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Mark Scheme (Results)

June 2016

Pearson Edexcel International GCSE Mathematics A (4MA0) Paper 3H

Pearson Edexcel Level 1/Level Certificate Mathematics A (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.

International GCSE Maths					
Apart from questions 6, 12, 17, 20 (where the mark scheme states otherwise) the correct answer, unless obtained from an incorrect method, should be taken to imply a correct method.					
Q		**Working**	**Answer**	**Mark**	**Notes**
1	a	60 ÷ 12 × 150 **or** 60 ÷ 12 (=5) **or** 150 ÷ 12 (=12.5)			M1 allow $x \div 12 \times 60$ oe where x is 300 **or** 250 **or** 100 **or** 2
			750	2	A1
	b	625 ÷ 250 × 12 oe			M1 complete method
			30	2	A1
					Total 4 marks

2	a	$2\times(-5)^2 + 6\times-2$ **or** $2(-5)^2 + 6(-2)$ **or** 50 and −12			M1
			38	2	A1
	b		$T = 4x + 10y$ oe	3	B3 for a correct final answer (award B2 if $T = 4x + 10y$ is incorrectly simplified) If not B3 then B2 for $T = 4x + ky$ **or** $T = kx + 10y$ (k may be 0)) **or** $4x + 10y$ B1 for $4x$ **or** $10y$ **or** $T =$ (linear expression in x and y)
					Total 5 marks

3	0×4 + 1×3 + 2×12 + 3×5 + 4×8 + 5×5 + 6×2 + 7×1 **or** (0) + 3 + 24 + 15 + 32 + 25 + 12 + 7 (=118)			M1	condone one error
	"118" ÷ "40"			M1	dep NB. Allow a value other than 40 provided it has clearly come from the sum of the frequency column
		2.95	3	A1	Accept 3 from 118÷40 SC: B2 for 3.05
					Total 3 marks

4	ai		6, 12	1	B1	cao
	aii		2,3,4,6,8,9,10,12,14	1	B1	cao
	b		no members in common	1	B1	accept , e.g. members of *A* are even and members of *B* are odd; no numbers the same
						Total 3 marks

5	<table><tr><td>x</td><td>−2</td><td>−1</td><td>0</td><td>1</td><td>2</td><td>3</td></tr><tr><td>y</td><td>−11</td><td>−8</td><td>−5</td><td>−2</td><td>1</td><td>4</td></tr></table>	$y = 3x - 5$ drawn from $x = -2$ to $x = 3$	4	B4	For a correct line between $x = -2$ and $x = 3$
				B3	For a correct straight line segment through at least 3 of (−2, −11) (−1, −8) (0, −5) (1, −2) (2, 1) (3, 4) **OR** for all of (−2, −11) (−1, −8) (0, −5) (1, −2) (2, 1) (3, 4) plotted but not joined
				B2	For at least 2 correct points plotted (ignore incorrect points) **OR** for a line drawn with a positive gradient through (0, −5) **and** clear intention to use a gradient of 3 (eg. a line through (0, −5) and (0.5, −2)
				B1	For at least 2 correct points stated (may be in a table) **or** may be shown in working eg. $3 \times 2 - 5 = 1$ **OR** for a line drawn with a positive gradient through (0, −5) **but not** a line joining (0, −5) and (3, 0) **OR** a line with gradient 3
					Total 4 marks

6 a	$\frac{9}{30} + \frac{4}{30}$		2	M1	for $\frac{9}{30}$ or $\frac{4}{30}$ **or** both fractions expressed as equivalent fractions with denominators that are a common multiple of 10 and 15 eg. $\frac{45}{150}$ and $\frac{20}{150}$
		shown		A1	conclusion to given answer coming from correct working
b	$\frac{21}{8} \div \frac{7}{6}$ **or** $\frac{21}{8}$ **and** $\frac{7}{6}$		3	M1	Both fractions expressed as improper fractions eg. $\frac{63}{24}, \frac{28}{24}$
	$\frac{21}{8} \times \frac{6}{7}$ **or** $\frac{126}{56}$			M1	**or** for both fractions expressed as equivalent fractions with denominators that are a common multiple of 8 and 6 eg. $\frac{126}{48} \div \frac{56}{48}$ **or** $\frac{63}{24} \div \frac{28}{24}$
		shown		A1	conclusion to $2\frac{1}{4}$ or $\frac{9}{4}$ from correct working – either sight of the result of the multiplication e.g. $\frac{126}{56}$ must be seen or correct cancelling prior to the multiplication with $\frac{9}{4}$
					Total 5 marks

7	a		$y(3y + 2)$	1	B1	
	b				M1	for 3 correct terms **or** 4 correct terms ignoring signs **or** $x^2 - 7x + a$ for any non-zero value of a **or** ... $- 7x - 18$
			$x^2 - 7x - 18$	2	A1	
	ci	$6k < 20 - 5$			M1	for a correct first step to solve the inequality (accept an equation in place of an inequality) **or** 2.5 oe given as answer
			$k < 2.5$ oe		A1	final answer must be an inequality
	cii		2	3	B1	for 2 **or** ft from an incorrect inequality of the form $k < a$ in (i)
	d		$7x^4y$	2	B2	accept $7x^4y^1$ B1 for $ax^n y^m$ with 2 of $a = 7$, $n = 4$, $m = 1$ ($n \neq 0$, $m \neq 0$) **or** correct expression with two of 7, x^4, y e.g. $\frac{7x^4y^3}{y^2}$
						Total 8 marks

8	$\sin 53^o = \frac{AB}{13.4}$ **or** $\frac{\sin 53}{AB} = \frac{\sin 90}{13.4}$ **or** $\frac{AB}{\sin 53} = \frac{13.4}{\sin 90}$ **or** $\cos 37 = \frac{AB}{13.4}$			M1	**Alternative methods** M1 for *AC* or angle *B* evaluated correctly **AND** then used in a correct method to find *AB* eg. $AB^2 + 8.06..^2 = 13.4^2$, $\tan 53 = \frac{AB}{8.06...}$
	$13.4 \times \sin 53^o$ **or** $\frac{13.4}{\sin 90} \times \sin 53$ **or** $13.4 \times \cos 37$			M1	M1 for a fully correct method eg.; $\sqrt{13.4^2 - 8.06..^2}$, $8.06\ldots \times \tan 53$
		10.7	3	A1	awrt 10.7
					Total 3 marks

9	$6000 \div (2 + 3 + 7) \times 7$ (=3500) **or** $6000 \div (2 + 3 + 7) \times 2$ (=1000)				M1
	$\frac{3}{5}$ × "3500" (=2100)				M1
	$(6000 \div (2 + 3 + 7) \times 2) + \frac{3}{5} \times$ "3500" (=3100) **or** 1000 + 2100				M1
	$\frac{"3100"}{6000} \times 100$				M1 dep on previous M1
		52	5		A1 Accept 51.6 - 52
					Total 5 marks

10	$\pi \times 2.5^2$ (=19.6...) **or** 13.8×7.6 (=104.88)			M1	
	$13.8 \times 7.6 - \pi \times 2.5^2$			M1	correct method
		85.2	3	A1	for answer in range 85 – 85.3
					Total 3 marks

11	a		4 ,11 ,32 ,53 ,71 ,78 ,80	1	B1	
	b			2	M1	ft from table for at least 5 points plotted correctly at end of interval **or** ft from sensible table for all 7 points plotted consistently within each interval in the **freq table** at the correct height
			correct cf graph		A1	accept curve or line segments accept curve that is not joined to (40,0)
	c	Reading from graph at $w = 85$ eg. reading of 60 – 64			M1	ft from a cumulative frequency graph provided method is shown
			16 − 20	2	A1	ft from a cumulative frequency graph provided method is shown
	d	Use of 20 and 60 (or 20.25 and 60.75) eg. readings of 61− 65 and 83−87 eg. 85 − 63			M1	ft from a cumulative frequency graph provided method is shown
			18 − 22	2	A1	ft from a cumulative frequency graph provided method is shown
						Total 7 marks

12	e.g. $12x + 15y = 39$ $-\ 12x - 8y = 108$ e.g. $4(\frac{27+2y}{3})+5y=13$		4	M1	for multiplication to give coefficients of x or y the same **and** correct operation selected to eliminate one variable (condone any one error in multiplication) **or** for correct rearrangement of one equation followed by correct substitution in the other
	$23y = -69;\ y = -3$			A1	cao depends on M1
	$12x + 15\times -3 = 39$			M1	(dep on 1st M1) for substituting the found variable **or** starting again to find second variable as M1 above
		$x = 7;\ y = -3$		A1	Award 4 marks for correct values if at least M1 scored
					Total 4 marks

13	e.g. $\frac{9-3}{6--2}\left(=\frac{3}{4}\right)$		5	M1	for method to find gradient of **L**	
	$y = "0.75"x + c$			M1	use of their gradient in an equation c may be numerical	M2 for $y--1="\frac{3}{4}"(x-5)$ oe
	$-1 = "0.75"\times 5 + c \quad (c = -\frac{19}{4})$			M1	method to find c	
	$y=\frac{3}{4}x+-\frac{19}{4}$ oe			A1	correct equation (equation in any form)	
		$4y - 3x = -19$		A1	oe with integer coefficients e.g. $3x - 4y = 19$; $4y = 3x - 19$	
					Total 5 marks	

14	a	$2 \times 3t^2$; $-12 \times 2t$; 7		2	M1	evidence of differentiation; at least two terms correct
			$6t^2 - 24t + 7$		A1	
	b	$6 \times 2t - 24 = 0$		2	M1	ft from a quadratic in (a) for correct differentiation **and** equating to zero
			2		A1	ft
						Total 4 marks

15	$\sqrt{\frac{120}{750}}\left(=\frac{2}{5}\right)$ oe **or** $\sqrt{\frac{750}{120}}\left(=\frac{5}{2}\right)$ oe **or**		3	M1	Correct linear scale factor (accept ratios)
	0.4^3 (= 0.064) oe **or** 2.5^3 (=15.625) oe			M1	or for $1600 \div 6.25^3$ oe **or** 1600×0.16^3 oe
		102.4		A1	
					Total 3 marks

16	angle *AHF* identified		4	M1	may be implied by a correct calculation
	(*FH*=) $\sqrt{17^2+5^2}$ **or** $\sqrt{314}$ (=17.7...)			M1	**or** (*AH* =) $\sqrt{17^2+5^2+8^2}$ (=19.4..) **or** $\sqrt{378}$ **or** $3\sqrt{42}$
	$\tan AHF = \frac{8}{"17.7..."}$			M1	dep on previous M1 **or** $\cos AHF = \frac{"17.7..."}{"19.4..."}$ **or** $\sin AHF = \frac{8}{"19.4..."}$ ($\times \sin 90$) **or** $\cos AHF = \frac{"19.4.."^2+"17.7.."^2-8^2}{2\times"19.4.."\times"17.7.."}$
		24.3		A1	answer in range 24.2 − 24.4
					Total 4 marks

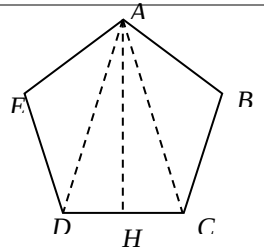
17	i	e.g. $\frac{1}{2}\times(x+6+3x-4)\times(x-1)$ **or** $(x+6)(x-1)$ **or** $(x-1)(3x-4)$ **or** $\frac{1}{2}\times(x-1)(3x-4-(x+6))$		6	M1	correct algebraic expression for any relevant area
		eg. $\frac{1}{2}\times(4x^2-2x-2)=119$			M1	for correct equation with at least one pair of brackets expanded correctly
			shown		A1	for completion to given equation
	ii	$(2x\pm15)(x\pm8)\ (=0)$ **or** $\frac{--1\pm\sqrt{(-1)^2-4\times2\times-120}}{2\times2}$ **or** $\left(x-\frac{1}{4}\right)^2-\left(\frac{1}{4}\right)^2-60=0$			M1	Start to solve quadratic condone one sign error in substitution if quadratic formula used; allow -1^2 or 1^2 or 1 in place of $(-1)^2$ ft from an incorrect 3 term quadratic equation
		$(2x+15)(x-8)\ (=0)$ **or** $\frac{1\pm\sqrt{1+960}}{4}$ **or** $x=\frac{1}{4}\pm\sqrt{\left(\frac{1}{4}\right)^2+60}$ **or** -7.5 **and** 8 given as solutions			M1	dep ft method from an incorrect 3 term quadratic equation
			8		A1	Award all 3 marks if first M1 awarded **and** 8 alone given as final answer
						Total 6 marks

18	$m(t-3) = t+1$ **or** $mt - 3m = t + 1$		4	M1	clearing fraction
	e.g. $mt - t = 1 + 3m$ **or** $t - mt = -1 - 3m$			M1	for expanding bracket **AND** rearranging so that all terms in t are isolated on one side of a **correct** equation
	$t(m-1)$ **or** $t(1-m)$			M1	take t out as a common factor (in an equation)
		$t = \frac{3m+1}{m-1}$		A1	**or** $t = \frac{-3m-1}{1-m}$ oe
					Total 4 marks

19	Angle $DCB = 180 - 75$ (=105)		4	M1	Use of opposite angles in a cyclic quadrilateral sum to 180^o
	Angle $DOB = 2 \times 75$ (=150)			M1	Use of angle at centre is twice angle at circumference
	E.g. $(180 - 105 - 27) + (180 - 150) \div 2$ **or** $360 - (150 + 105 + 27 + (180 - 150) \div 2)$			M1	Complete method
		63		A1	
					Total 4 marks

20	4.75 **or** 4.25 **or** 47.5 **or** 42.5		5	B1	Allow $4.74\dot{9}$
	3.5 **or** 2.5 **or** 35 **or** 25			B1	
	$\frac{4}{3}\times\pi\times 0.25^3$ (=0.0654498…) **or** $\frac{4}{3}\times\pi\times 2.5^3$ (=65.4498…) **or** 4.75 × 4.75 × 4.75 (= 107.171875) **or** 47.5 × 47.5 × 47.5 (=107171.875)			M1	Allow $4.74\dot{9}$
	"4.75"$^3 \div \left(\frac{4}{3}\times\pi\times"0.25"^3\right)$ (=1637.465...)			M1	indep – accept use of 4.5 and 0.3 or candidate's bounds **units must be consistent**
		1637		A1	1637 must come from correct working with correct figures
					Total 5 marks

21	eg. $\frac{3}{9}\times\frac{2}{8}\times\frac{1}{7}\left(=\frac{6}{504}=\frac{1}{84}\right)$		5	M1 (probabilities from selecting 2, 2, 2) allow $\frac{3}{9}\times\frac{2}{9}\times\frac{1}{9}\left(=\frac{6}{729}\right)$ **or** $\frac{3}{9}\times\frac{3}{9}\times\frac{3}{9}\left(=\frac{27}{729}\right)$
	eg. $\frac{2}{9}\times\frac{3}{8}\times\frac{4}{7}\left(=\frac{24}{504}=\frac{1}{21}\right)$			M1 (probabilities from selecting 1, 2, 3) allow $\frac{2}{9}\times\frac{3}{9}\times\frac{4}{9}\left(=\frac{24}{729}\right)$
	$6\times"\frac{24}{504}"\left(=\frac{144}{504}=\frac{6}{21}=\frac{2}{7}\right)$			M1 (probabilities for all combinations of 1, 2, 3) allow $6\times"\frac{24}{729}"\left(=\frac{144}{729}\right)$
	$6\times\frac{2}{9}\times\frac{3}{8}\times\frac{4}{7}\ +\ \frac{3}{9}\times\frac{2}{8}\times\frac{1}{7}\ \left(=\frac{6}{21}+\frac{1}{84}\right)$			M1 complete correct method
		$\frac{150}{504}$		A1 oe eg. $\frac{25}{84}$, 0.298, 0.297619… (NB. An answer of $\frac{150}{729}\left(=\frac{50}{243}\right)$ **or** $\frac{171}{729}\left(=\frac{19}{81}\right)$ scores M1M1M1M0A0)
				Total 5 marks

22	$12^2 + 8^2 - 2\times12\times8\times\cos(105)$ (=257...)			M1	
	257(....) or $\sqrt{257}$(=16.05..)			A1	for 257 or awrt 258 or 16 - 16.1 If M1 has been awarded then allow the use of the candidate's value for *AD* in all subsequent working
	eg.  $(AH =)\sqrt{"16.05.."^2 - 6.5^2}$ (=14.6...) **or** $(ADC =)\cos^{-1}\left(\frac{"16.05"^2 + 13^2 - "16.05"^2}{2\times"16.05"\times13}\right)$ (=66.08..)			M1	(dep on first M1) complete method to find height of pentagon or any angle within triangle *ADC* E.g. angle *ADC* = angle *ACD* = 66.08… angle *DAC* = 47.8… angle *DAH* = angle *CAH* = 23.9… (accept all these angles rounded or truncated to 3 or more sig figs)
	eg. $0.5\times12\times8\times\sin(105)$ (=46.3...) **or** $12\times8\times\sin(105)$ (=92.7…) **or** $0.5\times13\times"14.6"$ (=95.4...) **or** $0.5 \times 13 \times "16.05" \times \sin("66.1")$			M1	any one relevant area (any calculated values used must come from a correct method)
	eg. $2 \times 0.5\times12\times8\times\sin(105) + 0.5\times13\times"14.6"$ **or** $2\times0.5\times12\times8\times\sin(105) + 0.5 \times 13 \times "16.05" \times \sin("66.1")$			M1	(dep on first M1) complete correct method
		188	6	A1	accept answer in range 188 – 188.5
					Total 6 marks

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