Mark Scheme (Results)

Summer 2018

Pearson Edexcel International GCSE
In Mathematics A (4MA1) Paper 2H

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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

International GCSE Maths A June 2018 – Paper 2H Mark scheme				
Apart from Questions 4, 9, 15, 16, 21(a) 21(b) 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.				
Question	**Working**	**Answer**	**Mark**	**Notes**
1 (a)	$ac=M+bd$ **or** $-ac = -M - bd$ **or** $\frac{M}{c}=a-\frac{bd}{c}$		2	M1 For a correct first stage
		$a=\frac{M+bd}{c}$		A1 oe, eg $a=\frac{M}{c}+\frac{bd}{c}$, $a=\frac{-M-bd}{-c}$ [must have been seen with a = to award accuracy mark]
(b)	$5x<39+4$ oe		2	M1 Accept as equation or with the wrong inequality sign. Also award M1 for an answer of 8.6 or 8.6 with an = sign or the incorrect inequality sign.
		$x<8\frac{3}{5}$		A1 Accept $x<\frac{43}{5}$ **or** $x<8.6$ **or** $[-\infty, 8.6)$
(c)	eg $6e^2(3f^3-2ef)$, eg $2f(9e^2f^2-6e^3)$ eg $ef(18ef^2-12e^2)$		2	M1 Any correct partially factorised expression with at least 2 terms in the common factor **or** for the correct common factor and a 2 term expression inside the brackets with just one error
		$6e^2f(3f^2-2e)$		A1
				Total 6 marks

Question	Working	Answer	Mark	Notes
2	$\frac{3450}{2+6+7}$ (=230) **or** $\frac{2}{2+6+7}\times 3450(=460)$ **or** $\frac{7}{2+6+7}\times 3450(=1610)$ **or** $\frac{7-2}{2+6+7}$ $\left(=\frac{1}{3}\right)$		3	M1
	(7 – 2) × "230" **or** 7 × "230" – 2 × "230" **or** "1610" – "460" **or** $"\frac{1}{3}"\times 3450$			M1
		1150		A1
				Total 3 marks

3	$\frac{8}{100}\times 20000$ (=1600)		4	M1oe	Award M2 for 20000×1.08 or 21600
	$20000+\frac{8}{100}\times 20000$ (=21600) **or** (20 000 – 19200) + $\frac{8}{100}\times 20000$ (=2400)			M1	
	$\frac{"21600"-19200}{19200}(\times 100)$ **or** $\frac{"2400"}{19200}(\times 100)$ **or** "21600" ÷ 19200 (×100) oe			M1	or for 1.125 or $\frac{9}{8}$ or 112.5%
		12.5		A1	oe
					Total 4 marks

Question	Working	Answer	Mark	Notes
4	$\frac{25}{7}$ and $\frac{13}{8}$		3	M1 correct improper fractions **or** two improper fractions with a common denominator, at least one correct
	eg $\frac{200}{56}-\frac{91}{56}$ **or** $\frac{8\times25}{56}-\frac{7\times13}{56}$			M1 two correct fractions with a common denominator
	$\frac{109}{56} = 1\frac{53}{56}$ Or $\frac{109}{56}$ with RHS shown as $\frac{109}{56}$	correctly shown		A1 dep on M2 with sight of the result of the subtraction eg $\frac{109}{56}$ and $1\frac{53}{56}$ but allow showing that $1\frac{53}{56} = \frac{109}{56}$ on RHS in working
	Alternative method			
	eg $(3)\frac{32}{56}-(1)\frac{35}{56}$		3	M1 two improper fractions, with a common denominator, at least one correct
	$-\frac{3}{56}$			M1 correct subtraction of fractional parts
	$\frac{109}{56}$ or $2-\frac{3}{56}$	correctly shown		A1 dep on M2 with sight of the result of the subtraction eg $\frac{109}{56}$ or $2-\frac{3}{56}$
	Alternative method			
	eg $3\frac{32}{56}-1\frac{35}{56}$		3	M1 two correct fractions with a common denominator, at least one correct
	eg $2\frac{88}{56}-1\frac{35}{56}$			M1 complete correct method
	$1\frac{53}{56}$	correctly shown		A1 dep on M2
				Total 3 marks

Question	Working	Answer	Mark	Notes
5	$\angle OQT = 90^\circ$ **and** $\angle OQP = 18^\circ$ **or** 90 – 18		3	M1 For 90° **and** 18° correctly identified in the working or on the diagram **or** for 90 – 18 **or** for other fully correct method
		72		A1
	Angle between tangent and radius(or diameter) is 90 degrees			B1 Correct reason for 90° angle [If used alternate segment theorem]
				Total 3 marks

6	(a)	$2 \times \pi \times 0.56 \times 1.6$		2	M1 Award even if part of a calculation including 1 or 2 circles
			5.63		A1 awrt 5.63
	(b)	$\frac{0.6}{1.6}$ (=0.375) **or** $\frac{1.6}{0.6}$ $(=\frac{8}{3}=2.\dot{6})$ **or** $\frac{r}{0.56}=\frac{0.6}{1.6}$ **or** $(r=)\frac{0.56\times0.6}{1.6}$ **or** 0.56 ÷ $2.\dot{6}$ oe		2	M1 Correct scale factor (given as a fraction or ratio) or correct equation in *r* or a correct expression for *r*. Allow 2.6666... to 1 dp rounded or truncated
			0.21		A1 Allow 21 cm oe if units shown
					Total 4 marks

7	(a)	(28 + 32) × 72.6 (=4356) **or** 28 × 75 (=2100)		4	M1 Expression for total of both classes together or total for class A
		(28 + 32) × 72.6 – 28 × 75 (=2256)			M1 Expression for total of class B
		$\frac{(28+32)\times72.6-28\times75}{32}$ (="2256" ÷ 32)			M1 Correct calculation for mean of class B
			70.5		A1
	(b)	Highest in A = 39 + 57 (= 96) Highest in B = 33 + 60 (= 93)		3	M1 for 39 + 57(=96) **or** 33 + 60(=93)
		(39 + 57) – 33			M1 or for 33 – "96" or 33 to "96" oe
			63		A1
					Total 7 marks

Question	Working	Answer	Mark	Notes
8	$\cos 52 = \frac{12.6}{x}$ **or** sin 38 = $\frac{12.6}{x}$		3	M1 Or use of tan to find horizontal side 12.6 × tan 52 or $\frac{12.6}{\tan 38}$ (=16.12...) **and** a correct first stage to find x eg $x^2 = 12.6^2 + \text{“16.12...”}^2$ or $\sin 52 = \frac{\text{"16.12..."}}{x}$ oe Allow correct first stage of sine rule
	$(x =) \frac{12.6}{\cos 52}$ **or** $\frac{12.6}{\sin 38}$ $(= \frac{12.6}{0.61566...})$ **or**			M1 Accept decimal correct to at least 3SF Or $(x =) \sqrt{12.6^2 + \text{"16.12..."}^2}$ **or** $(x =) \frac{\text{"16.12..."}}{\sin 52}$ Allow fully rearranged sine rule
		20.5		A1 20.4 – 20.5
				Total 3 marks

Question	Working	Answer	Mark	Notes
9	eg $7x + 7y = 105$ – $7x - 5y = 3$ $5x + 5y = 75$ + $7x - 5y = 3$ $7(15 - y) - 5y = 3$ **or** $7x - 5(15 - x) = 3$ oe		3	M1 Correct method to eliminate x or y: coefficients of x or y the same **and** correct operation to eliminate selected variable (condone any one arithmetic error in multiplication) **or** writing x or y in terms of the other variable and correctly substituting
	"6.5" + y = 15 **or** x + "8.5" = 15 **or** 7 × "6.5" – 5y = 3 **or** $7x$ – 5 × "8.5" = 3			M1 dep Correct method to find second variable using their value from a correct method to find first variable or for repeating above method to find second variable
		$x = 6.5$, $y = 8.5$		A1oe dep on first M1
				Total 3 marks

10	(a)	$\frac{2^3}{2^7}$ **or** $2^3 \times 2^{-7}$ **or** $\frac{1}{2^4}$ **or** $\frac{1}{16}$ **and** $16 = 2^4$		2	M1
			-4		A1 Accept 2^{-4}
	(b)	$13^{-24} \times 13^5$		2	M1 for 13^{-24} or for $k = -6 \times 4 + 5$
			-19		A1 Accept 13^{-19}
					Total 4 marks

11	$V = \frac{4}{3} \times \pi \times 1.5^3$ (= 14.1(37)… or $\frac{9}{2}\pi$)		3	M1 Correct expression for volume.
	$D = \frac{109.6}{\frac{4}{3}\pi \times 1.5^3}$ oe			M1 dep
		7.75		A1 7.75 – 7.78
				Total 3 marks

NB: splitting the shape incorrectly (FDC and DEA are not straight lines) gains no marks for angles calculated from false information. However angles calculated that follow the scheme, such as $\angle EDC$ = 138° or interior angles of hexagon = 720° can be awarded. Other ways of correctly splitting the shape can be awarded full marks, eg FE to a point on AB or adding a parallel line eg from E parallel to AB NB: some students show lots of lines but actually work with the angles correctly so please check carefully.

Question	Working	Answer	Mark	Notes	
12	$\angle EDC$ = 180 − 42 (=138)		5	M1	May be marked on diagram.
	(2 × 6 − 4) × 90 (=720)			M1indep	Method to find sum of interior angles of hexagon **or** the correct sums for the interior angles of shapes used (eg 540° & 180° if the line through *FE* to point on *AB* drawn or 720° and 180° if line drawn from *E* parallel to *AB* or 540° & 180° if line through *FE* extended and joined to line through CB extended) oe
	eg "138" + 42 + 50 + 96 + 144 + *E*' = "720" **or** "138" + 42 + 50 + 96 + 144 + (360 − *E*) = "720" **or** 42 + 144 + "138" + (50 + 96) + *DEP* = "540" (where *P* is on *AB* and *FE* extended) oe			M1	dep on previous M marks Equation for *E* or E' where *E* is the obtuse angle of the hexagon and E' is the interior (reflex) angle **or** for an answer of 250 from correct working
	E' = "720" − "138" − 42 −50 − 96 − 144 (= 720 − 470 = 250) **and** *E* = 360 − "250" **or** *E* = "138" + 42 + 50 + 96 + 144 + 360 − "720" (= 830 − 720)			M1	A completely correct calculation for the correct angle *E*
		110		A1	from no incorrect working
					Total 5 marks

Question	Working	Answer	Mark	Notes
13 (a)		$\frac{4}{9}, \frac{4}{9}, \frac{1}{9}, \frac{5}{9}, \frac{3}{9}, \frac{1}{9}, \frac{5}{9}, \frac{4}{9}, 0$	2	B2oe Award B1 for any 3 correct. Decimals must be correct (recurring shown), 0 can be $\frac{0}{9}$ or the branch crossed out or left blank
(b)			3	M1 Award M1 for one correct product (ft tree diagram)
	$\frac{5}{10}\times\frac{4}{9}+\frac{4}{10}\times\frac{5}{9}+\frac{4}{10}\times\frac{3}{9}$ **or** $\frac{5}{10}\times\frac{4}{9}+\frac{4}{10}\times\frac{8}{9}$ oe **or** $1-\left(\frac{5}{10}\times\frac{4}{9}+\frac{5}{10}\times\frac{1}{9}+\frac{4}{10}\times\frac{1}{9}+\frac{1}{10}\right)$ oe			M1 A fully correct method (ft tree diagram)
		$\frac{52}{90}$		A1 oe decimals 0.577… or 57.7...% rounded or truncated to 2 or more sf
				Total 5 marks

Question	Working	Answer	Mark	Notes	
14 (a)		-6, 4, 0, -2, 4	2	B2	Award B1 for 2, 3 or 4 correct.
(b)		correct curve	2	B2	For correct smooth curve. If B2 not awarded, award B1 for at least 5 points plotted correctly ft from table dep on B1 or B2 in (a) (plots ±1 sq)
(c)	$x^3 - 2x^2 - 3x + 4 = -2x + 3$		4	M1	
	Plot $y = -2x + 3$			M1	Sufficient to cross curve at least once.
	-0.8 or 0.6 or 2.2			A1	Any one correct x value at intersection of graphs (or one or more points given as coordinates) ft dep on second M1 (Award even if curve in (a) is incorrect)
		−0.8 0.6 2.2		A1	Accept −0.9 to −0.7 Accept 0.4 to 0.7 Accept 2.1 to 2.4 (not coordinates) ft (±1 square) dep on second M1 must be 3 values SC B2 for all correct solutions from graph of $y = x^3 - 2x^2 - x + 1$
					Total 8 marks

15	$8.305 - 0.655$		2	M1	For either bound correct (used or seen). Accept 0.6549
		7.65		A1	dep on correct method shown
					Total 2 marks

Question	Working	Answer	Mark	Notes
16 (a)	$R = kt^2$ oe		3	M1 Equation consistent with $R \propto t^2$
	eg $10 = k \times 2^2$ **or** $40 = k \times 4^2$ **or** $k = 2½$			M1 Substitute values at any point on the graph or find the value of k. (Implies first M1.) Allow readings from graph for $t \pm 0.1$ and $R \pm 1$
		$R=\frac{5}{2}t^2$		A1 Award for $R=kt^2$ if the value of k is shown clearly in (a) or (b).
(b)	$\frac{8}{5x}="\frac{5}{2}t^2"$		2	M1 ft dep on answer of the form $R=kt^2$
		$t=\frac{0.8}{\sqrt{x}}$		A1 ft dep on answer of the form $R=kt^2$ Simplification of constant is not required. eg accept $t=\sqrt{\frac{16}{25}}\times\frac{1}{\sqrt{x}}$ [allow other clear arguments that clearly shows t is inversely proportional to $\sqrt{x}$]
				Total 5 marks

Question	Working	Answer	Mark	Notes
17 (a)		$3x^2-4x-15$	2	B2 Award B1 for any 2 or 3 of the 4 terms differentiated correctly.
(b)	$3x^2 - 4x - 15 < 0$ (or = 0)		4	M1 ft from (a) ie "their (a)" = 0 (or < 0)
	$(3x + 5)(x - 3)(< 0)$ **or** $\frac{-(-4)\pm\sqrt{(-4)^2-4\times3\times(-15)}}{2\times3}$			M1 ft from "their (a)" (=0) for 3 term quadratic, for correct factorisation **or** correct use of quadratic formula to find the two critical values, allow 1 sign error. [−(−4) could be 4 and $(-4)^2$ could be 4^2](condone missing brackets)
	$-\frac{5}{3}, 3$			M1 Both critical values correct Accept -1.66… rounded or truncated to 3SF.
		$-\frac{5}{3} < x < 3$		A1oe Inequality signs needed Allow $x > -\frac{5}{3}$, $x < 3$
				Total 6 marks

Question	Working	Answer	Mark	Notes
18	$14^2 = 10^2 + 8^2 - 2 \times 10 \times 8 \times \cos A$ **or** $\cos A = \frac{10^2+8^2-14^2}{2\times 8\times 10}$ oe		3	M1 Correct substitution in cosine rule for **any** angle or for 44.4... or 34.047....(the other 2 angles to 1dp or better)
				M1 $\cos^{-1}\left(\frac{10^2+8^2-14^2}{2\times 10\times 8}\right)$ oe ie $\cos^{-1}$ of the correct angle **or** a fully correct method to find the largest angle eg $180-\cos^{-1}\left(\frac{196+100-64}{280}\right)-\cos^{-1}\left(\frac{196+64-100}{224}\right)$ oe
		101.5		A1 101.5 to 101.6
				Total 3 marks

19	$BE^2 = 10^2 + 24^2 + 8^2$ (= 100 + 576 + 64 = 740) ($BE = 2\sqrt{185}$ =27.202 …)	$BD^2 = 8^2 + 24^2$ (=64 + 576 = 640) ($BD = 8\sqrt{10}$ = 25.298….)		3	M1 Complete method to find *BE* or BE^2 or *BD* or BD^2
	$\sin DBE = \frac{10}{\sqrt{"740"}}$ (= 0.3676 …)	$\tan DBE = \frac{10}{\sqrt{"640"}}$ (= 0.3952…) **or** $\cos DBE = \frac{\sqrt{"640"}}{\sqrt{"740"}}$ (=0.9428…)			M1 Allow use of sine or cosine rule $\sin DBE = \frac{10\sin 90}{\sqrt{"740"}}$ **or** $\cos DBE = \frac{"640"+"740"-10^2}{2\times\sqrt{"640"}\times\sqrt{"740"}}$ (=0.9299…)
			21.6		A1 21.5 – 21.6
					Total 3 marks

Question	Working	Answer	Mark	Notes
20	eg 4 × 5 + 1 × 10 = 30 small squares for 6 babies **or** 30 ÷ 6 **or** 5 small squares represent 1 baby **or** height of first bar $=\frac{4}{0.5}$ (= 8) **or** height of last bar $=\frac{2}{1}$ (=2) **or** 1 small square vertically = FD of 2 **or** 1cm vertically = FD of 10 oe		3	M1 Start working with area being proportional to frequency or show the height of the first or last bar or show a correct scale on the frequency density scale, with no inconsistent values. eg could be awarded by seeing total of little squares ÷ 5 oe
	eg (4 × 5 + 20 × 4 + 25 × 2 + 15 × 4) ÷ 5 **or** 4 + 40 × 0.4 + 50 × 0.2 + 30 × 0.4 **or** 4 + 16 + 10 + 12 oe			M1 Fully correct method, allow one error in products but must be the sum of 4 parts
		42		A1
				Total 3 marks

Question	Working	Answer	Mark	Notes
21 (a)	$\sqrt{9\times5}$ **and** $\sqrt{4\times5}$		2	M1 **or** for 45 = 3 × 3 × 5 **and** 20 = 2 × 2 × 5
		$5\sqrt{5}$ shown		A1 dep on M1 cao with sight of $3\sqrt{5}+2\sqrt{5}$ but we must see where these come from
(b)	$\frac{2}{\sqrt{3}-1}\times\frac{\sqrt{3}+1}{\sqrt{3}+1}$ or $\frac{2(\sqrt{3}+1)}{3-1}$ or $\frac{2\sqrt{3}+2}{2}$		2	M1 Rationalise denominator – award for seeing multiplication by $\frac{\sqrt{3}+1}{\sqrt{3}+1}$ or $\frac{-\sqrt{3}-1}{-\sqrt{3}-1}$
oe		$1+\sqrt{3}$		A1 dep on M1
(c)	$(x+3\sqrt{2})^2-(3\sqrt{2})^2-1$		2	M1 or $(x+3\sqrt{2})^2-18-1$ **or** for $a=3\sqrt{2}$ **or** $b=-19$
		$(x+3\sqrt{2})^2-19$		A1
				Total 6 marks

Incorrect working giving the radius as 16 cm gains M0A0					
Question	**Working**	**Answer**	**Mark**	**Notes**	
22	$7 \times 4 = 2(2r - 2)$ or $7 \times 4 = 2(d - 2)$		6	M1	Or a correct equation in r eg $5.5^2 - 1.5^2 = 4r - 4$
	$r = 8$ **or** $d = 16$			A1	
	$5 \times (5 + 4 + 7) = x \times (2 \times$ "8" $+ x)$			M1	Accept $5 \times 16 = x(2r + x)$
	$x^2 + 16x - 80\ (= 0)$			A1	
	$(x - 4)(x + 20)\ (= 0)$ $\frac{-16 \pm \sqrt{16^2 - 4 \times 1 \times (-80)}}{2 \times 1}$ **or** $\frac{-16 \pm \sqrt{576}}{2}$			M1	Correct factors or evidence of correct use of quadratic formula.
		4		A1	dep on first 2 method marks
					Total 6 marks

23	$\frac{48}{2}(2a + (48-1)d)$ **or** $\frac{36}{2}(2a + (36-1)d)$ oe		5	M1	For a correct expression for the first 48 terms or the first 36 terms
	$\frac{48}{2}(2a + (48-1)d) = 4 \times \frac{36}{2}(2a + (36-1)d)$ oe			M1	For a correct equation.
	$96a + 1392d = 0$ oe eg $4a + 58d = 0$, $2a + 29d = 0$ or $a = -14.5d$ etc			M1	
	$\frac{30}{2}(2a + (30-1)d)$			M1	Indep Allow substitution of any 'found' values of a and d
		0		A1	
					Total 5 marks

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