

Mark Scheme (Results)

January 2020

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
- awrt – answer which rounds to
- 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, mark the method that leads to the answer on the answer line; where no answer is given on the answer line, award the lowest mark from the methods shown.
  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 to another.

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Apart from questions 2, 6, 10, 13a, 18ai (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	e.g. $36 \div (2 + 6)$ $(= 4.5)$ **or** $36 \div \frac{2+6}{3+2+6} (= 49.5)$ oe **or** Asha = £9 **OR** Julie = £27			M1
	e.g. $3 \times$ "4.5" **or** $"49.5" \times \frac{3}{3+2+6}$ **or** $"9" \times \frac{3}{2}$ **or** $"27" \times \frac{3}{6}$			M1 or an answer of $\frac{27}{2}$
		13.5(0)	3	A1 SCB1 for 36/5 × 6 (=43.2) or 36/9 × 2 (=8)
				Total 3 marks

2	e.g. $\frac{16}{5}$ **and** $\frac{21}{8}$ oe			M1	both fractions expressed as improper fractions
	e.g. $\frac{\cancel{16}^{2}}{5} \times \frac{21}{\cancel{8}^{1}}$ **OR** $\frac{336}{40}$ oe			M1	correct cancelling **OR** multiplication of numerators and denominators without cancelling
	e.g. $\frac{16}{5} \times \frac{21}{8} = \frac{336}{40} = \frac{42}{5} = 8\frac{2}{5}$ **or** $\frac{16}{5} \times \frac{21}{8} = \frac{336}{40} = 8\frac{16}{40} = 8\frac{2}{5}$ **or** $\frac{\cancel{16}^{2}}{5} \times \frac{21}{\cancel{8}^{1}} = \frac{42}{5} = 8\frac{2}{5}$ **or** candidate clearly shows that in the question, the result of $8\frac{2}{5} = \frac{42}{5}$ and that their answer becomes $\frac{42}{5}$	shown	3	A1	Dep on M2 for conclusion to $8\frac{2}{5}$ from correct working – either sight of the result of the multiplication e.g. $\frac{336}{40}$ must be seen or correct cancelling prior to the multiplication to $\frac{42}{5}$ NB: use of decimals scores no marks
					Total 3 marks

3	a	e.g. $d - g = 2ac$ $\frac{d}{2c} = \frac{g}{2c} + a$			M1	for a correct first step e.g. subtract g from both sides **OR** divide all terms by 2 **OR** divide all terms by c **OR** divide all terms by $2c$
			$a = \frac{d-g}{2c}$	2	A1	oe
	b		$3f(3e-4)$	2	B2	(B1 for $3(3ef-4f)$ or $f(9e-12)$ or $3f(ke-4)$ or $3f(3e-m)$ where $k \neq 0$ and $m \neq 0$)
	c	$x^2 - 5x + 2x - 10$			M1	for any 3 correct terms **or** for 4 out of 4 correct terms ignoring signs **or** $x^2 - 3x\ldots$ **or** for $\ldots -3x - 10$
			$x^2 - 3x - 10$	2	A1	
	d	$\frac{n^{11}}{n^5}$ **OR** $n^{-1} \times n^7$ **OR** $n^4 \times n^2$ **OR** $n^4 \times n^7 \times n^{-5}$ **OR** $n^{"11"} \div n^5 = n^{("11"-5)}$			M1	for simplifying two terms
			n^6	2	A1	
						Total 8 marks

4	ai		b, l, u, e, g, r, y	1	B1	No incorrect or repeats
	aii		w, h, i, t	1	B1	No incorrect or repeats
	b		No with reason	1	B1	eg 'e is in all three sets' **OR** 'all three sets share a member' **OR** $B \cap G \cap W = (\{\})e(\{\})$
						Total 3 marks

5	$\pi \times 7.2^2 \div 2$ (= 81.4....)			M1	allow 81.3 – 81.5 for area of semi circle
	"81.4" ÷ 6 (= 13.5...) **or** 12 × 6 (= 72) **or** "81.4" ÷ 12 (= 6.7...)			M1	(dep) allow 13.5 – 13.6 for the number of boxes needed (NB: 12 × 6 = 72 alone is 0 marks)
		No with correct figures	3	A1	
					Total 3 marks

6	$(x \pm 9)(x \pm 4)$	$\frac{-(-5) \pm \sqrt{(-5)^2 - 4 \times 1 \times (-36)}}{2 \times 1}$ **or** $\frac{5 \pm \sqrt{25 + 144}}{2}$			M1	**or** $(x + a)(x + b)$ where $ab = -36$ **or** $a + b = -5$ **OR** correct substitution into quadratic formula (condone one sign error in a, b or c) (if + rather than ± shown then award M1 only unless recovered with answers)
	$(x - 9)(x + 4)$	$\frac{5 \pm \sqrt{169}}{2}$ **or** $\frac{5 \pm 13}{2}$			M1	**or** $\frac{5 \pm \sqrt{169}}{2}$ **or** $\frac{5 \pm 13}{2}$
			9, −4	3	A1	dep on at least M1
						Total 3 marks

7	20.40 ÷ (1 – 0.15)			M2	for a complete method eg 20.40 ÷ (1 – 0.15) for 20.40 ÷ (100 – 15) (= 0.24)
				(M1)	**or** e.g. $0.85x = 20.40$
		24	3	A1	
					Total 3 marks

8	28×5 (= 140) **OR** 26.5×2 (= 53)			M1	or 87
	$(28 \times 5 - 26.5 \times 2) \div (5 - 2)$			M1	for a complete method
		29	3	A1	
					Total 3 marks

9	$1.5 \times 2 \times 8$ (= 24 (cm^3))			M1	for finding the volume of the cuboid
	e.g. (V =) $\frac{5.73 \times 1000}{19.32}$ (= 296.58...) **or** (M =) 19.32 × "24" (= 463.68)			M2	complete method to find the volume of statue **or** the mass of one block, could work in g or kg (if not M2 then award M1 for correct use of density formula e.g. $19.32 = \frac{5.73 \times 1000}{V}$ **or** $19.32 = \frac{M}{"24"}$)
	e.g. "296.58" ÷ "24" (= 12.3576...) **or** "5730" ÷ "463.68" (= 12.3576...)			M1	could work in g or kg
		13	5	A1	cao
					Total 5 marks

10	e.g. $6(x - 1)$ ($= 6x - 6$)			M1	method to find expression for perimeter of hexagon
	e.g. $2(x + 5) + 2x - 3$ ($= 4x + 7$)			M1	method to find expression for perimeter of triangle
	"$6x - 6$" = "$4x + 7$"			M1	(dep on at least M1) for equating both expressions
	e.g. $6x - 4x = 7 + 6$			M1	(dep on previous M1 and equation of the form $ax + b = cx + d$) for rearranging the x terms on one side and the numerical terms on the other and all expansions correct.
		5.5	5	A1	oe (dep on M2)
					Total 5 marks

11	a		4.35	1	B1	accept 4.349&
	b		4.25	1	B1	cao
	c	17.5 **or** 9.35 **or** $e - f$ where $17 < e \leq 17.5$ and $9.35 \leq f < 9.4$			M1	
			8.15	2	A1	
						Total 4 marks

12	a		23	1	B1	accept 22 – 24
	b	e.g. 29 − 17			M1	For subtracting readings from 15 and 45
			12	2	A1	accept 10 – 14
	c				B1	ft comparison of the medians
			Two comparisons (at least one of which must be in context)	2	B1	ft comparison of the IQR **Note: to award 2 marks at least one comparison must be in context**
						Total 5 marks

13	a	e.g. $x = 0.57272....$ **and** $100x = 57.272....$ **OR** e.g. $10x = 5.7272....$ **and** $1000x = 572.72....$			M1	For 2 recurring decimals with correct algebraic labels that when subtracted give a whole number or terminating decimal eg 56.7 or 567 etc e.g. $100x = 57.272....$ **and** $x = 0.57272....$ **OR** $1000x = 572.72....$**and** $10x = 5.7272....$ **with intention to subtract.** (If recurring dots not shown then showing at least the digits 57272, ie 5sf)
		e.g. $100x - x = 57.272.... - 0.57272.... = 56.7$ **and** $\frac{56.7}{99} = \frac{63}{110}$ **or** $1000x - 10x = 572.72.... - 5.7272.... = 567$ **and** $\frac{567}{990} = \frac{63}{110}$	Shown	2	A1	for completion to $\frac{63}{110}$
	b	$\frac{3}{2-} \times \frac{2+}{2+}$ **or** $6+3\sqrt{y}$ **or** $4-y$			M1	for multiplying numerator and denominator by $(2+\sqrt{y})$ **or** a correct expression for the numerator or denominator
			$\frac{6+3\sqrt{y}}{4-y}$	2	A1	
						Total 4 marks

14	(AOC =) 38 × 2 (= 76)		4	M1
		52		A1
				B2 (dep on M1) for all reasons relevant to their method – underlined words must be seen. angle at the centre is 2 × (double) angle at circumference / angle at circumference is ½ angle at centre angles in a triangle add to 180° **or** angles in a triangle add to 180° base angles in an isosceles triangle (are equal) If not B2 then award B1 (dep on M1) for a correct circle theorem
				Total 4 marks

15	e.g. (EF =) 12cos40 (= 9.19...) **or** (FD =) 12sin40 (= 7.71...) **and** (EF =) $\sqrt{12^2 - "7.71"^2}$ (= 9.19...)			M2 complete method to find EF (if not M2 then M1 for a correct statement involving EF e.g. $\frac{EF}{12} = \cos 40$)
	e.g. $\frac{"9.19"}{EG} = \tan 28$ or $\tan 62 = \frac{EG}{"9.19"}$ **or** $\frac{"9.19"}{FG} = \sin 28 (= 19.5...)$ **and** $"19.5"^2 - "9.19"^2 (= 298.9...)$			M1 (dep on M2) for a correct trig statement involving EG **or** complete method to find FG **and** a correct start to Pythagoras process
		17.3	4	A1 accept 17.2 – 17.3
				Total 4 marks

16	0.42 ÷ 0.6 (= 0.7) oe			M1	(indep)
	1 – "0.7" (= 0.3) oe **OR** 1 – 0.6 (= 0.4) oe			M1	(indep)
	"0.3" × "0.4" oe **OR** 1 – (0.42 + 0.6 × "0.3" + "0.4" × "0.7") oe			M1	for a complete method
		0.12	4	A1	oe
					Total 4 marks

17	a		9	1	B1	
	b		f(x) ≥ 0	1	B1	accept $y \geq 0$ or f ≥ 0
	c	(g(2) =) $\frac{4}{2+3}\left(=\frac{4}{5}\right)$ oe			M1	**or** for sight of fg(x) e.g. $\left(\frac{4}{x+3}-4\right)^2$
			10.24	2	A1	oe e.g. $\frac{256}{25}$
						Total 4 marks

18	ai				B1	tangent drawn at P ($x = 2$)
					M1	(dep on B1) for a method to find gradient e.g. $\frac{\text{difference in } y\text{-values}}{\text{difference in } x\text{-values}}$
			−0.6	3	A1	(dep on B1) accept answers in range −0.4 to −0.7 **and** from correct figures for their line
	aii	e.g. $y = -0.6x + c$ **or** $y = mx + 3.6$ **or** $2.4 = -0.6 \times 2 + c$			M1	for start of method to find the tangent equation e.g. $y = mx + c$ where m is their gradient **or** $y = mx + c$ where c is the y-intercept for their tangent **or** for substituting a point from their tangent e.g. (2, 2.4) into $y = mx + c$ where m is their gradient
			$y = -0.6x + 3.6$	2	A1	ft their gradient from (i) and intercept of their tangent, so long as intercept / value of c is > 3
	b		3		B1	
			−1	2	B1	
						Total 7 marks

19	eg $5 \times 2x + 10 \times x = 160$ **OR** $160 \div 2$ (= 80) [freq of one bar] **OR** $40 \times 5 + 20 \times 10$ (= 400) [total no. of sml squares] **OR** $160 \div 16$ (= 10) [students per $1cm^2$] **OR** $1cm^2 = 10$ students **OR** **e.g.** 5 small squares = 2 students oe			M1	for setting up an appropriate equation **OR** finding the area of the 2^{nd} or 3^{rd} bar **OR** finding the total number of small squares **OR** for finding the number of students per $1cm^2$ **or** $1cm^2 = 10$ students **OR** other appropriate scale e.g. 5 small squares = 2 students
	'x' = 8 **OR** 8 or 16 seen in the correct position on the vertical scale **OR** $160 \div$ "400" (= 0.4 oe)			M1	for finding frequency density **OR** method to find the frequency of the 1^{st}, 4^{th} or 5^{th} bar (1^{st} is 108, 4^{th} is 90, 5^{th} is 12)
	"7.2" × 15 + 160 + "6" × 15 + "2.4" × 5 **OR** 160 + "0.4" × (18 × 15 + 15 × 15 + 5 × 6)			M1	(dep on at least M1) for a complete method to find the total frequency (allow one error or one repeat but no omission)
		370	4	A1	
					Total 4 marks

20	$\frac{1}{3}\times\pi\times r^2\times 2h\left(=\frac{2}{3}\pi r^2h\right)$ **OR** $\frac{1}{3}\times\pi\times(0.5r)^2\times h\left(=\frac{1}{12}\pi r^2h\right)$			M1	for finding the volume of the small or large cone
	$"\frac{2}{3}\pi r^2h" - "\frac{1}{12}\pi r^2h" \left(=\frac{7}{12}\pi r^2h\right)$			M1	(dep) method to find the volume of the frustum (condone missing brackets)
	$"\frac{2}{3}\pi r^2h" - "\frac{1}{12}\pi r^2h" = \frac{4\pi r^3}{3}$			M1	equating volume of frustum and sphere (must be correct including brackets)
	e.g. $\frac{7}{12}\pi r^2h = \frac{4\pi r^3}{3}$			M1	for a correct simplified formula (1 term on each side)
		$\frac{7}{16}h$	5	A1	accept $0.4375h$
					Total 5 marks

21	$CB = 13\sin 40$ (= 8.3562...)			M1
	$\frac{1}{2}\times 6\times "8.35..."\times \sin ACB = 22$			M1
	Acute version of $ACB = \sin^{-1}\left(\frac{22}{\frac{1}{2}\times 6\times "8.35..."}\right)$ (= 61.35…)			M1
	ACB = 180 – "61.353…" (= 118.647...)			M1
	$AB^2 = 6^2 + "8.35..."^2 - 2\times 6\times "8.35..."\times \cos "118.64"$ (= 153.98...)			M1
		12.4	6	A1 accept 12.3 – 12.5
				Total 6 marks

22	a			2	M1	for one correct value
			2.5, −60		A1	oe e.g. −2.5 & 120
					SC	M1 for drawing cos curve
	bi		(2, 5)	1	B1	
	bii		(4, −2)	1	B1	
						Total 4 marks

23	$(v=)\ 3t^2 + 2\times 4t - 5$				M1	2 out of 3 terms differentiated correctly
	$3T^2 + 8T - 5 = V$ **OR** $3T^2 + 8T - 5 - V = 0$				A1	correct equation
	$3(T^2 + \frac{8}{3}T) - 5$ **OR** $3(T^2 + \frac{8}{3}T - \frac{5}{3})$	$(T=)\ \frac{-8\pm\sqrt{8^2-4\times3\times(-5-V)}}{2\times3}$			M1	attempt to complete the square **OR** use quadratic formula (condone one sign error in a, b or c and ft their quadratic with mistake in a or b) (condone + instead of ±)
	$\left(T+\frac{4}{3}\right)^2 = \left(\frac{4}{3}\right)^2 + \frac{V+5}{3}$	$(T=)\ \frac{-8\pm\sqrt{124+12V}}{6}$			M1	sight of this method mark implies the previous M1 (condone + instead of ±) (ft their quadratic with mistake in a or b)
	$T = \frac{-4}{3} \pm \frac{1}{3}\sqrt{16+3V+15}$	$(T=)\ \frac{-8\pm2\sqrt{31+3V}}{6}$			M1	(condone + instead of ±) (ft their quadratic with mistake in a or b)
			$\frac{-4+\sqrt{31+3V}}{3}$	6	A1	accept $k = 31$ and $m = 3$
						Total 6 marks

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