



Mark Scheme (Results)

January 2016

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

Pearson Edexcel Certificate  
Mathematics A (KMA0)  
Paper 4H

## **Edexcel and BTEC Qualifications**

Edexcel and BTEC qualifications are awarded by Pearson, the UK's largest awarding body. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications websites at [www.edexcel.com](http://www.edexcel.com) or [www.btec.co.uk](http://www.btec.co.uk). Alternatively, you can get in touch with us using the details on our contact us page at [www.edexcel.com/contactus](http://www.edexcel.com/contactus).

## **Pearson: helping people progress, everywhere**

Pearson aspires to be the world's leading learning company. 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](http://www.pearson.com/uk)

January 2016

Publications Code UG043265

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
  - eoo – each error or omission
  - awrt – answer which rounds to

- **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 9c, 11, 13, 22 and 23 (where the mark scheme states otherwise), the correct answer, unless clearly obtained by an incorrect method, should be taken to imply a correct method.**

Q	Working	Answer	Mark	Notes
<b>1</b> (a)	2.14... $\div$ 4.4	0.4874(456952)	2	M1 for 2.14.... or 4.4 or $\frac{\sqrt{115}}{22}$
				A1 Accept if first four sig figs correct
(b)		0.487	1	B1 ft if (a) > 3 sig figs
				<b>Total 3 marks</b>
<b>2</b>	$3 \times (-5)^2 + 4 \times -5$ or $3 \times (-5)^2 - 20$ or 75	55	2	M1 for correct substitution, brackets essential
				A1
				<b>Total 2 marks</b>
<b>3</b>	$8 \times 4 (= 32)$ or $1 + 9$ or $10 - 1$  "32" - $(3 + 1 + 5 + 5 + 2 + 3)(=13)$ or $(3 + 1 + 5 + 5 + 2 + 3) + "10"(=29)$	3 and 10	3	M1
				M1 A correct method to find the total of the 2 missing numbers
				A1 If M0 scored then SCB1 for an answer of <b>two numbers</b> with a sum of 13 or <b>two numbers</b> that give a range of 9 for the 8 cards
				<b>Total 3 marks</b>

<b>4</b>	$\frac{2}{5} \times 30$ or $0.4 \times 30$	12	2	M1 A1 (an answer of $\frac{12}{30}$ gains M1 only)
				<b>Total 2 marks</b>

<b>5</b>	$180 - (40 + 30)$	110°  <u>angles in a triangle total 180°</u> <u>or corresponding angles</u>	3	M1 Completely correct method seen (no isw) A1 SCB1 if M0 scored, B1 for AED stated or labelled as 110° B1 At least one correct reason used
				<b>Total 3 marks</b>

<b>6</b>	$0.5 \times (1 + 6)$ or $0.5 \times (4 + 9)$	(3.5, 6.5)	2	M1 for a correct method to find one coordinate or for 1 coordinate given correctly or for (6.5, 3.5) A1
				<b>Total 2 marks</b>

<b>7</b>	(a)	$\frac{12}{100} \times 30$ or $0.12 \times 30$ or 3.6  30 – "3.6"	26.4(0)	3	M1  M1dep  A1	M2 for $\frac{88}{100} \times 30$ or $0.88 \times 30$
	(b)	$\frac{9}{0.12}$ or $\frac{9}{12} \times 100$ oe			M2 M1 for $\frac{9}{12}$ or $9 = 12\%$ or $9 = \frac{12}{100}$ oe  A1 (NB: if $75 \pm 9$ calculated, M2 only)	
<b>Total 6 marks</b>						

<b>8</b>	(a)	$1 - (0.2 + 0.05 + 0.15)$ or $1 - 0.4$	0.6	2	M1 A1	
	(b)	$6 + 6 \times 4 + 6 \times 3 + 6 \times 12$ (= $6 + 24 + 18 + 72$ ) or $6 \times 20$ or $\frac{6}{0.05}$ oe			120	2
<b>Total 4 marks</b>						

<b>9</b>	(a)		$x^2 + 2x$	1	B1	$2x + x^2$ or $x^2 + x^2$
	(b)	$4x > 3 + 7$ or $4x > 10$		2	M1	for $4x > 3 + 7$ or $4x > 10$ or $4x = 3+7$ or $4x = 10$ or $x = 2.5$ or $x < 2.5$ or an answer of 2.5 following $x > 2.5$ in working
			$x > 2.5$		A1	allow $x > \frac{10}{4}$ oe must have correct inequality sign
	(c)	$3 - 5m = 8 \times 4$ or $3 - 5m = 32$ or $32 + 5m = 3$		3	M1	Multiplying both sides by 4 as a correct first step
		$-5m = '32' - 3$ or $3 - '32' = 5m$ $-5m = 29$ or $-29 = 5m$			M1	for isolating $5m$ or $-5m$ in a correct equation
			$-5.8$		A1	oe eg $\frac{-29}{5}$ dependent on at least M1
		<i>Alternative for (c)</i>				
	(c)	$\frac{-5m}{4} = 8 - \frac{3}{4}$ or $\frac{5m}{4} = \frac{3}{4} - 8$		3	M1	For using quarters (or a multiple of 4) and isolating the term in $m$ in a correct equation
		$-5m = (8 - \frac{3}{4}) \times 4$ or $5m = (\frac{3}{4} - 8) \times 4$			M1	For isolating $5m$ or $-5m$ in a correct equation.
			$-5.8$		A1	oe eg $\frac{-29}{5}$ dependent on at least M1
						<b>Total 6 marks</b>



<b>10</b>	$\frac{24.5}{7} \times 2 (=7)$ or $\frac{24.5}{7} \times 6 (=21)$ or $\frac{24.5}{7} \times 8 (=28)$	52.5	3	M1	<b>Total 3 marks</b>
	$\frac{24.5}{7} \times 2 + \frac{24.5}{7} \times 6 + 24.5 (7 + 21 + 24.5)$			M1 fully correct method [M2 for $\frac{24.5}{7} \times (7 + 6 + 2)$ ]	
				A1	

<b>11</b>	Eg. $4x = 14$ or $4y = -2$ or $-4y = 2$ or $5(3 - y) + y = 17$ or $5x + 3 - x = 17$ or $x + 17 - 5x = 3$	$x = 3.5, y = -0.5$	3	M1 for correctly eliminating 1 variable	<b>Total 3 marks</b>
				A1oe A1oe dep on M1	

<b>12</b>	$m = -2$	$y = -2x + 13$	3	M1 For recognising gradient = -2, eg $y = -2x + c$ where $c \neq 4$	M2 for $7 = -2 \times 3 + c$
	$c = 13$			M1indep $c = 13$	
				A1 oe e.g. $y - 7 = -2(x - 3)$ SCB2 for $-2x + 13$	<b>Total 3 marks</b>

<b>13</b>	$180 - \frac{360}{10}$ or $\frac{(10-2)\times 180}{10}$ or 144 oe	108	4	M1	Unless inconsistently labelled
	$\frac{180 - '144'}{2}$ or 18			M1	Or M2 for $144 - (180 - 144)$
	'144' - $2 \times$ '18'			M1	
				A1	dep on M1
	<i>Alternative</i>				
	Pentagon approach – drawing in a pentagon or a statement recognising that the required angle is one of a regular pentagon	108	4	M1	May be implied by further work
	$180 - \frac{360}{5}$ or $\frac{(5-2)\times 180}{5}$			M2	(M1 for exterior angle of pentagon as long as not seen as interior angle or given as answer)
				A1	dep on M1
				<b>Total 4 marks</b>	

14 (a)	$5 \times \frac{10}{4}$ oe	12.5	2	M1 A1
(b)	$18 \div \frac{10}{4}$ oe	7.2	2	M1 A1
(c)		$6.25T$	1	B1 Accept $T \times \left(\frac{10}{4}\right)^2$
<b>Total 5 marks</b>				

15 (a)		Points correct  Curve or line segments joining points	2	B1 $\pm \frac{1}{2}$ square  B1 ft curve/line segments from points if 3 or 4 plotted correctly or if all 5 points are plotted consistently within successive 10 unit intervals at the correct heights.
(b)	30 (or 30.5) indicated on cf graph or stated, or vertical line corresponding to height = 30 (or 30.5)  ( $\pm \frac{1}{2}$ sq)	157 - 159	2	M1 30 or (30.5) indicated on cf graph or stated.  A1ft If M1 scored ft from a <b>cf graph</b> If M1 not scored, ft only from correct curve.
(c)	Vertical line or mark drawn at 174 cm or horizontal line corresponding to height = 174 cm  ( $\pm \frac{1}{2}$ sq)	5 or 6	2	M1 174 indicated on the cf graph  A1 ft If M1 scored ft from a <b>cf graph</b> If M1 not scored, ft only from correct curve. Whole number answer only
				<b>Total 6 marks</b>

<b>16</b>	(a)		$6x - 12$	2	M1 for $6x$ or $-12$ (allow $2 \times 3x$ for $6x$ ) A1 fully correct
	(b)	' $6x - 12$ ' = 18 oe		3	M1ft ft equation in form $ax + b$ ( $a \neq 0, b \neq 0$ ) M1 Full method to solve their equation A1 (5, 23)
			(5, 23)		
					<b>Total 5 marks</b>

<b>17</b>	(a)		$\frac{2e^2}{f^4}$	2	B2 Fully correct. Accept $2e^2f^{-4}$ B1 for 2 out of 3 correct terms in a product or quotient
	(b)			2	M1 for $2(y^2 - 36)$ or $(2y - 12)(y + 6)$ or $(2y + 12)(y - 6)$ A1
	(c)	$\frac{(p - 3)(2p + 5)}{p(p - 3)}$		3	M1 $(p - 3)(2p + 5)$ M1 $p(p - 3)$ or $(p + 0)(p - 3)$ A1 oe e.g. $2 + \frac{5}{p}$ (NB: if candidates incorrectly cancel a correct algebraic fraction they lose the A mark)
			$\frac{2p + 5}{p}$		
					<b>Total 7 marks</b>

18	(a)	$y = k\sqrt{x}$ or $cy = \sqrt{x}$		3	M1	M2 for $k = \frac{4}{7}$
		$4 = k \times \sqrt{49}$ or $4c = \sqrt{49}$			M1	
					A1	Accept $y = 0.571(1428)\sqrt{x}$ Note: Award M2A1 if answer given is $y = k\sqrt{x}$ with $k$ evaluated as $\frac{4}{7}$ in (a) or (b).
	(b)	$12 = \frac{4}{7} \times \sqrt{x}$ ( $\sqrt{x} = 21$ )	441	2	M1	Allow ft if M1 scored in (a) but not if $k=1$
					A1	ft from $12 = \frac{4}{7} \times \sqrt{x}$ but not if $k = 1$
					<b>Total 5 marks</b>	

19	$\tan 38 = \frac{QS}{8.4}$ or $\tan 52 = \frac{8.4}{QS}$ or $\frac{QS}{\sin 38} = \frac{8.4}{\sin 52}$	9.12	4	M1	Must be a correct equation
	$(QS =) 8.4 \tan 38$ or $(QS =) 8.4 / \tan 52$ or $(QS =) \frac{8.4 \sin 38}{\sin 52}$ (=6.56...)			M1	A correct calculation for $QS$ or 6.56...
	$(QR =) \frac{6.56'}{\cos 44}$ or $(QR =) \frac{6.56'}{\sin 46}$			M1	A correct calculation with their $QS$ for length $QR$
	$QR = 9.12(336459)$			A1	Awrt 9.12
	<i>Alternative</i>				
$\cos 38 = \frac{8.4}{PQ}$ or $\sin 52 = \frac{8.4}{PQ}$	9.12	4	M1	Must be a correct equation	
$(PQ =) \frac{8.4}{\cos 38}$ or $(PQ =) \frac{8.4}{\sin 52}$ (=10.65...)			M1	A correct calculation for $PQ$ Or 10.6\7...	
$(QR =) \frac{10.65..'}{\sin 46} \times \sin 38$			M1	A correct calculation with their $PQ$ for length $QR$	
$QR = 9.12(336459)$			A1	Awrt 9.12	
					<b>Total 4 marks</b>

<p><b>20</b></p>	<p><math>BP \times 10 = 15 \times 8</math> <b>or</b> <math>(10+AB) \times 10 = 15 \times 8</math> oe  <math>(BP =) (15 \times 8) \div 10 (= 12)</math> oe <b>or</b>  <math>10AB=120-100</math> oe <b>or</b>  <math>10 + AB = (15 \times 8) \div 10</math> oe</p>	<p>2</p>	<p>3</p>	<p>M1 for a correct equation  M1 a correct calculation for <math>BP</math> or a correct simplified equation for <math>AB</math>  A1</p>
				<p><b>Total 3 marks</b></p>

<p><b>21</b></p>	<p><math>(BC^2 =) 4.8^2 + 6.4^2 - 2 \times 4.8 \times 6.4 \times \cos 123^\circ</math>  <math>(BC^2 =) 23.04 + 40.96 + 33.46 \dots</math> oe  <math>(= 97.4(6262231))</math></p>	<p>9.87</p>	<p>3</p>	<p>M1 Correct use of cosine rule to find <math>BC^2</math>  M1 Correct order of operations &amp; correct values  A1 awrt 9.87</p>
				<p><b>Total 3 marks</b></p>



22	$\frac{6(x+1)-6(x-2)}{(x-2)(x+1)} \text{ or}$ $\frac{6(x+1)}{(x-2)(x+1)} - \frac{6(x-2)}{(x-2)(x+1)} (=1) \text{ oe}$ $6(x+1) - 6(x-2) = (x+1)(x-2) \text{ oe}$ $(18 = x^2 - x - 2)$ $x^2 - x - 20 (=0)$ $(x+4)(x-5) (=0)$	$x = 5, x = -4$	5	<p>M1 Correct single fraction or 2 fractions with the same correct common denominator If expanded, condone 1 error in numerator</p> <p>M1 Correct removal of denominator (M2 if a candidate goes straight to this stage) if expanded, condone 1 error</p> <p>A1 Correct 3 part quadratic (eg <math>x^2 - x - 20 (=0)</math> or <math>x^2 - x = 20</math> or <math>x^2 = x + 20</math>)</p> <p>M1 <math>(x+4)(x-5) (=0)</math> or a fully correct substitution into the quadratic formula eg <math>\frac{- -1 \pm \sqrt{(-1)^2 - 4 \times 1 \times -20}}{2 \times 1}</math> Condone no brackets around <math>-1</math> or <math>\frac{1 \pm \sqrt{81}}{2}</math></p> <p>A1 dep on last M1</p>
				<b>Total 5 marks</b>

23	Allow use of $\pi = 3.14..$ consistently throughout, for either scheme, but not a rounded decimal for the radius $\pi \times (4\sqrt{3})^2$ or $2\pi \times (4\sqrt{3})^2$ or $2\pi \times 4\sqrt{3}h$		5	M1	correct expression for curved surface area or area of 1 or 2 circles (condone missing brackets around $4\sqrt{3}$ for M1M1)
	$2\pi \times (4\sqrt{3})^2 + 2\pi \times 4\sqrt{3}h (=56\pi\sqrt{6})$			M1	correct expression for total surface area (candidate may have already divided by $\pi$ or do so at any stage if already working in an equation)
	$96\pi + 8\pi \times \sqrt{3}h (=56\pi\sqrt{6})$ $(h =) \frac{56\pi\sqrt{6} - 2\pi(4\sqrt{3})^2}{2\pi(4\sqrt{3})}$			M1	A correct simplified expression for total the total surface area or a correct expression for $h$
	$(h =) \frac{56\pi\sqrt{6} - 96\pi}{8\pi\sqrt{3}}$ or $(h =) \frac{56\sqrt{6} - 96}{8\sqrt{3}}$ oe			M1	correct rearrangement in terms of $h$ and simplified as a quotient
				A1	dep on M2
	<b>Alternative</b>				
	$2\pi rh + 2\pi r^2$ or $2\pi rh + \pi r^2$		5	M1	A correct algebraic expression for the csa + 2 circles or csa + 1 circle
$2rh + 2r^2 = 56\sqrt{6}$ or $rh + r^2 = 28\sqrt{6}$ or $2\pi r(h + r) = 56\pi\sqrt{6}$ or $2\pi rh = 56\pi\sqrt{6} - 2\pi r^2$	M1			A correct equation and correct division by $\pi$ or $2\pi$ or a correct factorisation or correctly isolating term in $h$	
$(h =) \frac{56\pi\sqrt{6}}{2\pi r} - r$ or $(h =) \frac{56\pi\sqrt{6} - 2\pi r^2}{2\pi r}$ oe	M1			A fully correct expression for $h$	
$(h =) \frac{56\pi\sqrt{6}}{2\pi 4\sqrt{3}} - 4\sqrt{3}$ or $(h =) \frac{56\pi\sqrt{6} - 96\pi}{8\pi\sqrt{3}}$ oe	M1			Correct substitution of $r$ into a correct equation or expression for $h$	
	A1			dep on M2	
					<b>Total 5 marks</b>

24	$\frac{50}{360} \times \pi \times r^2 = 20\pi$ oe	34.5	5	M1	A correct equation for area of sector
	$r^2 = \frac{360 \times 20}{50}$ or $\frac{360 \times 20\pi}{50\pi}$ oe (=144)			M1	Correct rearrangement in terms of $r^2$
	$r = 12$			A1	$r = 12$
	(perimeter =) $12 + 12 + \frac{50}{360} \times 2 \times 12 \times \pi$ (= $24 + \frac{10\pi}{3}$ ) (=24 + 10.47...)			M1ft	(ft dep on M2) for arc length $\frac{50}{360} \times 2 \times '12' \times \pi$ (=10.47...)  Or $l = \frac{20\pi}{12 \times 0.5}$ oe
				A1	Accept 34.4 - 34.5
				<b>Total 5 marks</b>	
	<i>Misread of 20 for 20π</i>				
	$\frac{50}{360} \times \pi \times r^2 = 20$			M1	Equation for area of sector using 20
	$r^2 = \frac{360 \times 20}{50\pi}$ (=45.8...)			M1	Correct rearrangement in terms of $r^2$
	$r = 6.77$			A0	
	(perimeter =) $6.77 + 6.77 + \frac{50}{360} \times 2 \times '6.77' \times \pi$ (=19.4....)			M1ft	(ft dep on M2) for arc length $\frac{50}{360} \times 2 \times '6.77' \times \pi$ (=5.91...)
				A0	
				<b>(Misread maximum 3 marks)</b>	

25	32 or 3.2 or $10^{10k}$ $32 \times 10^{10k}$ $3.2 \times 10^{10k+1}$	$3.2 \times 10^{10k+1}$	3	M1 M1 A1
				<b>Total 3 marks</b>

