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Mark Scheme (Results)

Summer 2013

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

  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 3(c), 19(b) and 20(b) (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 Number	Working	Answer	Mark	Notes
1	(0×13) + 1×2 + 2×3 + 3×8 + 4×14 or (0) + 2 + 6 + 24 + 56 or 88		3	M1 for sum of at least 3 products (products may or may not be evaluated)
	"88" ÷ 40			M1 (dep) for division by 40 (or by their 40)
		2.2		A1 accept 2.2 or $\frac{11}{5}$ or $2\frac{1}{5}$ Also accept '2' if both method marks are scored.
				Total 3 marks

2	(a)	$\frac{2.720294102}{7.7}$		2	M1 for 2.72029... if first 5 figures correct (rounded or truncated) **or** for 7.7 **or** for $\frac{2\sqrt{185}}{77}$
			0.35328(4948)		A1 Accept if first 5 figures correct
	(b)		0.35	1	B1 ft from (a) only if more than 2 sig figs given in (a)
					Total 3 marks

3 (a)		$6n - 12$	1	B1	
(b)		$p(p - 5)$	2	B2	Also accept $(p+0)(p-5)$ for B2 B1 for factors which, when expanded and simplified, give two terms, one of which is correct. SC B1 for $p(p - 5p)$
(c)	$7x-3=2x$		3	M1	for $7x-3=2x$ or $7x-3=2\times x$ or $\frac{7x}{2}-\frac{3}{2}=x$ oe
	$7x-2x=3$ or $5x=3$			M1	for $7x-2x=3$ or $5x=3$ or $5x-3=0$ or $\frac{7x}{2}-x=\frac{3}{2}$ or $\frac{5x}{2}=\frac{3}{2}$ NB. All these examples could be written with all terms 'on the other side' eg $-5x=-3$ etc
		$\frac{3}{5}$ oe		A1	**Award full marks if at least one method mark awarded and answer correct.**
					Total 6 marks

4	(a)	corresponding (angle(s))		1	B1	oe eg x corresponds to angle A; corresponding to angle A	
	(b)	(6 – 2) × 180 **or** 4 × 180 **or** (2 × 6 – 4) × 90 **or** 8 × 90 **or** 120 × 6 **or** (180 – 60)×6 **or** 360 + 360		4	M1		360–(73+46+38+88+57) Condone one incorrect ext angle
		720			A1	M1 A1 for 720 seen	58 M1 A1 for 58 seen
		"720" – (107 + 134 + 142 + 92 + 123) or "720" – 598			M1	dep on first M1	180 – "58"
			122		A1		
							Total 5 marks

5 (a)	$43=12x+2\times6.5$ **or** $43=12x+13$ **or** $P-2y=12x$ (oe with $\pm12x$ or $\pm x$ as the subject)		3	M1	for correct rearrangement of original equation or substitution	M2 for 43 − 2×6.5 (= 12*x*) **or** 30 (=12*x*)
	$12x=43-13$ **or** $12x=30$ **or** $-12x=13-43$ **or** $-12x=-30$			M1	for correct rearrangement and substitution	
		2.5 oe		A1	Correct answer scores full marks	
(b)	$4xy+\frac{1}{2}\times3x\times4x$ **or** $\frac{3x+y+y}{2}\times4x$		2	M1	for any one correct area eg $4xy$ oe **or** $\frac{1}{2}\times3x\times4x$ oe **or** $4x(3x+y)$	
		$4xy+6x^2$ etc		A1	for $4xy+6x^2$ **or** $4yx+6x^2$ **or** $2x(3x+2y)$ **or** $2(3x^2+2xy)$ **or** $x(6x+4y)$ (No fractions or uncollected terms but could be multiplication signs and/or brackets present)	
						Total 5 marks

6 (a)	$\frac{8}{100}\times 475$ oe **or** 38 **or** 437		3	M1		M2 for 475 × 1.08 oe
	475 + "38"			M1	(dep)	
		513		A1	cao	
(b)	1% = $\frac{48}{8}$ **or** 6 8% (of amount) = 48		3	M1	M2 for $\frac{48}{8}\times 100$ **or** 600 **or** $\frac{48}{0.08}$ **or** $\frac{48}{8}\times 108$ **or** $\frac{48}{0.08}\times 1.08$	
	"6" × 100 or 600			M1		
		648		A1	cao (NB: An answer of 600 scores M2A0)	
						Total 6 marks

7 (i)		u, a, e	2	B1		Any order. Brackets and commas not necessary
(ii)	s, q, r, a, e, i, o, u			B1	B0 if 'a' or 'e' or 'u' repeated	
						Total 2 marks

8	$2\times\pi\times5.1^2+2\times\pi\times5.1\times3.7$ oe **or** 163.42... + 118.56... (using π) **or** 163.3428 + 118.5036 (using 3.14) (rounded or truncated to at least 3 sig figs) **or** $2\times\pi\times5.1\times(5.1+3.7)$ **or** $\frac{2601}{50}\pi+\frac{1887}{50}\pi$ **or** $\frac{2244}{25}\pi$		3	M2	M1 for one of $2\times\pi\times5.1^2$ **or** value in range 163-163.43 inc **or** $\frac{2601}{50}\pi$ $2\times\pi\times5.1\times3.7$ oe **or** value in range 118-119 inc **or** $\frac{1887}{50}\pi$ NB. Accept 3.14(...) or 22/7 in place of π
		282		A1	for answer in range 281.8-282 inc
					Total 3 marks

9	**No approximation** $\frac{37527}{365}$ or $\frac{37527}{366}$ or $\frac{37527}{365.25}$ or $\frac{37527}{364}$			M2	M1 for $\frac{37527}{x}$ where $356 \leq x \leq 370$
		103		A2	Accept 102 if M2 awarded A1 for $102.5 \leq$ answer ≤ 103.1

9	**Alternative - with approximation** $\frac{x}{y}$ or $x \times \frac{1}{y}$ where x is $35\,000 \leq x \leq 40\,000$ **AND** $336 \leq y \leq 400$		4	M2	M1 for $\frac{x}{y}$ or $x \times \frac{1}{y}$ where either the value of x **or** the value of y is acceptable
		integer in the range 93 – 111 inclusive			**The award of any accuracy marks is dependent on the award of M2** A2 A1 for non-integer in the range 93 – 111
					Total 4 marks

10	use of cos		3	M1	cos must be selected for use in trig ratio **NOT** Cosine Rule	**or** M2 for sin and $\frac{\sqrt{"21.36"}}{9.5}$ following correct Pythagoras **or** M2 for tan and $\frac{\sqrt{"21.36"}}{8.3}$ following correct Pythagoras **or** correct Pythag and then correct use of sine or cosine rule with "21.36"
	cos ("x") = $\frac{8.3}{9.5}$ (=0.87…) **or** ("x" =) cos $^{-1}$ ($\frac{8.3}{9.5}$)			M1		
		29.1		A1	for awrt 29.1 e.g. (29.1103…)	
						Total 3 marks

11 (a)	54 = 2 × 3^3 and 90 = 2 × 3^2 × 5 **or** 1,2,3,6,9,18,27,54 and 1,2,3,5,6,9,10,15,18,30,45,90 **or** 2 × 3^2 oe		2	M1	Need not be products of powers; accept products or lists eg 2,3,3,3 and 2,3,3,5 accept 9, 2, 3 and 9, 2, 5 (may be seen in a Venn diagram or may be shown as factor trees or repeated division)
		18		A1	cao
(b)	2 × 3^3 × 5 oe eg 6 × 9 × 5 **or** 54,108,162,216,270 and 90,180,270		2	M1	Need not be products of powers; accept products or lists eg 2, 3, 3, 3, 5
		270		A1	cao
					Total 4 marks

12	(a)		Points correct	2	B1	$\pm$ ½ sq
		Curve or line segments			B1	ft from points if 4 or 5 correct or if points are plotted consistently within 50-60, 60-70, 70-80 etc at the correct heights Ignore any attempt at curve to left of first plotted point
	(b)	30 (or 30.5) indicated on cumulative frequency graph or stated		2	M1	for 30 (or 30.5) indicated on cumulative frequency axis or stated
			approx 66		A1	If M1 scored, ft from *their* cumulative frequency graph If M1 not scored, ft only from correct curve & if answer is correct ($\pm$ ½ sq tolerance) award M1 A1
						Total 4 marks

13	**NB : M2 cannot be awarded if angles are marked incorrectly on the diagram** 180 − 77 − 39 **or** $\angle BAD = 77°$ **and** $\angle ABD = 39°$ **or** $\angle BA"x" = 64°$ where x is on *PA* produced **or** a fully correct method to find angle *ADB*		3	M2 also accept 103 −39 M1 for $\angle BAD = 77°$ **or** $\angle ABD = 39°$	Angles may be stated or marked on diagram
		64		A1 cao	
				Total 3 marks	

14	(a)		$24p^5q^6$	2	B2	B1 for 2 of 24, p^5, q^6 correct in a single product with no additional terms **or** $24p^{3+2}q^{5+1}$
	(b)		$125x^6y^{12}$	2	B2	B1 for 2 of 125, x^6, y^{12} correct in a single product with no additional terms **or** $125x^{2\times3}y^{4\times3}$
	(c)		$(3a + b)(3a - b)$	2	B2	B1 for $(3a + b)(3a + b)$ **or** $(3a + b)^2$ **or** $(3a - b)(3a - b)$ **or** $(3a - b)^2$
						Total 6 marks

15	(a)		$x = 3, y = 2$	1	B1	cao
	(b)	**Use of gradient and** $y = mx + c$ or clear attempt to use $\frac{\text{vertical difference}}{\text{horizontal difference}}$ eg $\frac{2}{3}$ oe (ignore omission of − sign) **or** for $3y = 12 - 2x$ **or** $3y = -2x + 12$ **or** for $y = \frac{12-2x}{3}$ oe **or** gradient = $\frac{2}{3}$ stated or used		4	M1	Throughout question accept $\frac{2}{3}$ written as a decimal rounded or truncated to 2 or more decimal places
		(grad =) $-\frac{2}{3}$ oe or $y = 4 - \frac{2}{3}x$ oe			A1	
		$y = -\frac{2}{3}x + c$ **or** for $y = "-\frac{2}{3}"x + c$ where $c \neq 10$ **or** $-\frac{2}{3}x + 10$, $"-\frac{2}{3}"x + 10$, L= $-\frac{2}{3}x + 10$ etc			M1	ft from $"-\frac{2}{3}"$
		$y = -\frac{2}{3}x + 10$ oe **or** $2x + 3y = 30$ oe **or** $y = "-\frac{2}{3}"x + 10$ oe			A1	ft from $"-\frac{2}{3}"$

(b)	**Alternative scheme:** **Use of** $2x+3y=k$ $2x+3y=k$		4	M1	
	2× 0 + 3×10 (=*k*)			M1	Substitution of (0, 10) into $2x+3y=k$
	k = 30			A1	
		$2x+3y=30$ oe		A1	
(c)	(1,1) (1,2) (1,3) (2,2) marked	2	B2	B1 for 3 correct points marked and none wrong **or** for all correct points and either one or more of points on y axis ie. (0,−1) (0,0) (0,1) (0,2) (0,3) (0,4) points on $y=x-1$ ie (0,−1) (1,0) (2,1) (3,2)	
					Total 7 marks

16 (a)	$\frac{PR}{5}=\frac{14}{8}$ or $\frac{PR}{14}=\frac{5}{8}$		2	M1	or for 5 × $\frac{14}{8}$ oe	
		8.75		A1		
(b)	$\frac{14}{8}$ or $\frac{7}{4}$ or 1.75 or $\frac{8}{14}$ or $\frac{4}{7}$ or 0.571… (May be implied by second M1) Allow ratio notation		3	M1	Alternative method M1 for $\frac{1}{2}\times 8\times 5\times \sin A$ and sin *A* = 0.8	
	1.75^2 oe eg 3.0625, $\frac{49}{16}$ or $\left(\frac{4}{7}\right)^2$ oe eg $\frac{16}{49}$, 0.326… allow ratio notation			M1	M1 (dep) for $\frac{1}{2}\times 14\times$"8.75"$\times 0.8$	
		49		A1	cao SC : B1 for an answer of 28	
					Total 5 marks	

17	(a)	0.3 × 0.1 **or** (1 − 0.7) × 0.1 and no other terms		2	M1	
			0.03 oe		A1	
	(b)	0.7 × 0.8 **or** 0.7 × (1 − 0.2) **or** 0.3 × 0.9 **or** (1 − 0.7) × (1 − 0.1)		3	M1	M1 for "(a)" + 0.7 × 0.2 **or** 0.3 × 0.1 + 0.7 × 0.2 (=0.17) **or** (1 − 0.7) × 0.1 + 0.7 × 0.2
		0.7 × 0.8 + 0.3 × 0.9 **or** 0.7 × (1 − 0.2) **+** (1 − 0.7) × (1 − 0.1)			M1	M1 for 1 − ("(a)" + 0.7 × 0.2) **or** 1 − "0.17" (M2 for 1 − "(a)" − 0.7 × 0.2)
			0.83 oe		A1	
						Total 5 marks

18	$\frac{2.9}{\sin 36°} = \frac{QS}{\sin(180-62)°}$		3	M1 for correct substitution into the Sine Rule	Condone use of 62 instead of 118
	$(QS =) \frac{2.9\sin"118"°}{\sin 36°}$ oe			M1 for correct rearrangement (there may be partial evaluation)	
		4.36		A1 for awrt 4.36	
					Total 3 marks

19	(a)	3.65 x 6		2	M1	for 3.65 or $3.649\dot{}$ or 3.6499…
			21.9		A1	Also accept $21.89\dot{}$ or 21.899…
	(b)	75 **or** 12.5 **or** $12.49\dot{}$		3	M1	
		$\frac{75}{12.5}$ **or** 75 = w × 12.5 **or** $\frac{75}{12.49\dot{}}$ **or** 75 = w × $12.49\dot{}$			M1	for 75 **and** 12.5 (or $12.49\dot{}$)used correctly
			6		A1	cao dep on both method marks
						Total 5 marks

20 (a)	$\frac{20-2x}{2}$ or $10-x$ seen as the width or $\sqrt{8^2-x^2}$ oe		4	B1
	$x^2+(10-x)^2=8^2$ **or** $x^2+(10-x)^2=64$ **or** $2x+2\sqrt{8^2-x^2}=20$ **or** $x+\sqrt{8^2-x^2}=10$			M1 accept $\frac{20-2x}{2}$ in place of $10-x$ for all method marks
	$x^2+100-10x-10x+x^2=64$ **or** $(2\sqrt{8^2-x^2})^2=400-40x-40x+4x^2$ **or** $(\sqrt{8^2-x^2})^2=100-10x-10x+x^2$			M1 (dep on previous M1) for correct expansion of $(10-x)^2$ **or** correct expansion of $(20-2x)^2$
		$x^2-10x+18=0$		A1 for correct manipulation resulting in given equation
(b)	$\frac{--10\pm\sqrt{(-10)^2-4\times1\times18}}{2\times1}$ **or** for this expression with one or more of $(--10)$, $(-10)^2$, 10^2, $-4\times1\times18$, 2×1, $(-10)^2-4\times1\times18$ evaluated e.g. $\frac{10\pm\sqrt{28}}{2}$		3	M1 correct substitution brackets not necessary (accept 10^2) **or** $(x-5)^2-25+18=0$ oe
	$\sqrt{28}$ **or** $2\sqrt{7}$ **or** $\sqrt{100-72}$ **or** 5.29...			M1 (independent) for correct simplification of discriminant (if evaluated at least 3sf rounded or truncated) **or** $x-5=\pm\sqrt{7}$ oe

		2.35 7.65		A1	for values rounding to 2.35 and 7.65 (2.35424... 7.64575...) Award full marks for correct solutions if at least 1 method mark scored.
					Total 7 marks

21	$\frac{1}{2}\times 7\times 16\times \sin 150°$		6	M1	for $\frac{1}{2}\times 7\times 16\times \sin 150°$	
				M1	for $\pi\times 7^2$ **or** 49π **or** for value rounding to 153.9	
	$\frac{210}{360}\times\pi\times 7^2$ **or** $\pi\times 7^2 - \frac{150}{360}\times\pi\times 7^2$			M2	correct method for sector of circle	M1 for $\frac{210}{360}$ oe inc 0.5833... rounded or truncated to at least 3 decimal places or for $\frac{360}{210}$ oe inc 1.714... rounded or truncated to at least 2 decimal places
				A1	for value rounding to 89.8 or $\frac{343\pi}{12}$ for area of sector **or** 28 for area of triangle	
		118		A1	for value rounding to 118	
						Total 6 marks

22	$\frac{y(x+4)}{x(x+4)}+\frac{2xy}{x(x+4)}=3$ **or** $\frac{y(x+4)}{x(x+4)}+\frac{2xy}{x(x+4)}=\frac{3x(x+4)}{x(x+4)}$		5	M1	LHS may be two separate fractions or one single fraction (brackets may or may not be removed on RHS and denominator)
	$y(x + 4) + 2xy = 3x(x + 4)$ **or** $\frac{xy+4y}{x(x+4)}+\frac{2xy}{x(x+4)}=3$ **or** $\frac{xy+4y}{x(x+4)}+\frac{2xy}{x(x+4)}=\frac{3x(x+4)}{x(x+4)}$			M1	LHS may be two separate fractions or one single fraction; if one fraction, numerator on LHS may or may not be simplified **(implies previous M1)** (brackets may or may not be removed on RHS and denominator)
	$xy+4y+2xy=3x^2+12x$ **or** $xy+4y_2xy=3x(x+4)$ **or** $3xy+4y=3x^2+12x$ **or** $3xy+4y=3x(x+4)$			M1	(brackets may or may not be removed on RHS) **(implies previous two M1s)**
	$y(3x+4)=3x(x+4)$ **or** $y(3x+4)=3x^2+12x$			M1	LHS factorised correctly - expression in bracket on LHS may or may not be simplified
		$\frac{3x(x+4)}{3x+4}$		A1	$\frac{3x(x+4)}{3x+4}$ or $\frac{3x^2+12x}{3x+4}$ a fully correct method must be seen in order to award full marks
					Total 5 marks

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