Mark Scheme (Results)

Summer 2017

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  If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.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: Apart from Question 9, 10, 14b, 19b and 22, 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	(a)		$5(2a + 5)$	1	B1
	(b)		$w(7w - 4)$	1	B1
	(c)				M1 for p^3 or $(-)5p^2$
			$p^3 - 5p^2$	2	A1
	(d)	$x^2 + 7x - 3x - 21$			M1 for 3 correct terms **or** 4 correct terms ignoring signs **or** $x^2 + 4x +$ c **or** .... + $4x - 21$
			$x^2 + 4x - 21$	2	A1
	(e)	$2^3 - 7 \times 2$ **or** $8 - 14$ **or** $8 - 7 \times 2$ **or** $2^3 - 14$			M1
			-6	2	A1
					Total 8 marks

2 (a)		Vertices at (−5, 3) (−5, 9) (−3, 9) (−3, 5) (−1, 5) (−1, 3)	2	B2	If not B2 then award B1 for shape of correct size and orientation in incorrect position **or** 4 out of 6 vertices correct
(b)		Vertices at (7, −1) (7, −3) (4, −3) (4,−2) (6, −2) (6,−1)	2	B2	If not B2 then award B1 for correct orientation but incorrect position or B1 for rotation 90°clockwise about (7, 3)
					Total 4 marks

3 (a)	E.g. $\frac{300}{4}\times 10$			M1	for a correct scale factor or a correct first step E.g. $\frac{300}{4}$ **or** 75 **or** $\frac{10}{4}$ **or** 2.5 **or** 300 ÷ 4 (=75)
		750	2	A1	
(b)	E.g. $\frac{920}{115}\times 4$			M1	for a correct scale factor or a correct first step E.g. $\frac{920}{115}$ **or** 8 **or** $\frac{115}{4}$ **or** 28.75
		32	2	A1	
					Total 4 marks

4	(a)		$3 < L \leq 4$	1	B1	Accept $3 - 4$
	(b)	Eg $0.5\times4 + 1.5\times5 + 2.5\times11 + 3.5\times14 + 4.5\times6$ **or** $2 + 7.5 + 27.5 + 49 + 27$ **or** 113			M2	$f \times d$ for at least 4 products with correct mid-interval values **and** intention to add. If not M2 then award M1 for d used consistently for at least 4 products within interval (including end points) **and** intention to add **or** for at least 4 correct products with correct mid-interval values with no intention to add
		$(0.5 \times 4 + 1.5 \times 5 + 2.5 \times 11 + 3.5 \times 14 + 4.5 \times 6) \div 40$ **or** $113 \div 40$			M1	dep on M1 (ft their products) NB: accept their 40 if addition of frequencies is shown
			2.8	4	A1	Allow 2.82, 2.83 or 2.825
						Total 5 marks

5	(a)				M1	for $\frac{47}{32}$ **or** 1.46875 **or** $\frac{121}{25}$ **or** 4.84 **or** $\frac{5047}{800}$ **or** 6.30875 truncated or rounded to at least 1 dp
			6.30875	2	A1	
	(b)		6.31	1	B1	ft from (a) provided answer to (a) has more than 3 sig figs
						Total 3 marks

6	(−3, −2) (−2, 0) (−1, 2) (0, 4) (1, 6) (2, 8) (3, 10)	Correct line between $x = -3$ and $x = 3$	3	B3	for a correct line between $x = -3$ and $x = 3$ (inclusive) If not B3 then award B2 for a correct line through at least 3 of (−3, −2) (−2, 0) (−1, 2) (0, 4) (1, 6) (2, 8) (3, 10) **or** for all above points plotted correctly but not joined If not B2 then award B1 for any 2 correct points stated (could be in a table) or plotted or may be seen in working e.g. $2 \times 1 + 4 = 6$ **or** for a line with a positive gradient through (0, 4) **or** for a line with gradient 2
					Total 3 marks

7	$\cos 22 = \frac{14.9}{AC}$ **or** $\sin(90-22) = \frac{14.9}{AC}$ **or** $\frac{AC}{\sin 90} = \frac{14.9}{\sin(90-22)}$ oe			M1	M1 for $BC = 14.9 \times \tan 22$ oe (= 6.019 – 6.02) **AND** $(AC^2 =)\ 14.9^2 + 6.019\ldots^2$
	$(AC =)\ \frac{14.9}{\cos 22}$ **or** $\left(AC =\right)\frac{14.9}{\sin 68}\ (\times \sin 90)$			M1	M1 for $(AC) = \sqrt{14.9^2 + 6.019...^2}$
		16.1	3	A1	Accept 16.07 − 16.1
					Total 3 marks

8 (a)	668.8 − 640 **or** 28.8			M1	M2 for $\frac{668.8}{640}(\times 100)$ **or** 1.045 **or** 104.5
	"28.8" ÷ 640 (×100) **or** 0.045			M1 dep	
		4.5	3	A1	
(b)	$\frac{668.8}{95}\times 100$ oe **or** $\frac{668.8}{0.95}$ oe			M2 for a complete method If not M2 then award M1 for $\frac{668.8}{95}$ (=7.04) **or** $0.95x = 668.8$ oe	
		704	3	A1	
					Total 6 marks

9	Arc centre Q cutting QP and QR at A and B with $AQ = BQ$ **and** arcs with same radius centre A and B intersecting in guidelines			M1	for a relevant pair of intersecting arcs within guidelines
		Correct angle bisector	2	A1	dep on M1 SC: B1 for line within guidelines
					Total 2 marks

10	Eg $10x + 35y = 155$ $-\ 10x - 6y = 32$	$6x + 21y = 93$ $+\ 35x - 21y = 112$			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)
			$x = 5, y = 3$	4	A1	cao Award 4 marks for correct values if at least first M1 scored
						Total 4 marks

11	(a)	$\frac{16+8+4}{90}$			M1	
			$\frac{28}{90}$ oe	2	A1	for $\frac{28}{90}$ oe E.g. $\frac{14}{45}$, 0.31(1…), 31(.1…)%
	(b)		4, 32, 62, 78, 86, 90	1	B1	cao
	(c)	(30, 4) (40, 32) (50, 62) (60, 78) (70, 86) (80, 90)			M1	(ft from sensible table i.e. clear attempt at addition) for at least 4 points plotted correctly at end of interval **or** for all 6 points plotted consistently within each interval in the **freq table** at the correct height (e.g. used values of 25, 35, 45 etc on age axis)
			correct cf graph	2	A1	accept curve or line segments accept curve that is not joined to (20,0)
	(d)	E.g. reading from graph at $t = 65$ **or** reading of 82 – 84 **or** mark on cf axis from using $t = 65$			M1	for evidence of using graph at $t = 65$ ft from a cumulative frequency graph provided method is shown
			6 – 8	2	A1	dep on a cf graph in part (c) ft from a cumulative frequency graph provided method is shown
						Total 7 marks

12	(a)		4.51×10^{-4}	1	B1	cao
	(b)	$\frac{780000}{0.00024}$			M1	for 3250000000 oe (e.g. 325×10^7) **or** $3.25 \times 10^{5--4}$ oe **or** 3.25×10^{n} where n is an integer
			3.25×10^{9}	2	A1	
						Total 3 marks

13	(a)	E.g. $\frac{8}{12}(=0.66...)$ **or** $\frac{12}{8}(=1.5)$ **or** $\frac{d}{9}=\frac{8}{12}$ oe **or** $\frac{9}{12}(=0.75)$ **or** $\frac{12}{9}(=1.33...)$			M1	for a correct scale factor **or** a correct equation (may be in ratio form e.g. 12 : 8 = 9 : *d*) accept 0.66… or 1.33… rounded or truncated to 2 or more decimal places
			6	2	A1	
	(b)	$160\times\left(\frac{12}{8}\right)^3$ oe **or** $\sqrt[3]{\frac{V}{160}}=\frac{12}{8}$			M1	for a correct scale factor $\left(\frac{12}{8}\right)^3 (=3.375)$ or $\left(\frac{8}{12}\right)^3 (=0.296...)$
			540	2	A1	
	(c)				M1	for $\sqrt{\frac{q}{p}}$ or $\sqrt{\frac{p}{q}}$ or $\left(\sqrt{\frac{p}{q}}\right)^3$ or $\left(\sqrt{\frac{q}{p}}\right)^3$ oe
			$w\times\left(\sqrt{\frac{q}{p}}\right)^3$ oe	2	A1	for $w\times\left(\sqrt{\frac{q}{p}}\right)^3$ oe e.g. $w\times\left(\frac{q}{p}\right)^{\frac{3}{2}}$
						Total 6 marks

14	(a)		x^4	1	B1	
	(b)	$6 + 4y = 3(5 - 2y)$			M1	for removing fraction
		$6 + 4y = 15 - 6y$			M1	for correct expansion of bracket in a correct equation
		$4y + 6y = 15 - 6$ **or** $10y = 9$			M1	for a correct equation with y terms isolated on one side ft their equation if first M1 awarded
			$\frac{9}{10}$ oe	4	A1	dep on at least M2 SC: B2 for an answer of $y = 1.5$ oe with working shown **or** $y = -0.1$oe with working shown
		Alternative scheme				
		$\frac{6}{3} + \frac{4y}{3} = 5 - 2y$			M1	for dividing both terms on LHS by 3 allow 1.3(3…)
		$\frac{4y}{3} + 2y = 5 - \frac{6}{3}$			M1	for a correct equation with y terms isolated on one side allow 1.3(3…)
		$\frac{10y}{3} = 3$			M1	for y terms collated allow 3.3(3…)
			$\frac{9}{10}$ oe	4	A1	dep on at least M2

14 (c)	$g - gh = 3h + 1$ **or** $-1 - 3h = gh - g$			M1	for a correct equation with terms in g isolated on one side of the equation
	$g(1 - h) = 3h + 1$ **or** $-1 - 3h = g(h - 1)$			M1	for taking g out as a common factor (must be two terms in g but terms may not be correct (terms in g may not be isolated))
		$g = \frac{3h+1}{(1-h)}$ oe	3	A1	for $g = \frac{3h+1}{(1-h)}$ oe e.g. $g = \frac{-1-3h}{(h-1)}$
					Total 8 marks

15	$P = kr^3$			M1	Allow $mP = r^3$ Do not allow $P = r^3$
	$343 = k \times 3.5^3$ oe or $k = 8$ **or** $m \times 343 = 3.5^3$ oe or $m = 0.125$ oe			M1	for correct substitution into a correct equation. Implies first M1
		$P = 8r^3$	3	A1	for $P = 8r^3$ oe (P must be the subject) (Award M2A0 for correct equation with r as subject given as final answer) Award M2A1 if $P = kr^3$ on the answer line and k evaluated as 8 Award M2A0 if $P \propto 8r^3$ is given as final answer
					Total 3 marks

16	E.g. $5\sqrt{2}\times3\sqrt{2} + 5e\sqrt{2} - 3e\sqrt{2} - e^2$ **or** $30 + 2e\sqrt{2} - e^2$			M1	for rational terms correct $(5\sqrt{2}\times3\sqrt{2} - e^2)$ **or** irrational terms correct $(5e\sqrt{2} - 3e\sqrt{2})$ NB: $5\sqrt{2}\times3\sqrt{2}$ may be fully or partially simplified
	$5\sqrt{2}\times3\sqrt{2} - e^2 = -6$ oe **or** rational terms correct **and** $e = 6$ **or** $5\sqrt{2}\ e - 3\sqrt{2}\,e = \sqrt{2}f$ oe **or** $5e - 3e = f$ oe			M1	dep on M1
		$e = 6$ $f = 12$	3	A1	
					Total 3 marks

17	(a)(i)		$-\mathbf{a} + \mathbf{b}$ oe	1	B1	
	(a)(ii)		$-\mathbf{a} + 0.5\mathbf{b}$	1	B1	for $-\mathbf{a} + 0.5\mathbf{b}$ oe ft from (i)
	(a)(iii)		$0.5\mathbf{a} + 0.5\mathbf{b}$	1	B1	for $0.5\mathbf{a} + 0.5\mathbf{b}$ oe (may not be simplified) ft from (i)
	(b)	$\overrightarrow{PX} = 1.5\begin{pmatrix}4\\2\end{pmatrix}\left(=\begin{pmatrix}6\\3\end{pmatrix}\right)$ **or** (7, 3) seen as coordinates for R			M1	
		$\overrightarrow{PV} = 1.5\begin{pmatrix}4\\2\end{pmatrix} + \begin{pmatrix}-5\\4\end{pmatrix}$ **or** $\begin{pmatrix}6\\3\end{pmatrix} + \begin{pmatrix}-5\\4\end{pmatrix}$ **or** $\begin{pmatrix}1\\7\end{pmatrix}$ **or** $(X) = (3 + 1.5 \times 4, 1 + 1.5 \times 2)$ **or** $(3 + 6, 1 + 3)$ **or** (9, 4) **or** $\vec{OX} = \begin{pmatrix}9\\4\end{pmatrix}$				
		$\overrightarrow{OV} = \begin{pmatrix}3\\1\end{pmatrix} + \begin{pmatrix}1\\7\end{pmatrix}$ **or** $\begin{pmatrix}4\\8\end{pmatrix}$ **or** V ("9"-5 , "4" + 4)			M1	dep
			(4, 8)	3	A1	SC: If M0 then award B1 for (4, y) or (x, 8)
						Total 6 marks

18	(a)		1, 4, 5, 40	2	B2	for all four correct (B1 for 2 or 3 correct)
	(b)(i)		1	1	B1	ft from their Venn diagram
	(b)(ii)		45	1	B1	ft from their Venn diagram
						Total 4 marks

19 (a)	$x = \frac{4}{y-3}$ $x(y-3) = 4$	$y = \frac{4}{x-3}$ $y(x-3) = 4$			M1 for $x(y-3) = 4$ **or** $y(x-3) = 4$
	$xy = 4 + 3x$ **or** $y - 3 = \frac{4}{x}$	$xy = 4 + 3y$ **or** $x - 3 = \frac{4}{y}$			M1 (implies the first M1)
			$\frac{4+3x}{x}$ oe	3	A1 for $\frac{4+3x}{x}$ oe e.g. $\frac{4}{x}+3$

19 (b)	E.g. $\left(\text{fg}(a)=\right)\dfrac{4}{\dfrac{a-2}{a}-3}$ **or** $4=\dfrac{a-2}{a}-3$ **or** $\dfrac{4a}{a-2-3a}(=1)$			M1	for a correct expression for fg(a)
	E.g. $4a=a-2-3a$ **or** $7a=a-2$			M1	for a correct equation where the fraction has been removed.
		$a=-\dfrac{1}{3}$ oe	3	A1	dep on M1 Accept −0.333(333...) rounded or truncated to at least 3SF Condone the use of x rather than a
(b)	**Alternative scheme**				
	E.g. $\text{g}(a)=\text{f}^{-1}(1)$ **or** $\text{g}(a)=\dfrac{4+3\times1}{1}$ oe **or** $\dfrac{4+3\times1}{1}=\dfrac{a-2}{a}$ **or** $7=\dfrac{a-2}{a}$			M1	for use of $\text{f}^{-1}\text{fg}(a)=\text{f}^{-1}(1)$ NB. ft for "f^{-1}"
	E.g. $7a=a-2$			M1	for a correct equation where the fraction has been removed. NB. ft for "f^{-1}"
		$a=-\dfrac{1}{3}$ oe	3	A1	dep on M1 Accept −0.333(333...) rounded or truncated to at least 3SF
					Total 6 marks

20	$\frac{4}{12}\times\frac{3}{11}\times\frac{8}{10}\ \left(=\frac{96}{1320}\right)$ oe **or** $\frac{4}{55}$ **or** $\frac{4}{12}\times\frac{3}{11}\times\frac{6}{10}\left(=\frac{72}{1320}\right)$ and $\frac{4}{12}\times\frac{3}{11}\times\frac{2}{10}\left(=\frac{24}{1320}\right)$ oe **or** $3\times\frac{4}{12}\times\frac{3}{11}\times\frac{6}{10}\left(=\frac{216}{1320}\right)$ oe **or** $3\times\frac{4}{12}\times\frac{3}{11}\times\frac{2}{10}\left(=\frac{72}{1320}\right)$ or			M1
	$3\times\frac{4}{12}\times\frac{3}{11}\times\frac{8}{10}$ oe or $3\times\left(\frac{4}{12}\times\frac{3}{11}\times\frac{6}{10}\ +\ \frac{4}{12}\times\frac{3}{11}\times\frac{2}{10}\right)$			M1 for a complete method
		$\frac{288}{1320}$	3	A1 for $\frac{288}{1320}$ oe e.g. $\frac{12}{55}$ accept 0.218(1818...) **or** 21.8(18…)% rounded or truncated to at least 3SF
				SC : with replacement (maximum 2 marks) M1 for $\frac{4}{12}\times\frac{4}{12}\times\frac{8}{12}$ oe **or** $\frac{128}{1728}$ oe e.g. $\frac{2}{27}$ **or** $\frac{4}{12}\times\frac{4}{12}\times\frac{6}{12}$ and $\frac{4}{12}\times\frac{4}{12}\times\frac{2}{12}$ oe **or** $3\times\frac{4}{12}\times\frac{4}{12}\times\frac{6}{12}$ **or** $3\times\frac{4}{12}\times\frac{4}{12}\times\frac{2}{12}$ A1 for $\frac{384}{1728}$ oe e.g. $\frac{2}{9}$
				Total 3 marks

21				B1	for identifying the correct angle on the diagram (may be implied by a correct trig statement)
	$(MC=)\ \sqrt{5^2+18^2}$ or $\sqrt{349}$ or 18.6(8154....) $(VC=)\ \sqrt{5^2+7^2+18^2}$ or $\sqrt{398}$ or 19.9(499..)			M1	for a correct method to find *MC* or *VC* Accept 18.6(8154....) rounded or truncated to at least 3sf. Accept 19.9(4993..) rounded or truncated to at least 3 sf
	$(VCM=)\tan^{-1}\left(\frac{7}{\sqrt{349}}\right)$ **or** $(VCM=)\sin^{-1}\left(\frac{7}{\sqrt{398}}\right)$ **or** $(VCM=)\cos^{-1}\left(\frac{\sqrt{349}}{\sqrt{398}}\right)$			M1	dep M1 for a complete method to find angle *VCM* (could be use of sine or cosine rule) e.g. $90 - \tan^{-1}\left(\frac{\sqrt{349}}{7}\right)$
		20.5	4	A1	accept 20.5 − 20.62
					Total 4 marks

22	E.g. $\frac{3}{2(x+6)}-\frac{x-15}{(x-8)(x+6)}$ or $\frac{3}{2x+12}-\frac{x-15}{(x-8)(x+6)}$			M1 $x^2-2x-48$ correctly factorised NB : May be seen at a later stage
	E.g. $\frac{3(x-8)-2(x-15)}{2(x-8)(x+6)}$ **or** $\frac{3(x-8)}{2(x-8)(x+6)}-\frac{2(x-15)}{2(x-8)(x+6)}$			M1 for a correct common denominator with numerators correct This may be a single fraction or two fractions; denominators may be expanded – if so, must be correct.
	$\frac{3x-24-2x+30}{2(x-8)(x+6)}$			M1 for a correct single fraction with brackets in numerator removed correctly; denominators may be expanded – if so, must be correct.
	$\frac{x+6}{2(x-8)(x+6)}$			M1 for a correct single fraction with the numerator simplified; denominators may expanded – if so, must be correct.
		$\frac{1}{2(x-8)}$	5	A1 dep on at least M2 for $\frac{1}{2(x-8)}$ or $\frac{1}{2x-16}$ or $\frac{-1}{16-2x}$ or $\frac{-1}{2(8-x)}$
				Total 5 marks

	Alternative scheme			
22	E.g. $\frac{3}{2(x+6)}-\frac{x-15}{(x-8)(x+6)}$ or $\frac{3}{2x+12}-\frac{x-15}{(x-8)(x+6)}$			M1 $x^2-2x-48$ correctly factorised NB : May be seen at a later stage
	$\frac{3(x^2-2x-48)-(2x+12)(x-15)}{(2x+12)(x^2-2x-48)}$			M1 for a correct common denominator with numerators correct This may be a single fraction or two fractions; denominators may be expanded – if so, must be correct.
	E.g. $\frac{3x^2-6x-144-2x^2+30x-12x+180}{(2x+12)(x^2-2x-48)}$ **or** $\frac{x^2+12x+36}{(2x+12)(x^2-2x-48)}$			M1 for a correct single fraction with brackets in numerator removed correctly; denominators may be expanded – if so, must be correct ($2x^3+8x^2-120x-576$)
	E.g. $\frac{(x+6)^2}{(2x+12)(x^2-2x-48)}$ **or** $\frac{x+6}{2(x-8)(x+6)}$			M1 for a correct single fraction with the numerator factorised; denominators may expanded – if so, must be correct.
		$\frac{1}{2(x-8)}$	5	A1 dep on at least M2 for $\frac{1}{2(x-8)}$ or $\frac{1}{2x-16}$ or $\frac{-1}{16-2x}$ or $\frac{-1}{2(8-x)}$
				Total 5 marks

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