Mark Scheme (Results)

January 2019

Pearson Edexcel International GCSE
Mathematics A (4MA0) Higher Tier
Paper 4HR

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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.

  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, 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

The correct answer, unless clearly, obtained by an incorrect method, should be taken to imply a correct method with the exception of Q5a, 7, 12a, 16, 19 and 20

Question	Working	Answer	Mark	Notes
1 (a)	15 400 × 63.21	973 434	2	M1 A1
(b)	$\frac{240}{15400}\times 100$	1.56	2	M1 A1 1.558441... Accept 1.558 → 1.56 inc.
2	$\sqrt{400} = 20$ $\pi\times$ '20' oe	62.8	3	M1 M1 dep A1 62.83185 ... Accept 62.8 → 62.9 inc.
3	40 min = $\frac{40}{60}$ hr $9720 \div 11\frac{40}{60}$ or 9720 ÷ 11.4 Alt: 11 hr 40 mins = 11×60 + 40 = 700 min 9720 ÷ 700 × 60	833 833	3	M1 M1 (accept 11.66 or 11.67 or better for 11 40/60) A1 833.1428.. Accept 833 → 833.2 inc. M1 M1 A1 833.1428.. Accept 833 → 833.2 inc. NB. Answer of 852(.63..) or 853 implies 9720 ÷ 11.4 M1M0A0

Question	Working	Answer	Mark	Notes
4 (a)	472 ÷ 20	23.6	2	M1 A1
(b)	10.8 ×100 (= 1080) '1080' ÷ 60 Alt: 60 ÷100 = 0.6 10.8 ÷ '0.6'	18 18	3	M1 working in cms M1 dep A1 (accept 1 : 18 or 18 : 1) M1 working in metres M1 dep A1 (accept 1 : 18 or 18 : 1)
5 (a)	5x – x = 8 + 2	2.5oe	3	M2 collecting x terms on one side **and** all numbers on the other side (accept 4x = 10) M1 for collecting x terms on one side **or** all numbers on one side (e.g. 6x = 8 + 2 or 4x = 8 – 2) A1 dep on at least M1 Accept x = 10/4 or 5/2
(b)		$t(3-5y)$	1	B1
(c)		k^6	1	B1
(d)	$\frac{5}{2h}-\frac{2}{2h}$ or $\frac{5h-2h}{2h\times h}$	$\frac{3}{2h}$	2	M1 for a correct (but possibly unsimplified) common denominator A1

Question	Working	Answer	Mark	Notes
6	$9^2 - 6^2$ (=45) $\sqrt{(9^2 - 6^2)}$ (=$\sqrt{45}$)	6.71	3	M1 or $9^2 = h^2 + 6^2$ or for a complete method to find an unknown angle, x (correct to 1 d.p) in the triangle e.g. $\cos^{-1}(6/9)$ (= 48.2°) or $\sin^{-1}(6/9)$ (= 41.8°) M1 for a complete method, using x, to find h e.g. 6 × tan 48.2° A1 Accept 6.7 → 6.71 inc.
7	$\frac{9}{4}$ $\frac{9}{4} \times \frac{5}{6} = \frac{45}{24}$ $\frac{45}{24} = 1\frac{21}{24}$ or $\frac{45}{24}$ cancelled down to $\frac{15}{8}$ Alt: $\frac{9}{4}$ cancelling 9 and 6 to get $\frac{3}{4} \times \frac{5}{2} = \frac{15}{8}$		3	M1 converting $2\frac{1}{4}$ into an improper fraction (e.g. $\frac{9}{4}$) M1 A1 dep M2 M1 converting $2\frac{1}{4}$ into an improper fraction (e.g. $\frac{9}{4}$) M1 A1 (dep M2)

Question	Working	Answer	Mark	Notes
8	6 × 12 (=72) or 0.5 × 7 × 4 (=14) or 6 × 5 (=30) or 7×6 (=42) 0.5 × {6+10} × 7 (=56) '30' + '42' +'14' or '72' +'14' or '30' + '56' '86' × 25 Alt: 6×12×25 (=1800) or 0.5×7×4×25 (=350) or 6×5×25 (=750) or 7×6×25 (=1050) or 0.5×{6+10}×7 (=1400) '1800'+ '350' or '750' + '1400' or '750' + '1050' + '350'	2150 2150	4	M1 for any correct calculation of a component of the cross-section (i.e. leading to 72 or 14 or 30 or 56 or 42) M1 dep correct cross-section components added to get total cross section (=86) M1 (dep on previous M1) A1 cao M1 for any correct calculation seen of one volume block (i.e. leading to 1800 or 350 or 750 or 1050 or1400) (M2 for any two correct volume calculations seen) M1 (dep on previous M2) correct volume components selected to be added A1

Question	Working	Answer	Mark	Notes
9	120 × 50 (= 6000) $120\times\frac{3}{4}\times80$ (=7200) or $120\times\frac{1}{4}\times40$ (=1200) ('7200' + '1200' – '6000') ÷ '6000' × 100 or ({'7200' + '1200'}÷ '6000' – 1) × 100 Alt: 120 × 50 (= 6000) $120\times\frac{3}{4}\times(80-50)$ (=2700) or $120\times\frac{1}{4}\times(40-50)$ (= – 300) ('2700' + ' – 300') ÷ '6000' × 100	40 40	4	M1 cost price M1 part profits M1 dep on M2 A1 M1 cost price M1 profit or loss M1 dep on M2 A1
10 (a)		1,3,5,7,8,9,10	1	B1
(b)		3, 9	1	B1
(c)		e.g. 1,2,4,5	2	B2 any set of 4 elements , one of which is 5 and the other three are from {1, 2, 3, 4, 6} (no repeats) If not B2 then B1 for either any set of 4 elements, from {1, 2, 3, 4, 6}(no repeats) or 5 and the other three are from {6, 7, 8, 9, 10} (no repeats)

Question	Working	Answer	Mark	Notes
11 (a)		10n +1	2	M1 10n + k oe (k any integer ≠ 1) A1
(b)		(x – 6)(x – 1)	2	B2 cao If not B2 then B1 for (x – a)(x – b) with ab = 6 or a + b = ±7
(c)	$6e^2 – 9ef – 8ef + 12f^2$	$6e^2 – 17ef + 12f^2$	2	M1 for 4 correct terms excluding signs or 3 correct terms with correct signs A1
12 (a)	20 28 **32** 32 36 36 37 37 **40** 41 42 40 – 32	8	3	M1 ordering all 11 numbers correctly M1 identifying 32 as LQ and 40 as UQ A1 dependent on M1
(b)		42	2	M1 identifying 11th data item in a new (correct) ordered list A1 (no working reqd)
13 (a)	$\frac{5}{4} = \frac{5+CE}{7}$ oe	3.75oe	2	M1 accept $(\frac{7}{4}\times 5 - 5)$ or $\frac{3}{4}\times 5$ A1
(b)	ASF = $\left(\frac{7}{4}\right)^2$ $(= 3.0625)$ '3.0625' × 8 – 8 oe	16.5	3	M1 M1 complete method A1

Question	Working	Answer	Mark	Notes
14	$1000\pi = 2\pi \times 10^2 + 2\pi \times 10\text{h} + \pi \times 10^2$ oe	35	3	M2 (π as a decimal: 3140 → 3143 = 628 → 629 + (62.8 → 62.9)h + 314) If not M2 then M1 for SA of hemisphere $= 2\pi \times 10^2$ ($= 200\pi$ oe) or for TSA of cylinder = $2\pi \times 10\text{h} + \pi \times 10^2$ ($= 20\pi\text{h} + 100\pi$ oe) A1
15 (a)	3/10 oe and label g or green Three extra branches drawn All labels and values correct on six branches		3	B1 correct label and value for first green branch B1 correct binary structure B1 see diagram at end
(b)	7/10 × '6/10' oe	0.42 oe	2	M1 ft from td with correctly labelled 2nd green branch A1
(c)	P(RR) + P(RG) + P(GR) = 7/10×'4/10' + 7/10×'6/10' + '3/10'×'4/10'			M2 ft from td 3 correctly labelled branches with an intention to add If not M2 then M1 for any 2 correctly labelled branches (ft from td) with an intention to add
	Alt: 1 – P(GG) = 1 – '3/10' × '6/10'	0.82 oe	3	M2 ft from td 2 correctly labelled branches If not M2 then M1 for '3/10' × '6/10' (ft from td) A1
16	$x^2 < 16$ or $x^2 < 32/2$ ± 4 or $\pm\sqrt{16}$ or $(x-4)(x+4)$	$-4 < x < 4$	4	M1 accept $x^2 = 16$ or $x^2 - 16 = 0$ or $x^2 - 16 < 0$ or $(x+4)(x-4) = 0$ or > 0 ignore ≤ in place of < at this stage. B1 (must see ±) A2 accept $x < 4$ **and** $x > -4$ if not A2 then A1 for $x < 4$ **or** $x > -4$ A marks dep on M1

Question	Working	Answer	Mark	Notes
17	Either BAD = 180 – 112 (=68) or (reflex) BOD = 2 × 112 (=224) Either ABD = 90 or (obtuse) BOD = 136 or BOA = 44 Alt: ACD = 90 (Angles in a semicircle) ACB = 112 – 90 = 22 ADB = 22 (Angles in the same segment / angles from the same chord)	22	5	M1 A1 can be marked on diagram (must be associated with correct angle) A1 2nd angle calculated A1 angle ADB B1 fully correct reasons for their paths NB: This is the most economical method (only requires 2 reasons) A1 M1 A1 A1 + B1 for both reasons Reasons: Opposite angles in a cyclic quadrilateral add up to 180 degrees Angles in a semicircle = 90 degrees / right angle or triangle with a diameter has a right angle / 90 degrees Angles in a triangle add up to 180 degrees Angles at centre = 2 × angles at circumference Base angles in an isosceles triangle are equal Angles on a straight line add up to 180 degrees Angles in the same segment / Angles from the same chord are equal **NB: Be careful here CBD and CDB ≠ 34 but this still gives correct answer**

Question	Working	Answer	Mark	Notes
18 (a)	$\frac{ds}{dt} = 1 - 36/t^2$	$1 - 36/t^2$	2	M1 for 1 or $-36/t^2$ Do <u>not</u> accept $(+)36/t^2$ or 1 from dividing s by t A1
(b)	'$1 - 36/t^2$' = 0 $t^2 = 36$	6	2	M1 ft part (a) = 0 followed by isolating t or t^2 A1 cao (ignore answer of –6)
(c)	$\frac{dv}{dt} = 2 \times 36/t^3$	9	2	M1 ft (a) A1 cao
19	$x^2 + (8 - 2x)^2 = 29$ $x^2 + 64 - 32x + 4x^2 = 29$ $5x^2 - 32x + 35 = 0$ '$(x - 5)(5x - 7)$' (= 0) $x = 5$, $x = 1.4$	$x = 5$, $y = -2$ $x = 1.4$, $y = 5.2$	6	M1 substitution for y M1 (indep) correct expansion of $(8 - 2x)^2$ A1 correct 3 term quadratic = 0 M1ft or formula $\frac{-(-)32 \pm \sqrt{(-32)^2 - 4 \times 5 \times 35}}{2 \times 5}$ or better <u>NB. 1 method mark can be awarded here for solving a 3 term quadratic provided the first M1 has been awared.</u> A1 Correct two x values or correct two y values A1 Correct pairing. Accept y = 26/5, x = 7/5, (1.4, 5.2) or (7/5, 26/5) (both A marks dep on first 2 method marks)
20	$(2^2)^n \times (2^3)^{n+1} = 24$ or $4^n \times (4)^{1.5(n+1)} = 4^2$ $2n + 3(n + 1) = 4$ or $n + 1.5(n + 1) = 2$	0.2	3	M1 Expressing all 3 terms as powers of 2 or powers of 4 M1 A1 dep on M2

Question	Working	Answer	Mark	Notes
21	$10 \times 1 + 20 \times 1.7 + 30 \times 2 + 20 \times 0.8$ $(= 10 + 34 + 60 + 16 = 120)$ $\frac{(110-90)\times h}{"120"+(110-90)\times h} \times 100 = 4$ oe $2000h = 4(“120” + 20h)$ $h = 0.25$ Alt: $10 \times 1 + 20 \times 1.7 + 30 \times 2 + 20 \times 0.8$ $(= 10 + 34 + 60 + 16 = 120)$ $\frac{x}{"120"+x} \times 100 = 4$ oe $100x = 4(‘120’ + x)$ $x = 5$ or 125 Alt: $5 \times 10 + 10 \times 17 + 15 \times 20 + 10 \times 8$ $(= 50 + 170 + 300 + 80 = 600)$ $\frac{600}{96} \times 4$ (small squares) = 25 Alt: $2 + 6.8 + 12 + 3.2$ (= 24) $\frac{24}{96} \times 4$ (big squares) = 1	Bar drawn Bar drawn Bar drawn	4	M1 calculating areas of existing 4 bars M1 dep setting up equation for height of bar $0.04 \times [‘120 + (110 – 90)h] = (110 – 90)h$ $4.8 + 0.8h = 20h$ A1 calculated height (fd) of 110 ~ 90 bar A1 bar at height 0.25 and width 20 M1 calculating areas of existing 4 bars M1 dep setting up equation / calculation for freq of 90→110 bar or total freq) $0.04 \times [‘120’ + x] = x$ or $(x =) \frac{120}{96} \times 4$ or $(x =) \frac{120}{96} \times 100$ $4.8 + 0.04x = x$ A1 calculated freq of 110 ~ 90 bar or total frequency A1 bar at height 0.25 and width 20 M1 calculating number of existing small squares M1 calculating number of small squares for 4% A1 A1 bar at height 0.25 and width 20 M1 calculating number of existing big squares M1 calculating number of big squares for 4% A1 A1 bar at height 0.25 and width 20

22	$1-\dfrac{2x+1+\dfrac{1}{3x-2}}{2x+1+\dfrac{1}{x-1}}$ $a+\dfrac{1}{b}=\dfrac{6x^2-x-1}{3x-2}=\dfrac{(3x+1)(2x-1)}{3x-2}$ $a+\dfrac{1}{c}=\dfrac{2x^2-x}{x-1}=\dfrac{x(2x-1)}{x-1}$ $1-\dfrac{(3x+1)(x-1)}{x(3x-2)}$ $\dfrac{(3x^2-2x)-(3x^2-2x-1)}{x(3x-2)}$	$\dfrac{1}{3x^2-2x}$		M1 correct substitution M1(ind) expressing $a+\dfrac{1}{b}$ as a single fraction M1 (ind) expressing $a+\dfrac{1}{c}$ as a single fraction M1 expressing unsimplified answer as a single fraction A1 accept $\dfrac{1}{x(3x-2)}$
	Alt: $1-\dfrac{2x+1+\dfrac{1}{3x-2}}{2x+1+\dfrac{1}{x-1}}$ $\dfrac{2x+1+\dfrac{1}{x-1}-\left(2x+1+\dfrac{1}{3x-2}\right)}{2x+1+\dfrac{1}{x-1}}$ $\dfrac{\dfrac{1}{x-1}-\dfrac{1}{3x-2}}{2x+1+\dfrac{1}{x-1}}$	$\dfrac{1}{3x^2-2x}$	5	M1 correct substitution M1 correct expression over a common denominator M1 M1 A1 accept $\dfrac{1}{x(3x-2)}$

	$\dfrac{\dfrac{2x-1}{(x-1)(3x-2)}}{\dfrac{2x^2-x}{(x-1)}}$ or $\dfrac{\dfrac{2x-1}{(x-1)(3x-2)}}{\dfrac{x(2x-1)}{(x-1)}}$			
	Alt: $1-\dfrac{a+\dfrac{1}{b}}{a+\dfrac{1}{c}}=1-\dfrac{\dfrac{ab+1}{b}}{\dfrac{ac+1}{c}}$ $1-\dfrac{c(ab+1)}{b(ac+1)}$ $\dfrac{b-c}{b(ac+1)}$ $\dfrac{(3x-2)-(x-1)}{(3x-2)(2x^2-x)}$ $\dfrac{2x-1}{(3x-2)x(2x-1)}$	$\dfrac{1}{3x^2-2x}$	5	M1 M1 M1 expressing as a single fraction in a,b,c M1 expressing as a single fraction fully factorised A1 accept $\dfrac{1}{x(3x-2)}$