

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

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications come from Pearson, the world's leading learning company. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information, please visit our website at www.edexcel.com.

Our website subject pages hold useful resources, support material and live feeds from our subject advisors giving you access to a portal of information. If you have any subject specific questions about this specification that require the help of a subject specialist, you may find our Ask The Expert email service helpful.

www.edexcel.com/contactus

Pearson: helping people progress, everywhere

Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk

Summer 2016

Publications Code 4MA0_3H_1606_MS

All the material in this publication is copyright

© Pearson Education Ltd 2016

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
 - eeo – 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 × (-5) ² + 6 × -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	$0 \times 4 + 1 \times 3 + 2 \times 12 + 3 \times 5 + 4 \times 8 + 5 \times 5 + 6 \times 2 + 7 \times 1$ or $(0) + 3 + 24 + 15 + 32 + 25 + 12 + 7 (=118)$			M1 condone one error
	“118” \div “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 $118 \div 40$ 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 <i>A</i> are even and members of <i>B</i> are odd; no numbers the same
				Total 3 marks

5	<table border="1" style="display: inline-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>	x	-2	-1	0	1	2	3	y	-11	-8	-5	-2	1	4	$y = 3x - 5$ drawn from $x = -2$ to $x = 3$	4	<p>B4 For a correct line between $x = -2$ and $x = 3$</p>
	x	-2	-1	0	1	2	3											
	y	-11	-8	-5	-2	1	4											
					<p>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</p>													
				<p>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 $(0.5, -2)$)</p>														
				<p>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</p>														
				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 $\dots - 7x - 18$
			$x^2 - 7x - 18$	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	$\sin 53^\circ = \frac{AB}{13.4}$ 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. $AB^2 + 8.06..^2 = 13.4^2$, $\tan 53 = \frac{AB}{8.06...}$
	$13.4 \times \sin 53^\circ$ or $\frac{13.4}{\sin 90} \times \sin 53$ or $13.4 \times \cos 37$			M1	M1 for a fully correct method eg.; $\sqrt{13.4^2 - 8.06..^2}$, $8.06... \times \tan 53$
		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	
	$\frac{3}{5} \times "3500" (=2100)$			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	$\pi \times 2.5^2 (=19.6\dots)$ or $13.8 \times 7.6 (=104.88)$			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. $12x + 15y = 39$ $- 12x - 8y = 108$		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)
	e.g. $4\left(\frac{27+2y}{3}\right) + 5y = 13$			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
	$-1 = "0.75" \times 5 + c \quad (c = -\frac{19}{4})$		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 $\sqrt{314} (=17.7\dots)$			M1 or $(AH =) \sqrt{17^2 + 5^2 + 8^2} (=19.4\dots)$ or $\sqrt{378}$ or $3\sqrt{42}$	
	$\tan AHF = \frac{8}{"17.7\dots"}$			M1 dep on previous M1 or $\cos AHF = \frac{"17.7\dots"}{"19.4\dots"}$ or $\sin AHF = \frac{8}{"19.4\dots"} (\times \sin 90)$ or $\cos AHF = \frac{"19.4\dots"^2 + "17.7\dots"^2 - 8^2}{2 \times "19.4\dots" \times "17.7\dots"}$	
		24.3		A1 answer in range 24.2 – 24.4	
					Total 4 marks

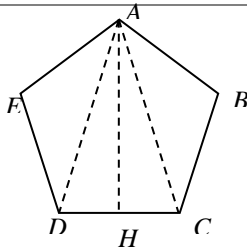
17	i	e.g. $\frac{1}{2} \times (x+6+3x-4) \times (x-1)$ or $(x+6)(x-1)$ or $(x-1)(3x-4)$ or $\frac{1}{2} \times (x-1)(3x-4-(x+6))$		6	M1 correct algebraic expression for any relevant area
		eg. $\frac{1}{2} \times (4x^2 - 2x - 2) = 119$			M1 for correct equation with at least one pair of brackets expanded correctly
			shown		A1 for completion to given equation
	ii	$(2x \pm 15)(x \pm 8) (=0)$ or $\frac{- -1 \pm \sqrt{(-1)^2 - 4 \times 2 \times -120}}{2 \times 2}$ 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°
	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 $4.75 \times 4.75 \times 4.75$ (= 107.171875) or $47.5 \times 47.5 \times 47.5$ (=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	$12^2 + 8^2 - 2 \times 12 \times 8 \times \cos(105) (=257\dots)$			M1
	$257(\dots)$ or $\sqrt{257}(=16.05\dots)$			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. 			M1 (dep on first M1) complete method to find height of pentagon or any angle within triangle ADC E.g. angle $ADC =$ angle $ACD = 66.08\dots$ angle $DAC = 47.8\dots$ angle $DAH =$ angle $CAH = 23.9\dots$ (accept all these angles rounded or truncated to 3 or more sig figs)
	$(AH =) \sqrt{16.05\dots^2 - 6.5^2} (=14.6\dots)$ or $(ADC =) \cos^{-1} \left(\frac{16.05\dots^2 + 13^2 - 16.05\dots^2}{2 \times 16.05\dots \times 13} \right) (=66.08\dots)$			M1 any one relevant area (any calculated values used must come from a correct method)
	eg. $0.5 \times 12 \times 8 \times \sin(105) (=46.3\dots)$ or $12 \times 8 \times \sin(105) (=92.7\dots)$ or $0.5 \times 13 \times 14.6 (=95.4\dots)$ or $0.5 \times 13 \times 16.05 \times \sin(66.1)$ eg. $2 \times 0.5 \times 12 \times 8 \times \sin(105) + 0.5 \times 13 \times 14.6$ or $2 \times 0.5 \times 12 \times 8 \times \sin(105) + 0.5 \times 13 \times 16.05 \times \sin(66.1)$			M1 (dep on first M1) complete correct method
	188	6	A1 accept answer in range 188 – 188.5	
				Total 6 marks

Pearson Education Limited. Registered company number 872828
with its registered office at 80 Strand, London, WC2R 0RL, United Kingdom