Mark Scheme (Results)

November 2020

Pearson Edexcel International GCSE
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 1, 3c, 12, 13b, 19, 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.				
Q	**Working**	**Answer**	**Mark**	**Notes**
1	e.g. $\frac{15}{4}$		3	M1 for $3\frac{3}{4}$ expressed as an improper fraction
	e.g. $\frac{\cancel{15}^{5}}{4}\times\frac{7}{\cancel{9}^{3}}$ **OR** $\frac{105}{36}$ oe			M1 correct cancelling or multiplication of numerators and denominators without cancelling
	e.g. $\frac{\cancel{15}^{5}}{4}\times\frac{7}{\cancel{9}^{3}}=\frac{35}{12}=2\frac{11}{12}$ **or** $\frac{15}{4}\times\frac{7}{9}=\frac{105}{36}=\frac{35}{12}=2\frac{11}{12}$ **or** $\frac{15}{4}\times\frac{7}{9}=\frac{105}{36}=2\frac{33}{36}=2\frac{11}{12}$	shown		A1 dep on M2, for conclusion to $2\frac{11}{12}$ from correct working – either sight of the result of the multiplication e.g. $\frac{105}{36}$ oe must be seen **or** correct cancelling prior to the multiplication to $\frac{35}{12}$ NB: use of decimals scores no marks
				Total 3 marks

2			2	M1 Arcs on *BC*, *AB* and arcs from these points meeting **or** for bisector without arcs
		Correct bisector		A1 must see correct arcs
				Total 2 marks

3	(a)		h^9	1	B1	
	(b)	$(-5)^2 - 4 \times -5$ oe e.g. 25 + 20		2	M1	for a correct substitution
			45		A1	
	(c)	$5x - 3 = 4(2x + 3)$ oe **or** $\frac{5x}{4} - \frac{3}{4} = 2x + 3$ oe		3	M1	for correctly removing the denominator, condone missing brackets
		e.g. $5x - 8x = 12 + 3$ **or** $-3x = 12 + 3$ **or** $8x - 5x = -12 - 3$ **or** $3x = -12 - 3$ **or** $-\frac{3}{4} - 3 = 2x - \frac{5x}{4}$ **or** $-\frac{15}{4} = \frac{3x}{4}$			M1	for a correct rearrangement with terms in x on one side and numbers on the other, allow correct rearrangement of their equation in the form $ax + b = cx + d$
			-5		A1	dep on at least M1 SCB2 for an answer of $x = -2$ coming from $5x - 3 = 8x + 3$ **or** $x = 5$ coming from $5x - 3 = 2x + 12$
						Total 6 marks

4	(a)		$30 < t \leq 40$	1	B1	
	(b)	e.g. $5 \times 4 + 15 \times 10 + 25 \times 15 + 35 \times 25 + 45 \times 6$ (= 1690) **or** 20 + 150 + 375 + 875 + 270 (= 1690)		4	M2	For correct products using midpoints (allowing one error) with intention to add. If not M2 then award M1 for products using frequency and a consistent value within the range (allowing one error) with intention to add or correct products using midpoint without addition.
		"1690" ÷ 60			M1	dep on M1
			28.2		A1	accept 28.1 – 28.2
						Total 5 marks

5	(a)	8265 – 7500 (= 765) **or** $\frac{8265}{7500}(=1.102)$		3	M1	8265 – 7500 could be embedded in another calculation.
		$\frac{"765"}{7500}\times 100$ oe **or** "1.102" × 100 – 100 oe			M1	
			10.2		A1	oe
	(b)	e.g. 31.5(0) ÷ (1 – 0.3)		3	M2	for a complete method e.g. 31.5(0) ÷ (1 – 0.3)
					(M1)	for 31.5(0) ÷ (100 – 30) (= 0.45) **or** e.g. (1 – 0.3)x = 31.5(0)
			45		A1	
						Total 6 marks

6	e.g. $a = (-3 + 47) \div 2$ (= 22) **or** $\frac{11+b}{2} = -19$ ($b = -38 - 11 = -49$) **or** method to add 25 to −3 **or** method to subtract 25 from 47 **or** method to subtract 30 from −19 **or** method to subtract 60 from 11		2	M1	for a correct method to find either coordinate or one coordinate correct. Look for correct method on their diagram, if used.
		$a = 22,\ b = -49$		A1	both correct
					Total 2 marks

7	Use of 2 hrs 42 mins = 2.7 hrs **or** 162 mins		4	B1	
	e.g. 90×2.7 (= 243) **or** e.g. $\frac{90}{60} \times 162 (= 243)$ **or** e.g. $\frac{S}{90} = \frac{2.7}{3}$			M1	for use of $D = S \times T$ (accept use of their time e.g. 90×2.42) **or** for setting up an equation using proportion
	e.g. "243" ÷ 3 **or** $(S =) \ 90 \times \frac{2.7}{3}$			M1	(dep on M1) for their $D \div 3$ **or** for solving their equation
		81		A1	
					Total 4 marks

8	for 0.08×1200 oe (= 96) **or** 1.08×1200 oe (= 1296)	**OR** 1200×1.08^3		3	M1	for 0.08×1200 oe (= 96) **or** 1.08×1200 oe (= 1296)	**OR** M2 for 1200×1.08^3 **or** 1200×1.08^4 (= 1632.59)
	$1.08 \times$ "1296" (= 1399.68) oe $1.08 \times$ "1399.68" (= 1511.6544) oe				M1	for completing method to find total amount in the account	(M1 for 1200×1.08^2 (= 1399.68))
			1512		A1	accept 1511 – 1512	
						SC: if no other marks gained award M1 for 0.24×1200 oe **or** 288 **or** 1488 accept (1 + 0.08) as equivalent to 1.08 throughout	
							Total 3 marks

9	e.g. 1.5 × 1.5 (= 2.25 oe)		3	M1	for calculating the area of the square, may be seen embedded within a calculation
	e.g. 34.8 × "2.25"			M1	for a complete method to find the force
		78.3		A1	oe
					Total 3 marks

10	e.g. $\frac{3}{"10"} \times 80 (= 24)$ **or** $\frac{2}{"10"} \times 80 (= 16)$ **or** $\frac{5}{"10"} \times 80 (= 40)$		5	M2	for a complete method to find the number of chocolate cakes **or** lemon cakes **or** fruit cakes "10" comes from 3 + 2 + 5
				(M1	for correct use of the ratio e.g. 80 ÷ "10" (= 8))
	e.g. "16" × $\frac{3}{4}$ × 1.7(0) (= 20.4(0)) **or** "40" × $\frac{7}{8}$ × 2.4(0) (= 84)			M1	for a method to find the profit for lemon cakes **or** fruit cakes
	e.g. "24" × 2 (= 48) **and** "16" × $\frac{3}{4}$ × 1.7(0) (= 20.4(0)) **and** "40" × $\frac{7}{8}$ × 2.4(0) (= 84)			M1	for a method to find the profit for all 3 cakes
		152.4(0)		A1	
					Total 5 marks

11	(a)		9, 28, 45, 63, 76, 80	1	B1	
	(b)			2	B2	for a correct cf graph with points at ends of intervals and joined with a curve or line segments If not B2 then B1 for 5 or 6 of their points (ft from a table with only one arithmetic error) at ends of intervals and joined with a curve or line segments **OR** for 5 or 6 points plotted correctly at ends of intervals not joined **OR** for 5 or 6 of their points from table plotted consistently within each interval (not at upper ends of intervals) at their correct heights and joined with a curve or line segments
	(c)	e.g. reading across from 40 and reading down		2	M1	ft reading from a cf graph provided method is shown
			35 - 38		A1	ft from their cf graph
						Total 5 marks

12	e.g. $35x + 10y = 27.5$ **or** $21x + 6y = 16.5$ $6x - 10y = 34$ $\quad$ $21x - 35y = 119$ $41x = 61.5$ $\quad$ $41y = -102.5$ e.g. $3x - 5\left(\frac{5.5-7x}{2}\right) = 17$ or $7\left(\frac{17+5y}{3}\right) + 2y = 5.5$ oe		4	M1	for a correct method to eliminate x or y: coefficients of x or y the same **and** correct operator 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.
		$x = 1.5$ **or** $y = -2.5$		A1	oe, dep on M1
				M1	(dep on 1st M1) for a correct method to find other variable by substitution of found variable into one equation **or** for repeating the above method to find the second variable.
		$x = 1.5$ **and** $y = -2.5$		A1	oe, dep on M1
					Total 4 marks

13	(a)		$15x^2 - 2x - 6$	2	B2 (B1	for correct differentiation for 2 of $15x^2$, $-2x$, -6 correct)
	(b)	e.g. "$15x^2 - 2x - 6$" = 2 oe		4	M1	ft, for equating their dy/dx to 2
		$15x^2 - 2x - 8$ (= 0)			M1	(dep on M1) ft their three-term quadratic
		e.g. $(3x + 2)(5x - 4)$ (= 0) $x = \frac{2 \pm \sqrt{(-2)^2 - (4 \times 15 \times -8)}}{2 \times 15}$			M1	for solving their quadratic equation using any correct method - if factorising, allow brackets which expanded give 2 out of 3 terms correct (if using formula or completing the square allow one sign error and some simplification – allow as far as e.g. $\frac{2 \pm \sqrt{4 + 480}}{30}$ oe)
			$-\frac{2}{3}, \frac{4}{5}$		A1	oe, dep on M2 (allow -0.66 or better), Both values – isw any attempt to find y coordinates
						Total 6 marks

14	$(4x+1)(x-3)=4x^2-12x+x-3(=4x^2-11x-3)$ $(4x+1)(5x+6)=20x^2+24x+5x+6(=20x^2+29x+6)$ $(x-3)(5x+6)=5x^2+6x-15x-18(=5x^2-9x-18)$		3	M1	for multiplying 2 brackets with at least 3 out of 4 terms correct
	$(5x+6)(4x^2-11x-3)=20x^3-55x^2-15x+24x^2-66x-18$ $(x-3)(20x^2+29x+6)=20x^3+29x^2+6x-60x^2-87x-18$ $(4x+1)(5x^2-9x-18)=20x^3-36x^2-72x+5x^2-9x-18$			M1	(dep) for multiplying the product of the first 2 brackets (ft from the 1st stage) by the 3rd bracket, and getting at least 3 out of 6 or 4 out of 8 terms correct
		$20x^3-31x^2-81x-18$		A1	
	Alternative				
	$20x^3+24x^2-60x^2+5x^2-15x+6x-72x-18$			B2	for at least 6 out of 8 terms correct (B1 for 4 or 5 out of 8 correct terms)
		$20x^3-31x^2-81x-18$		A1	
					Total 3 marks

15		*BDF* = 70°	4	B1	may be marked on diagram
		Alternate segment theorem		B1	reason, the angle between a tangent and a chord is equal to the angle subtended in the alternate segment
		EFB = 180 – (70 + 40) = 70 opposite angles in a cyclic quadrilateral		B1	Angle *EFB* with reason, opposite angles in a cyclic quadrilateral sum to 180°
		CBF = *EFB* alternate angles therefore *EF* is parallel to *ABC*		B1	conclusion, alternate angles are equal
					Total 4 marks

16	(a)		−4	1	B1	
	(b)	(f(2.6) =) 5 × 2.6 − 7 (= 6) **or** $gf(x) = \frac{5(5x-7)}{5x-7+4}$ oe		2	M1	for finding f(2.6) **or** gf(x)
			3		A1	
	(c)	$5\left(\frac{5x}{x+4}\right)-7=2$ **or** $\frac{5x}{x+4}=\frac{2+7}{5}$ oe		3	M1	
		$25x = 9(x + 4)$ oe			M1	for removing the denominator $(x + 4)$ in a correct equation
			2.25		A1	oe
	ALT (c)	$fg(x) = 2 \Rightarrow g(x) = f^{-1}(2)$ (=9/5) and attempt at f^{-1} or $f^{-1}(2)$			M1	
		$x = g^{-1}$("9/5")			M1	
			2.25		A1	oe
	(d)	$y=\frac{5x}{x+4}$ **or** $x=\frac{5y}{y+4}$ $y(x+4)=5x$ $x(y+4)=5y$		3	M1	
		e.g. $4y = x(5 - y)$ **or** e.g. $4x = y(5 - x)$			M1	for a correct rearrangement and factorising
			$\frac{4x}{5-x}$		A1	oe e.g. $\frac{-4x}{x-5}$
						Total 9 marks

17 (a)	(*FH* =) $\sqrt{12^2+12^2}$ (=16.97... or $\sqrt{288}$ or $12\sqrt{2}$)		3	M1	
	$\tan CFH = \frac{10}{"16.97..."}$ oe **or** e.g. (*CF* =) $\sqrt{"16.97"^2+10^2}$ (=19.69... or $\sqrt{388}$ or $2\sqrt{97}$) **and** e.g. $\frac{\sin CFH}{10} = \frac{\sin 90}{"19.69"}$			M1	for a correct trig statement involving *CFH*
		30.5		A1	accept 30.4 – 30.7
(b)	(*BG* =) 10 + $\sqrt{15^2-12^2}$ (=19)		3	M1	
	(*BE* =) $\sqrt{"19"^2+"16.97..."^2}$ oe			M1	ft their *FH*
		25.5		A1	accept 25.4 – 25.6
					Total 6 marks

18	$a + 5d = 39$ **or** $a + 18d = 7.8$ **or** $13d = -31.2$ oe		4	M1	
	$a = 51$ **or** $d = -2.4$			A1	
	e.g. $\frac{25}{2}(2\times 51+(25-1)\times -2.4)$ oe **or** $12.5(2a + 23d + d) = 12.5(39 + 7.8 – 2.4)$ oe			M1	for substituting their values for *a* and *d* into S_n, *a* and *d* must be clearly stated.
		555		A1	
					Total 4 marks

19	8.35 **or** 7.25 **or** 6.15 **or** 5.25		3	B1	
	(8.35×7.25) – (6.15×5.25)			M1	Allow $UB_{AD}\times UB_{DC} - LB_{EH}\times LB_{HG}$ where $8.3 < UB_{AD} \leq 8.35$, $7.2 < UB_{DC} \leq 7.25$ $6.15 \leq LB_{EH} < 6.2$, $5.25 \leq LB_{HG} < 5.3$
		28.25		A1	oe, dep on M1
					Total 3 marks

20	(i)		(−3, −2)	1	B1	
	(ii)		(−1.5, 4)	1	B1	oe
						Total 2 marks

21	$12^2 = 2^4 \times 3^2$ **or** $2 \times 12^2 = 2^5 \times 3^2$ oe **or** $\frac{2\times12^2}{3^2}(=32) = 2^5$		5	M1	
	$18^{4n} = (2 \times 3^2)^{4n}$ **or** $2^{4n} \times 3^{2\times4n}$			M1	
	$3n^2 - 14n - 5\ (= 0)$			A1	
	e.g. $(3n + 1)(n - 5)(= 0)$ $n = \frac{14 \pm \sqrt{(-14)^2 - (4\times3\times-5)}}{2\times3}$			M1	for solving their 3 term quadratic equation using any correct method - if factorising, allow brackets which expanded give 2 out of 3 terms correct (if using formula or completing the square allow one sign error and some simplification – allow as far as e.g. $\frac{14 \pm \sqrt{196+60}}{6}$ oe)
		$-\frac{1}{3}$, 5		A1	Allow −0.33 or better for $-\frac{1}{3}$
					Total 5 marks

22	Ext angle of octagon = 360 ÷ 8 (= 45) **or** Int angle of octagon (8 – 2) × 180 ÷ 8 oe (= 135)		6	M1	for method to find the size of one exterior **or** one interior angle of a regular octagon
	e.g. 10 + 2 × 10 × sin45 (= $10+10\sqrt{2}$ or 24.1...) **or** e.g. $\frac{10\sin 112.5}{\sin 22.5}$ (= 24.1…)			M1	method to find *HE* **or** *AD* 22.5 comes from (180 – "135") ÷ 2 112.5 comes from "135" – "22.5"
	e.g. 10 × ("$10+10\sqrt{2}$") (= 100 + $100\sqrt{2}$ or 241.4...) **or** 10 × "24.1…" (= 241.4…)			M1	area *ADEH*
	e.g. 10 × sin45° (=5 $\sqrt{2}$ or 7.07...) **or** e.g. $\sqrt{10^2+10^2-2\times10\times10\times\cos"135"}$ (= 18.4…) **or** $\frac{10\sin"135"}{\sin 22.5}$ (= 18.4…)			M1	finds perpendicular height of triangle *ACD* (may be found before, but must realise this is also height of triangle) **or** finds the length of *AC* 22.5 comes from (180 – "135") ÷ 2
	e.g. 0.5 × "24.1..." × "7.07…" (= 85.3...) **or** $0.5\times10\times"18.4..."\times\sin112.5$ (= 85.3…)			M1	finds the area of triangle *ACD* 112.5 comes from "135" – "22.5"
		327		A1	accept 326 – 327
	Alternative (splitting octagon into triangles and subtracting trapezium and triangle)				
	Ext angle of octagon = 360 ÷ 8 (= 45) **or** Int angle of octagon (8 – 2) × 180 ÷ 8 oe (= 135) **or** one of 8 angles at centre = 360 ÷ 8 (= 45)		6	M1	for method to find the size of one exterior **or** one interior angle of a regular octagon **or** method to find one angle at centre of octagon when split into 8 equal triangles
	e.g. 0.5 × 10 × 5 × tan67.5 (= 60.35...) **or** $0.5\times\left(\frac{10\sin 67.5}{\sin 45}\right)^2\times\sin 45$(= 60.35...) **or** Octagon = 8 × "60.35" (= 482.8...)			M1	Area of one triangle (one-eighth of octagon) **or** octagon
	e.g. 10 + 2 × 10×sin45°(= $10+10\sqrt{2}$ =24.14..)			M1	Method to find *HE*
	0.5 × (10 + $10+10\sqrt{2}$)× $5\sqrt{2}$ (=120.71...)			M1	Method to find area of trapezium *HEGF*
	0.5 × 10 × 10 × sin135°(= 35.35...)			M1	Method to find area of triangle *ABC*
		327		A1	accept 326 – 327
					Total 6 marks

23	e.g. $\frac{3}{x+7}\times\frac{2}{x+6}+\frac{4}{x+7}\times\frac{3}{x+6}+\frac{x}{x+7}\times\frac{x-1}{x+6}(=\frac{3}{8})$ **or** e.g. $\frac{3}{N}\times\frac{2}{N-1}+\frac{4}{N}\times\frac{3}{N-1}+\frac{N-7}{N}\times\frac{N-8}{N-1}(=\frac{3}{8})$ oe		4	M2	for all correct products and intention to add (M1 for one correct product)
	$5x^2 - 47x + 18 = 0$ oe ($x = 9$) **or** $5N^2 - 117N + 592 = 0$			M1	Correct quadratic equation
		16		A1	dep on M3
					Total 4 marks

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