Mark Scheme (Results)

January 2019

Pearson Edexcel International GCSE
In Mathematics (4MA0) Higher Tier
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.

  If a candidate misreads a number from the question. Eg. uses 252 instead of 255; method marks may be awarded provided the question has not been simplified. Examiners should send any instance of a suspected misread to review. 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 6b, 19b, 20, 21c, 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.				
Question	**Working**	**Answer**	**Mark**	**Notes**
1	315 ÷ 75 (4.2) "4.2" × 60 (=252) **or** "4.2 − 4" × 60 (=12)	4 hours 12 mins	3	M1 M1 A1
2	$\left(\frac{4+9}{2}, \frac{-1+7}{2}\right)$ oe	(6.5, 3)	2	M1 for one coordinate correct or correct method to find one coordinate **or** (3, 6.5) A1 oe
3 (a)(i) (a)(ii) (b)		3,6,9 3, 6, 9, 12, 18 E.g. Yes as (12) is not in (set) *A*	1 1 1	B1 B1 no repeats B1 for Yes with reason(s)
4	π × 18 oe **or** 2 × π × $\frac{18}{2}$ oe	56.5	2	M1 A1 for 56.5 – 56.6

Question	Working	Answer	Mark	Notes
5	13 + 9 (=22) **or** 18 + 4 (=22) or 40 −18 (=22) "22 × 2" (=44) **or** (22 – 18) + 18 + 13 + 9 (=44)	$\frac{9}{44}$	3	M1 M1 A1 for $\frac{9}{44}$ or 0.204(54545…)
5 ALT	$\frac{18+x}{40+x} = \frac{1}{2}$ 36 + 2x = 40 + x oe	$\frac{9}{44}$	3	M1 M1 (dep) for a correct equation of the form $ax + b = cx + d$ **or** $x = 4$ A1 for $\frac{9}{44}$ or 0.204(54545…)

Question		Working	Answer	Mark	Notes	
6	(a)		$y(y + 1)$	1	B1	
	(b)	$3m + 21 (= 12 – 5m)$	−1.125	3	M1	
		$3m + 5m = 12 – 21$			M1	For isolating terms in m in a correct equation or ft from $3m + 7 = 12 – 5m$
					A1	for -1.125 or $-\frac{9}{8}$ or $-1\frac{1}{8}$ oe dep on M1
	(c)	$g^2 + 2g – 7g – 14$	$g^2 – 5g – 14$	2	M1	for 3 terms correct or 4 terms correct without signs or $g^2 - 5g$ …. or ….– $5g – 14$
					A1	
	(d)		$-4 < x \leq 3$	2	B2	or for $-4 < x$ and $x \leq 3$ if not B2 then B1 for $-4 < x$ or $x \leq 3$ or $-4 \leq x < 3$

Question	Working	Answer	Mark	Notes
7	96 ÷ (5 + 7) = 8 5 × "8" (=40) **or** 7 × "8" (=56) 0.35 × "40" (=14) **or** $\frac{3}{14}$ × "56" (=12) 0.35 × "40" + $\frac{3}{14}$ × "56"	26	5	M1 M1 0.35 × 5 (=1.75) M1 $\frac{3}{14}$ × 7 (=1.5) M1 (1.75 + 1.5) × "8" A1

<table>
<tr><th>Question</th><th>Working</th><th>Answer</th><th>Mark</th><th colspan="2">Notes</th></tr>
<tr>
<td>8</td>
<td>
<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>10</td><td>7</td><td>4</td><td>1</td><td>−2</td><td>−5</td></tr>
</table>
</td>
<td>$y + 3x = 4$ drawn from
$x = -2$ to $x = 3$</td>
<td>3</td>
<td>B3</td>
<td>For a correct line between $x = -2$ and $x = 3$

B2 For a correct straight line segment through at least 3 of (−2, 10) (−1, 7) (0, 4) (1, 1) (2, −2) (3, −5)
OR
for all of (−2, 10) (−1, 7) (0, 4) (1, 1) (2, −2) (3, −5) plotted but not joined
OR
for a line drawn with a negative gradient through (0, 4) and clear intention to use a gradient of −3 (eg. a line through (0, 4) and (0.5, 1)

B1 For at least 2 correct points plotted (ignore incorrect points)
or stated (may be in a table) or may be shown in working eg. $4 – 3 \times 1 = 1$ OR
for a line drawn with a negative gradient through (0, 4)
OR
a line with gradient –3</td>
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Question	Working	Answer	Mark	Notes
9	$\tan 52^o = \frac{RP}{12.7}$ **or** $\tan (90 - 52)^o = \frac{12.7}{RP}$ **or** $\frac{RP}{\sin 52^o} = \frac{12.7}{\sin(90-52)^o)}$ **or** $\frac{\sin 52^o}{RP} = \frac{\sin(90-52)^o}{12.7}$ (RP=) $12.7 \times \tan 52^o$ **or** $\frac{12.7}{\tan(90-52)^o}$ **or** $\frac{12.7 \times \sin 52^o}{\sin(90-52)^o}$	16.3	3	M1 M1 for a complete method A1 for 16.25 – 16.3
10	$2 \times 3.50 + 4 \times 4.25$ (=24) "24" – 7.60 (=16.4) **or** $\frac{"24"}{7.60} \times 100$ (=315.7..) $\frac{"16.4"}{7.6} \times 100$ **or** "315.7" – 100	216	4	M1 M1 M1 for a complete method A1 for 215.7 – 216

Question	Working	Answer	Mark	Notes
11	$\frac{1}{2}(27+21)\times 8$ (=192) $2 \times \frac{1}{2}(27+21)\times 8$ (+) 21 × 30 (+) 10 × 30 (+) 27 × 30 (+) 8 × 30	2364	3	M1 for area of cross section (but $\frac{1}{2}(27+21)\times 8 \times 30$) is M0 M1 for area of at least 4 faces A1
12	24 × 113 (2712) or 16 × 110 (=1760) (24 × 113 + 16 × 110) ÷ 40	111.8	3	M1 M1 for a complete method A1 accept 112 from a correct method and working

Question	Working	Answer	Mark	Notes		
13	0.012 × 18 000 (=216)		3	M1	for interest for first year or 18216 **or** 648 **or** answer of 18 648	M2 for 1.012^3 × 18 000 oe
	e.g. 0.012 × (18 000 + "216") (=218.592) **and** 0.012 × (18 000 + "216" + "218.592") (= 221.215..) **and** 18 000 + "216" + "218.592" + " 221.215.."			M1	for a complete method	
		18 656		A1	Accept answer in range 18655 – 18656 NB: Answer in range 655 – 656 gets M2A0	

Question	Working	Answer	Mark	Notes
14 (a)		8, 28, 55, 84, 102, 113, 120	1	B1 cao
(b)	(5, 8) (10, 28) (15, 55) (20, 84) (25, 102) (30, 113) (35, 120)	correct cf graph	2	M1 (ft from sensible table i.e. clear attempt at addition) for at least 5 points plotted correctly at end of interval **or** for all 7 points plotted consistently within each interval in the **freq table** at the correct height A1 accept curve or line segments accept curve that is not joined to (0,0)
(c)	E.g. readings from graph at cf=30 and cf=90	10 – 12	2	M1 for evidence of using graph at cf=30 **and** cf=90 ft from a cumulative frequency graph provided method is shown A1 ft from a cumulative frequency graph provided method is shown

Question	Working	Answer	Mark	Notes
15 (a)		g^6	1	B1
(b)		$18e^3m^{11}$	2	B2 If not B2 then award B1 for Ae^nm^k with 2 of $A = 18$, $n = 3$, $k = 11$
(c)		$8a^3c$	2	B2 If not B2 then award B1 for Fa^xc^y with 2 of $F = 8$, $x = 3$, $y = 1$ or Fa^xc with one of $F = 8$, $x = 3$
(d)		$(x - 1)(x + 1)$	1	B1
(e)	$f^2 = \frac{1-2k}{3}$	$k = \frac{1-3f^2}{2}$	3	M1 for removing the square root
	$3f^2 - 1 = -2k$ **or** $1 - 3f^2 = 2k$			M1 for isolating term in k
				A1 for $k = \frac{1-3f^2}{2}$ oe with k the subject

Question	Working	Answer	Mark	Notes
16 (a)	$\frac{15}{6}$ oe (=2.5) or $\frac{6}{15}$ oe (=0.4) or $\frac{6}{5}$ oe (=1.2) or $\frac{5}{6}$ oe(=0.83…)	7.5	3	M1 for a correct scale factor
	e.g. $RP = \frac{15}{6} \times 5$ (=12.5) or $RP = \frac{5}{6} \times 15$ (=12.5)			M1 for a method to find *RP* or *AP*
	e.g. $AP = \frac{15}{6} \times 5 - 5$ or $AP = \frac{5}{6} \times 15 - 5$			A1
(b)	$88 \times \left(\frac{6}{15}\right)^2$ **or** $88 \times \left(\frac{5}{5+"7.5"}\right)^2$	14.08	2	M1 ft from a correct scale factor for corresponding sides from (a) A1 Accept 14 or 14.1 if correct working seen
17	e.g. $x = 0.02424\ldots$ $100x = 2.42424\ldots$ **or** $10x = 0.2424\ldots$, $1000x = 24.2424\ldots$	shown	2	M1 for identifying two decimals that, when subtracted, leave a terminating decimal A1 for conclusion to given fraction

Question	Working	Answer	Mark	Notes
18 (a)	$\begin{pmatrix}6\\4\end{pmatrix}-\begin{pmatrix}4\\-2\end{pmatrix}$	$\begin{pmatrix}2\\6\end{pmatrix}$	2	M1 or for $\begin{pmatrix}2\\y\end{pmatrix}$ or $\begin{pmatrix}x\\6\end{pmatrix}$ where x, y are numbers A1
(b)	$\begin{pmatrix}-8\\4\end{pmatrix}$	Yes and $\begin{pmatrix}-8\\4\end{pmatrix}$ with reason	2	M1 $\begin{pmatrix}-8\\y\end{pmatrix}$ or $\begin{pmatrix}x\\4\end{pmatrix}$ where x, y are numbers A1 e.g. $\begin{pmatrix}-8\\4\end{pmatrix}$ is a multiple of $\begin{pmatrix}4\\-2\end{pmatrix}$ SC B2 for 'Yes and $\mathbf{a}-\mathbf{b}=-2\mathbf{c}$'

Question		Working	Answer	Mark	Notes
19	(a)	$\frac{(x+5)}{(2x+1)(x+5)} - \frac{3(2x+1)}{(x+5)(2x+1)}$ $\frac{x+5-6x-3}{(2x+1)(x+5)}$	$\frac{2-5x}{(2x+1)(x+5)}$	3	M1 Allow this first mark for $\frac{x+5-6x+3}{(2x+1)(x+5)}$ written as the first step M1 If the denominator is expanded it must be correct for this mark A1
	(b)	e.g. $(x-1)^2 > 4$ **or** $6(x^2 - x - x + 1) > 24$ $x - 1 > 2$; $x - 1 < -2$ **or** $(x-3)(x+1) > 0$ **or** $\frac{12 \pm \sqrt{(-12)^2 - 4\times6\times(-18)}}{2\times6}$ or $\frac{12 \pm \sqrt{576}}{2\times6}$	$x > 3$ $x < -1$	4	M1 for a correct first step; allow "=" M1 method to solve correct quadratic equation or inequality, allowing one sign error if using the formula A1 For $x = 3$ and $x = -1$ **or** for one correct out of $x > 3$ $x < -1$ or for $-1 < x < 3$ dep M1M1 A1 dep M1M1

Question	Working	Answer	Mark	Notes
20	e.g. angle *CAO* = 29° or angle *TAO* = 90° or angle *AOB* = 2 × 29° or angle *TAB* = 29° or angle *CAB* =90° e.g. 180 – 90 – 29 – 29	32	4	M1 For a correct angle M1 For a complete method A2 for 32 and at least two appropriate reasons of which one must be a circle theorem E.g. Angle between tangent and radius is 90°; angle in a semi-circle is 90° Base angles of an isosceles triangle are equal; the sum of the angles in a triangle is 180° , the sum of angles on a straight line is 180° If not A2 then A1 for 32 with one appropriate reason which must be a circle theorem.

Question	Working	Answer	Mark	Notes
21 (a)		4.5 oe	1	B1
(b)		1.5 oe	1	B1
(c)	$y - 3 = 0.5x$ **or** $x - 3 = 0.5y$			M1 starts to find $f^{-1}(x)$
	$[f^{-1}(x) =] \ 2(x - 3)$ oe or $y = 2(x - 3)$ oe			M1 full method to find $f^{-1}(x)$
	$[gf(x) = \dfrac{14}{2\left(\frac{1}{2}x + 3\right) - 3}$ **or** $\dfrac{14}{x + 3}$			M1 find $gf(x)$
	$2(x - 3) = \dfrac{14}{2\left(\frac{1}{2}x + 3\right) - 3}$ **or** $2(x - 3) = "\dfrac{14}{x + 3}"$			M1 (Dep on M3)
	e.g. $x^2 - 9 = 7$ or $2x^2 - 18 = 14$			M1 reduces to a correct quadratic equation of the form $ax^2 - b = c$
		4, −4	6	A1 Dep on all method marks

Question	Working	Answer	Mark	Notes
21 (c)	**Alternative mark scheme**			
	$f^{-1}(x) = gf(x)$ therefore $x = fgf(x)$		M1	
	$gf(x) = \dfrac{14}{2\left(\frac{1}{2}x+3\right)-3}$ **or** $\dfrac{14}{x+3}$		M1	find $gf(x)$
	$fgf(x) = \dfrac{1}{2}\left(\dfrac{14}{x+3}\right)+3$		M1	
	$x = \dfrac{1}{2}\left(\dfrac{14}{x+3}\right)+3$		M1	
	e.g. $x^2 - 9 = 7$ or $2x^2 - 18 = 14$		M1	reduces to a correct quadratic equation of the form $ax^2 - b = c$
		4, −4	6 A1	Dep on all method marks

Question	Working	Answer	Mark	Notes
22	e.g. $13.3^2 = 14.6^2 + 7.5^2 - 2\times14.6\times7.5\times\cos P$ $P = \cos^{-1}\left(\frac{14.6^2 + 7.5^2 - 13.3^2}{2\times14.6\times7.5}\right)$ (=65.0…) e.g. $0.5 \times 7.5 \times 14.6 \times \sin(\text{“}65\text{”})$ (=49.6…)	99.2	4	M1 correct substitution into cosine rule to find any angle M1 M1 (dep on 1st M1) correct method to find area of half or whole parallelogram A1 99.2 - 99.3
23	5.25 or 5.35 or 346.55 or 346.65 or 79.95 or 80.05 $\frac{346.65 - 79.95}{5.25}$	50.8	3	M1 accept $5.34\dot{9}$, $346.64\dot{9}$, $80.04\dot{9}$ M1 or for $\frac{\text{UB - LB}_1}{\text{LB}_2}$ oe where $346.6 < \text{UB} \leq 346.65$ and $79.95 \leq \text{LB}_1 < 80.0$ and $5.25 \leq \text{LB}_2 < 5.3$ A1 dep on M2 – correct working must be seen

Question	Working	Answer	Mark	Notes
24	$\frac{5}{8}\times\frac{4}{7}$ or $\frac{3}{8}\times\frac{5}{7}$ or $\frac{5}{8}\times\frac{3}{7}$			M1 for correct probability of taking two appropriate counters from X
	$\frac{5}{8}\times\frac{4}{7}\times\frac{5}{9}$ or $\frac{3}{8}\times\frac{5}{7}\times\frac{5}{9}$ or $\frac{5}{8}\times\frac{3}{7}\times\frac{5}{9}$			M1 for correct probability of one case where numbers of white and black counters in X are the same
	$\frac{5}{8}\times\frac{4}{7}\times\frac{5}{9}+\frac{3}{8}\times\frac{5}{7}\times\frac{5}{9}+\frac{5}{8}\times\frac{3}{7}\times\frac{5}{9}$ oe			M1 for a complete method
		$\frac{250}{504}$	4	A1 for $\frac{250}{504}$ oe or 0.496…