edexcel

Mark Scheme (Results)

June 2016

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

Pearson Edexcel Level 1/Level 2 Certificate
Mathematics A (KMA0)
Paper 4H

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_4H_1606_MS

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 June 2016 – Paper 4H Mark scheme				
Apart from Questions 2, 15(c), 19, 20 and 22(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.				
Q	**Working**	**Answer**	**Mark**	**Notes**
1		$3n + 4$	2	M1 For $an + 4$ where a is an integer and $a \neq 0$ or for $3n + b$ where b is an integer A1 Fully correct expression ScB1 for $n = 3n + 4$ ScB1 for $3t + 4$, etc.
				Total 2 marks

2	$(8y - 18 =)\ 3y + 9$ $8y - 3y = 9 + 18$ or $5y = 27$ oe	5.4 oe	3	M1 For correct expansion of bracket M1 For collecting terms in y on one side and constant terms on the other (as part of a correct equation) A1 Eg $\frac{27}{5}$ or $5\frac{2}{5}$ Dep on at least M1 ScB1 for $8y - 18 = 3y + 3$ **AND** $8y - 3y = 3 + 18$ or $8y - 18 = 3y + 3$ **AND** $5y = 21$
	Alternative Method $\frac{8y - 18}{3} = y + 3$ or $\frac{8y}{3} - \frac{18}{3} = y + 3$ oe $\frac{8y}{3} - y = 3 + \frac{18}{3}$ or $5y = 27$ oe	5.4 oe	3	M1 For dividing both sides of the equation by 3 as part of a correct equation M1 For collecting terms in y on one side and constant terms on the other (as part of a correct equation) A1 Eg $\frac{27}{5}$ or $5\frac{2}{5}$ Dep on at least M1
				Total 3 marks

3	(a)	0.8 × 485 or 485 – 0.2 × 485 or 485 – "97" oe	388	3	M2 A1	For a complete method If not M2 then: M1 for 0.2 × 485 or 97 oe cao
	(b)	$\frac{79}{0.2}$ or $\frac{79}{20}$ × 100 or 3.95 × 100 or 79 × 5 oe	395	3	M2 A1	For a complete method If not M2 then: M1 For 20% = 79 or 0.2x = 79 or $\frac{79}{20}$ or 3.95 or $\frac{x}{79} = \frac{100}{20}$ oe cao ScB2 for 316
						Total 6 marks

4	(a)		63	1	B1	
	(b)		50	1	B1	
	(c)	Eg $(6 – 2) \times 180$ or 4×180 or 720 oe Eg $3x + x + 164 + 139 + 97 + 156 = 720$ or $4x + 556 = 720$ oe or $\frac{\text{“720”} - (164 + 139 + 97 + 156)}{4}$ or $\frac{\text{“720”} - 556}{4}$ or $\frac{164}{4}$ oe	41	3	M1 M1 A1	For complete method to find the total of interior angles or 720 Dep For a correct equation using their 720 or For a complete numerical method
		Alternative Method Eg $180 – 156 + 180 – 139 + 180 – 164 + 180 – 97 + 180 – x + 180 – 3x = 360$ or $24 + 41 + 16 + 83 + 180 – x + 180 – 3x = 360$ or $1080 – 556 – 4x = 360$	41	3	M2 A1	For an equation coming from the correct method relating to the sum of exterior angles.
						Total 5 marks

5	(a)		m^7	1	B1	
	(b)		c^8	1	B1	
	(c)		a^{15}	1	B1	
	(d)	$8x + 12 + 2x + 10$	$10x + 22$	2	M1 A1	Any three terms correct out of four. Allow $2(5x + 11)$ Do not ISW
						Total 5 marks

6	Eg (3×4) + (9×6) + (15×8) + (21×9) + (27×3) or 12 + 54 + 120 + 189 + 81	456	3	M1 $f \times x$ for 4 products with x used consistently within interval (including end points) & intention to add. M1 (dep) for use of all correct half-way values A1 Do not ISW ScB2 for 15.2
				Total 3 marks

7	(a)		7, (2), −1, (−2), (−1), 2, 7	2	B2 B1 for at least 2 correct
	(b)	(−1, 7), (0, 2), (1, −1), (2, −2), (3, −1), (4, 2), (5, 7)	Correct curve	2	B2 For the correct smooth curve through all 7 points ($\pm\frac{1}{2}$ sq) B1 ft for at least 6 points from their table plotted correctly ($\pm\frac{1}{2}$ sq) provided at least B1 scored in (a)
					Total 4 marks

8	(a)		Enlargement
			Scale factor 2
			Centre (1, 0)
				3	B1
					B1
					B1
						For Enlargement
						For (Scale factor =) 2
						For (Centre) (1, 0)
						NB if more than one transformation mentioned then no marks.

	(b)		Correct triangle at (10, −2), (7, −2), (7,−1)	1	B1	Correct triangle in correct place
	(c)		Correct triangle at (1, 0),(2, 0),(2, 3)	2	M1 A1	Triangle congruent to **D** and with correct orientation ScB1 for triangle with vertices at (4, 2), (5, 2) and (4, −1)
						Total 6 marks

9	$13.5^2 + 60^2$ or 182.25 + 3600 or 3782.25 $\sqrt{"3782.25"}$ or awrt 61.5 13.5 + 60 + $\sqrt{"3782.25"}$ or 13.5 + 60 + 61.5	135	4	M1 For squaring and adding M1 (Dep) for square root M1 Dep A1 cao NB: A0 if 61.5 is rounded from an inexact value (eg 61.505…)
	Alternative method – using Trigonometry Eg A = 77.3(196…) **and** sin"77.3" = $\frac{60}{AC}$ (AC =) $\frac{60}{\sin"77.3"}$ or awrt 61.5 13.5 + 60 + $\frac{60}{\sin"77.3"}$ or 13.5 + 60 + 61.5	135	4	M1 For finding a correct angle **AND** a correct trig statement M1 (Dep) For an expression for AC M1 Dep A1 cao NB: A0 if 61.5 is rounded from an inexact value (eg 61.505…)
				Total 4 marks

10	20 = 2, 2, 5 140 = 2, 2, 5, 7 420 = 2, 2, 3, 5, 7			M1	For identifying the prime factors for 2 of the 3 numbers 20,140,420 (can be implied by a factor tree, repeated division or Venn diagram) or For a complete Venn diagram for x and 140 with 20 in the intersection or $x = 20 \times 3$ or $20 \times 7 \times y = 420$ or $\frac{420}{20 \times 7}$ or At least the 1st 3 multiples of 20 or $140x = 420 \times 20$ oe
		60	2	A1	Allow $2\times2\times3\times5$
					Total 2 marks

11	(a)		97 000 000	1	B1	
	(b)		1.4×10^8	1	B1	Accept, for example, 1.40×10^8
	(c)	$1.4 \times 10^9 - 3.2 \times 10^8$ or 1 400 000 000 – 320 000 000 or 1 080 000 000	1.08×10^9	2	M1 A1	For $1.4 \times 10^9 - 3.2 \times 10^8$ or digits 108 Accept 1.1×10^9
	(d)	$(1.3 \times 10^9) \div (1.2 \times 10^8)$ or 1 300 000 000 ÷ 120 000 000 or 10.8(333…)	11	2	M1 A1	Condone missing brackets Accept 1.1×10^1
						Total 6 marks

12	(a)	Eg $\frac{13.5}{6}$ or $\frac{9}{4}$ or 2.25 or $\frac{6}{13.5}$ or $\frac{4}{9}$ or 0.444(444…) or (*AB* =) 11.7 ÷ $\frac{9}{4}$ or (*AB* =) 11.7 × $\frac{4}{9}$ or (*AB* =) 6 × $\frac{11.7}{13.5}$ oe $\frac{AB}{11.7} = \frac{4}{9}$ or $\frac{AB}{6} = \frac{11.7}{13.5}$ oe	5.2	2	M1 A1	For correct scale factor or correct equation involving *AB* or correct expression for *AB* Accept 0.444(444…) rounded to at least 3SF
	(b)	Eg (A*D* =) $\frac{9}{4}$ × 4 or (A*D* =) $\frac{4}{"5.2"}$ × 11.7 or (*ED*) = [$\frac{9}{4}$ × 4] – 4 or (*ED*) = $\frac{4}{"5.2"}$ × (11.7 – "5.2") or $\frac{AD}{4} = \frac{9}{4}$ or $\frac{AD}{11.7} = \frac{4}{"5.2"}$ or *ED* + 4 = $\frac{9}{4}$ × 4 or $\frac{ED}{11.7 - "5.2"} = \frac{4}{"5.2"}$ or A*D* = 9	5	2	M1 A1	For a correct expression for *ED* or *AD* or For a correct equation involving *ED* or *AD*
						Total 4 marks

13	(a)	$M = k \times p^3$ $128 = k \times 8^3$	$M = 0.25p^3$	3	M1 M1 A1	For $M = kp^3$ or $p^3 = \frac{M}{k}$ oe Do not allow $M = p^3$ oe For a correct substitution into a correct equation. Implies first M1. Award M2 if $k = 0.25$ stated unambiguously in (a) or (b). Award 3 marks if answer is $M = kp^3$ but k is evaluated in part (b)
	(b)		31.25	1	B1ft	for their value of k only for equations of the form $M = kp^3$ oe and if $k \neq 1$
						Total 4 marks

14	$\underline{(x - 5)(x + 5)}$ $(2x + 1)(x - 5)$	$\frac{x + 5}{2x + 1}$	3	M1 M1(indep) A1	For $(x + 5)(x - 5)$ For $(2x + 1)(x - 5)$ or $2(x + 0.5)(x - 5)$ or $2(2x + 1)(0.5x - 2.5)$ cao No ISW
					Total 3 marks

15	(a)	Eg $\frac{3(x+3)}{3\times5} + \frac{5(x-2)}{3\times5}$ or $\frac{3(x+3)+5(x-2)}{3\times5}$ oe Eg $\frac{3x+9+5x-10}{3\times5}$ or $\frac{3x+9}{3\times5} + \frac{5x-10}{3\times5}$ oe	$\frac{8x-1}{15}$	3	M1 M1 A1	For a common denominator as part of 1 or 2 fractions (must be a correct expression) For a correct expansion of brackets as part of 1 or 2 fractions (must be a correct expression) cao Do not ISW
	(b)		$2a^3e^2$	2	M1 A1	For two of 2, a^3, e^2 in a product with three terms Do not ISW
	(c)	Eg $\frac{16+9}{24}y$ (= 5) or $\frac{16}{24}y + \frac{9}{24}y$ (= 5) or $\frac{25}{24}y$ (= 5) or $y(\frac{2}{3} + \frac{3}{8})$ (= 5) or $y(0.\dot{6} + 0.375)$ (= 5) or $1.041\dot{6}y$ (= 5) or $24 \times \frac{2}{3}y + 24 \times \frac{3}{8}y = 24 \times 5$ Eg $25y = 5 \times 24$ or $25y = 120$ or $y = 5 \div 1\frac{1}{24}$ or $y = \frac{5}{1.041\dot{6}}$ or $y = \frac{5}{\frac{2}{3}+\frac{3}{8}}$	4.8	3	M1 M1 A1oe	For simplifying the LHS or multiplying both sides by 24 Dep on 1st M1 gained For the removal of the denominator(s) as part of a correct equation or for correctly isolating y Dep on 1st M1 gained. ScM2 for $16y + 9y = 120$ M0A0 for trial and improvement NB: Decimals must be exact to gain any credit: Eg Award M0 for $y(0.667 + 0.375)$
						Total 8 marks

16	(a)		$\frac{6}{20}, \frac{4}{20}$ $\frac{9}{19}\ \frac{6}{19}\ \frac{4}{19}\ \frac{10}{19}\ \frac{5}{19}\ \frac{4}{19}\ \frac{10}{19}\ \frac{6}{19}\ \frac{3}{19}$	2	B1 B1	For $\frac{6}{20}, \frac{4}{20}$ correct on LH branches For all other branches correct
	(b)	$\frac{4}{20} \times \frac{3}{19}$	$\frac{12}{380}$ oe	2	M1ft A1ft	From their Tree diagram From their Tree diagram oe. Eg $\frac{3}{95}$ Accept 0.031(57…) rounded or truncated to at least 3 decimal places.
	(c)	$\frac{6}{20} \times \frac{5}{19}$ or 0.078(947 ...) or $\frac{6}{20} \times \frac{4}{19}$ or 0.063(157 ...) or $\frac{4}{20} \times \frac{3}{19}$ or 0.031(578…) $\frac{6}{20} \times \frac{5}{19} + \frac{6}{20} \times \frac{4}{19} + \frac{4}{20} \times \frac{6}{19} + \frac{4}{20} \times \frac{3}{19}$	$\frac{90}{380}$ oe	3	M1ft M1ft A1	For one correct product from their Tree diagram For sum of all correct products from their Tree diagram For $\frac{9}{38}$ oe or 0.236(842…) NB: Accept use of decimals if rounded or truncated to at least 3 decimal places.

	With Replacement $\frac{6}{20} \times \frac{6}{20}$ or 0.09 or $\frac{6}{20} \times \frac{4}{20}$ or 0.06 or $\frac{4}{20} \times \frac{4}{20}$ or 0.04 $\frac{6}{20} \times \frac{6}{20} + \frac{6}{20} \times \frac{4}{20} + \frac{4}{20} \times \frac{6}{20} + \frac{4}{20} \times \frac{4}{20}$ or $\frac{100}{400}$ or 0.25 oe			M1 M1
	Alternative method Eg 1 – $\left(\frac{10}{20} \times \frac{9}{19} + \frac{10}{20} \times \frac{6}{19} + \frac{10}{20} \times \frac{4}{19} + \frac{6}{20} \times \frac{10}{19} + \frac{4}{20} \times \frac{10}{19}\right)$ or $\frac{10}{20} \times \frac{9}{19}$ oe	$\frac{90}{380}$ oe	3	M2 For a complete method. Ft from their Tree diagram A1 For $\frac{9}{38}$ oe or 0.236(842…) NB: Accept use of decimals if rounded or truncated to at least 3 decimal places.
				Total 7 marks

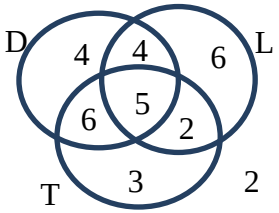
17	(a)		3	1	B1	
	(b)		7	2	M1 A1	For $2((-4)^2 - 10) - 5$ oe or $(-4)^2 - 10$ or 6
	(c)	$2x = y + 5$ or $2y = x + 5$ or $\frac{1}{2}(y + 5)$	$\frac{1}{2}(x + 5)$	2	M1 A1	oe
	(d)	$(2x - 5)^2 - 10$ (= −1) or $4x^2 - 10x - 10x + 25 - 10$ (= −1) $4x^2 - 20x + 16$ (= 0) or $2x^2 - 10x + 8$ (= 0) or $x^2 - 5x + 4$ (= 0) or $(2x - 5)^2 = 9$ $(4x - 4)(x - 4)$ (= 0) or $(2x - 2)(x - 4)$ (= 0) or $(x - 4)(x - 1)$ (= 0) or $2x - 5 = \pm 3$ $\frac{--5 \pm \sqrt{(-5)^2 - 4(1)(4)}}{2(1)}$ (may be partially evaluated; condone lack of brackets around negative numbers)	$x = 1,\ x = 4$	4	M1 M1 M1 A1	For a correct expression for gf(x) For a correct 3 part quadratic or For $(2x - 5)^2 = 9$ For factorising a correct equation or for use of quadratic formula with a correct equation or For $2x - 5 = \pm 3$

	Alternative method Eg $a^2 - 10 = -1$ oe $a^2 = 9$ $2x - 5 = \pm 3$	 $x = 1,\ x = 4$	 4	 M1 For a correct equation relating to g(a) = – 1 M1 For $a^2 = 9$ M1 For $2x - 5 = \pm 3$ A1
				Total 9 marks

18	(a)	2 + 4 + 9	15	2	M1 For $\frac{9}{15}$ or 0.6 or $0.2 \times 10 + 0.8 \times 5$ or 2 + 4 or 6 For at least 1 correct frequency density on scale without incorrect values (1cm = 0.1 fd) or For 1 cm square = 0.5 person oe stated A1
	(b)		Correct bar drawn	2	M1 $\frac{12}{25}$ or 0.48 or $\frac{24}{5}$ or 4.8 or a bar drawn with the correct height A1 4.8 cm high
					Total 4 marks

19	Eg $7 \times 5 - 7 \times 2 \times \sqrt{2} + 5 \times 2 \times \sqrt{50} - 2 \times 2 \times \sqrt{50} \times \sqrt{2}$ or $35 - 14\sqrt{2} + 10\sqrt{50} - 4\sqrt{100}$ or $35 - 14\sqrt{2} + 10\sqrt{50} - 40$ or $35 - 14\sqrt{2} + 50\sqrt{2} - 20 \times 2$	$-5 + 12\sqrt{18}$	3	M1 M1 A1	For brackets expanded correctly (need not be simplified) $a = -5$ or $b = 12$ Dep on scoring the first M1 Dep on M1
					Total 3 marks

20	$\pi \times 20 \times 10$ or 200π or 628.(318…) oe $\sqrt{10^2 + 10^2}$ or $10\sqrt{2}$ or 14.1(421…) oe $\pi \times 10 \times 10\sqrt{2}$ or $100\pi\sqrt{2}$ or 444.(288…) or 141.(421…)π oe Eg $100\pi + 200\pi + \pi \times 10 \times 10\sqrt{2}$	Correct solution	4	M1 M1 M1dep A1	For the curved surface area of the cylinder For the slant height of the cone For the curved surface area of the cone cso For a correct exact expression for the total surface area that will lead to $(300 + 100\sqrt{2})\pi$ Dep on M3
					Total 4 marks

21 (a)			3	M1 M1 A1	For 5 in the middle and 1 from 4(D∩L∩T′) or 2(L∩T∩D') or 6(D∩T∩L') For any 4 correct entries For all correct including 2 outside the circles inside the rectangle
(b)		$\frac{5}{9}$	1	B1	ft from incorrect diagram
					Total 4 marks

22	(a) (i)		$2\mathbf{q} - 4\mathbf{p}$ oe	1	B1	Eg $2(\mathbf{q} - 2\mathbf{p})$
	(ii)		$\mathbf{q} - \frac{1}{2}\mathbf{p}$ oe	1	B1	Eg $0.5(-\mathbf{p} + 2\mathbf{q})$
	(b)	Eg $(\overrightarrow{QR} =) -\mathbf{q} + \mathbf{p} + \mathbf{q} - \frac{1}{2}\mathbf{p}$ or $\frac{1}{2}\mathbf{p}$ oe Eg $(\overrightarrow{QR} =) \frac{1}{2}\mathbf{p}$ **and** $\overrightarrow{QR} = 0.5\overrightarrow{OP}$ or $(\overrightarrow{QR} =) \frac{1}{2}\mathbf{p}$ **and** $\overrightarrow{OP} = 2\overrightarrow{QR}$	Shown	2	M1 A1	For $(\overrightarrow{QR}) = \frac{1}{2}\mathbf{p}$ or For $(\overrightarrow{QR}) = -\mathbf{q} + \mathbf{p}$ + "their a(ii)" or $(\overrightarrow{QR}) = \mathbf{q}$ – "their a(ii)" For $(\overrightarrow{QR}) = \frac{1}{2}\mathbf{p}$ **and** a valid conclusion such as: $\overrightarrow{QR} = 0.5\overrightarrow{OP}$ or $\overrightarrow{OP} = 2\overrightarrow{QR}$ or **p** is a multiple of $\frac{1}{2}\mathbf{p}$ or They have the same direction but *OP* is twice as long or They have the same vector component.
						Total 4 marks

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