Mark Scheme (Results)

January 2018

Pearson Edexcel International GCSE
Mathematics A (4MA0)
Higher Paper 3HR

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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.
- 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  If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.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.

Question	Working	Answer	Mark	Notes
1 (a)	$5x+5y-3x+3y$	$2x + 8y$	2	M1 A1
(b)		t^{10}	1	B1
(c)		m^{12}	1	B1
2	$\angle ADE = 180 - 124$ (= 56) or $\angle ADE = \frac{360 - 2 \times 124}{2}$ (=56) $\angle DAE = \angle ADE =$ '56' $\angle AEC = 2 \times$ '56'	112	4	M1 M1 M1 for $2 \times$ '56' **or** for $\angle AED = 180 - 2 \times$ '56' (=68) **and** $\angle AEC = 180 -$ '68' A1

Question	Working	Answer	Mark	Notes
3	210 ÷ 9.72 (= (€)21.60..) ‘21.60..’ × 1.10 (= ($)23.765) 79 − 23.765..	55	4	M1 for 210 ÷ 9.72 **or** ($)1 = 9.72 ÷ 1.10 (= 8.836.. (EGP)) oe M1 for‘21.60..’ × 1.10 **or** 210 ÷ ‘8.836..’ (= 23.765..) oe M1 A1 (Accept answer in the range 55 – 55.3)
ALT	79 ÷ 1.1 × 9.72 (= 698.7..) **OR** 79 ÷ 1.1 (= 71.81...) **and** 210 ÷ 9.72 (= 21.60...) ‘698’ – 210 (= 488.7...) **OR** ’71.8’ – ’21.6’ (= 50.21...) ‘488’ ÷ 9.72 × 1.1 **OR** ’50.2’ × 1.1	55	4	M1 convert $79 into pounds **OR** convert $79 into euros **and** 210 pounds into euros M1 (dep) for subtraction ‘698’ – 210 **or** ‘71.8’ – ‘21.6’ M1 for conversion of answer into dollars A1 (Accept answer in the range 55 – 55.3)

Question	Working	Answer	Mark	Notes
4 (a)	<table><tr><td>x</td><td>−2</td><td>−1</td><td>0</td><td>1</td><td>2</td><td>3</td></tr><tr><td>y</td><td>−6</td><td>−2</td><td>2</td><td>6</td><td>10</td><td>14</td></tr></table>	Correct line	3	B3 for a correct line between $x = -2$ and $x = 3$ If not B3 then award B2 for a correct line through at least 3 of (−2, −6) (−1, −2) (0, 2) (1, 6) (2, 10) (3, 14) **OR** for all of (−2, −6) (−1, −2) (0, 2) (1, 6) (2, 10) (3, 14) plotted, not joined **OR** line through (0, 2) and clear attempt to use a gradient of 4 eg line through (0, 2) and (1, 10) If not B2 then award B1 for at least 2 correct points stated or plotted (may be in a table) **OR** for a line drawn with a positive gradient through (0, 2) **OR** for a line with a gradient of 4
(b)	$4p + 2 = 50$	12	2	M1 $4p + 2 = 50$ A1
5	$\frac{(24+30)}{2} \times 12 (= 324)$ $\sqrt{'324'}\ (= 18)$ $4 \times '18'$	72	4	M1 for a complete method for the area M1 M1 A1

Question	Working	Answer	Mark	Notes
6	$\pi \times 80$ (= 251.327....) $\pi \times 80 - 2 \times 80$ (= 91.327...)	91.3	3	M1 oe M1 for a complete method A1 91.2 − 91.43
7	$\frac{3}{4} \times 24$ (= 18) **or** $\frac{1}{4} \times 24$ (= 6) '18' × 30 (= 540) **or** '6' × 20 (= 120) $\frac{'540' + '120' - 400}{400} \times 100$ (= 65) oe	65%	4	M1 M1 M1 for a complete method A1 SC: B3 for an answer of 165%
8	50 000 × 30 (= 1500000) **or** 50 000 ÷ (100 × 1000) (= 0.5) **or** 30 ÷ (100 × 1000) (= 0.0003) '1500000' ÷ (100 × 1000) **or** '0.5'× 30 **or** '0.0003' × 50000	15	3	M1 for a correct first step **or** an answer with the digits 15 eg 0.0015, 1500 M1 for a complete method A1

Question	Working	Answer	Mark	Notes
9	$\frac{5}{8}\times\frac{3}{4}\left(=\frac{15}{32}\right)$ $\left(1-\frac{5}{8}\right)\times\frac{2}{3}\left(=\frac{6}{24}\right)$ '$\frac{15}{32}$' + '$\frac{6}{24}$' oe $\frac{5}{8}\times 320$ (= 200) **or** $\left(1-\frac{5}{8}\right)$ × 320 (= 120) $\frac{3}{4}\times$'200' (= 150) oe **and** $\frac{2}{3}$ × '120' (= 80) oe $\frac{\text{'150'+'80'}}{320}$ oe	$\frac{23}{32}$	4	M1 M1 M1 for a complete method A1 oe
10 (a)		2, 3, 4, 6, 8, 9, 10, 12	1	B1
(b)		5, 7, 11, 13	2	B2 (B1 any set of 4 elements which satisfies exactly one of $A\cap C = \varnothing$, $B\cap C = \varnothing$ **or** just 2 or 3 of 5, 7, 11, 13 **or** all four correct values and one incorrect value eg 1, 5, 7, 11, 13)
11	$20^2 - 10^2 (= 300)$ $BD = \frac{\sqrt{\text{'300'}}}{2}$ (= 8.66…) $AD^2 = 10^2 + (0.5 \times \text{their } BC)^2$	13.2	4	M1 M1 M1 (indep) A1 for answer in the range 13.2 − 13.25

Question	Working	Answer	Mark	Notes
12 (a)	$\frac{12}{8}$ oe **or** $\frac{8}{12}$ oe **or** $\frac{5}{8}$ oe **or** $\frac{8}{5}$ oe	7.5	2	M1 A1 oe
(b)	$13.5-\frac{8}{12}\times 13.5$ oe	4.5	2	M1 for a complete method A1 oe
13	Total distance = $b + x$ **or** v km/h = $v \times 1000 \div 3600$ m/s (T =) $(b + x) / (v \times 1000 \div 3600)$	$T=\frac{18(b+x)}{5v}$	3	M1 for total distance **or** conversion from km/h to m/s M1 for any correct expression for T A1 correct and fully simplified (numerator may not be factorised)
14	$3000 \times (1 + 0.024)^3$ (= 3221.22(5...)) **or** 3072, 3145.72(8), 3221.22(5...) '3221.22(5...)' – [('3221.22(5...)' – 3000) × 0.4] oe	3132.74	4	M2 for a complete method to find the amount in the account after 3 years **before** the 40% deduction If not M2 then M1 for $3000 \times (1 + 0.024)$ oe **or** $3000 \times (1 + 0.024)^2$ oe M1 (indep) for finding 60% of their interest A1 3132 – 3133

Question	Working	Answer	Mark	Notes
15	eg $3x - 4y = 8$ | eg $15x - 20y = 40$ $10x - 4y = 22$ | $15x - 6y = 33$ $7x = 14$ | $-14y = 7$ eg $3 \times$ '2' $- 4y = 8$ $3x - 4 \times$ '–0.5' $= 8$	$2, -\frac{1}{2}$	3	M1 for a complete method to eliminate one variable (condone one arithmetic error) M1 (Dep on M1) for substituting the found variable or starting again to eliminate the other variable A1 dep on M1 NB: candidates showing no correct algebraic working score 0 marks.
16 (a)		700	1	B1 Answer in the range 700 - 720
(b)	eg $Q_1 = 510$, eg $Q_3 = 870$	360	2	M1 for a correct method to identify lower and upper quartiles eg readings from 30 and 90 from the vertical axis A1 Answer in the range 330 - 380
(c)	$\frac{85}{100} \times 120\ (= 102)$ or $\frac{15}{100} \times 120\ (= 18)$	940	3	M1 M1 for using the graph to find the value of N A1 930 - 950

Question	Working	Answer	Mark	Notes
17 (a)	eg $\frac{(x+1)^2}{(2x+1)(x+1)} - \frac{1}{(2x+1)(x+1)}$ **OR** $\frac{(x+1)^2-1}{(2x+1)(x+1)}$ **OR** $\frac{x^2+2x+1-1}{(2x+1)(x+1)}$	Shown	2	M1 for correctly writing both fractions over a common denominator A1 shown with fully correct working
(b)	$x^2 + 2x = 1$ $\frac{-2 \pm \sqrt{2^2 - 4\times1\times-1}}{2}$ | $(x+1)^2 - 1 = 1$ $\frac{-2 \pm \sqrt{8}}{2}$ | $(x+1) = \pm\sqrt{2}$ **OR** $\frac{-2 \pm \sqrt{2^2+4}}{2}$ **OR** $\frac{-2 \pm 2\sqrt{2}}{2}$	0.414, −2.41	4	M1 for $x^2 + 2x = 1$ oe M1 for substituting values from their quadratic equation into the formula (condone one sign error in substitution) **or** a correct first step for completing the square M1 for method to solve their equation A1 awrt dep on the second M mark (accept 0.41)

Question	Working	Answer	Mark	Notes
18 (a)	$\frac{4}{7}\times\frac{3}{6}$	$\frac{12}{42}$	2	M1 A1 oe
(b)	P(1, 3) = $\frac{1}{7}\times\frac{1}{6}\times 4\ (=\frac{4}{42})$ **OR** P(3, 1) = $\frac{1}{7}\times\frac{1}{6}\times 4\ (=\frac{4}{42})$ **OR** P(2, 2) = $\frac{3}{7}\times\frac{2}{6}\ =(\frac{6}{42})$	$\frac{14}{42}$	4	M1 for method to find P(1, 3) **OR** P(3, 1) **OR** P(2, 2)
	Two of P(1, 3) = $\frac{1}{7}\times\frac{1}{6}\times 4\ (=\frac{4}{42})$ P(3, 1) = $\frac{1}{7}\times\frac{1}{6}\times 4\ (=\frac{4}{42})$ P(2, 2) = $\frac{3}{7}\times\frac{2}{6}\ =(\frac{6}{42})$			M1 for method to find two of P(1, 3), P(3, 1), P(2, 2)
	eg $\frac{1}{7}\times\frac{1}{6}\times 4+\frac{1}{7}\times\frac{1}{6}\times 4+\frac{3}{7}\times\frac{2}{6}$			M1 for a complete method A1 oe SC With replacement B2 for an answer of $\frac{14}{49}$ (B1 for $\frac{1}{7}\times\frac{1}{7}\times 8$ or $\frac{3}{7}\times\frac{2}{7}$)

Question	Working	Answer	Mark	Notes
19	$\angle TOB = 2 \times 78$ (= 156) Reflex $\angle TOB$ = 360 – '156' (= 204) **and** $\angle OTP = 90$ $\angle OBT = \angle OTB$ = (180 – 56) ÷ 2 (= 12) **and** $\angle OTP = 90$ $\angle OBP$ = 360 – '204' − 90 − 34 **or** $\angle OBP$ = 180 – 90 – '12' × 2 − 34 **NOTE:** Values could be marked on the diagram	32	4	M1 M1 for method to find reflex $\angle TOB$ **and** $\angle OTP$ M1 for method to find $\angle OBT$, $\angle OTB$ **and** $\angle OTP$ M1 for a complete method A1
20	e.g. 5 × 25 (= 125) 10 × 10 × 3 (= 300) Area from 55 to 90 is 5 × '25' + 10 × 10 × 3 (= 425)	$\frac{425}{1875}$	3	M1 for frequency found for any bar between 10 and 55 or between 55 and 90 M1 for a complete method to find the number of snails with lengths more than 55 mm A1 oe

Question	Working	Answer	Mark	Notes
21 (a) (i)	$4a^k(a^2x^3)^w$ $(= 4ax^2)$	$\frac{2}{3}$	4	M1 for substitution A1
(ii)	compare powers of a eg $1 = k + "2w"$	$-\frac{1}{3}$		M1 forming and equation for k A1
ALT (a) (i)	$x = \left(\frac{z}{a^2}\right)^{\frac{1}{3}}$	$\frac{2}{3}$		M1 for making x the subject A1
(a) (ii)	$y = 4a\left(\left(\frac{z}{a^2}\right)^{\frac{1}{3}}\right)^2$	$-\frac{1}{3}$		M1 (may be seen in a(i)) A1
(b)	$m = 1000$, so $m \times m^m = 1000 \times 1000^{1000}$ $(= 1000^{1001})$	10^{3003}	3	M1 oe eg $\left(10^3\right)^{10^3+1}$ M1 for method which is 1 step away from the correct answer eg $\left(10^3\right)^{1001}$ A1

Question	Working	Answer	Mark	Notes
22	eg $\frac{1}{3}\times\pi\times(3r)^2\times 4r\ (=12\pi r^3)$ **or** $\frac{1}{2}\times\frac{4}{3}\times\pi\times(3r)^3\ (=18\pi r^3)$	$\sqrt[3]{11}$	5	M1 for a method to find the volume of the cone **or** the hemisphere (condone missing brackets)
	eg $\frac{1}{3}\times\pi\times(3r)^2\times 4r+\frac{1}{2}\times\frac{4}{3}\times\pi\times(3r)^3$			M1 for a method to find the total volume of the cone and the hemisphere (condone missing brackets)
	eg $\frac{1}{3}\times\pi\times(3r)^2\times 4r+\frac{1}{2}\times\frac{4}{3}\times\pi\times(3r)^3=330\pi$			M1 for a correct equation
	$30\pi r^3=330\pi$			M1 for a correct simplified equation A1

Question	Working	Answer	Mark	Notes
23 (a)	$(a+1)^2 = \frac{25}{9}$	$\frac{2}{3}$	3	M1
	$a+1 = (\pm)\frac{5}{3}$			M1 or $a+1=\frac{5}{3}$ **or** solving a correct quadratic equation of the form $ax^2 + bx + c = 0$ e.g. $a^2+2a-\frac{16}{9}=0$ followed by $\left(a-\frac{2}{3}\right)\left(a+\frac{8}{3}\right)(=0)$ or $a=\frac{-2\pm\sqrt{2^2-4\times1\times-\frac{16}{9}}}{2}$ (allow 1 sign error)
				A1 (DEP on at least M1) for $\frac{2}{3}$ as the only value
(b)	fg(x) = f$\left(\frac{1}{x}\right) = \left(\frac{1}{x}+1\right)^2$	Shown	2	M1
	$x^2\left(\frac{1}{x}+1\right)^2 = $ etc.			A1
(c)	$y=(x+1)^2 \therefore \sqrt{y} = x+1$ or $x = (y+1)^2 \therefore \sqrt{x} = y+1$	$\sqrt{x}-1$	2	M1 (accept $\pm\sqrt{y}=x+1$ or $\pm\sqrt{x}=y+1$)
				A1