GCSE MARKING SCHEME

AUTUMN 2023

GCSE
MATHEMATICS
UNIT 1 – HIGHER TIER
3300U50-1

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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.

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WJEC GCSE MATHEMATICS

AUTUMN 2023 MARKING SCHEME

GCSE Mathematics **Unit 1: Higher Tier**	**Mark**	**Comments**
1. (Amount of tea in full cup =) (44 ÷ 2) × 7 or equivalent = 154 (ml)	M1 A1	M1 for full complete method. May be seen in stages. If M0 awarded, award SC1 for one of the following: • appropriate sight of 22 • final answer of 61·6 (ml) (from (44 ÷ 5) × 7) .
1. <u>Alternative method</u> *(Amount of tea in full cup =)* *(44 ÷ 2) × 5 + 44* *= 154 (ml)*	*M1* *A1*	*M1 for full complete method.* *May be seen in stages.* *If M0 awarded, award SC1 for appropriate sight of 22.*
Organisation and Communication. Accuracy of writing.	OC1 W1	For OC1, candidates will be expected to: • present their response in a structured way • explain to the reader what they are doing at each step of their response • lay out their explanation and working in a way that is clear and logical • write a conclusion that draws together their results and explains what their answer means For W1, candidates will be expected to: • show all their working • make few, if any, errors in spelling, punctuation and grammar • use correct mathematical form in their working • use appropriate terminology, units, etc
2. (a) 3	B2	Award B1 for sight of $\sqrt[3]{27}$. Mark final answer.
2. (b) $(\sqrt[3]{8 \times 25x})^3 = 10^3$ or $200x = 1000$ or equivalent (x =) 5 ISW	M1 A1	Award M1 for $8 \times 25x = 10^3$ CAO Unsupported answer of 5 is awarded M1A1. Allow M1A1 for a correct embedded answer (e.g. 5 × 8 × 25 = 1000), BUT M1A0 if contradicted by $x \neq 5$).
3. (a) $4n + 7$ or equivalent	B2	Mark final answer. Award B1 for sight of $4n$. Award B0 for $-4n$.
3. (b) –4, –1, 4	B2	Answer space takes precedence. Award B1 for one of the following: • two correct • −5, −4, −1 • −1, 4, 11

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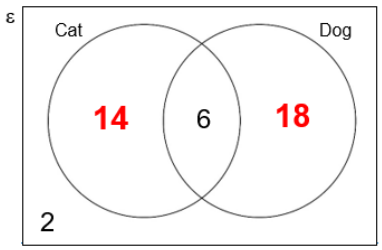
4. (a) For a correct method that produces 2 prime factors from the set {3,3,5,11} before 2nd error. 3, 3, 5, 11 $3^2 \times 5 \times 11$	M1 A1 B1	Must be a method that involves only division. Check for errors in the method before checking the 2 prime factors from the set. (Note: 495 = 3 × 165 495 = 5 × 99 495 = 11 × 45) CAO For sight of the four correct factors (Ignore 1s). Do not FT non-primes. FT 'their primes' provided at least one index form used with at least a square. Allow $(3^2)(5)(11)$ and $3^2.5.11$ Do not allow 3^2,5,11 Inclusion of 1 as a factor gets B0.
4. (b) Any valid reason referring to not all the indices being even e.g "the powers are not (all) even" "only one index is even"	E1	Allow reference to $22^2 = 484$ and $23^2 = 529$ Do not accept "they are not (all) even" "all factors are not (all) even" "the 5 and 11 are not squared" "the prime factors are all odd" "the little numbers are not even".
4. (c) 60 = 2 × 2 × 3 × 5 or equivalent correct strategy (HCF =) 15	M1 A1	M1 for sight of 2,2,3,5 'together' Allow M1 for selection of 2 × 2 × 15 or 4 × 15 (Not for other products e.g. 2 × 30, 3 × 20, 5 × 12, 6 × 10) (Not for just listing all the factors 1,2,3,4,5,6,10,12,15,20,30,60) Mark final answer. M1A0 for 3 × 5 FT 'their answer to 4(a)' only if equivalent difficulty (at least two common prime factors). Unsupported 15 gains M1 A1. If no marks awarded, award SC1 for sight of all common factors (1, 3, 5 and 15) and no other factors.
5. [n(just dog) =] 18 [n(just cat) =] 14  	B2 B1	Diagram takes precedence. Entries must be whole numbers. B1 for sight of ($\frac{3}{5} \times 40 =$) 24 from correct working. FT 32 – 'their 18', provided all sections not blank or 0.

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6. $\frac{34.2}{90} \times 100$ OR $\frac{34.2}{0.9}$ or equivalent = 38	M1 A1	Accept a **complete** and **convincing** method of trial and improvement. Award M1A1 for an embedded answer (e.g. 0·9 × 38 = 34·2 or $\frac{34.2}{38} \times 100$ = 90%), BUT only M1A0 if contradicted by stating original amount ≠ 38. Unsupported 38 is awarded M1A1.
7. (a) Any full valid explanation with reference to one or both correct scale factors (if fractions used, must be with a common denominator or in their simplest form) e.g. "the scale factor for one (corresponding) pair of sides is 1·5, the other is 1·25" "9/6 = 1·5 1·5 × 8 = 12 1·5 × 8 ≠ 10" "8/6 = 4/3 which is not the same as 10/9" "3/2 and 5/4 are not the same" "in A, the width is ¾ of the length, but in B it is not"	E2	Award E1 for partial explanation e.g. • "the scale factor is not the same for each pair of sides" • "10/8 is not the same as 9/6" • "10/9 ≠ 8/6" • "9 : 10 ≠ 6 : 8" • "8/10 is not the same as 6/9" • "the sides should be 12 (cm) and 9 (cm)" • "the sides should be 10 (cm) and 7·5 (cm)" **OR** Award E1 for • two scale factors which can be compared (one must be correct) e.g. 1·5 and 1·3 or two fractions with a common denominator (4/2 and 3/2).
7.(b) <u>Method 1</u> *8 × $\frac{9}{6}$ or 8 × 1·5 or equivalent* *Length = 12 (cm) and Width = 9 (cm)*	*M1* *A1*	*Answer space takes precedence.* *M1 for correct <u>use</u> of linear ratio.* *Allow Length = 9 (cm) and Width = 12 (cm)*
7.(b) <u>Method 2</u> *6 × $\frac{10}{8}$ or 6 × 1·25 or equivalent* *Length = 10 (cm) and Width = 7·5 (cm)*	M1 A1	*Answer space takes precedence.* *M1 for correct <u>use</u> of linear ratio.* *Allow Length = 7·5 (cm) and Width = 10 (cm)*

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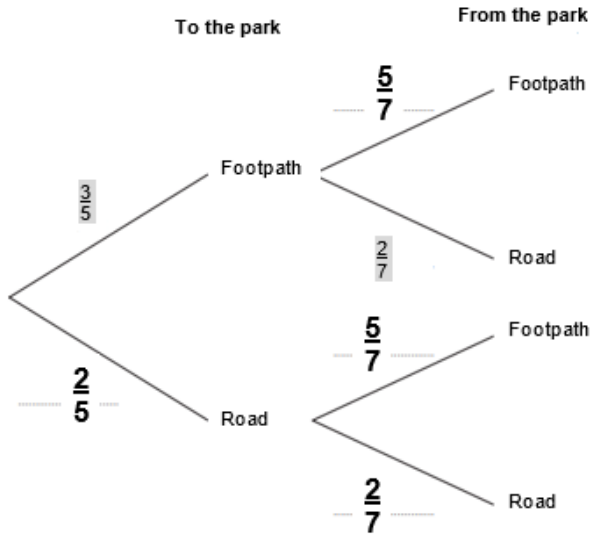
8.*(a)* Complete diagram 	B2	**If B2 not awarded,** award B1 for **one** of the following: • 2/5 or equivalent on Road to the park branch • 5/7 on a Footpath from the park branch.
8.(b) $\frac{3}{5} \times \frac{5}{7}$ or equivalent $\frac{15}{35}$ or equivalent ISW	M1 A1	FT $\frac{3}{7}$ × 'their $\frac{5}{7}$' (on 'uppermost footpath home branch') provided less than 1.
9. $(x - 10)(x + 2)$ $(x =)\ 10$ AND $(x =)\ -2$	B2 B1	B1 for one of the following: • $(x \ldots 10)(x \ldots 2)$. • two brackets which multiply to give $x^2 - 8x + k$ • two brackets which multiply to give $x^2 + kx - 20$. **Strict FT** from their pair of brackets. If no factorising shown, allow the following. B2 for $x - 10\ (=0)$ AND $x + 2\ (=0)$ (B1) $(x =)\ 10$ AND $(x =)\ -2$ (B1) B1 for $x + 10\ (=0)$ AND $x - 2\ (=0)$ (B0) $(x =)\ -10$ AND $(x =)\ 2$ (B1) FT B1 if only $(x =)\ 10$ AND $(x =)\ -2$ seen (B1)
10. (*AOB* =) 180 – 90 – 42 or 90 – 42 48(°) x = 24(°)	 M1 A1 B1	Check diagram for answers. Note: 180 – 132 May be implied by sight of a final answer of 24. FT 'their 48' ÷ 2, provided 'their 48' ≠ 42.
10. Alternative method *(x =) $\frac{180 - 90 - 42}{2}$ or $\frac{90 - 42}{2}$* *x = 24(°)*	 *M2* *A1*	*Check diagram for answers.* *Award M2 for complete method.*

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11. Correct equation e.g. $\frac{50x + 10 - 21x + 9}{(15)} = \frac{9 \times 3 \times 5}{(15)}$ $(29x + 19 = 135)$ $\quad 29x = 116$ $x = 4$	 B2 B1 B1	FT until 2nd error. Award B1 for one of the following: • 1 error in one term • Sight of $5(10x + 2)$ AND $-3(7x - 3)$ or equivalent • Sight of $50x + 10 - 21x + 9$. Subsequent work may show use of common denominator in order to award the B2. Mark final answer. Award the final B0 for $\frac{116}{29}$ If FT leads to a whole number answer, it must be shown as a whole number. Otherwise, accept a fraction. Allow B2B1B1 for a correct embedded answer BUT only B2B1B0 if contradicted by $x \neq 4$ or equivalent. Note 1: $\frac{50x + 10 - 21x - 9}{(15)} = \frac{135}{(15)}$ B1 (one error –9) $29x = 134$ B1 $x = \frac{134}{29}$ B1 Note 2: $\frac{50x + 10 - 21x + 9}{(15)} = \frac{9}{(15)}$ B1 (one error = 9) $29x = -10$ B1 $x = \frac{-10}{29}$ B1 Note 3: $\frac{50x + 10 - 21x - 9}{(15)} = \frac{9}{(15)}$ B0 B0 B0 (2 errors –9 & 9) Award B2B1B1 for unsupported answer of 4, or for an answer which has come from a non-algebraic method.
12. $x \leq 2$ or equivalent $y \leq 3$ or equivalent $y \geq -x + 1$ or equivalent	 B1 B1 B2	Accept in any order. Accept '<'. Accept '<'. Accept '>'. B1 for one of the following: • $y = -x + 1$ or $y < -x + 1$ or $y \leq -x + 1$ • $y \geq kx + 1$ or $y > kx + 1$ (with $k \neq -1$ and either $k < 0$ or $k = 1$) • $y \geq -x + c$ or $y > -x + c$ (with $c \neq 1$)

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<table>
<tr><td>13. (a) $y \propto \frac{1}{x^2}$ OR $y = \frac{k}{x^2}$ or equivalent

$16 = \frac{k}{5^2}$ OR $k = 16 \times 5^2$ (= 400)

$(y =) \frac{400}{x^2}$</td><td>B1

M1

A1</td><td>Allow $y \propto \frac{k}{x^2}$. May be implied by completely correct further working.
FT for B0 M1 from $y \propto \frac{1}{x^n}$ with $n > 0$ and $n \neq 2$
No FT from direct proportion.

May be seen (explicitly) in part (b).
Allow $y \propto \frac{400}{x^2}$.</td></tr>
<tr><td>13. (b)
<table><tr><td>x</td><td>5</td><td>0·1</td><td>(±)2</td></tr><tr><td>y</td><td>16</td><td>40 000</td><td>100</td></tr></table></td><td>B2</td><td>Check working space if table is empty.
Table takes precedence over working space.

B1 for one correct value.
FT from ‘their k’ (using $y = \frac{k}{x^2}$)
or
FT for inverse proportion only, but <u>not</u> from $y = \frac{k}{x}$.</td></tr>
<tr><td>14. (Arc BC – Arc AD =)
$\frac{300}{360} \times 2\pi \times (14 + 6) - \frac{300}{360} \times 2\pi \times 14$
or $\frac{300}{360} \times [2\pi \times (14 + 6) - 2\pi \times 14]$
or equivalent

$= 10\pi$</td><td>M2

A1</td><td>May be seen in parts.
M1 for one correct product for an arc length
e.g. $\frac{300}{360} \times 2\pi \times (14 + 6)$ or $\frac{300}{360} \times 2\pi \times 14$
Allow use of 3·14 for M1 or M2.

CAO

If no marks, award:
SC2 for
• an <u>answer of 2π</u> (using 60˚) from
$\frac{60}{360} \times 2\pi \times (14 + 6) - \frac{60}{360} \times 2\pi \times 14$
or $\frac{60}{360} \times [2\pi \times (14 + 6) - 2\pi \times 14]$
OR
SC1 for a full method using 60˚
• $\frac{60}{360} \times 2\pi \times (14 + 6) - \frac{60}{360} \times 2\pi \times 14$
or $\frac{60}{360} \times [2\pi \times (14 + 6) - 2\pi \times 14]$
OR
SC1 for one of the following <u>final</u> answers:
• $\frac{40\pi}{3}$ or equivalent (from using radii of 14 cm and 6 cm)
• 20π (from using 2πD for circumference)
• 5π (from using πr for circumference)
• 10 (from omitting π)

No marks for working with whole circumference (unless also subtracting fraction of circumference).
No marks for working with area of circle.</td></tr>
</table>

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15. Formally identifying (in writing) two appropriate pairs of equal angles e.g. *BAC* = *DAE* and *BCA* = *DEA* (*CA* = *AE* given) or *BAC* = 79˚ and *DEA* = 27˚ (*CA* = *AE* given) AND Explanation that the triangles are congruent due to angle, side, angle or ASA or equivalent.	E2	(Check diagram) If all three angles are used, they must all be correct. For reference: *BAC* = *DAE* = 79° (vertically opposite angles) *BCA* = *DEA* = 27° (alternate angles) *ABC* = *ADE* = 74° (angles in a triangle with alternate angles) Award E1 for one of the following: • formally identifying at least one correct pair of angles AND explanation that the triangles are congruent due to angle, side, angle or ASA or equivalent. OR • a correctly completed diagram (at least two pairs of angles) AND Explanation that the triangles are congruent due to angle, side, angle or ASA or equivalent. OR • formally identifying (in writing) two pairs of matching angles (with no incorrect angles) e.g. *BAC* = *DAE* and *BCA* = *DEA* (*CA* = *AE* given) or *BAC* = 79˚ and *DEA* = 27˚ (*CA* = *AE* given)
16. (a)(i) 16	B1	
16. (a)(ii) $\frac{1}{100}$	B1	
16. (b) $100x = 7{\cdot}141414.....$ and $10000x = 714{\cdot}1414....$ with an attempt to subtract on both sides $\frac{707}{9900}$	M1 A1	Or x and $100x$, or equivalent. Or a complete alternative method. The multiplied decimals must be correct. An answer of $\frac{7{\cdot}07}{99}$ gains M1 only. ISW
16. (b) *Alternative method* *0·07 + 0·00141414…..* $= \frac{7}{100} + \frac{14}{9900}$ *or equivalent* $\frac{707}{9900}$	*M1* *A1*	 *ISW*
16. (c) $\frac{3\sqrt{5}}{2}$	B2	B1 for one of the following: • a numerator of $3\sqrt{5}$ • $\frac{\sqrt{45}}{\sqrt{4}}$ or $\frac{\sqrt{9}\times\sqrt{5}}{\sqrt{4}}$ i.e. for one step of simplification of surds (but not for $\sqrt{\frac{45}{4}}$) • sight of $1 \cdot 5\sqrt{5}$ (from $\sqrt{2 \cdot 25}\sqrt{5}$).
16. (d) An appropriate irrational number within the required range	B1	e.g. 2π, $\pi + 3$, $\sqrt{40}$, $3\sqrt{5}$, $8 - \sqrt{2}$. Ignore additional irrational numbers within range. B0 for multiple answers, unless all are irrational numbers within the required range.

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17. $4n^2 - 2n - 2n + 1$ [+ 7] or equivalent $4n^2 - 4n + 8$ or $4(n^2 - n + 2)$ AND concluding statement, e.g. "4 is a common factor" "The expression is a multiple of 4"	B2 E1	Correct expansion of brackets and intention to add. B1 for one of the following: • 3 correct terms (and 1 incorrect or missing term) • 4 correct terms, but no intention to add • $4n^2 + kn + 1$ [+ 7], $k \neq 0, -4$ Factorisation is not explicitly required for this mark, provided statement is convincing. <u>If B0,</u> award SC1 for a concluding statement resulting from an expansion of $4n^2 + 1 + 7$. Award no marks for trialling numbers.
18. Sight of $ct^3 - 9 = t^3$ $(c - 1)\,t^3 = 9$ $t^3 = \frac{9}{c-1}$ OR $t^3 = \frac{-9}{1-c}$ $t = \sqrt[3]{\frac{9}{c-1}}$ OR $t = \sqrt[3]{\frac{-9}{1-c}}$	 B1 B1 B1 B1	<u>No FT</u> for 'splitting' the cube root into a sum of two roots, otherwise FT until 2nd error for equivalent level of difficulty. Cubing Isolating terms in t^3 <u>and</u> factorising. FT a formula with three or more terms AND with at least two terms in t^3. Isolating t^3. Taking cube root. B0 for inclusion of ±
19. 109° and 289° with no other values	B2	Check diagram. B1 for either angle. Allow embedded answers. Ignore extra (correct or incorrect) values outside the required range. Penalise –1 for each extra value within range (beyond 2 attempts). If no marks, award SC1 for sight of 180–71 AND 360–71 (or equivalent).
20. Horizontal translation to the left with curve intercepting x axis at (3, 0) and (7, 0). (5, –1)	B2 B1	Mark clear intention. If not B2, award B1 for a horizontal translation to the left. CAO

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21. (a) $\frac{7}{11} \times \frac{6}{10} + \frac{3}{11} \times \frac{2}{10} + \frac{1}{11} \times \frac{0}{10}$ $= \frac{48}{110} \left(= \frac{24}{55}\right)$	M2 A1	Full method for finding P(B,B) + P(W,W) + P(R,R). May be seen in parts. Allow the omission of P(R,R). M1 for sight of $\frac{7}{11} \times \frac{6}{10}$ or $\frac{3}{11} \times \frac{2}{10}$. M1 if additional incorrect products are included. ISW If no marks, SC1 for one of the following: • an answer of $\frac{59}{121}$ (method with replacement) • a correctly evaluated final answer from an incorrect total in denominator e.g. $\frac{48}{90}$ (from a total of 10).
<u>Alternative method 1</u>: *21. (a)* $1 - \left(\frac{7}{11} \times \frac{4}{10} + \frac{3}{11} \times \frac{8}{10} + \frac{1}{11} \times \frac{10}{10}\right)$ $= \frac{48}{110} \left(= \frac{24}{55}\right)$	*M2* *A1*	*Full method for finding 1 – P(BB' or WW' or RR')* *M1 if one of the subtracted products is incorrect or missing.* *ISW* *If no marks, SC1 for one of the following:* • *an answer of* $\frac{59}{121}$ *(method with replacement)* • *a correctly evaluated final answer from an incorrect total in denominator e.g.* $\frac{28}{90}$ *(from a total of 10)*
<u>Alternative method 2</u>: *21. (a)* $1 - 2 \times \left(\frac{7}{11} \times \frac{3}{10} + \frac{3}{11} \times \frac{1}{10} + \frac{1}{11} \times \frac{7}{10}\right)$ *or equivalent* $= \frac{48}{110} \left(= \frac{24}{55}\right)$	*M2* *A1*	*Full method for finding* *1 – P(BW or WB or WR or RW or RB or BR)* *M1 if one or two of the subtracted products are incorrect or missing.* *ISW* *If no marks, SC1 for one of the following:* • *an answer of* $\frac{59}{121}$ *(method with replacement)* • *a correctly evaluated final answer from an incorrect total in denominator e.g.* $\frac{28}{90}$ *(from a total of 10)*
21. (b) $\frac{n}{2n+1} \times \frac{n-1}{2n}$ or equivalent $= \frac{n-1}{2(2n+1)}$ or $\frac{n-1}{4n+2}$	M2 A1	M1 for sight of $\frac{n}{2n+1}$ or $\frac{n-1}{2n}$ or equivalent For M1, FT 'their $2n+1$' – 1 in denominator of 2nd fraction. CAO

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