = 2x + x		
					69 - x = 2x $55.5 + 55.5 + 2$	2x + x = 190	
					33.3 + 33.3 + 3 111 - x + 2x +		
					$34\frac{1}{2} + \frac{1}{2}x = 2x$	x	
		23		A1	cao		
						s for an answer	of 23 if M1 or
					M2 scored		
							Total 6 marks

Question	Working	Answer	Mark	Notes
Number				

19.	eg $\frac{72}{360} \times \pi \times 5.4^2 - \frac{1}{2} \times 5.4^2 \times \sin 72^\circ$		5	M1	for $\frac{72}{360}$ oe inc 5
				M1	for $\pi \times 5.4^2$
					or value which rounds to 91.6 seen
				M1	for completely correct method of finding the
					area of triangle <i>OAB</i> eg $\frac{1}{2} \times 5.4^2 \times \sin 72^\circ$
					or $5.4 \times \sin 36^{\circ} \times 5.4 \times \cos 36^{\circ}$
	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
					$(\pi \to 4.45536)$
					or for answer rounding to 4.45
					$(3.14 \rightarrow 4.44607)$
					If all M1s scored, award 5 marks for an
					answer which rounds to 4.46 or 4.45
					Total 5 marks

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Question Number	Working	Answer	Mark	Notes

20.	42.875 seen		4	B1	Also accept 42.874%, 42.87499 throughout
	$\sqrt[3]{42.875}$			B1	Also award for 3.5 if first B1 scored ie if
	V 12.073				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	Working	Answer	Mark	Notes
Number				

_			T	1	
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)			M1	(2y-25)(y-32)(=0)
	or $2x(x+4) - 5(x+4) = 0$				or $2y(y-32) - 25(y-32) = 0$
	or $x(2x-5) + 4(2x-5) = 0$				or $y(2y-25)-32(2y-25)(=0)$
	or $\frac{-3 \pm \sqrt{3^2 - 4 \times 2 \times (-20)}}{2 \times 2}$				or $\frac{89 \pm \sqrt{(-89)^2 - 4 \times 2 \times 800}}{2 \times 2}$
	or $\frac{-3 \pm \sqrt{9 + 160}}{4}$				or $\frac{89 \pm \sqrt{7921 - 6400}}{4}$
	or $\frac{-3 \pm \sqrt{169}}{4}$ or $\frac{-3 \pm 13}{4}$				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
		$x = \frac{5}{2}, y = \frac{25}{2}$		A1	$x = \frac{5}{2}, y = \frac{25}{2}$
		x = -4, y = 32			x = -4, y = 32
					dep on all preceding marks
					Accept answers given as coordinates
			-		Total 5 marks

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