GradeMax



Mark Scheme (Results)

January 2019

Pearson Edexcel International GCSE In Mathematics (4MA0) Higher Tier 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.
- 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.

Question		Working	Answer	Mark	Notes	
1	(a)	0.07 × 560 (=39.2(0)) oe		3	M1	M2 for 1.07 × 560
		560 + "39.2"			M1	
			599.2(0)		A1	SC: If no marks awarded, award B1 for an answer of 520.8(0)
	(b)	42 ÷ 7 (= 6) oe or 42 ÷ "39.2"(=1.07(14...))		3	M1	
		(42 ÷ 7) × 100 oe or "1.07…" × 560			M1	oe e.g. 42 ÷ 0.07 or ft from (a)
			600		A1	
2		$\pi \times 15^2$ (= 225π = 706(.858...)) **or** 707 **or** $2 \times \pi \times 15^2$ (= 450π = 1413(.7…)) **or** 1414		4	M1	for area of one or two circles
		110 × 55 (= 6050)			M1	
		"6050" – 2 × "706..."			M1	both values must come from a correct method
			4640		A1	for 4635 - 4640
3	(a)	1 – (0.17 + 0.1 + 0.13 + 0.15) oe		2	M1	
			0.45 oe		A1	
	(b)	0.1 × 360		2	M1	
			36		A1	

Question	Working	Answer	Mark	Notes
4 (a)		$(3,6)(6,9)(9,9)(9,3)(6,3)$	2	B2 for a fully correct enlargement If not B2 then award B1 for an enlargement SF 3 with shape in correct orientation but incorrect position **or** for a correct enlargement of SF 2 or SF 4 with centre O **or** for 4 out of 5 vertices correct
(b)		Rotation centre (1,−1) 90° clockwise	3	B1 for rotation B1 for (centre) (1,−1) B1 90° clockwise **or** -90° **or** 270^o anticlockwise NB: no marks if more than one type of transformation mentioned

Question	Working	Answer	Mark	Notes
5	e.g. 630 = 2 × 315 = 2 × 3 × 105 = 2 × 3 × 3 × 35		2	M1 for at least 2 correct steps in repeated factorisation (may be seen in a tree diagram or 'ladder')
		2 × 3 × 3 × 5 × 7		A1 dep on M1 or for $2 \times 3^2 \times 5 \times 7$
6 (a)	2, −1, _, _, 2, 7	Correct table	2	B2 If not B2 then award B1 for 2 or 3 correct *y* values
(b)		Correct graph	2	M1 for plotting at least 4 points correctly for their table (dep on B1 earned in (a) A1 for a fully correct curve
(c)		−0.7, 2.7	2	B1 for −0.6 to – 0.8 **or** ft graph B1 for 2.6 to 2.8 **or** ft graph NB: solutions must come from the candidate's graph Can ft from an incorrect graph dep on M1 scored in (b)

Question	Working	Answer	Mark	Notes
7	540 **or** $5\times\left(180-\frac{360}{5}\right)$ **or** 3×180 oe		3	M1 for use of 540 or a correct calculation for angles in a pentagon
	e.g. $2x + 37 + 3x + 90 + 130 + 3x – 5 = n$ **or** $8x$ = "540" – 252 (= 288)			M1ft for an equation or correct calculation for x NB: n can be any value provided $n > 360$
		36		A1 cao

Question	Working	Answer	Mark	Notes
8	760 ÷ (2 + 3 + 5) (=76)			M1 or for $\frac{2}{10}, \frac{3}{10}, \frac{5}{10}$ oe e.g. 20%, 30%, 50%
	for at least 2 of: 2 × "76"(=152), 3 × "76"(=228), 5×"76"(=380)			M1 or for $\frac{1}{2}\times\frac{2}{10}\left(=\frac{1}{10}\right)$ oe **or** $\frac{2}{3}\times\frac{3}{10}\left(=\frac{2}{10}\right)$ oe **or** $0.3\times\frac{5}{10}\left(=\frac{15}{100}\right)$ oe
	$\frac{1}{2}$ × "152" oe (=76) **or** $\frac{2}{3}$ × "228" oe (=152) **or** $\frac{30}{100}$ × "380" oe (=114)			M1 or for $"\frac{1}{10}"+"\frac{2}{10}"+"\frac{15}{100}"\text{oe} = 10\% + 20\% + 15\% = 45\%$
	$\frac{1}{2}$ × "152" + $\frac{2}{3}$ × "228" + $\frac{30}{100}$ × "380" oe or "76" + "152" + "114"			M1 or for $\frac{45}{100}\times 760$ oe
		342	5	A1 NB: An answer of 418 scores M4 A0

Question	Working	Answer	Mark	Notes
9 (a)		c^8	1	B1
(b)		5	1	B1
(c)	$8x - 12y - 6x - 2y$	$2x - 14y$ oe	**2**	M1 for 3 correct terms A1
10	$m = -3$ e.g. $y = -3x + c$ where $c \neq 5$ e.g. $-4 =$ "-3" $\times 6 + c$ **or** $y - -4 =$ "-3"$(x - 6)$ oe **or** $c = 14$	$y = -3x + 14$	3	M1 M1 allow 3 or $\frac{1}{3}$ only for "-3" for substitution of $(6, -4)$ into $y = -3x + c$ **or** a correct equation **or** $L = 14 - 3x$ oe A1 oe NB: The equation can be in any form
11 (a)		5.4×10^{-7}	1	B1 cao
(b)	$0.576 \times 9.92 \times 10^6$ oe **or** 5713920 (rounded to 2sf or better)	5.7×10^6	2	M1 A1 or better but must be in standard form
(c)	$(1.4 \times 10^9) \div (7.4 \times 10^6)$	189	2	M1 or for digits 189(189…) **or** digits 1892 A1 Allow 1.89×10^2

Question	Working	Answer	Mark	Notes
12	e.g. $9x + 6y = 16.5$ or $15x + 10y = 27.5$ $+ 10x - 6y = -26$ $\quad$ $15x - 9y = -39$ $19x = -9.5$ $\quad$ $19y = 66.5$		4	M1 for coefficients of x or y the same with the correct operation to eliminate one variable (allow one arithmetic error in multiplication) **or** for correct rearrangement of one equation followed by substitution in the other.
	$x = -0.5$ **or** $y = 3.5$			A1 dep on M1
	e.g. $3 \times -0.5 + 2y = 5.5$ **or** $3x + 2 \times 3.5 = 5.5$			M1 (dep on M1) for substituting for the other variable **or** starting again to eliminate the other variable
		$x = -0.5$ oe, $y = 3.5$ oe		A1 dep on first M1 NB: correct solution with no working scores no marks

Question	Working	Answer	Mark	Notes
13 (a)	15, 40, 120, 170,190, 200	Correct table	1	B1 For correct cumulative frequencies
(b)			2	M1 ft from (a) if only one addition error for at least 4 points plotted correctly at end of interval **or** for all 6 points plotted consistently within each interval in the frequency table at the correct height (Eg. using values of 20, 40, 60 etc on *x* axis)
		Correct cumulative frequency graph		A1 accept curve or line segments accept curve which is not joined to (0,0)
(c)		54 – 58	1	B1 ft from their cf graph
(d)	e.g. a reading of 162		2	M1 for reading from the cf axis using a mark of 75
		38 – 44		M1 for 38 – 44 **or** ft from their cf graph provided method is shown

Question	Working	Answer	Mark	Notes
14 (a)	e.g. $\frac{3(2w-3)}{21}+\frac{7(2w-5)}{21}(=2)$ **or** $\frac{3(2w-3)+7(2w-5)}{21}(=2)$ **or** $3(2w-3)+7(2w-5)=2\times 21$		3	M1 for a method to deal with fractions eg. finds common denominator (21 or a multiple of 21) **or** multiplies by a common multiple in a correct equation.
	e.g. $6w-9+14w-35=42$			M1 for method to expand brackets and multiply by common denominator NB: condone **one** one error in expansion of brackets
		4.3 oe		A1 dep on M1
(b)	$t^2=\frac{3e+7}{e-3}$		4	M1 for squaring both sides
	$et^2-3t^2=3e+7$ oe			M1 for multiplying by $(e-3)$ and removing bracket in a correct equation
	$t^2e-3e=7+3t^2$ **or** $-3t^2-7=3e-et^2$ oe			M1 for isolating terms in e on one side of a correct equation
		$e=\frac{3t^2+7}{t^2-3}$		A1 or for $e=\frac{-3t^2-7}{3-t^2}$ oe

Question	Working	Answer	Mark	Notes
15 (a)	$\frac{5}{8}\times\frac{4}{7}$		2	M1
		$\frac{20}{56}$ oe		A1 for $\frac{20}{56}$ oe eg. $\frac{5}{14}$, 0.357(14…)
(b)	$\frac{5}{8}\times\frac{4}{7}$ **or** $\frac{5}{8}\times\frac{2}{7}$ **or** $\frac{5}{8}\times\frac{1}{7}$ **or** $\frac{5}{8}\times 1$ **or** $\frac{5}{8}\times\frac{3}{7}$ **or** $\frac{3}{8}\times\frac{2}{7}\left(=\frac{6}{56}\right)$ **or** $\frac{2}{8}\times\frac{1}{7}\left(=\frac{2}{56}\right)$ **oe**		3	M1 for any one correct probability for a total of 6p or 7p or 10p or 2p or 3p or 4p
	$2\times\frac{5}{8}\times\frac{2}{7}+2\times\frac{5}{8}\times\frac{1}{7}+\frac{5}{8}\times\frac{4}{7}$ **or** $\frac{5}{8}+\frac{5}{8}\times\frac{3}{7}$ oe **or** $1-\frac{3}{8}\times\frac{2}{7}$ **or** $1-\left(\frac{2}{8}\times\frac{1}{7}\times 3\right)$			M1 for a complete method
		$\frac{50}{56}$ oe		A1 for $\frac{50}{56}$ oe eg. $\frac{25}{28}$, 0.892(85…)
				SC: Non-replacement award B2 for an answer of $\frac{55}{64}$ oe eg. 0.859(3…)

Question	Working	Answer	Mark	Notes
16 (a)	$p = kw^3$ oe		3	M1 allow $w^3 = mp$ Do not allow $p = w^3$
	$37.5 = k \times 5^3$ **or** $k = 0.3$			M1 for a correct substitution into a correct equation; implies first M1 Award M2 if k = 0.3 oe is stated unambiguously (or $m = \frac{10}{3}$ oe) Condone use of proportional sign in place of equals sign
		$p = 0.3w^3$ oe		A1 if $p = kw^3$ on answer line and k=0.3 seen elsewhere then award M1M1A1
(b)		19.2		B1ft If formula is in form $p = kw^3$ oe
17		$125h^4g^6$	3	B2 If not B2 then award B1 for ah^mg^n where 2 of a, m and n are correct. Condone inclusion of × signs

Question	Working	Answer	Mark	Notes
18 (a)	f(7) = $\frac{3\times 7}{4-7}$ oe (=−7) **or** for $(gf(x)=)\frac{2\left(\frac{3x}{4-x}\right)+1}{3}$		2	M1
		$-4\frac{1}{3}$	A1	$-\frac{13}{3}$ **or** $-4.\dot{3}$ (not -4.3)
(b)	$3y = 2x + 1$ **or** $3x = 2y + 1$ oe		2	M1
		$\frac{3x-1}{2}$ oe	A1	or for $\frac{3x}{2}-\frac{1}{2}$ NB an answer of $\frac{3y-1}{2}$ oe scores M1A0
(c)	$\frac{3\left(\frac{2x+1}{3}\right)}{4-\left(\frac{2x+1}{3}\right)}$ oe		2	M1
		$\frac{3(2x+1)}{11-2x}$	A1	numerator may not be factorised

Question	Working	Answer	Mark	Notes
19	$CA = \sqrt{15^2 + 10^2}$ $(= \sqrt{325} = 18(.0..))$ oe **or** C to X= $\sqrt{7.5^2 + 5^2}$ $(= 9(.0...))$ oe		4	M1 Where X is the midpoint of the rectangle
	$\cos CEA = \dfrac{12^2 + 12^2 - "18.0.."^2}{2 \times 12 \times 12}$ $\left(= -\dfrac{37}{288} = 0.128(4...)\right)$ oe **or** $\sin CEX = \dfrac{"9.0.."}{12}$ oe			M1 or for a fully correct method to find angle ECA or CAE (= 41.2…) it must be clear that this is the angle that the candidate is intending to find
	$CEA = \cos^{-1}\left(\dfrac{12^2 + 12^2 - "18.01.."^2}{2 \times 12 \times 12}\right)$ oe **or** $CEA = 2 \times \sin^{-1}\left(\dfrac{"9.01"}{12}\right)$ oe			M1 or for 180 – 2 × “41.2” oe
		97.4		A1 for 97.3 – 97.4

Question	Working	Answer	Mark	Notes
20	$\overrightarrow{AC} = 4\mathbf{b} - 3\mathbf{a}$ or $\overrightarrow{CA} = 3\mathbf{a} - 4\mathbf{b}$ $\overrightarrow{BP} = \frac{1}{3}(3\mathbf{a} - 3\mathbf{b})$ $(= \mathbf{a} - \mathbf{b})$ or $\overrightarrow{AP} = \frac{2}{3}(3\mathbf{b} - 3\mathbf{a})$ $(= 2\mathbf{b} - 2\mathbf{a})$ $\overrightarrow{OP} = \mathbf{a} + 2\mathbf{b}$ oe $\overrightarrow{PQ} = \frac{1}{5}\mathbf{a} + \frac{2}{5}\mathbf{b}$ oe $\overrightarrow{OQ} = \frac{6}{5}\mathbf{a} + \frac{12}{5}\mathbf{b}$ oe	Correct vectors and correct statement	4	M1 can be implied by $\overrightarrow{OQ}$ or $\overrightarrow{PQ}$ correct M1 Correct vector for $\overrightarrow{BP}$ or $\overrightarrow{PB}$ or $\overrightarrow{AP}$ or $\overrightarrow{PA}$ can be implied by $\overrightarrow{OP}$ or $\overrightarrow{PQ}$ correct A1 for any two appropriate vectors that could be used for the proof NB: for this mark vectors may not be simplified A1 Correct pair of simplified vectors from $\overrightarrow{OP}$ & $\overrightarrow{PQ}$ **or** $\overrightarrow{OP}$ & $\overrightarrow{OQ}$ **or** $\overrightarrow{OQ}$ & $\overrightarrow{PQ}$ oe with conclusion E.g. $\overrightarrow{OP} = 5\overrightarrow{PQ}$ so OPQ is a straight line

Question	Working	Answer	Mark	Notes
21	$(x + 2)^2 + (2x + 7)^2 = (x + 14)^2$ oe		6	M1 for a correct equation
	$x^2 + 4x + 4 + 4x^2 + 28x + 49 = x^2 + 28x + 196$			M1 independent mark for correct expansions
	$4x^2 + 4x - 143$ (= 0) oe			A1 Correct 3 term quadratic
	$(2x + 13)(2x - 11)$ (=0)			M1 ft a 3 term quadratic (dep on first M1) for correct factorisation or use of formula or completing the square
	$x = 5.5$ (must be selected as the only solution)			A1 dep on M3
		67.5		A1 dep on M3

Question	Working	Answer	Mark	Notes
22	$\frac{x}{360} \times \pi \times 30 = 3\pi$ **or** $3\pi = 15x$		5	M1 for a correct first stage to find angle *AOC*
				A1 for (angle *AOC* =) 36° **or** $\frac{3\pi}{15}$ use of 0.1 oe as fraction of circle in area of sector calculation
	$\frac{36}{360} \times \pi \times 15^2$ oe (=70.6(85...)) **or** 70.7 **or** ½ × 15 × 15 × sin 36 oe (= 66.1258...)			M1 for a correct method to find area of sector *OABC* **or** area of triangle *OAC* (NB: *AC* = 9.27… , *OD* = 14.2… where *D* is midpoint of *AC*)
				ft candidate's angle if first M1 awarded **or** an angle of 72°
	$\frac{36}{360} \times \pi \times 15^2$ **and** ½ × 15 × 15 × sin (36) oe			M1 for a correct method to find area of sector *OABC* **and** area of triangle *OAC*
				ft candidate's angle if first M1 awarded **or** an angle of 72°
		4.6		A1 for 4.5 – 4.6