

Mark Scheme (Results)

Summer 2018

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

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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  If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.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 June 2018 – Paper 3HR Mark scheme				
Apart from Questions 7, 17, 19 and 20 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	**Working**	**Answer**	**Mark**	**Notes**
1 (a)	$(26.72\ldots)^2$ or $\frac{15775.36}{22.09}$	714.1(40335)	2	M1 for 26.72… or 15775.36 or 22.09 A1
(b)		714	1	B1 ft if at least 4 significant figures in (a)
2	$60 \times \frac{5}{6}$	50	2	M1 A1 NB: $\frac{50}{60}$ gains M1 A0
3 (a)	$(-1, 6), (0, 4), (1, 2), (2, 0), (3, -2)$	correct line between $x = -1$ and $x = 3$	3	B3 for a correct line between $x = -1$ and $x = 3$ If not B3 then award B2 for a straight line segment through at least 3 of $(-1, 6), (0, 4), (1, 2), (2, 0), (3, -2)$ **OR** for all of $(-1, 6), (0, 4), (1, 2), (2, 0), (3, -2)$ plotted and not joined **OR** for a line drawn through (0, 4) with a clear attempt at a gradient of −2 (eg a line through (0, 4) and (0.5, 2) If not B2 then award B1 for at least 2 correct points stated or plotted (may be in a table); **ignore any incorrect points either plotted or evaluated** **OR** for a line drawn with negative gradient through (0, 4) **OR** for a straight line with gradient -2
(b)		(1.5, 1) oe	1	B1 for (1.5, 1) **or** ft from (a)

Question		Working	Answer	Mark	Notes
4		E.g. $\frac{x}{60}=\frac{12}{16}$ oe **or** 12 : 16 = x : 60 oe **or** $\frac{12\times60}{16}$ oe **or** $\frac{24\times60}{32}$ oe	45	2	M1 for a correct equation (accept ratios) **or** a correct calculation A1 cao
5	(a)	$\frac{360}{n}=24$ oe **or** $\frac{360}{24}$ **o**r $180-\frac{180(n-2)}{n}=24$ oe **or** $\frac{180(n-2)}{n}=156$ oe	15	2	M1 for a correct equation or a correct calculation A1 cao
	(b)	$(2\times5-4)\times90$ (=540) **or** (5 – 2) × 180 (=540)	95	3	M1 Complete method to find sum of interior angles.
		$540-(90+137+90+128)$ **or** $540-445$			M1 dep A1 cao SC : If no marks awarded then award B1 for 137 + 128 + 90 + 90 + t = m oe **or** m – (137 + 128 + 90 + 90) **or** m − 445 where m > 360
		Alternative scheme – using exterior angles			
		2 × (180 – 90) + (180 – 137) + (180 – 128) + (180 – t) = 360 **or** 90 + 43 + 90 + 52 + 180 – t = 360 oe	95	3	M1 for a correct equation using exterior angles
		455 – 360 (= t) **or** 90 + 43 + 90 + 52 + 180 – 360 (= t) oe			M1 (dep) for isolating t on one side of the equation A1 cao

Question	Working	Answer	Mark	Notes
6 (a)		*B*	1	B1 cao
(b)		Description	2	M1 for reference to both • length greater than 20cm • weigh more than 1 kg **or** for identifying ∪ as 'or'
				A1 for a complete correct statement eg 'fish that have length greater than 20cm **OR** weigh more than 1 kg (or both)' (accept and/or)
(c)		Explanation	1	B1 for a complete correct statement eg '**no** fish that are less than 1 year old **and** weigh more than 1 kg' , 'all the fish that weigh more than 1 kg are older than 1 year'

Question	Working	Answer	Mark	Notes
7 (a) (i)	$(4x+1)+(4x+1)+(2x+2)+(2x+2)$ $(=12x+6)$		1	B1 for a correct expression, may not be simplified, but if simplified it must be correct
(ii)	$(x+3)+(x+3)+2x$ $(=4x+6)$		1	B1 for a correct expression, may not be simplified, but if simplified it must be correct
(b)	$(4x+1)+(4x+1)+(2x+2)+(2x+2) =$ $2[(x+3)+(x+3)+2x]$ oe	$1\frac{1}{2}$ oe	4	M1 ft from (a) if at least B1 awarded **OR** one perimeter correct **and** 2 × (perimeter of triangle)
	E.g 6 = 4x E.g. 4x + 6 = 12 oe **or** 12x − 6 = 8x oe			M2 (dep on M1) ft for an equation in the form $ax = b$ If not M2 then award M1 (dep on M1) for correct simplification of all x terms **OR** correct simplification of all number terms
				A1 for 1.5 **or** $\frac{6}{4}$ **or** $\frac{3}{2}$ **or** $1\frac{1}{2}$ from correct algebraic working

Question	Working	Answer	Mark	Notes
8 (a)		4 – 6	1	B1
(b)	$2 \times 5 + 5 \times 12 + 8 \times 10 + 11 \times 4 + 14 \times 1$ **or** $10 + 60 + 80 + 44 + 14$ (= 208)	6.5	4	M2 for at least 4 correct products added (need not be evaluated) If not M2 then award M1 for consistent use of value within interval (including end points) for at least 4 products which must be added **OR** correct mid-points used for at least 4 products and not added
	$\frac{2\times5+5\times12+8\times10+11\times4+14\times1}{5+12+10+4+1}\left(=\frac{208}{32}\right)$			M1 dep on at least M1 Allow division by their $\sum f$ provided addition or total under column seen
				A1 for 6.5 **or** $6\frac{1}{2}$ allow 6 **or** 7 if 6.5 oe seen or 208 ÷ 32 seen

Question	Working	Answer	Mark	Notes		
9	e.g. $\frac{27}{8} \div \frac{9}{4}$, $\frac{27}{8} \div \frac{18}{8}$	$1\frac{1}{2}$	3	M1	for two correct improper fractions	
	$\frac{27}{8} \times \frac{4}{9}$ **or** $\frac{4 \times 27}{8 \times 9}$ **or** $\frac{108}{72}$ or $\frac{27}{8} \div \frac{18}{8}$			M1	accept division of any two correct fractions with a common denominator which is a multiple of 8	
				A1	**for correct working leading to** $1\frac{1}{2}$ must show correct cancelling of fractions before multiplication **or** a correct mixed number eg $1\frac{36}{72}$, $1\frac{9}{18}$ **or** a correct improper fraction eg. $\frac{108}{72}$	
10	$x^2 + 11^2 = 15^2$ **or** $15^2 - 11^2$ oe	10.2	3	M1	for a correct use of Pythagoras's theorem	M1 for an angle found from a correct method (42.8… , 47.1…) **and used** with a correct trig statement with x eg. sin 42.8 = $\frac{x}{15}$
	$\sqrt{15^2 - 11^2}$ **or** $\sqrt{104}$ **or** $2\sqrt{26}$			M1	dep on M1	M1 for correct trig statement with x the subject eg. (x =) 15 × sin 42.8
				A1	for answer in range 10.19 – 10.2	

Question	Working	Answer	Mark	Notes
11 (a)	$y = \frac{20-4x}{5}$ or $y = \frac{20}{5} - \frac{4}{5}x$	$-\frac{4}{5}$ oe	2	M1 for correct rearrangement of equation for term in x (condone any errors in constant term) A1
(b)	$y = mx + 4$ **or** $y = 2x + c$	$y = 2x + 4$	2	M1 ft "4" from (a) m and c may be left as letters or shown as any values (c may be 0) **OR** for an answer of $2x + 4$ **or** $M = 2x + 4$ A1 for $y = 2x + 4$ oe
12 (a) (i)		102	1	B1
(ii)			1	B1 (dep on B1 in (i)) for opposite angles of a cyclic quadrilateral add up to 180°
(b)	angle RSQ = 62 **or** angle PRQ = (180 – 62 – 78) (=40)	40	2	M1 ft from (a) for "102" – 62 may be marked on the diagram A1
13 (a)	(CF =) 44	350	2	M1 Stated or marked on graph, or corresponding vertical line marked. Also allow 44.5 A1 Allow 345 – 355
(b)	80 (may be seen on graph)	8	2	M1 for use of the graph at 500 calories (can be indicated by a vertical line from 500 to the curve) A1

Question	Working	Answer	Mark	Notes
14 (a)		$p < 28$	1	B1
(b)	$q^2 > \frac{9}{16}$ oe **or** $q > \sqrt{\frac{9}{16}}$ **or** $(\pm)\ 4q > 3$ **or** $\frac{3}{4}$ oe **or** $(4q-3)(4q+3) > 0$ **or** $\frac{0 \pm \sqrt{0-4\times16\times(-9)}}{2\times16}$	$q < -\frac{3}{4}$ or $q > \frac{3}{4}$	3	M1 Allow as equations or incorrect inequality sign
	$\frac{3}{4}$ and $-\frac{3}{4}$ oe **or** $\pm\frac{3}{4}$ oe **or** $\pm\sqrt{\frac{9}{16}}$			M1 for finding both values. A1 for both correct inequalities
15 (a)	$\pi \times 4^2 \times 12$	603	2	M1 Accept 3.14 or better for π A1 for answer in range 603 – 603.3
(b)	$\frac{21}{12}$ oe (=1.75) **or** $\frac{12}{21}$ oe (=0.571..) **or** $\frac{12}{8}$ oe (= 1.5) **or** $\frac{8}{12}$ oe (=0.666…) **or** $\frac{d}{21} = \frac{8}{12}$	14	2	M1 for the correct linear scale factor **or** a correct equation (may be seen in ratio form) A1
(c)	E.g. $\left(\frac{h}{12}\right)^3 = \frac{64V}{V}$ **or** $\left(\frac{h}{12}\right)^3 = 64$ **or** $\sqrt[3]{64}$ (= 4)	48	3	M1 Correct equation for height **or** correct expression for scale factor. ft from (a) if a value is used for the volume.
	$12 \times \sqrt[3]{64}$ **or** 12×4 **or** $\sqrt[3]{12^3 \times 64}$ oe **or** $\frac{"603" \times 64}{\pi \times (4 \times \sqrt[3]{64})^2}$			M1 for a correct expression for height. A1

Question		Working	Answer	Mark	Notes	
16	(a)	E.g. 13 300 ÷ 0.76	17 500	3	M2	If not M2 then award M1 for $x \times 0.76 = 13\,300$ **or** $13\,300 \div 76$ NB: Accept 1 – 0.24 in place of 0.76
					A1	NB: An answer of 16 492 scores no marks
	(b)	E.g. $13\,300(1-x)^3 = 6500$ **or** $13\,300y^3 = 6500$	21.2	3	M1	for a correct equation condone use of $(1-x)^4$ **or** y^4 accept x% or y% in equation
		$\sqrt[3]{\frac{6500}{13300}}$ (=0.787…) **or** $1-\sqrt[3]{\frac{6500}{13300}}$ (=0.212…)			M1	condone use of 4th root rather than cube root
					A1	for an answer in the range 21.2 – 21.24 SC: If no marks scored then award B2 for an answer of 16.38 – 16.4 (from using 4 years)
17	(a)		$6x^2 - 6$	2	B2	If not B2 then award B1 for $6x^2$ or $3 \times 2x^2$ or -6
	(b)		18	1	B1	ft from (a)
	(c)	$6x^2 - 6 = 7.5$ oe	1.5, −1.5 oe	3	M1	ft from (a)
		$x^2 = \frac{13.5}{6}$ $\left(= \frac{27}{12} = \frac{9}{4}\right)$			M1	correct expression for x^2
					A1	dep on at least M1 scored

Question	Working	Answer	Mark	Notes
18 (a)	$\frac{1}{6}\times\frac{1}{6}\left(=\frac{1}{36}\right)$	$\frac{3}{36}$ oe	2	M1 or for a fully correct sample space with (3,1) (1,3) (2,2) selected **or** $\frac{x}{36}$ where $x < 36$
				A1 for $\frac{3}{36}$ oe **or** 0.083(3…) **or** 8.3(3…)%
(b)	$\left(1-\frac{3}{36}\right)^3$ **or** $\left(\frac{33}{36}\right)^3$ **or** $\left(\frac{11}{12}\right)^3$	$\frac{1331}{1728}$ oe	2	M1 ft $\frac{3}{36}$ from (a) for $(1-(a))^3$ provided answer to (a) < 1
				A1 for $\frac{1331}{1728}$ oe accept 0.77 to 0.771

Question	Working		Answer	Mark	Notes
19	$5x^2 - 3x - 4(=0)$ **or** $5x^2 - 4 = 3x$ oe $\frac{-(-3) \pm \sqrt{(-3)^2 - 4 \times 5 \times (-4)}}{2 \times (5)}$ or $\frac{3 \pm \sqrt{89}}{10}$ $(x =) -0.64339...$ or $(x =) 1.24339\ldots$	$5y^2 - 49y + 80(=0)$ **or** $5y^2 - 49y = -80$ oe $\frac{-(-49) \pm \sqrt{(-49)^2 - 4 \times 5 \times 80}}{2 \times 5}$ or $\frac{49 \pm \sqrt{801}}{10}$ $(y =) 2.06980...$ or $(y =) 7.73019...$	$x = 1.24$ $y = 7.73$ $x = -0.64$ $y = 2.07$	4	M1 Correct quadratic (condone = 0 missing). M1 Correct substitution into quadratic formula, which may be partially evaluated. Accept 3^2 or -3^2 Accept 49^2 or -49^2 A1 (dep on first M1) for both values of x **or** both values of y correct to at least 2 dp A1 (dep on first M1) for correct x and y values, correctly paired.
20	$\frac{5\sqrt{2} - 3\sqrt{2}}{4}$ E.g. $\frac{2\sqrt{2}}{4}$ **or** $\frac{5\sqrt{2} - 3\sqrt{2}}{4} \times \frac{\sqrt{2}}{\sqrt{2}}$		$\frac{1}{\sqrt{2}}$	3	M1 for $5\sqrt{2}$ **and** $3\sqrt{2}$ M1 dep on first M1 for method to rationalise the denominator A1 (dep on M2) for correct steps to correct answer

Question		Working	Answer	Mark	Notes
21	(a)	$\frac{1}{2}\times 7\times 10\times \sin 105$	33.8	2	M1 A1 for answer in range 33.8 – 33.81
	(b)	$(AB^2 =)\ 7^2 + 10^2 - 2 \times 7 \times 10 \times \cos(105)$	45.2	5	M1
		$(AB =)\sqrt{100+49--36.2(346)}$ $\left(=\sqrt{185.2(346)}=13.6...\right)$			M1 for correct order of operations and square root
		$\frac{10}{\sin A}=\frac{"13.6"}{\sin 105}$ oe **or** $10^2 = 7^2 + "13.6"^2 - 2\times 7\times "13.6"\times \cos A$ **or** $\frac{1}{2}\times 7\times "13.6"\times \sin A\left(=33.8(074..)\right)$ **or** E.g. $\frac{\sin B}{7}=\frac{\sin 105}{"13.6..."}$ **or** angle $B = 29.7\ldots$			M1 (dep on 1st M1) ft 13.6 ft 33.8 dep on M1 in (a) **or** for a start to a method to find angle B
		E.g. $\sin A=\frac{10\sin 105}{"13.6"}\left(=\frac{9.65(925)}{"13.6"}=0.7(09712)\right)$ or $\sin A=\frac{33.8}{\frac{1}{2}\times 7\times "13.6"}\left(=\frac{33.8}{47.6(353)}=0.7(09712)\right)$ **or** $\cos A=\frac{7^2+"13.6"^2-10^2}{2\times 7\times "13.6"}\left(=0.7(03...)\right)$ **or** $180 - 105 - \sin^{-1}\left(\frac{\sin 105}{"13.6..."}\times 7\right)$			M1 for a correct expression or value for $\sin A$ **or** $\cos A$ **or** A A1 for answer in range 45.2 to 45.3

Question	Working	Answer	Mark	Notes
22	$\frac{3(2x+1)(2x-1)}{(3x+4)(2x-1)}$	$\frac{3(2x+1)}{3x+4}$	3	M1 for $(2x + 1)(2x – 1)$ **or** $(6x + 3)(2x – 1)$ **or** $(2x + 1)(6x – 3)$
				M1 for $(3x + 4)(2x – 1)$ **or** $(−3x – 4)(1 – 2x)$
				A1 for $\frac{3(2x+1)}{3x+4}$, accept $\frac{6x+3}{3x+4}$
23 (a)		$x > 4$	1	B1
(b)	$y^2 = 4 – x$ **or** $x^2 = 4 – y$	$4 – x^2$ oe	2	M1
				A1
(c)	$\sqrt{4-(5-x)(x-1)}$	$x-3$	4	M1
	$\sqrt{4-(5x-5-x^2+x)}$ **or** $\sqrt{4-5x+5+x^2-x}$			M1
	$\sqrt{x^2-6x+9}$			M1
				A1 Allow $(3-x)$ but not $\pm(x-3)$
	Alternative scheme	$x-3$	4	M1 if simplified, must be correct
	$(5 – x)(x – 1) = 5x – 5 – x^2 + x$ $(= 6x – 5 – x^2)$			
	$\sqrt{4-(5x-5-x^2+x)}$ **or** $\sqrt{4-5x+5+x^2-x}$			M1 ft from their expansion (must be a quadratic)
	$\sqrt{x^2-6x+9}$			M1
				A1 accept $(3-x)$ but not $\pm(x-3)$