



# **Mark Scheme (Results)**

**Summer 2018**

**Pearson Edexcel International GCSE  
In Mathematics A (4MA1) Paper 1HR**

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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.

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Q	Working	Answer	Mark	Notes
1	$20 \times 14 (= 280)$	460	4	M1
	$\frac{20+16}{2} \times (24-14) (= 180)$			M1
	“280” + “180”			M1 (dep) on at least one of the previous M marks
				A1
				<b>Total 4 marks</b>
	<b>Alternative scheme 1</b>			
	$(24+14) \div 2 (= 19)$ <b>and</b> $(20-16) \div 2 (=2)$	460	4	M1
	$2 \times 19 (= 38)$ <b>and</b> $16 \times 24 (= 384)$			M1
	“38” + “38” + “384”			M1 (dep) on at least one of the previous M marks
				A1
				<b>Total 4 marks</b>
	<b>Alternative scheme 2</b>			
	$20 \times 24 (= 480)$	460	4	M1
	$(20-16) \div 2 (=2)$ <b>and</b> $24 - 14 (= 10)$ $2 \times 10 = 20$			M1
	“480” – “20”			M1 (dep) on at least one of the previous M marks
				A1
				<b>Total 4 marks</b>

<b>2</b>	$1 \times 5 + 3 \times 9 + 5 \times 24 + 7 \times 40 + 9 \times 7 (= 495)$ <b>or</b> $5 + 27 + 120 + 280 + 63 (= 495)$	5.8	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 <b>OR</b> correct mid-points <b>used</b> for at least 4 products and not added
	"495" $\div 85$			M1 dep on at least M1 Allow division by their $\sum f$ provided addition or total under column seen
				A1 for 5.8 – 5.824
				<b>Total 4 marks</b>

<b>3</b> (a)		Correct <b>R</b> (5,6), (3,6), (3,5)	2	B2 fully correct If not B2 then B1 for correct orientation of <b>R</b> but in wrong position
(b)		Correct <b>T</b> (2,-1), (2,-3), (1,-3)	1	B1
				<b>Total 3 marks</b>

<b>4</b>	$675 \div (5 + 4) \times 5 (= 375)$	225	3	M1	M2 $675 \div (5 + 4) \times 3$
	"375" $\div 5 \times 3$			M1 dep M1	
				A1	
					<b>Total 3 marks</b>

<b>5</b>	For example,		No + reason	2	M1 for evaluating $E$ correctly for any value of $n$
	$n$	$E$			
	1	7			
	2	11			
	3	17			
	4	25			
	5	35			
					A1 for No with $E$ evaluated correctly as a non-prime number
					<b>Total 2 marks</b>

<b>6</b>	Angle $EBG = 180 - 2 \times 65 (= 50)$ or Angle $ABE = 180 - (38 + 65) (= 77)$	27	3	M1
	Angle $ABE = 180 - (38 + 65) (= 77)$ <b>and</b> Angle $ABG = "77" - "50"$			M1 for a complete method to find angle $ABG$
				A1
				<b>Total 3 marks</b>
	<b>Alternative scheme 1</b>			
	Angle $EBG = 180 - 2 \times 65 (= 50)$ or Angle $EBC = 103$	27	3	M1
	Angle $EBC = 103$ <b>and</b> Angle $ABG = 180 - (103 + "50")$			M1 for a complete method to find angle $ABG$
				A1
				<b>Total 3 marks</b>

<b>7</b>	(a)		$4n + 2$	2	M1 for $4n + k$ ( $k$ may be 0 or absent) oe
					A1 oe e.g $6 + (n - 1)4$
	(b)		$4n + 6$	1	B1 oe ft part (a) providing M1 in part (a) is awarded e.g $4(n + 1) + 2$
					<b>Total 3 marks</b>

<b>8</b>	(a)		$1.39 \times 10^6$	1	B1
	(b)		$5 \times 10^{-3}$	1	B1
					<b>Total 2 marks</b>

<b>9</b>		$2.5 - 0.6 = 1.9$	2 hours 51 minutes	4	M1
		$3 \times 12 \times "1.9" (= 68.4)$			M1 for using length $\times$ width $\times$ height to find a volume
		$"68.4" \times 1000 \div 400$ (= 171 minutes)			M1 for their volume $\times 1000 \div 400$
					A1
					<b>Total 4 marks</b>
		<b>Alternative scheme</b>			
		$250 - 60 = 190$	2 hours 51 minutes	4	M1
		$300 \times 1200 \times "190" (= 6.84 \times 10^7)$			M1 for using length $\times$ width $\times$ height to find a volume
		$"6.84 \times 10^7" \div 10^6 \times 1000 \div 400$ (= 171 minutes)			M1 for their volume $\div 10^6 \times 1000 \div 400$
					A1
					<b>Total 4 marks</b>



<b>10</b>	$16x = 32$ or $32y = 144$	(2, 4.5)	3	M1 for a correct sequence of operations which leads to 1 equation in one unknown, allowing one arithmetical error
	$3 \times '2' + 2y = 15$ or $3x + 2 \times '4.5' = 15$			M1 (dep) substitute found value of one variable in one equation
				A1
				<b>Total 3 marks</b>

<b>11</b>	$72 \times 1000 (= 72000)$ or $72 \div 60 (= 1.2)$ or $72 \div 60 \div 60 (= 0.02)$ or $60 \div 60 \times 1000 (= 3.6)$	20	3	M1 for at least <b>one</b> of $\times 1000$ or $\div 60$
	$\frac{72}{60 \times 60} \times 1000$			M1 (dep) for a complete method
				A1
				<b>Total 3 marks</b>

<b>12</b>	(a)	$6 \times 25 + 6 \times 45 (= 150 + 270 = 420)$	20	4	M1 for $6 \times 25 (=150)$ or $6 \times 45 (=270)$
		"150" + "270" – 350 (= 70) or "420" – 350			M1
		$\frac{70}{350} \times 100$			M1 (dep on M2)
					A1
		<b>Alternative scheme</b>			
		$6 \times 25 + 6 \times 45 (= 150 + 270 = 420)$	20	4	M1 for $6 \times 25 (=150)$ or $6 \times 45 (=270)$
		$\frac{420}{350} \times 100 = 120$			M1
		"120" – 100			M1 (dep on M2)
					A1
	(b)	$500\,000 \div 8 (=62\,500)$	6 250 000	3	M1
		$500\,000 \div 8 \times 100$			M1 for a complete method
					A1
					<b>Total 7 marks</b>

<b>13</b>	$\frac{1}{3} + \frac{1}{5} (= \frac{8}{15})$ or 0.53... or 53.3.....% or 53%	900	4	M1
	$1 - \frac{8}{15}$ (= $\frac{7}{15}$ ) or 0.46..... or 0.47 or 46.6...% or 47%			M1
	$420 \div \frac{7}{15}$ (= 900) oe			M1
				A1
				<b>Total 4 marks</b>

<b>14</b> (a)		$8e^6f^9$	2	B2 B1 for 2 correct terms in a product of 3 terms
(b)	$3x^2 + 9xy - 4yx - 12y^2$	$3x^2 + 5xy - 12y^2$	2	M1 M1 for 3 correct terms out of 4 <b>or</b> for 4 correct terms ignoring signs <b>or</b> for $3x^2 + 5xy + c$ for any non zero value of $c$ <b>or</b> for $d + 5xy - 12y^2$ for any non zero value of $d$
				A1
(c)	$a^{\frac{1}{2}} \times a = a^{\frac{3}{2}}$ or $\frac{a}{a^{-2}} = a^3$  or $\frac{a^{\frac{1}{2}}}{a^{-2}} = a^{\frac{5}{2}}$	$\frac{7}{2}$	2	M1 for one correct step
				A1 oe
(d)	$\frac{2^n - 1}{(2^n - 1)(2^n + 1)}$	$\frac{1}{2^n + 1}$	2	M1 for $(2^n - 1)(2^n + 1)$
				A1
				<b>Total 8 marks</b>

15	(a)		$\frac{9}{20}$ on first red branch	3	B1
			Correct binary structure		B1
		$\frac{9}{16}, \frac{7}{16}, \frac{9}{16}, \frac{7}{16}$	Labels and correct probabilities on all second branches		B1
	(b)	$\frac{9}{20} \times \frac{7}{16}$	$\frac{63}{320}$ or 0.196(875)	2	M1
					A1 oe ft diagram Accept 0.20 or better
	(c)	$\frac{9}{20} \times \frac{7}{16} + \frac{11}{20} \times \frac{9}{16}$	$\frac{162}{320}$ or 0.506(25)	3	M1 for $\frac{11}{20} \times \frac{9}{16}$
					M1 for $\frac{9}{20} \times \frac{7}{16} + \frac{11}{20} \times \frac{9}{16}$
					A1 oe Accept 0.51 or better
					<b>Total 8 marks</b>

<b>16</b>	(a)	$x(x+4) = 12(12+x)$	Shown	3	M1	
		$x^2 + 4x = 144 + 12x$			M1	for at least one correct expression
					A1	for completion
	(b)	$x = \frac{- -8 \pm \sqrt{(-8)^2 - 4 \times 1 \times (-144)}}{2} \text{ or } \frac{8 \pm \sqrt{8^2 - 4 \times 1 \times (-144)}}{2} \text{ or } \frac{8 \pm \sqrt{-8^2 - 4 \times 1 \times (-144)}}{2}$	20.6	4	M1	M1 for correctly substituting into the quadratic formula condone one sign error in substitution; allow partial correct evaluation
		$\frac{8 \pm \sqrt{640}}{2} \text{ or } \frac{- -8 \pm \sqrt{(-8)^2 - -576}}{2 \times 1}$ $\text{or } \frac{8 \pm 8\sqrt{10}}{2}$ <p>NB denominator must be <math>2 \times 1</math> or 2 <b>and</b> there must be evidence for correct order of operations in the numerator Allow + instead of <math>\pm</math> in the formula</p>			M1	If the first M1 is awarded and an answer of 16.6.... or $4 + 4\sqrt{10}$ seen award this M mark
					A1	(dep on M1) 16.6....
					B1	(dep on M1) 20.6 - 20.65 ft
					<b>Total 7 marks</b>	

  

<b>17</b>		FDs are 2, 3, 2.8, 0.7, 0.8	Correct histogram	3	M1	for any two correct FD calculations (can be implied by at least two correct bars)
					M1	for any three correct FDs (can be implied by at least three correct bars )
					A1	fully correct histogram
						(SC: B2 for all five bars of correct width with heights in the correct ratio)
						(SC: B1 for three bars of correct width with heights in the correct ratio)
					<b>Total 3 marks</b>	

<b>18</b>	$SQ^2 = 8^2 + 12^2 - 2 \times 8 \times 12 \times \cos 120^\circ$	91.4	6	M1	If this mark is awarded then ft on the remaining M marks
	$(SQ) = \sqrt{304}$			M1	for correct order of operations e.g. $64 + 144 + 96$ or $304$ or $17.4\dots$ or $4\sqrt{19}$
	$\frac{\sin R}{\sqrt{304}} = \frac{\sin 27^\circ}{9}$			M1	
	$R = \sin^{-1} \left( \frac{\sin 27^\circ \times \sqrt{304}}{9} \right)$			M1	can be implied by 61.5833...
	61.58			A1	for 61.58 - 61.6
				B1	ft dep M3 $180 - "61.6" - 27$
				<b>Total 6 marks</b>	

<b>19</b>	$\frac{dy}{dx} = 3x^2 - 27$	108		M1	for at least one of $3x^2$ or 27
	$3x^2 - 27 = 0$			M1	(dep) for a 2 or 3 term quadratic =0
	$x = \pm 3$			A1	
	When $x = -3$ , $b = (-3)^3 - 27(-3) + k (= 54 + k)$ When $x = 3$ , $d = 3^3 - 27(3) + k (= -54 + k)$			M1	for either substituting $x = 3$ or $x = -3$ into the y expression. Only award this mark if $k$ or a number representing $k$ is in the expression for $b$ or $d$
	$b - d = 54 + k - (-54 + k)$			M1	dep on all previous M marks Expressions for $b$ and $d$ must have $k$ or the same number representing $k$
				A1	
				<b>Total 6 marks</b>	

<b>20</b>	$h = f\left(\frac{x+1}{2}\right) = 1 + \frac{1}{\frac{x+1}{2}} \left(= 1 + \frac{2}{x+1}\right)$	$\frac{2}{x-1} - 1$ or $\frac{3-x}{x-1}$	4	M1 for $1 + \frac{1}{\frac{x+1}{2}}$
	$\left(y = 1 + \frac{2}{x+1}\right)$ $y - 1 = \frac{2}{x+1}$ or $y(x+1) = 1(x+1) + 2$			M1 (dep on M1) for a correct first step to change the subject
	$x + 1 = \frac{2}{y-1}$ or $xy - x = 3 - y$			M1 (dep on M1)
	$x = \frac{2}{y-1} - 1$ or $x = \frac{3-y}{y-1}$			A1 oe
				<b>Total 4 marks</b>
	<b>Alternative scheme</b>			
	$h = f\left(\frac{x+1}{2}\right) = 1 + \frac{1}{\frac{x+1}{2}} \left(= 1 + \frac{2}{x+1} = \frac{x+3}{x+1}\right)$	$\frac{3-x}{x-1}$	4	M1 for $1 + \frac{1}{\frac{x+1}{2}}$
	$\left(y = \frac{x+3}{x+1}\right)$ $y(x+1) = (x+3)$			M1 (dep on M1) for a correct first step to change the subject
	$xy - x = 3 - y$			M1 (dep on M1)
	$x = \frac{3-y}{y-1}$			A1 oe
				<b>Total 4 marks</b>
<b>Note: Allow candidates to swap <math>x</math> and <math>y</math> when finding the inverse</b>				

<b>21</b>	(a)	$x(x^2 - 1)$ or $(x^2 - x)(x + 1)$	$x^3 - x$	1	B1 for correct expansion of a pair of brackets and then $x^3 - x$ written down
	(b)	(One of the numbers) is even <b>or</b> multiple of 2 <b>or</b> 2 is a factor	Proof	3	M1
		(One of the numbers) is a multiple of 3 <b>or</b> 3 is a factor			M1
		Hence a multiple of 6			A1
					<b>Total 4 marks</b>

<b>22</b>	$\frac{4}{3} \times \pi \times R^3 - \frac{4}{3} \times \pi \times 1.2^3$ or $\frac{4}{3} \times \pi \times (1.2 + t)^3 - \frac{4}{3} \times \pi \times 1.2^3$	3.9	5	M1 for an expression for the volume of the inner sphere
	$\left( \frac{4\pi}{3} R^3 - \frac{4}{3} \times \pi \times 1.2^3 \right) \times 2700 = 1980$			M1
	$\frac{4\pi}{3} R^3 = \frac{4}{3} \times \pi \times 1.2^3 + \frac{1980}{2700}$ $= 7.238229474 + 0.7333333$ $= 7.97(1562807)$			M1 for a correct expression or sight of 7.23(8229474) + 0.73(33333) or sight of 7.97(1562807)
	$R = \sqrt[3]{\left( \frac{3}{4\pi} \times \left( \frac{4}{3} \times \pi \times 1.2^3 + \frac{1980}{2700} \right) \right)} = 1.2392...$ $1.2392 - 1.2 = 0.0392$			M1 for a correct expression or sight of $\sqrt[3]{1.90(3070437)}$ or sight of 1.23(9229151) or sight of 0.0392(29151)
				A1 for 3.9 – 3.92
				<b>Total 5 marks</b>

<b>23</b>	(First term = 3 and last term = 999) or $a = 3$ and $d = 3$	166 833	4	M1
	$999 \div 3 (= 333)$			M1 for finding the number of terms Allow $1000 \div 3 = 333.3 = 333$
	Sum = $\frac{333}{2}(3 + 999)$ or Sum = $\frac{333}{2}(2 \times 3 + (333 - 1)3)$			M1 for using a correct method to find the sum
				A1
				<b>Total 4 marks</b>

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