



GCSE MARKING SCHEME

SUMMER 2023

**GCSE
MATHEMATICS
UNIT 1 – HIGHER TIER
3300U50-1**

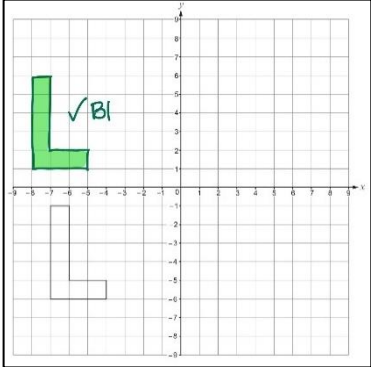
INTRODUCTION

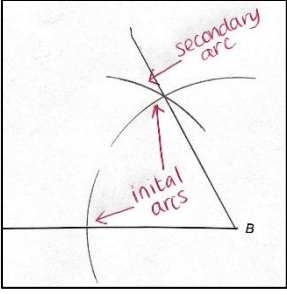
This marking scheme was used by WJEC for the 2023 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

WJEC GCSE MATHEMATICS
SUMMER 2023 MARK SCHEME

Unit 1: Higher Tier	Mark	Comments
1.(a) 	B1	
1.(b) $\begin{pmatrix} 1 \\ -7 \end{pmatrix}$	B1	Award B0 for $\frac{1}{-7}$ (missing brackets) $\begin{pmatrix} -7 \\ 1 \end{pmatrix}$ $(1, -7)$ $\frac{1}{-7}$ with or without brackets. $-\begin{pmatrix} -1 \\ 7 \end{pmatrix}$.
2.(a) For a single method that produces 2 prime factors from the set {3, 3, 3, 5, 5} before the 2 nd error. $3, 3, 3, 5, 5$ $3^3 \times 5^2$	M1 A1 B1	Must be a method that involves only division. Check for errors in the method before checking the 2 prime factors from the set. (Note $675 = 5 \times 135$ $675 = 3 \times 225$ $135 = 5 \times 27$ $135 = 3 \times 45$) CAO. For sight of the five correct factors (Ignore 1s) Do not FT non-primes. FT ' <u>their primes</u> ' provided at least one index form used with at least a square. Allow $(3^3)(5^2)$ and $3^3.5^2$ and 3^35^2 Do not allow $3^3,5^2$ Inclusion of 1 as a factor gets B0.
2.(b) 10	B1	Do not accept 2×5 .
3.(a)(i) m^7	B1	
3.(a)(ii) m^{10}	B1	
3.(b) $7n - 3$	B2	Mark final answer. B1 for sight of $7n$. Allow notation of $n7$ or $7 \times n$ or $n \times 7$ for $7n$. Allow N for n , but penalise -1 for use of a different letter.

3.(c)	7, 8 and 9	B2	Answer line takes precedence. Award B2 for all three integers and no extras. Award B1 for one of the following indicated as a final answer: • 7, 8, 9 and only one other incorrect value • for two correct with no incorrect value • 7 to 9 • 7, 7.5, 8, 8.5, 9 • sight of $6.5 < n < 9.5$ or equivalent • 14,16,18 • 14,15,16,17,18. Allow B2 for correct embedded answers of 7, 8 and 9 (e.g. sight of only $2 \times 7 = 14$, $2 \times 8 = 16$, $2 \times 9 = 18$ with no other calculations) BUT only B1 if contradicted on answer line (e.g. 14, 16, 18 for the example above).
4.(a)	Correct construction of 60°	B1	Must be at point B. Correct construction arcs (two or three) must be seen (initial and secondary). B0 if 60° and 30° drawn. Ignore additional lines provided intended 60° is clear (e.g any triangle, including equilateral ABC). For example: 
4.(b)	Correct construction of 90°	B1	Must be at point R above or below LM. Correct construction arcs (initial and secondary) must be seen.
4.(c)	<u>All</u> correct construction arcs shown	M1	Arc, <u>centre P</u>, intersecting XY at two points. (X may be one of the points with no arc seen at point X.) [Note to markers: These arcs may be identified by the fact that they will 'cross the line XY at an acute angle'. Arcs 'crossing the line at 90°' is evidence of an inappropriate method.] AND Intersecting arcs (equal radii) using the above two points as centres. Ignore line extended above XY for M1.
	Line drawn	A1	Ignore line extended above XY for M1A1.
4.(c)	<u>Alternative method</u> (Using the properties of a kite.) <u>All</u> correct construction arcs shown.	M1	Intersecting arcs whose centres are any two points on the line XY and respective radii equal in length to the distance from the points to the point P. [Note to markers: The arcs will always intersect at a point that is a 'reflection of point P' in the line XY.]
	Line drawn	A1	

10.(a)	(AOY =) 36(°) (% shaded =) $\frac{36}{360} (\times 100)$ or equivalent
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12. (Volume of sphere $\Rightarrow 36\pi$ (cm³) (Volume of cone $\Rightarrow 300\pi$ (cm³) 3 : 25	B1 B1 B2	Allow 113.04 (from using $\pi = 3.14$). Allow 942 (from using $\pi = 3.14$). Accept absence of π (in <u>both</u> expressions). If neither volume has been correctly evaluated, award SC1 for at least one correct volume calculation: $\frac{4}{3} \times \pi \times 3^3$ OR $\frac{1}{3} \times \pi \times 10^2 \times 9$ (allowing the use of $\pi = 3.14$). Calculations may be seen in stages. B1 for partially simplified ratio in the form a : b where a, b are integers (with π eliminated and fractions or decimals cleared) or B1 for $3\pi : 25\pi$. FT 'their volumes' if possible (provided at least B1 or SC1 already awarded). An answer of 24 : 25 (from $288\pi : 300\pi$, using 6 cm for radius of sphere) is awarded B1 FT B2.
12. <u>Alternative method</u> (without explicitly calculating volumes): $\frac{4}{3} \times \pi \times 3^3$ OR $\frac{1}{3} \times \pi \times 10^2 \times 9$ or equivalent $4 \times \pi \times 3^3 : \pi \times 10^2 \times 9$ or equivalent OR $\frac{4}{3} \times 3^3 : \frac{1}{3} \times 10^2 \times 9$ or equivalent 3 : 25	B1 B1 B2	Calculation for at least one volume (allowing the use of $\pi = 3.14$). Calculations may be seen in stages. Accept absence of π (in <u>both</u> expressions). Both calculations correct AND one further step (clearing fractions OR eliminating π). Ratio may be implied. B1B0 for partially simplified ratio in the form a : b where a, b are integers (with π eliminated and fractions or decimals cleared) or B1B0 for $3\pi : 25\pi$ or B0B1 for one error in calculation of integers followed by correct simplification e.g. $12:300 = 1:25$. FT 'their volumes' if possible (provided at least B1 already awarded). An answer of 24 : 25 (from $288\pi : 300\pi$, using 6 cm for radius of sphere) is awarded B0 B1 FT B2.

13.(a) (Area of triangle $\Rightarrow \frac{1}{2} \times 4x \times (2x - 1)$) $\frac{8x^2 - 4x}{2} = \frac{3}{4} \quad \text{or equivalent}$ $16x^2 - 8x - 3 = 0$	M1 m1 A1	Allow award of M1 if brackets omitted. Accept equivalent e.g. using area of rectangle = 1.5. Expanding brackets and equating. Clearing fractions and equating to zero. Must be convincing.
13.(b)(i) $(4x - 3)(4x + 1) [= 0]$ $x = \frac{3}{4} \quad \text{AND} \quad x = -\frac{1}{4}$	M2 A1	Solution may be seen in part (a). If seen in both, the work in the answer space for part (b)(i) takes precedence. M1 for $(4x \dots 3)(4x \dots 1)$ M1 for two brackets which multiply to give $16x^2 - 8x + k$ or $16x^2 + mx - 3$. Strict FT from M1 <u>Using quadratic formula</u> $(x =) \frac{-(-8) \pm \sqrt{(-8)^2 - 4(16)(-3)}}{2(16)} \quad \text{M1}$ For M1, allow one error, in sign or substitution, but not in formula. $x = \frac{8 \pm \sqrt{256}}{32} \quad \text{A1}$ $x = \frac{3}{4} \quad \text{or} \quad x = -\frac{1}{4} \quad (\text{both answers required}) \quad \text{A1}$ Do not allow a trial and improvement method.
13.(b)(ii) $(BC = 2 \times \frac{3}{4} - 1 \Rightarrow) 0.5 \text{ (m)}$ AND a valid statement e.g. length cannot be negative; length must be positive.	E1	Solution may be seen in part (a) or (b)(i). If seen in both, the work in the answer space for part (b)(ii) takes precedence. FT 'their x' provided an equivalent decision is required i.e. one value of x is greater than $\frac{1}{2}$ and the other is less than $\frac{1}{2}$.
14.(a)(i) 2.5	B1	
14.(a)(ii) At least 6 correct plots and no incorrect plot. A smooth <u>curve</u> drawn through their plots.	P1 C1	FT 'their (0.5, 2.5)'. Allow '$\pm \frac{1}{2}$ a small square'. FT 'their 7 plots' OR a curve through the 6 given plots and through (0.5, 2.5). Allow for the intention to pass through their plots (± 1 small square horizontal OR vertical). The curve should NOT intercept the y-axis.
14.(b) Two correct readings from their graph.	B2	For reference, $x = 0.4$ AND 2.6 to 1d.p. B1 for one correct reading. Strict FT 'their graph'. If more than two points of intersection, award B1 for one correct answer, B2 for a complete set of answers. If no marks, award SC1 for drawing the line $y = 3$.

15. (a) $P(BBB \text{ or } YYY) =$ $\frac{5}{8} \times \frac{4}{7} \times \frac{3}{6} + \frac{3}{8} \times \frac{2}{7} \times \frac{1}{6}$ or equivalent $\frac{66}{336} (= \frac{11}{56})$ or equivalent	M2 A1	M1 for sight of one correct product. M0 for use of an incorrect total e.g. 9. Must show intention to <u>add</u> for second M mark. ISW If no marks awarded, SC1 for an answer of $\frac{152}{512}$ or equivalent (from a method 'with replacement').
15. (b) $P(BYY \text{ or } YBY \text{ or } YYB)$ $\frac{5}{8} \times \frac{3}{7} \times \frac{2}{6} + \frac{3}{8} \times \frac{5}{7} \times \frac{2}{6} + \frac{3}{8} \times \frac{2}{7} \times \frac{5}{6}$ or $\frac{5}{8} \times \frac{3}{7} \times \frac{2}{6} \times 3$ or equivalent $\frac{90}{336} (= \frac{15}{56})$ or equivalent	S1 M1 A1	FT from part (a) consistent use of a wrongly calculated denominator ($8 \times 7 \times 6$) OR use of an incorrect total e.g. 9. Consideration of 3 permutations (may be implied) M1 implies S1. Must show intention to <u>add</u> for second mark. ISW If no marks awarded, SC1 for sight of one correct product or SC1 for an answer of $\frac{135}{512}$ or equivalent (from a method 'with replacement').
15.(b) <i>Alternative method:</i> $1 - P(YYY \text{ or } YBB \text{ or } BYB \text{ or } BBY \text{ or } BBB)$ $= 1 - [\frac{3}{8} \times \frac{2}{7} \times \frac{1}{6} + \frac{3}{8} \times \frac{5}{7} \times \frac{4}{6} \times 3 + \frac{5}{8} \times \frac{4}{7} \times \frac{3}{6}]$ or equivalent $= 1 - [\frac{6}{336} + \frac{180}{336} + \frac{60}{336}]$ $\frac{90}{336} (= \frac{15}{56})$ or equivalent	S1 M1 A1	<i>A complete method.</i> FT 'their $P(BBB)$' or 'their $P(YYY)$' or both from (a). M1 implies S1. ISW If no marks awarded, SC1 for $1 - [\frac{3}{8} \times \frac{2}{7} \times \frac{1}{6} + \frac{3}{8} \times \frac{5}{7} \times \frac{4}{6} + \frac{5}{8} \times \frac{4}{7} \times \frac{3}{6}] (= \frac{5}{8})$ from not considering 3 different permutations of BBY or SC1 for an answer of $\frac{135}{512}$ or equivalent (from a method 'with replacement').
16. (a) 242° and 298° with no other values	B2	B1 for either angle. Check diagram. Penalise -1 for each extra value within range (beyond 2 attempts). Ignore extra (correct or incorrect) values outside the required range. If only two angles offered and no marks gained, award SC1 for sight of both $180^\circ + 62^\circ$ and $360^\circ - 62^\circ$.

16.(b)(i) Reflection in x -axis with maximum at $(270^\circ, +1)$, minimum at $(90^\circ, -1)$	B2	Mark clear intention. Must be the correct shape, i.e. a single cycle of a negative sine <u>curve</u>, with x-intercepts at $x = 0$, $x = 180^\circ$ and $x = 360^\circ$, minimum at $x = 90^\circ$, maximum at $x = 270^\circ$. Accept any clear indication of y-coordinates. If not B2, award B1 for one of the following: - Fully correct shape and position (both for $0 \leq x \leq 180^\circ$ and for $180^\circ \leq x \leq 360^\circ$) without correct coordinates indicated OR - Correct shape and position either for $0 \leq x \leq 180^\circ$ or for $180^\circ \leq x \leq 360^\circ$ (a sine curve entirely between $y = -1$ and $y = 1$) AND indication of $y = -1$ and $y = 1$. SC1 for a graph which is fully correct (including labelling) other than having pointed minimum and maximum (formed from straight lines).
16.(b)(ii) Vertical translation +1 with maximum at $(90^\circ, +2)$, minimum at $(270^\circ, 0)$, with y -intercept at +1.	B2	Mark clear intention. Must be the correct shape, i.e. a single cycle of a sine <u>curve</u>, with consistent y values at $x = 0$, $x = 180^\circ$ and $x = 360^\circ$, maximum at $x = 90^\circ$, minimum at $x = 270^\circ$. Accept any clear indication of y-coordinates. Must have correct points for $x = 180^\circ$ and $x = 360^\circ$. 1 and 2 indicated on the y-axis. If not B2, award B1 for one of the following: - Fully correct shape and position (both for $0 \leq x \leq 180^\circ$ and for $180^\circ \leq x \leq 360^\circ$) without correct coordinates indicated OR - Correct shape and position either for $0 \leq x \leq 180^\circ$ or for $180^\circ \leq x \leq 360^\circ$ (a sine curve entirely between $y = 0$ and $y = 2$) AND indication of $y = 1$ and $y = 2$. SC1 for a graph which is fully correct (including labelling) other than having pointed minimum and maximum (formed from straight lines).
17.(a) $4 + 4 \times \sqrt{6} - (1 \times) \sqrt{6} - 6$ or equivalent $= 3\sqrt{6} - 2$ or $-2 + 3\sqrt{6}$	M1 A1	$(\sqrt{6})^2$ or $\sqrt{6}\sqrt{6}$ is insufficient for 6. Mark final answer. If no marks awarded, SC1 for 3 of the 4 terms correct.
17.(b)(i) Any square number greater than 5 e.g. 9, 16, 25, 36, ...	B1	
17.(b)(ii) Any cube number greater than 5 e.g. 8, 27, 64, 125, 216, ...1000, ...	B1	
17.(b)(iii) Any value of n^6 where n is an integer > 1 . e.g. 64, 729, ... 1 000 000, ...	B1	Allow 2^6 or 3^6 or ...