Mark Scheme (Results)

Summer 2018

Pearson Edexcel International GCSE
In Mathematics A (4MA0) 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

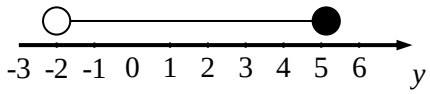
- **No working**
  If no working is shown then correct answers normally score full marks
  If no working is shown then incorrect (even though nearly correct) answers score no marks.
- **With working**
  If there is a wrong answer indicated on the answer line always check the working in the body of the 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 3H				
Apart from Questions 6b, 11, 13, 14, 17, 21c (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)	$\frac{3167.352831}{13.7}$	231.19(3637)	2	M1 For 3167.35(2831) rounded or truncated to at least 2 decimal places or for 13.7 or for 231.(193....) rounded or truncated to at least 3 significant figures A1 Accept rounded or truncated to at least 2 decimal places
(b)		230	1	B1 ft from (a) provided more than 3 significant figures
2	62.8 ÷ 8 (=7.85) **or** 12 ÷ 8 (=1.5) **or** 62.8 ÷ 2 (=31.4) **or** 62.8 ÷ 4 (15.7) **or** $8x = 62.8 \times 12$ **or** $8x = 753.6$	94.20	2	M1 Or for a complete method Eg $62.8 \times \frac{12}{8}$ **or** 62.8×1.5 A1 Accept 94.2

Question	Working	Answer	Mark	Notes
3 (a)	2.25 **or** 2 × 60 + 15 (=135) Eg 40 ÷ 2.25 **or** $40 \div 2\frac{1}{4}$ **or** $\frac{40}{2.25}$ **or** $\frac{40}{2\frac{1}{4}}$ **or** 40 ÷ '135' × 60 **or** $\frac{160}{9}$ oe	18	3	M1 For 2.25 **or** 2 × 60 + 15 **or** 135 M1 For a complete method A1 Accept $17\frac{7}{9}$ **or** 17.7(777...) rounded or truncated to at least 3 significant figures SCB1 for 40 ÷ 2.15 **or** 18.6(046) rounded or truncated to at least 3 significant figures
(b)	28 500 × 0.024 oe (=684) 28 500 + "684"	29 184	3	M1 M2 for 28 500 × 1.024 oe M1 dep A1
(c)	702 ÷ 3 (=234) **or** 100 ÷ 3 (=33.3…) **or** 1.03x = 702 + x **or** 0.03x = 702 oe "234" × 100 **or** "33.3…" × 702	23 400	3	M1 M2 for 702 ÷ 0.03 oe M1 dep A1 SCB2 for 24102

Question	Working	Answer	Mark	Notes
4 (a)		Reflection in the line with equation $x = 6$	2	B1 for reflection B1 for $x = 6$ NB. Award no marks if more than one transformation given
(b)		trapezium with vertices (4, −2) (4, −4) (7, −6) (7, −2)	2	B2 If not B2 then award B1 for trapezium in correct orientation **or** a trapezium with 3 vertices correct
5 (a)	$x + 2x + 3x + x + x$ **or** $8x$	$\frac{1}{8}$ oe	3	M1
	$x + 2x + 3x + x + x = 1$ **or** $8x = 1$ **or** $\frac{x}{8x}$			M1 A1 Oe
(b)	$3 \times "\frac{1}{8}" \times 200$ **or** $\frac{3x}{8x} \times 200$ **or** $200 \times 3x$ **or** $600x$	75	2	M1 ft from (a) if 0 < "(a)" < 1 A1 ft from (a) if 0 < "(a)" < 1 SCB1 for an answer of 25 Only award A1 for numerical answers

Question		Working	Answer	Mark	Notes	
6	(a)		$m(m + 7)$	1	B1	
	(b)	$7x + 21$	-12.5 oe	3	M1	for $7x + 21$ or division of all terms by 7
		eg $7x - 5x = -4 - 21$ or $2x = -25$ **or** $21 + 4 = 5x - 7x$ **or** $25 = -2x$			M1	for isolation of terms in x on one side of a correct equation ft from $7x + 3 = 5x - 4$ (eg $7x - 5x = -4 - 3$ or $2x = -7$)
					A1	dep on at least M1 awarded
	(c)	$y^2 + 9y - 4y - 36$	$y^2 + 5y - 36$	2	M1	for 3 terms correct **or** all 4 terms correct ignoring signs **or** $y^2 + 5y + \ldots$. **or** $\ldots\ldots + 5y - 36$
					A1	
	(d)		$64e^9 f^6$	2	B2	For $64e^9 f^6$ Accept $64 \times e^9 \times f^6$ If not B2 then B1 for $4^3 \times e^{3\times3} \times f^{2\times3}$ **or** ae^9f^6 $a \neq 64$ **or** $64e^mf^6$ $m \neq 9$ **or** $64e^9f^n$ $n \neq 6$

Question	Working	Answer	Mark	Notes
7	Eg (HJ^2=) $16.2^2 - 11.8^2$ (= 123.2) **or** (HJ^2=) 262.44 – 139.24 Eg (HJ=) $\sqrt{16.2^2 - 11.8^2}$ **or** $\sqrt{"123.2"}$	11.1	3	M1 For squaring and subtracting M1 Dep (for square rooting) A1 For 11.09 – 11.1 Award M2 for trigonometry used only for a complete method
8 (a)	$-3 - 4 < x < 9 - 4$ **or** $-7 < x$ **or** $x < 5$	$-7 < x < 5$	2	M1 Or for -7 and 5 A1 Accept $x > -7$ **and** $x < 5$
(b)			2	B2 B1 for a line that extends from -2 to 5 **or** for both correct circles in correct place with either no line or incorrect lines **or** for a correct circle at 5 with line to the left (with or without arrow) **or** for a correct circle at -2 with line to the right (with or without arrow)

Question	Working	Answer	Mark	Notes
9 (a)		8.2×10^7	1	B1 Cao Accept 8.20×10^7
(b)		0.000 029	1	B1 Cao
(c)	$(1.898 \times 10^{27}) \div (3.285 \times 10^{23})$	5800	2	M1 Condone omission of brackets A1 Accept 5700 - 5800 Accept answers in standard form

Question		Working	Answer	Mark	Notes
10	(a)		$164 < w \leq 168$	1	B1
	(b)	$162 \times 12 + 166 \times 20 + 170 \times 14 + 174 \times 7 + 178 \times 4 + 182 \times 3$ **or** $1944 + 3320 + 2380 + 1218 + 712 + 546$	10120	3	M2 freq × all correct midpoint values stated (or evaluated) with intention to add (condone any two errors in midpoints or frequencies) If not M2 then award M1 for all products $w \times f$ (and w is consistently within the interval, including end values) and intention to add (condone any two errors in their midpoints or frequencies) A1 SCB2 for 168.(666...) rounded or truncated to at least 3 significant figures

Question	Working	Answer	Mark	Notes
10 (c)		12, 32, 46, 53, 57, 60	1	B1
(d)	(164,12), (168,32), (172,46), (176,53), (180,57), (184,60)	Correct cf graph	2	M1 For at least 4 points plotted correctly at end of interval **or** for all 6 points plotted consistently within each interval in the **freqency table** at the correct height. (Eg, using values of 162, 166, 170, etc, on *x* axis) A1 Accept curve or line segments Accept curve that is not joined to (160,0)
(e)	Eg 171.5 (Q3) − 164.5 (Q1)	6-8	2	M1 For a correct method to find lower and upper quartile **and** an intention to subtract Eg for a correct reading from 45/45.75 or 15/15.25 from vertical axis to find Q1 and Q3 **and** an intention to subtract. Ft from a cf graph A1 Accept 6 - 8 ft from a cf graph

Question	Working	Answer	Mark	Notes
11	Eg $+$ $21x-6y=123$ / $8x+6y=22$; $-$ $28x-8y=164$ / $28x+21y=77$ $x=5$ **or** $y=-3$ Eg $4\times$ '5' $+3y=11$ $x=5$ **and** $y=-3$	$x=5$ $y=-3$	4	M1 For coefficient of x or y the same **and** correct operation to eliminate selected variable (condone any one arithmetic error in multiplication) **or** for correct rearrangement of one equation followed by correct substitution in the other. A1 cao (dep on M1) M1 (dep on 1st M1) for substituting their found value into one of the equations **or** correct method of elimination to find the second variable (as for first M1) A1 cao. Award 4 marks for correct values if at least first M1 scored without any incorrect working.
12	Eg (y =) $\frac{(5-2)\times180}{5}$ **or** $180-\frac{360}{5}$ **or** 108 $\frac{(6-2)\times180}{6}$ **or** $180-\frac{360}{6}$ **or** 120 $(5-2)\times180$ **or** 540 **or** $(6-2)\times180$ **or** 720 **or** $2y+4x=720$ **or** Eg $\frac{(5-2)\times180}{5}$ (= 108) **and** $(6-2)\times180$ (=720) Eg $(6-2)\times180=$ "108" $\times2+4x$ **or** $720=216+4x$ **or** $4x=504$ **or** ("720" – 2 × 108) ÷ 4 **or** $\frac{504}{4}$	126	4	M1 For correct method to find y **or** the size of an angle of a regular hexagon the sum of interior angles of a pentagon **or** the sum of interior angles of a hexagon **or** M1 For correct method to find y **and** the sum of interior angles of a hexagon M1 Dep on previous two method marks. For a correct equation in x only **or** for a complete method to find x A1

Question	Working	Answer	Mark	Notes
13	$\frac{-6\pm\sqrt{52}}{8}$ **or** $\frac{-6\pm\sqrt{6^2--16}}{2\times4}$ **or** $\frac{-6\pm\sqrt{6^2+16}}{8}$ or $\frac{-6\pm2\sqrt{13}}{8}$ NB: denominator must be 2×4 or 8 **and** there must be evidence for correct order of operations in the numerator Accept 36 in place of 6^2	0.151, −1.65	3	M2 Or for $\frac{-6\pm\sqrt{6^2-4\times4\times-1}}{2\times4}$ **and** $\frac{-3\pm\sqrt{13}}{4}$ (allow partial correct evaluation) If not M2 then M1 for $\frac{-6\pm\sqrt{6^2-4\times4\times-1}}{2\times4}$ Condone one sign error in substitution Allow partial evaluation A1 For 0.151 to 0.1514 **and** −1.65 to −1.6514 dep on at least M1 without any incorrect working. SCB2 for 0.151 to 0.1514 **or** −1.65 to −1.6514 if method for M1 shown without any incorrect working.

Question	Working	Answer	Mark	Notes
14	(Angle *GDE* =) 98÷2 (=49) **or** (reflex angle *GOE* =) 360 – 98 (=262) (Angle *GFE* =) 180 – "49" **or** "262"÷2 **or** 131 Angle at the centre is twice the angle at the circumference **AND** The opposite angles in a cyclic quadrilateral total 180° **or** Angle at centre is twice angle at circumference **AND** Angles at a point sum to 360^o	131	4	M1 M1 dep A2 for 131° **and** fully correct reasons If not A2 then A1 for 131^o and one correct circle theorem reason Eg Accept double in place of twice, origin (*O*) in place of centre and edge/arc in place of circumference Accept 'angle at circumference is half the angle at the centre' oe Accept 'angle at the centre is twice angle inscribed on the circle Accept supplementary in place of 'total 180^o' SCB2 for one correct circle theorem if method for first M1 seen

Question	Working	Answer	Mark	Notes
15 (a)	Eg $\frac{2(x+3)}{x(x+3)}-\frac{x}{x(x+3)}$ **or** $\frac{2(x+3)-x}{x(x+3)}$	$\frac{x+6}{x(x+3)}$	3	M1 For a correct expression with a correct common denominator Condone brackets in denominator expanded
	Eg $\frac{2x+6}{x(x+3)}-\frac{x}{x(x+3)}$ **or** $\frac{2x+6-x}{x(x+3)}$			M1 For a correct expression with brackets expanded Condone brackets in denominator expanded
				A1 Accept $\frac{x+6}{x^2+3x}$ SCB1 for $\frac{2x+3}{x(x+3)}-\frac{x}{x(x+3)}$ **or** $\frac{2x+3-x}{x(x+3)}$ Do not ISW
(b)	$(3x + 2)(3x – 2)$ $(3x – 2)(x – 5)$	$\frac{3x+2}{x-5}$	3	M1 M1 indept A1 Do not ISW

Question	Working	Answer	Mark	Notes
16	Eg $\frac{\sin R}{12.7}=\frac{\sin 78}{18.5}$ **or** $\frac{12.7}{\sin R}=\frac{18.5}{\sin 78}$ **or** $(\sin R)=\frac{12.7\sin 78}{18.5}$ oe Eg $(R=)\sin^{-1}\left(\frac{\sin 78}{18.5}\times 12.7\right)$ **or** $(R=)\sin^{-1}\left(0.671(485...)\right)$ **or** $42.1(817...)$ Eg $\frac{1}{2}\times 12.7\times 18.5\times\sin(180-78-"42.1(817...)")$ $\frac{1}{2}\times 12.7\times 18.5\times\sin(59.8(182...))$	102	4	M1 For correct use of the sine rule M1 For the correct method to find R Accept (R =) 42.1(817...) rounded or truncated to at least 3 significant figures **or** (R=) 42 M1 Dep on M2 For the correct method to find the area of triangle PQR A1 For 101 – 102

Question		Working	Answer	Mark	Notes
17		Eg $\frac{6+\sqrt{10}}{\sqrt{2}}\times\frac{\sqrt{2}}{\sqrt{2}}$ **or** $\frac{(6+\sqrt{10})\sqrt{2}}{\sqrt{4}}$ **or** $\frac{6\sqrt{2}+\sqrt{20}}{\sqrt{4}}$ **or** $\frac{6+\sqrt{5}\sqrt{2}}{\sqrt{2}}\times\frac{\sqrt{2}}{\sqrt{2}}$ **or** $\frac{6\sqrt{2}+\sqrt{10}\sqrt{2}}{\sqrt{4}}$ Eg $\frac{6\sqrt{2}+2\sqrt{5}}{\sqrt{4}}$ **or** $\frac{6\sqrt{2}}{\sqrt{4}}+\frac{2\sqrt{5}}{\sqrt{4}}$ **or** $\frac{6\sqrt{2}}{\sqrt{4}}+\sqrt{5}$ Accept 2 in place of $\sqrt{4}$ for both method marks	$3\sqrt{2}+\sqrt{5}$	3	M1 For the correct method to rationalise the denominator **or** for $\frac{6}{\sqrt{2}}+\sqrt{5}$ M1 For partial simplification (the denominator must be rationalised at this stage). Implies first M1 A1 Correct solution only dep on M2
18	(a)	(s =) $3 + t^{-1}$	$-\frac{1}{t^2}$	2	M1 For $\frac{1}{t}=t^{-1}$ A1 oe Eg $-t^{-2}$
	(b)	$-1\times-2t^{-3}$ or $-1\times-2(6)^{-3}$ oe	$\frac{1}{108}$	2	M1 ft from (a) provided of form $a + t^n$, where a is a constant and $n < 0$ A1 Oe Eg 0.00925(925...) rounded or truncated to at least 3 significant figures Accept answers in standard form

Question	Working	Answer	Mark	Notes
19	Eg $\frac{1}{3}\times\pi\times15^2\times18$ **or** 1350π **or** 424(1.150...) **or** $\frac{1}{3}\times\pi\times15^2\times18+\pi\times15^2\times20$ **or** 1350 π + 4500 π **or** 5850 π **or** 424(1.150...) + 141(37.1...) **or** 183(78.3...) 9 × 1000 − "1350 π" **or** 475(8.84…) **or** "5850 π" − 9 × 1000 **or** 937(8.31...) "475(8.84…)" = $\pi \times 15^2 \times h$ **or** "937(8.31...)" = $\pi \times 15^2 \times h$ $\frac{\text{"475(8.84...)"}}{\pi\times15^2}$ **or** 6.73(239…) **or** $\frac{\text{"937(8.31...)"}}{\pi\times15^2}$ **or** 13.2(676...)	24.7	5	M1 For correct method to find the volume of the cone **or** volume of the container Accept 424(1.150...), 141(37.1...) and 183(78.3...) rounded or truncated to at least 3 significant figures M1 Accept 475(8.84…) and 937(8.31...) ... rounded or truncated to at least 3 significant figures M1 M1 Accept 6.73(239…) and 13.2(676...) rounded or truncated to at least 3 significant figures A1 Accept 24.7 – 24.8 Allow use of litres or cm³ for method marks (but not mixed in the same calculation)

Question	Working	Answer	Mark	Notes
20	$\frac{3}{9}\times\frac{2}{8}\times\frac{6}{7}$ **or** $\frac{1}{14}$ oe **or** 0.071(428...) **or** $\frac{6}{9}\times\frac{5}{8}\times\frac{4}{7}$ **or** $\frac{5}{21}$ oe **or** 0.238(095...)	$\frac{228}{504}$	4	M1 Accept 0.071(428...), 0.238(095...) and 0.214(285...) rounded or truncated to at least 3 decimal places
	Eg $\frac{3}{9}\times\frac{2}{8}\times\frac{6}{7}$ **AND** $\frac{6}{9}\times\frac{5}{8}\times\frac{4}{7}$ **or** $\frac{3}{9}\times\frac{2}{8}\times\frac{6}{7}+\frac{3}{9}\times\frac{6}{8}\times\frac{2}{7}+\frac{6}{9}\times\frac{3}{8}\times\frac{2}{7}$ oe **or** $3\times\frac{3}{9}\times\frac{2}{8}\times\frac{6}{7}$ **or** $\frac{3}{14}$ oe **or** 0.214(285...)			M1
	Eg $3\times\frac{3}{9}\times\frac{2}{8}\times\frac{6}{7}+\frac{6}{9}\times\frac{5}{8}\times\frac{4}{7}$ oe **or** $1-(\frac{3}{9}\times\frac{2}{8}\times\frac{1}{7}+3\times\frac{6}{9}\times\frac{5}{8}\times\frac{3}{7})$ **or** $1-\frac{23}{42}$ oe			M1 For a complete method A1 oe Eg $\frac{19}{42}$ Accept 0.45(238...) rounded or truncated to at least 2 decimal places

	With Replacement (maximum 2 marks) $\frac{3}{9}\times\frac{3}{9}\times\frac{6}{9}$ **or** $\frac{2}{27}$ oe **or** 0.074(074...) **or** $\frac{6}{9}\times\frac{6}{9}\times\frac{6}{9}$ **or** $\frac{8}{27}$ oe **or** 0.296(296...) $3\times\frac{3}{9}\times\frac{3}{9}\times\frac{6}{9}+\frac{6}{9}\times\frac{6}{9}\times\frac{6}{9}$ **or** $\frac{14}{27}$ **or** 0.51(851...) oe $1-(\frac{3}{9}\times\frac{3}{9}\times\frac{3}{9}+3\times\frac{6}{9}\times\frac{6}{9}\times\frac{3}{9})$ **or** $1-\frac{13}{27}$ oe			M1 Accept 0.074(074...), 0.296(296...) and 0.222(222...) rounded or truncated to at least 3 decimal places M1 For a complete method Accept 0.51(851...) rounded or truncated to at least 2 decimal places SC B2 for an answer of $\frac{378}{729}$ oe

Question	Working	Answer	Mark	Notes
21 (a)		11	1	B1
(b)	Eg $y-3=-2x$ **or** $2x=3-y$ **or** $\frac{y}{2}=\frac{3}{2}-x$ $x-3=-2y$ **or** $2y=3-x$ **or** $\frac{x}{2}=\frac{3}{2}-y$	$\frac{3-x}{2}$	2	M1 For correct first step **or** $\frac{3-y}{2}$ **or** $\frac{y-3}{-2}$ A1 oe Eg $\frac{3}{2}-\frac{x}{2}$ **or** $\frac{x-3}{-2}$
(c)	Eg $(gf(x)=)\ (3-2x)^2-5$ **or** $(ff(x)=)\ (3-2(3-2x))$ Eg $(3-2x)^2-5 = 3-2(3-2x)$ **or** $(gf(x)=)\ 9-6x-6x+4x^2-5$ **or** $4x^2-12x+4$ **or** $(ff(x)=)\ 3-6+4x$ **or** $4x-3$ oe Eg $9-6x-6x+4x^2-5 = 3-6+4x$ **or** $4x^2-12x+4=4x-3$ Eg $4x^2-16x+7\ (=0)$ or $(2x-1)(2x-7)\ (=0)$ oe	0.5, 3.5	5	M1 For $gf(x)$ or $ff(x)$ M1 For a correct equation **or** $gf(x)$ brackets expanded correctly **or** $ff(x)$ brackets expanded correctly M1 For a correct equation with all brackets expanded correctly M1 For a correct 3-term quadratic (all terms on the same side) A1 oe Dep on at least M3