GCSE MARKING SCHEME

SUMMER 2023

GCSE
MATHEMATICS
UNIT 1 – FOUNDATION TIER
3300U10-1

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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.

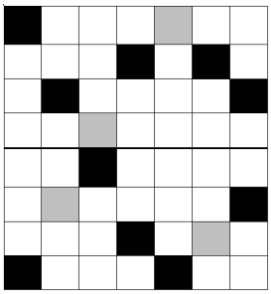
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WJEC GCSE MATHEMATICS

SUMMER 2023 MARK SCHEME

Unit 1: Foundation Tier	Mark	Comments
1(a) 60 043	B1	Allow 60,043 and 60043 (no space between the 0s)
1(b) 7000 or 7 thousand(s)	B1	Accept thousand(s). Do not accept 1000.
1(c) 63	B1	
1(d) 406	B1	
1(e) 651	B1	
2. 	B2	B1 for all 4 correct squares and no more than 2 incorrect squares shaded OR B1 for 3 correct squares and no more than 1 incorrect square shaded OR B1 for 2 correct squares and no incorrect squares shaded
3.(a) 137°	B1	Accept answers in the range 135° to 139°.
3.(b) Perpendicular line drawn through C.	B1	Allow perpendicular line stopping at C. If two sections are drawn, both must lie within the given tolerance.
0·4.(a) 116	B1	
4.(b) 3 OR – 3	B1	B0 for 3 ×3
4.(c) $\frac{40}{100}$ × 120 or equivalent 48	M1 A1	Other possible methods for M1 include • 10% is 12 so 40% is 4×12 • 0·4×120 • 120×4/10. Allow M1 for sight of four 12s, either written in a column or row. M0 for 12 alone M1A0 for 48 followed by 72 or 168. SC1 for unsupported 72 or 168.
5.(a) 500g	B1	
5.(b) 7m	B1	

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6. (Length of Rod A =) 5 cm AND (Length of Rod B =) 2 cm (3 x Rod A + 4 x Rod B =) 3 x 5 + 4 x 2 (= 15 cm + 8 cm) (Total length =) 23 (cm) or 230 (mm) ***Alternative measurements using inches (in)*** *Length of Rod A =) 2 in AND (Length of Rod B =) 0·8 in* *(3 x Rod A + 4 x Rod B =) 3 x 2 + 4 x 0·8* *(= 6 inches + 3·2 inches)* *(Total length =) 9·2 (in)*	 B1 M2 A1 *B1* *M2* *A1*	Allow tolerance of +/- 2mm for every measurement throughout. Allow measurements throughout in mm. May be implied in further work FT 'their 5 cm' and 'their 2 cm'. Award M1 for sight of (3 x Rod A =) 3 x 5 OR (4 x Rod B =) 4 x 2 A0 for 230 cm or 23 mm. *Allow tolerance of +/- 0·1 in for every measurement throughout.* *May be implied in further work* *FT 'their 2 in' and 'their 0·9 in'.* *Award M1 for sight of* *(3 x Rod A =) 3 x 2 OR (4 x Rod B =) 4 x 0·8*
Organisation and Communication • Labels describing statements • Conclusion Accuracy in Writing • Clear calculations • Units in final answer • Correct mathematical form	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
7. Sight of 0·3 x 20 or equivalent 6	M1 A1	Award M1 only for 3/10 = 6/20 without a final answer of 6. Allow 3/10 of 20 for M1. If candidates calculate the number of apples, bananas and lemons, they must clearly indicate numbers of apples = 6. Allow 6 out of 20 for M1 A1
8.(a) (£) 15*m*	B1	Mark final answer Accept *m15, 15×m, m×15*
8.(b) 20 – *k* (oranges)	B1	Mark final answer
9. 2 rectangles 3 cm by 4 cm correctly placed 2 rectangles 5 cm by 4 cm correctly placed	B1 B1	

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10. Correct plots of 3 or 4 of the points A, B, C, D AND no incorrect plots. Length = 8 (cm) AND Width = 6 (cm) (Perimeter = 2 × 8 + 2 × 6 or equivalent =) 28 (cm)	 B3 B1 B1	A correct and unambiguous length (8 cm) and width (6 cm) implies the first B3B1 B2 for either • three correct plots and one incorrect plot OR • two correct plots and no more than two incorrect plots B1 for either • one correct plot and no more than three incorrect plots OR • consistent use of reverse coordinates and no other plots The length (8 cm) AND width (6 cm) may be seen in either order. A correct and unambiguous length (8 cm) and width (6 cm) implies the first B3, if not previously awarded. FT from their plots only if a single rectangle has been formed or if three points are plotted and they form a right angle when joined. FT 2×'their 8' + 2×'their 6', provided previous B1 awarded. OR FT 2×'their stated 8' + 2×'their stated 6', provided a rectangle seen or implied
Alternative method ***(if no plots shown)*** *(Length =) 3 – (– 5) OR 3 + 5* *= 8 (cm)* *(Width =) 4 – (– 2) OR 4 +2* *= 6 (cm)* *(Perimeter = 2 × 8 + 2 × 6 or equivalent =) 28 (cm)*	 *M1* *A1* *M1* *A1* *B1*	 *FT 2 × 'their 8' + 2 × 'their 6', provided at least one M1~~)~~ previously awarded*

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11. Showing 40% and (9%) and 30% OR $\frac{40}{100}$ and $\frac{9}{100}$ and $\frac{30}{100}$ OR 0·4 and 0·09 and (0·3) OR three correct calculations for a common amount. 9% 0·3 $\frac{2}{5}$ in order	B2 B1	Award B2 for one of the following: • all correct % ($\frac{40}{100}$ or $\frac{30}{100}$ must be shown as 40% or 30%) • all correct fractions with a **common denominator** (could include decimals as numerators and denominators) • all correct decimals • correct work using a common amount • a valid combination that allows full comparison (e.g. 2/5 = 0·4 and 0·3 = 30%). Award B1 for one of the following: • one correct conversion (percentage or decimal) • two correct fractions with a common denominator • two correct calculations for a common amount. Allow any unambiguous indication (e.g. 'converted' values.) Correct answer with no incorrect conversions seen gains the final B1. If incorrect conversions seen, then **strict FT** of 'their work' only if B1 gained. Correct answer, with no other marks awarded, gains final B1 only.
12. Length = 20 (cm) Width = 4 (cm)	B2	Answer space takes precedence. Must be in the correct order for B2. Award B1 for one of the following as a final answer or final attempt: • length × width = 80 (e.g. length = 4 AND width = 20 or length = 16 AND width = 5) • 80 ÷ width = length e.g. 80 ÷ 5 = 16 or 80 ÷ 20 = 4 or 80 ÷ 10 = 8 • length = 5 × width e.g. length = 16 AND width = 3·2 or 3×5 = 15 If no answers are given on answer space: • Length = 20 (cm) and Width = 4 (cm) must be explicitly identified as a final answer for B2.
13.(a) $3x = 27$ (x =) 9	B1 B1	Mark final answer. FT from $3x = k$. Unsupported answer of 9 is awarded B1B1. $x = \frac{27}{3}$ is awarded B1B0. If FT leads to a whole number answer, it must be shown as a whole number. Otherwise accept a fraction (e.g. if $3x = 7$, then $x = \frac{7}{3}$ is awarded B0B1, but $x = 7 \div 3$ is awarded B0B0). Allow B1B1 for a correct embedded answer BUT B1B0 if contradicted by $x \neq 9$.

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<table>
<tr><td>13.(b)
$8f - 13g$</td><td>B2</td><td>Mark final answer.
Must be an expression for B2.
Award B1 for one of the following:
• sight of $(+)8f$
• sight of $-13g$ (do not allow …..– $-13g$)
• $8f$ + – $13g$.</td></tr>
<tr><td>14.(a) 11 lb</td><td>B1</td><td></td></tr>
<tr><td>14.(b) 175 pints</td><td>B1</td><td></td></tr>
<tr><td>15.
$2(n - 7)$ or equivalent e.g. $2n - 14$.</td><td>B3</td><td>Answer space takes precedence.

For B3, accept as a final answer of:
• $2 \times (n - 7)$
• $(n - 7)2$
• $(n - 7) \times 2$.
Award B2 if incorrect subsequent working for one of the above.

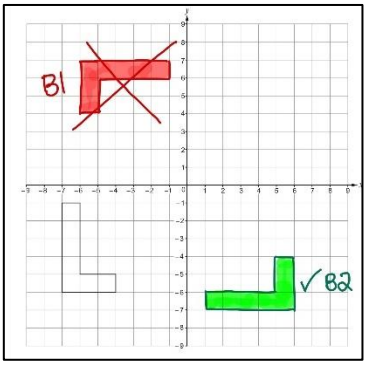
Award B2 for sight of one of the following:
<table><tr><th>missing brackets</th><th>error in Samir’s age</th></tr><tr><td>• $2 \times n - 7$
• $n - 7 \times 2$</td><td>• $2(n + 7)$
• $2 \times (n + 7)$
• $(n + 7)2$
• $(n + 7) \times 2$
• $2(7 - n)$
• $2 \times (7 - n)$
• $(7 - n)2$
• $(7 - n) \times 2$
• $2n + 14$
• $14 - 2n$</td></tr></table>
Award B1 for sight of one of the following:
• $n - 7$
• $2 \times n + 7$
• $n + 7 \times 2$
• $2 \times 7 - n$
• $7 - n \times 2$
• $2n - 7$
• $n - 14$
• $n - 72$.

Allow use a different letter for n.</td></tr>
<tr><td>16.(a) 28</td><td>B1</td><td>Allow B1 for a correct embedded answer
(e.g. 28 ÷ 4 = 7 BUT B0 if contradicted by total ≠ 28).
Allow the sequence 7,14,21,28 for B1, but only if no further numbers are shown.</td></tr>
</table>

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16.(b) Four numbers (in any order) with a total of 28 and range of 6 e.g. **3 7 9 9** **3 8 8 9** **4 7 7 10** **4 6 8 10** **4 5 9 10** **4 4 10 10** **5 5 7 11** **5 6 6 11**	B2	Numbers may be seen in any order. Accept answers using fractions and decimals. FT 'their total' from 16(a). Award B1 for **four** numbers with one of the following: • total = 28 • total = 'their total' from 16(a) • range = 6.
17. a = 63(°) b = 117(°) c = 117(°)	B1 B1 B1	Answer line takes precedence. Check diagram for answers if no answers written on answer lines. FT 'their b'.
18. Identifying 12 possible combinations Identifying the 3 correct combinations that give a score of 6 or more (**2** and **4**, **3** and **3**, **3** and **4**) (Probability of '6 or more' =) $\frac{3}{12}$ or equivalent ISW (but note comment for M1 below) (Number of winning scores =) $\frac{3}{12} \times 60$ or equivalent = 15	B1 B1 B1 M1 A1	Award B1 for convincing identification of the 12 combinations, for example: • simply stating 12 • (3 × 4 =) 12 • showing all combinations 1+1, 1+2, etc. • all 12 'totals' • (2,3,3,4,4,4,5,5,5,6,6,7) shown with no extras • completed sample space drawn (3 by 4). **Strict FT** only if a list of all possible scores previously stated. A fraction with a denominator of 12 implies the first B1. Unsupported $\frac{3}{12}$ or equivalent implies previous B1B1. Probability may be implied in later working (e.g. 60 ÷ 12 = 5, 5 × 3 = 15). FT if a clear numerator and denominator can be identified from previous work. e.g. Possible scores 2, 3, 4 ,5, 6, 7 (B0) 2 scores of 6 or more (B1 FT) Probability = $\frac{2}{6}$ (B1 FT) FT 'their $\frac{3}{12}$' If 'their $\frac{3}{12}$' incorrectly simplified and used then award B0 previously. Must not come from incorrect working. Award M1 A0 for a final answer of ($\frac{3}{12}$ =) $\frac{15}{60}$ Note: using 'a winning score of 6' instead of 'a winning score of 6 or more' can be awarded a maximum of B1B0B1M1A1.

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19.(a)	$\frac{48}{400}$ (× 100) or equivalent = 12(%)	M1 A1	M1 for sight of 0·12. Note: other complete valid methods to look out for include: • 48 ÷ 4 • 10% + 1% + 1% (= 40 + 4 + 4) • (48 out of 400 =) 12 out of 100 = 12(%)
19.(b)	Use of $\frac{45}{9}$ or equivalent (£)40 AND (£)5	M1 A1	Sight of an appropriate 5 (or 40) implies M1. Accept in either order.
19.(c)	(1 −) $\frac{1}{8}$ = $\frac{7}{8}$	B1 B1	Award B1 for sight of $\frac{1}{8}$ or 0·125 or 1 ÷ 8. FT from 1 – $\frac{m}{n}$ where $\frac{m}{n}$ clearly shown as 'their $\frac{1}{8}$' provided it is written as a fraction and not $\frac{1}{2}$ Mark final answer. A final answer of 0·875 is awarded B1B0.
19(c)	*Alternative method* $\frac{8-1}{8}$ *or* $\frac{2^3-1}{2^3}$ = $\frac{7}{8}$	*B1* *B1*	*For consistent correct use of $2^3 = 8$* *FT for 'their consistent value of 2^3'* *e.g.* $\frac{6-1}{6} = \frac{5}{6}$ *gains B0B1.* *Mark final answer.* *A final answer of 0·875 is awarded B1B0.*
20.		B2	Award B2 for the correct rotation drawn with no other shapes drawn on the grid. Award B1 for a 90° correct clockwise rotation with either: • no other shapes drawn on the grid • the correct rotation (no others).

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GCSE MARKING SCHEME

SUMMER 2023

GCSE
MATHEMATICS
UNIT 2 – FOUNDATION TIER
3300U20-1

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WJEC GCSE MATHEMATICS

SUMMER 2023 MARK SCHEME

Unit 2: Foundation Tier	Mark	Comments
1.(a) 15 214	B1	
1.(b) 5	B1	Allow embedded answers.
1.(c) 824	B1	
2.(a) certain	B1	
2.(b) impossible	B1	
2.(c) unlikely	B1	
3.(a) $\frac{12}{19}$ $\frac{42}{79}$	B2	B2 for the two correct fractions circled, with no incorrect fractions circled. B1 for one of the following: • one fraction circled, which is correct. • two fractions circled, one of which is correct. • three fractions circled, two of which are correct.
3.(b) 4 boxes shaded	B1	
4.(a) cylinder	B1	
4.(b) (regular) pentagon	B1	
4.(c) parallelogram	B1	
5. 11 13 15 17 20 22 29 or 29 22 20 17 15 13 11 (Median =) 17	M1 A1	For arranging the 7 numbers in ascending or descending order
6. a = 30 b = 17 c = 40 d = 13	 B1 B1 B1 B1	Answer space takes precedence. CAO F.T. 107 – 3 × 'their a' F.T. 57 – 'their b' Strict F.T. 100 – 'their a' – their b' – 'their c'
7.(a) acute	B1	
7.(b) square	B1	
8.(a)(i) subtract eleven (from the previous term)	B1	Accept 'take away 11', '– 11' or '73 - 11n'. B0 for n – 11.
8.(a)(ii) multiply (previous term) by four	B1	Accept 'times by 4' or '× 4'. B0 for n × 4
8.(b)(i) (x =) 31	B1	Accept embedded answers, unless contradicted.
8.(b)(ii) (w =) 103.1	B1	Accept embedded answers, unless contradicted.
9.(a) $\frac{3}{8}$ × 142 OR (142 ÷ 8) × 3 = 53.25 ISW	M1 A1	 Award M1 A0 for one of the following: • $\frac{213}{4}$ • $53\frac{1}{4}$ • 426 ÷ 8 • An unsupported 53.3
9.(b) 17.16 ISW	B1	

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10. (Number of red discs = 2/5 × 10 =) 4	B1	Allow 4/10 or '4 out of 10' or (number of blue discs = 3/5 x 10 =) 6
(Total number of discs = 10 + 10 =) 20	B1	May be seen in the denominator of their answer. Implied by number of red discs = 4 AND number of blue discs = 16. F.T. 'their number of red discs'.
(Probability of a red disc =) $\frac{4}{20}$ ISW	B1	F.T. $\frac{\text{'their number of red discs'}}{20}$ provided < 1. Award B1 B1 B1 for an unsupported final answer of 4/20 or equivalent.
10. Alternative method *(Probability of a red disc =) 2/5 ÷ 2*	*M2*	
2/10 ISW	*A1*	
10. Organisation and Communication	OC1	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.
Accuracy of writing	W1	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.
11.(a) (x =) 360 – (115 + 97 + 42) or equivalent. = 106	M1 A1	Check diagram for answer. Note: 360 – 254 Note: Award M1A1 for a correct embedded answer BUT only M1A0 if contradicted by $x \neq 106$.
11.(b) $y = \frac{180 - 78}{2}$ = 51	M1 A1	Check diagram for answer. Note: $\frac{102}{2}$ Award M1 for sight of $78 + y + y = 180$. Note: Award M1A1 for a correct embedded answer BUT only M1A0 if contradicted by $y \neq 51$.
12.(a) $\frac{1}{6}$	B1	

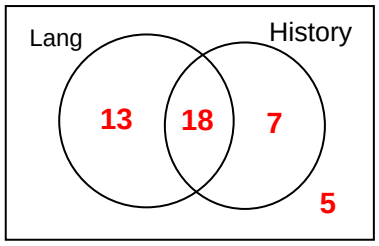
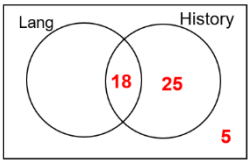
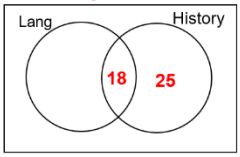
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12.(b)	31 43 47	B2	Answer space takes precedence. Award B2 for all three primes. Accept in any order. Award B1 for two correct primes. If no answers given on answer spaces, and numbers given are circled/clearly indicated, award B1 for one of the following: • two correct primes provided no more than 3 numbers selected • all 3 primes and 1 incorrect number if 4 numbers selected.
13.	Isaac **36** Nadia **12** Dewi **24**	 B1 B1 B1	Answer space takes precedence. CAO FT ⅓ of 'their Isaac'. Allow truncation or rounding where a whole number does not result on FT. FT 2 × 'their Nadia'. Allow truncation or rounding where a whole number does not result on FT. If no answers are given on answer space, ages must explicitly be identified as a final answer for a possible B1B1B1.
14.(a)	−2 (+)4	B2	Award B1 for one of the following: • −2 • 'their −2' + 6 evaluated correctly provided 'their –2' is negative.
14.(b)	0·7 or equivalent	B2	Mark final answer. Award B2 for unsupported 0·7 or not from incorrect working. Award B1 for one of the following: • sight of (+)27·9 (not (+)27·9g and not –27·9(g)) • sight of −27·2 (not −27·2h) • 0·7 (with additional letters) • a final answer of 55·1 (27·9 implied).

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15. Correctly drawn pie chart within tolerance **AND** correctly labelled **Red** = 72(°) (allow 70° to 74°) **Green** = 108(°) (allow 106° to 110°)	B3	Award B2 for one of the following: • correctly drawn pie chart within tolerance but not labelled or incorrectly labelled • pie chart drawn within tolerance but not a straight line • pie chart drawn not starting from the centre (but end point within tolerance) • sight of red = 72(°) • sight of green = 108(°). Award B1 for sight of one of the following: • 72(°) • 108(°) • (red=) $\frac{2}{10} \times 360$ or equivalent • (red=) $\frac{2}{5} \times 180$ or equivalent • (green=) $\frac{3}{10} \times 360$ or equivalent • (green=) $\frac{3}{5} \times 180$ or equivalent • 'their **derived** 72' and 'their **derived** 108' drawn correctly, provided that 'their 72' + 'their 108' = 180 and identified as red and green, and not 90°.
16. $\frac{45}{1{\cdot}25}$ or equivalent 36 (mph)	M2 A1	May be seen in stages. Must be a complete and correct method e.g. $\frac{45}{75} \times 60$ or $\frac{45}{5} \times 4$ (working with 15 mins) Award M1 for sight of one of the following: • $\frac{45}{\text{1 hour 15 mins}}$ • $\frac{45}{1{\cdot}15}$ • 39·13(0…) • $\frac{45}{75}$ • 0·6 CAO.
17. (Volume of cuboid = $4 \times 5 \times 20$ =) 400 (cm^3) (Volume of cube = $3 \times 3 \times 3$ =) 27 (cm^3) (Number of cubes =) $\frac{4 \times 5 \times 20}{3 \times 3 \times 3}$ or equivalent = 14·8(…..) (Number of complete cubes =) 14	B1 B1 M1 A1 B1	Award B0 if 400 has come from incorrect working or if subsequent working is seen (e.g. finding the total surface area or $4 \times 5 \times 20 = 400$, $400 \times 2 = 800$). FT 'their 400' ÷ 'their 27', provided 'their 27' ≠ 3 and that **B1 has previously been awarded or $4 \times 5 \times 20$ and $3 \times 3 \times 3$ seen.** May be implied in the final answer. FT only if truncation required. If $\frac{4 \times 5 \times 20}{3 \times 3 \times 3}$ = 14 (complete cubes) is seen, then award B1 B1 M1 A1 B1.

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18.(a)(i)	235(°)	B1	
18.(a)(ii)	055(°)	B1	B0 for 55(°)
18.(b)	P and S	B1	Ignore any sketches (correct or incorrect). Accept in any order. Allow (00)5(°) and 355(°).
19.(a)	 5 AND 18 in correct position. Total of 25 for *History.* Overall total of 43	 B1 B1 B1	Diagram takes precedence. If 'notches/tallies' are used, penalise −1 once. Award B0 for one of the following: • any other number written in the same section • 4 and 1 written for 5. FT 'their 7' + 'their 18', provided both sections are non-zero and no section is blank. FT 'their 13' + 'their 18'+ 'their 7' + 'their 5' provided all sections are non-zero and no section is blank. Note: The following answers are awarded  B1B0B0  B0B0B0
19.(b)	$\frac{31}{43}$ or equivalent. ISW	B2	For B2 or B1, the numerator and denominator must both be whole numbers. For B2, accept: • 72·0(9…)% or 0·720(9…). • 72·1% or 0·721 • 72% or 0·72 from correct working. FT $\frac{\text{'their 13' + 'their 18'}}{43}$ provided neither section is blank. Award B1 for one of the following: • a numerator of 31 in a fraction < 1 • FT 'their 13' + 'their 18', provided neither section is blank, as a numerator in a fraction < 1 • a denominator of 43 in a fraction < 1. An answer of $\frac{31}{43}$ gains B2 regardless of 'their Venn diagram'. Penalise incorrect notation (e.g. '31 in 43') −1.

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GCSE MARKING SCHEME

SUMMER 2023

GCSE
MATHEMATICS
UNIT 1 – INTERMEDIATE TIER
3300U30-1

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Unit 1: Intermediate Tier	Mark	Comments
1. Showing 40% and (9%) and 30% OR $\frac{40}{100}$ and $\frac{9}{100}$ and $\frac{30}{100}$ OR 0·4 and 0·09 and (0·3) OR three correct calculations for a common amount.	B2	Award B2 for one of the following: • all correct % ($\frac{40}{100}$ or $\frac{30}{100}$ must be shown as 40% or 30%) • all correct fractions with a **common denominator** (could include decimals as numerators and denominators) • all correct decimals • correct work using a common amount • a valid combination that allows full comparison (e.g. 2/5 = 0·4 and 0·3 = 30%). Award B1 for one of the following: • one correct conversion (percentage or decimal) • two correct fractions with a common denominator • two correct calculations for a common amount.
9% 0·3 $\frac{2}{5}$ in order	B1	Allow any unambiguous indication (e.g. 'converted' values.) Correct answer with no incorrect conversions seen gains the final B1. If incorrect conversions seen, then **strict FT** of 'their work' only if B1 gained. Correct answer, with no other marks awarded, gains final B1 only.
2. Length = 20 (cm) Width = 4 (cm)	B2	Answer space takes precedence. Must be in the correct order for B2. Award B1 for one of the following as a final answer or final attempt: • length × width = 80 (e.g. length = 4 AND width = 20 or length = 16 AND width = 5) • 80 ÷ width = length e.g 80 ÷ 5 = 16 or 80 ÷ 20 = 4 or 80 ÷ 10 = 8 • length = 5 × width e.g length = 16 AND width = 3·2 or 3 × 5 = 15 If no answers are given on answer space: • Length = 20 (cm) and Width = 4 (cm) must be explicitly identified as a final answer for B2.
3.(a)(i) (x =) 24	B1	Mark final answer. Allow B1 for a correct embedded answer BUT B0 if contradicted by $x \neq 24$.

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<table>
<tr><td>3.(a)(ii)
$3x = 27$
(x =) 9</td><td>B1
B1</td><td>Mark final answer.

FT from $3x = k$.
Unsupported answer of 9 is awarded B1B1.
$x = \frac{27}{3}$ is awarded B1B0.
If FT leads to a whole number answer, it must be shown as a whole number. Otherwise accept a fraction (e.g. if $3x = 7$, then $x = \frac{7}{3}$ is awarded B0B1, but $x = 7 \div 3$ is awarded B0B0).

Allow B1B1 for a correct embedded answer BUT B1B0 if contradicted by $x \neq 9$.</td></tr>
<tr><td>3.(b)
$8f - 13g$</td><td>B2</td><td>Mark final answer.
Must be an expression for B2.
Award B1 for one of the following:
• sight of $(+)8f$
• sight of $-13g$ (do not allow …..– $-13g$)
• $8f + -13g$.</td></tr>
<tr><td>4.(a) 11 lb</td><td>B1</td><td></td></tr>
<tr><td>4.(b) 175 pints</td><td>B1</td><td></td></tr>
<tr><td>5.

$2(n - 7)$ or equivalent e.g. $2n - 14$.</td><td>

B3</td><td>Answer space takes precedence.

For B3, accept as a final answer of:
• $2 \times (n - 7)$
• $(n - 7)2$
• $(n - 7) \times 2$.
Award B2 if incorrect subsequent working for one of the above.

Award B2 for sight of one of the following:
<table><tr><th>missing brackets</th><th>error in Samir's age</th></tr><tr><td>• $2 \times n - 7$
• $n - 7 \times 2$</td><td>• $2(n + 7)$
• $2 \times (n + 7)$
• $(n + 7)2$
• $(n + 7) \times 2$
• $2(7 - n)$
• $2 \times (7 - n)$
• $(7 - n)2$
• $(7 - n) \times 2$
• $2n + 14$
• $14 - 2n$</td></tr></table>
Award B1 for sight of one of the following:
• $n - 7$
• $2 \times n + 7$
• $n + 7 \times 2$
• $2 \times 7 - n$
• $7 - n \times 2$
• $2n - 7$
• $n - 14$
• $n - 72$.

Allow use of a different letter for n.</td></tr>
</table>

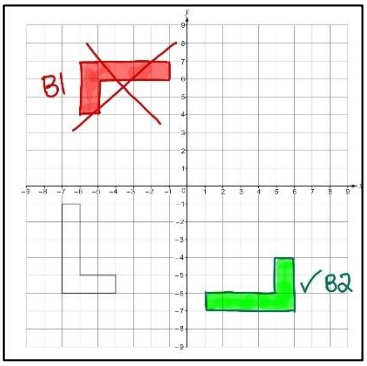
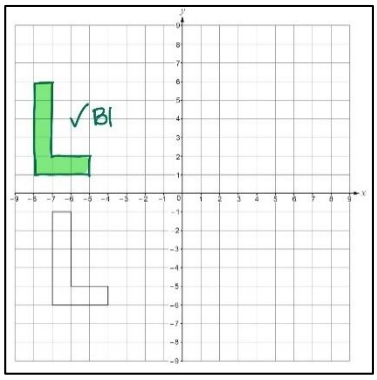
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6.(a) 28	B1	Allow B1 for a correct embedded answer (e.g. 28 ÷ 4 = 7 BUT B0 if contradicted by total ≠ 28). Allow the sequence 7,14,21,28 for B1, but only if no further numbers are shown.
6.(b) Four numbers (in any order) with a total of 28 and range of 6 e.g. **3 7 9 9** **3 8 8 9** **4 7 7 10** **4 6 8 10** **4 5 9 10** **4 4 10 10** **5 5 7 11** **5 6 6 11**	B2	Numbers may be seen in any order. Accept answers using fractions and decimals. FT 'their total' from 6(a). Award B1 for **four** numbers with one of the following: • total = 28 • total = 'their total' from 6(a) • range = 6.
7. a = 63(°) b = 117(°) c = 117(°)	 B1 B1 B1	Answer line takes precedence. Check diagram for answers if no answers written on answer lines. FT 'their b'.
8. Identifying 12 possible combinations Identifying the 3 correct combinations that give a score of 6 or more (**2** and **4**, **3** and **3**, **3** and **4**) (Probability of '6 or more' =) $\frac{3}{12}$ or equivalent ISW (but note comment for M1 below) (Number of winning scores =) $\frac{3}{12}$ × 60 or equivalent = 15	B1 B1 B1 M1 A1	Award B1 for convincing identification of the 12 combinations, for example: • simply stating 12 • (3 × 4 =) 12 • showing all combinations 1+1, 1+2, etc. • all 12 'totals' • (2,3,3,4,4,4,5,5,5,6,6,7) shown with no extras • completed sample space drawn (3 by 4). **Strict FT** only if a list of all possible scores previously stated. A fraction with a denominator of 12 implies the first B1. Unsupported $\frac{3}{12}$ or equivalent implies previous B1B1. Probability may be implied in later working (e.g. 60 ÷ 12 = 5, 5 × 3 = 15). FT if a clear numerator and denominator can be identified from previous work. e.g. Possible scores 2, 3, 4 ,5, 6, 7 (B0) 2 scores of 6 or more (B1 FT) Probability = $\frac{2}{6}$ (B1 FT) FT 'their $\frac{3}{12}$' If 'their $\frac{3}{12}$' incorrectly simplified and used then award B0 previously. Must not come from incorrect working. Award M1 A0 for a final answer of ($\frac{3}{12}$ =) $\frac{15}{60}$ Note: using 'a winning score of 6' instead of 'a winning score of 6 or more' can be awarded a maximum of B1B0B1M1A1.

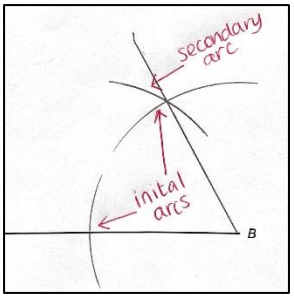
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8. Organisation and Communication.	OC1	For OC1, candidates will be expected to: • present their response in a structured way • explain to the reader what they are doing at each step of their response • lay out their explanation and working in a way that is clear and logical • write a conclusion that draws together their results and explains what their answer means
Accuracy of writing.	W1	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.
9.(a) $\frac{48}{400}$ (× 100) or equivalent = 12(%)	M1 A1	M1 for sight of 0·12. Note: other complete valid methods to look out for include: • 48 ÷ 4 • 10% + 1% + 1% (= 40 + 4 + 4) • (48 out of 400 =) 12 out of 100 = 12(%)
9.(b) Use of $\frac{45}{9}$ or equivalent (£)40 AND (£)5	M1 A1	Sight of an appropriate 5 (or 40) implies M1. Accept in either order.
9.(c) (1 −) $\frac{1}{8}$ = $\frac{7}{8}$	B1 B1	Award B1 for sight of $\frac{1}{8}$ or 0·125 or 1 ÷ 8. FT from 1 – $\frac{m}{n}$ where $\frac{m}{n}$ clearly shown as 'their $\frac{1}{8}$' provided it is written as a fraction and not $\frac{1}{2}$ Mark final answer. A final answer of 0·875 is awarded B1B0.
9(c) Alternative method $\frac{8-1}{8}$ *or* $\frac{2^3-1}{2^3}$ = $\frac{7}{8}$	*B1* *B1*	*For consistent correct use of $2^3 = 8$* *FT for 'their consistent value of 2^3'* *e.g. $\frac{6-1}{6} = \frac{5}{6}$ gains B0B1.* *Mark final answer.* *A final answer of 0·875 is awarded B1B0.*
10. $\frac{3}{4}$ × 512 OR 512 – $\frac{1}{4}$ × 512 or equivalent = 384 $\frac{3}{4}$ × 384 OR 384 – $\frac{1}{4}$ × 384 or equivalent (OUTPUT =) 288 ISW	M1 A1 M1 A1	Award M1 for full method for calculating the OUTPUT.(Note: 512 – 128). Award M1 for full method for calculating the OUTPUT.(Note: 384 – 96). FT 'their 384' if greater than 300. FT if 'their 288' < 300, or further evaluation correctly carried out until their output < 300. If no marks gained allow SC1 for sight of 128. Award M2 for $\frac{9}{16}$ × 512 with answer of 288 is awarded A2.

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11.(a) 	B2	Award B2 for the correct rotation drawn with no other shapes drawn on the grid. Award B1 for a 90° correct clockwise rotation with either: • no other shapes drawn on the grid • the correct rotation (no others).
11.(b)(i) 	B1	
11.(b)(ii) $\begin{pmatrix}1\\-7\end{pmatrix}$	B1	Award B0 for • 1 -7 (missing brackets) • $\begin{pmatrix}-7\\1\end{pmatrix}$ • $(1,-7)$ • $\frac{1}{-7}$ with or without brackets. • $-\begin{pmatrix}-1\\7\end{pmatrix}$.
12.(a) For a single method that produces 2 prime factors from the set {3, 3, 3, 5, 5} before the 2nd 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 × 135 675 = 3 × 225 135 = 5 × 27 135 = 3 × 45) CAO. For sight of the five 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 $(3^3)(5^2)$ and $3^3.5^2$ and 3^35^2 Do not allow $3^3,5^2$ Inclusion of 1 as a factor gets B0.
12.(b) 10	B1	Do not accept 2 × 5.
13.(a)(i) m^7	B1	
13.(a)(ii) m^{10}	B1	
13.(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.

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13.(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).
14.(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: 
14.(b)	Correct construction of 90°	B1	Must be at point *R* above or below *LM*. Correct construction arcs (initial and secondary) **must** be seen.
14.(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.
14.(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*	

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15. $(AC^2 =)\ 8^2 + 6^2$ $(AC =) \sqrt{8^2 + 6^2}$ or equivalent $(AC =)$ 10 (cm) (Curved length =) • $\frac{6 \times 3{\cdot}14}{2}$ • $\frac{2 \times 3 \times 3{\cdot}14}{2}$ • $3 \times 3{\cdot}14$ • 3π • 9·42 or equivalent (Perimeter of shape = 8 + 10 + 9·42 =) 27·42(cm)	M1 m1 A1 B1 A1	Check diagram. Note: $(AC^2 =)\ 64 + 36$ FT from $\sqrt{'their\ 8^{2\prime} + 'their\ 6^{2\prime}}$ CAO. Final answer of AC = 100 is M1m0A0. Do not ignore subsequent working e.g. 3 × 3·14 = 9·42, then 9·42 × 2 or 9·42 ÷ 2 would gain B0. Allow 27·4(cm). Award A0 for 18 + 3π. FT 'their *AC*' **only** if M1 gained. FT 'their curved length' **only** if B0 awarded **and** for one of the following: • 3·14 used to find the circumference of a circle • area of a semicircle used. For example, M1m1A1 awarded for 10 (cm), B1 for 3 × 3·14 = 9 (cm) A0 for 8 + 10 + 9 = 27 (cm) as B1 previously awarded. Note, if a final answer of: • 33·4(2)(cm) is given (6cm also included) award M1m1A1B1A0 • 36·8(4)(cm) is given (full circumference used) award M1m1A1B0A1 • 32·1(3) (cm) is given (area semicircle used) award M1m1A1B0A1.
16. Sight of 4(hr) 35(min) AND 2(hr) 45(min) OR Sight of 275(min) AND 165(min) OR sight of 2 × 5(min) in an appropriate calculation. Valid method e.g. • 4(hr) 35(min) + 2(hr) 45(min)(=6(hr) 80(min)) 275(min) + 165(min) (= 440 (min)) • 6 (hr) 90 (min) – 10 (min) • 7 (hr) 30 (min) – 10 (min) • 4(hr) 40(min) + 2(hr) 50(min) – 10 (min) • 280 (min) + 170 (min) – 10(min) 7 (hr) 20 (min)	B1 M1 A1	Allow incorrect notation for time (e.g. 4:35 for 4(hr) 35(min)). If B0, FT provided unambiguously chosen: '4h 30m ≤ t_1 < 4h 40m' and '2h 40m ≤ t_2 < 2h 50m' OR '270m ≤ t_1 < 280m' and '160m ≤ t_2 < 170m' Allow incorrect notation for time (e.g. 4:35 for 4(hr) 35(min)). CAO. If units are given they must be correct. Award B1M1A0 for a final answer of 6hrs 80min, 6:80 or 7:20.
17.(a) P(Bus =) 1 − 0·25 − 0·45 = 0·3 AND shown on relevant branch. 0·96 shown on <u>all</u> three branches.	M1 A1 B1	 Award M1A0 for 0·3 in working space and not on diagram.
17.(b) 0·25 × 0·04 or equivalent = 0·01 or equivalent	M1 A1	 CAO

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18. (Length) Area None Length Volume Length	B3	*Must use the terminology given in the question.* B3 for all 5 correct. B2 for 3 or 4 correct. B1 for 2 correct. B0 otherwise.
19.(a) $7{\cdot}6 \times 10^{-3}$	B1	
19.(b) 6×10^{5}	B1	
19.(c) $2{\cdot}8 \times 10^{4}$	B2	Mark final answer. Award B1 for one of the following: • sight of 28×10^{3} • sight of 28 000 • equivalent correct value but not in standard form • sight of 23 000 AND 5000 • 'their 28000' is written correctly in standard form, following one place value error in one of the numbers from work seen.
20.(a) (*AOY* =) 36(°) (% shaded =) $\frac{36}{360}$ (× 100) or equivalent = 10(%)	B1 M1 A1	Check diagram. FT 'their derived or stated angle *AOY*' provided not 54°. Award M0A0 for $\frac{360(°)}{36(°)}$ = 10, but award M1A1 if a final answer of 10% is seen. If no marks awarded, award: • SC2 for unsupported 10% (*AOY* not shown or stated to be 36(°)) • SC1 for a final answer of 15% (from using 54(°)).
20.(b) Statement explaining that, 'The **tangent** at any point on a circle is **perpendicular** (or equivalent) to the **radius** at that point'.	E1	Accept unambiguous similar wording. e.g. 'Radius and tangent 90(°)'. Diameter could be used in place of radius. Must refer to tangent and radius by name (not simply *AY* and *OA* or description).

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GCSE MARKING SCHEME

SUMMER 2023

GCSE
MATHEMATICS
UNIT 2 – INTERMEDIATE TIER
3300U40-1

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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

SUMMER 2023 MARK SCHEME

Unit 2: Intermediate Tier	Mark	Comments
1.(a) (x =) 360 – (115 + 97 + 42) or equivalent. = 106	 M1 A1	Check diagram for answer. Note: 360 – 254 Note: Award M1A1 for a correct embedded answer BUT only M1A0 if contradicted by $x \neq 106$.
1.(b) $y = \frac{180 - 78}{2}$ = 51	 M1 A1	Check diagram for answer. Note: $\frac{102}{2}$ Award M1 for sight of $78 + y + y = 180$. Note: Award M1A1 for a correct embedded answer BUT only M1A0 if contradicted by $y \neq 51$.
2.(a) $\frac{1}{6}$	B1	
2.(b) 31 43 47	B2	Answer space takes precedence. Award B2 for all three primes. Accept in any order. Award B1 for two correct primes. If no answers given on answer spaces, and numbers given are circled/clearly indicated, award B1 for one of the following: • two correct primes provided no more than 3 numbers selected • all 3 primes and 1 incorrect number if 4 numbers selected.
2.(c) (n =) 4	B1	Note: Award B1 for a correct embedded answer e.g. $3^4 = 81$, BUT B0 if contradicted by $n \neq 4$.
3. Isaac **36** Nadia **12** Dewi **24**	 B1 B1 B1	Answer space takes precedence. CAO FT ⅓ of 'their Isaac'. Allow truncation or rounding where a whole number does not result on FT. FT 2 × 'their Nadia'. Allow truncation or rounding where a whole number does not result on FT. If no answers are given on answer space, ages must explicitly be identified as a final answer for a possible B1B1B1.
4.(a) −2 (+)4	B2	Award B1 for one of the following: • −2 • 'their −2' + 6 evaluated correctly provided 'their –2' is negative.

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<table>
<tr>
<td>4.(b) 0·7 or equivalent</td>
<td>B2</td>
<td>Mark final answer.
Award B2 for unsupported 0·7 or not from incorrect working.
Award B1 for one of the following:
• sight of (+)27·9 (not (+)27·9g and not –27·9(g))
• sight of −27·2 (not −27·2h)
• 0·7 (with additional letters)
• a final answer of 55·1 (27·9 implied).</td>
</tr>
<tr>
<td>5.(a) Correctly drawn pie chart within tolerance
AND correctly labelled

Red = 72(°) (allow 70° to 74°)
Green = 108(°) (allow 106° to 110°)</td>
<td>B3</td>
<td>Award B2 for one of the following:
• correctly drawn pie chart within tolerance but not labelled or incorrectly labelled
• pie chart drawn within tolerance but not a straight line
• pie chart drawn not starting from the centre (but with end point within tolerance)
• sight of red = 72(°)
• sight of green = 108(°).

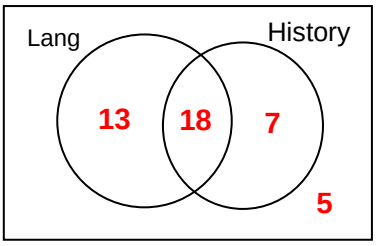
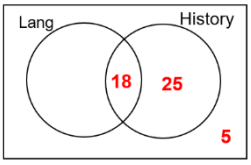
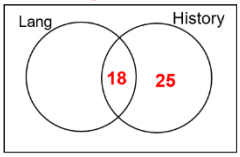
Award B1 for sight of one of the following:
• 72(°)
• 108(°)
• (red=) $\frac{2}{10} \times 360$ or equivalent
• (red=) $\frac{2}{5} \times 180$ or equivalent
• (green=) $\frac{3}{10} \times 360$ or equivalent
• (green=) $\frac{3}{5} \times 180$ or equivalent
• ‘their derived 72’ and ‘their derived 108’ drawn correctly, provided that ‘their 72’ + ‘their 108’ = 180 and identified as red and green, and not 90°.</td>
</tr>
<tr>
<td>5.(b) D A C B</td>
<td>B2</td>
<td>Award B2 for writing the correct fractions in order
$\frac{1}{7}$ $\frac{1}{6}$ $\frac{1}{4}$ $\frac{1}{2}$

Award B1 for one of the following:
• sight of correct fractions
• BCAD (reversed order)
<table>
<tr><th>DCB in order</th><th>DAC in order</th><th>DAB in order</th><th>ACB in order</th></tr>
<tr><td>ADCB
DCAB
DCBA
DCB</td><td>BDAC
DBAC
DABC
DAC</td><td>CDAB
DCAB
DABC
DABC</td><td>ADCB
ACDB
ACBD
ACB</td></tr>
</table>
Do not accept repeated letters.</td>
</tr>
</table>

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6. $\frac{45}{1{\cdot}25}$ or equivalent	M2	May be seen in stages. Must be a complete and correct method e.g. $\frac{45}{75} \times 60$ or $\frac{45}{5} \times 4$ (working with 15 mins) Award M1 for sight of one of the following: • $\frac{45}{1 \text{ hour } 15 \text{ mins}}$ • $\frac{45}{1{\cdot}15}$ • 39·13(0…) • $\frac{45}{75}$ • 0·6
36 (mph)	A1	CAO.
7. 360 ÷ 15 or equivalent	M1	
= 24(°)	A1	Mark final answer. If no marks awarded, award SC1 for one of the following: • a final answer of 156° • sight of 24° (if final answer is not 24°).
8. (Volume of cuboid = 4 × 5 × 20 =) 400 (cm^3)	B1	Award B0 if 400 has come from incorrect working or if subsequent working is seen (e.g. finding the total surface area or 4 × 5 × 20 = 400, 400 × 2 = 800).
(Volume of cube = 3 × 3 × 3 =) 27 (cm^3)	B1	
(Number of cubes =) $\frac{4 \times 5 \times 20}{3 \times 3 \times 3}$ or equivalent	M1	FT 'their 400' ÷ 'their 27', provided 'their 27' ≠ 3 and that **B1 has previously been awarded or 4 × 5 × 20 and 3 × 3 × 3 seen.**
= 14·8(…..)	A1	May be implied in the final answer.
(Number of complete cubes =) 14	B1	FT only if truncation required. If $\frac{4 \times 5 \times 20}{3 \times 3 \times 3}$ = 14 (complete cubes) is seen, then award B1 B1 M1 A1 B1.
8. Organisation and Communication.	OC1	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
Accuracy of writing.	W1	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

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9.(a)(i)	235(°)	B1	
9.(a)(ii)	055(°)	B1	B0 for 55(°).
9.(b)	P and S	B1	Ignore any sketches (correct or incorrect). Accept in any order. Allow (00)5(°) and 355(°).
10.(a)	 5 AND 18 in correct position. Total of 25 for *History.* Overall total of 43	 B1 B1 B1	Diagram takes precedence. If 'notches/tallies' are used, penalise −1 once. Award B0 for one of the following: • any other number written in the same section • 4 and 1 written for 5. FT 'their 7' + 'their 18', provided both sections are non-zero and no section is blank. FT 'their 13' + 'their 18'+ 'their 7' + 'their 5' provided all sections are non-zero and no section is blank. Note: The following answers are awarded  B1B0B0  B0B0B0
10.(b)	$\frac{31}{43}$ or equivalent. ISW	B2	For B2 or B1, the numerator and denominator must both be whole numbers. For B2, accept: • 72·0(9…)% or 0·720(9…). • 72·1% or 0·721 • 72% or 0·72 from correct working. FT $\frac{\text{'their 13' + 'their 18'}}{43}$ provided neither section is blank. Award B1 for one of the following: • a numerator of 31 in a fraction < 1 • FT 'their 13' + 'their 18', provided neither section is blank, as a numerator in a fraction < 1 • a denominator of 43 in a fraction < 1. An answer of $\frac{31}{43}$ gains B2 regardless of 'their Venn diagram'. Penalise incorrect notation (e.g. '31 in 43') −1.

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11.(a)			FT until 2nd error.
	$7 + 5x - 10 = 3x + 8$ or equivalent.	B1	Bracket must be expanded or correct division by 5 e.g $x - 2 = \frac{3x}{5} + \frac{1}{5}$ (but not $x - 2 = \frac{3x + 1}{5}$)
	$2x = 11$ OR $-11 = -2x$	B1	Or equivalent Correctly simplifying the equation to a single x term and number term (e.g. $2x - 11 = 0$).
	$x = \frac{11}{2}$ or 5·5 or equivalent.	B1	Mark final answer. Correct answer implies B1B1B1. Do not allow $-x = \frac{-11}{2}$ or $x = \frac{-11}{-2}$ A final answer of '11 ÷ 2' is B1B1B0. If FT leads to a whole number answer, it must be shown as a whole number. Otherwise, accept a fraction. Allow any decimal answer to be rounded or truncated to 1 or more decimal place. Allow B1B1B1 for a correct embedded answer BUT only B1B1B0 if contradicted by $x \neq \frac{11}{2}$ or equivalent. Note: $12x - 24 = 3x + 8$ B0 $9x = 32$ B1 (FT) $x = \frac{32}{9}$ or $3{\cdot}5(55\ldots)$ or $3{\cdot}6$. B1 (FT) If no marks awarded, award SC1 for sight of one of the following: • $5x - 10$ • $12x - 24$.
11.(b)	$2f = 13 - h$ or $h - 13 = -2f$ $f = \frac{13 - h}{2}$ or $\frac{h - 13}{-2} = f$ or equivalent	B1 B1	Or equivalent. Or equivalent. Must not come from incorrect working. Mark final answer. FT only from $\pm 2f = \pm 13 \pm h$. Unsupported $f = \frac{\pm 13 \pm h}{\pm 2}$ implies B0B1 unless B2. Award B1B0 for $-f = \frac{h - 13}{2}$ or equivalent. **If no marks**, award SC1 for a final answer of either: • $f = (13 - h) \div 2$ with or without brackets • $f = (h - 13) \div -2$ with or without brackets • $\frac{13 - h}{2}$ ('$f =$' missing). • $\frac{h - 13}{-2}$ ('$f =$' missing).
11.(c)	$5(3x - 7y)$	B1	Mark final answer. Allow $-5(-3x + 7y)$ or $5(3x + -7y)$.

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12.(a) P(Bronze) = 0·2 **AND** P (No Prize) = 0·6 or equivalent	B2	The values in the table takes precedence. Award B1 for one of the following: • P(Bronze) = 0·2 (must be clearly identified) • P(No Prize) = 0·6 • P(Bronze) + P(No Prize) = 0·8 • P(Bronze) = ⅓ P(No Prize) provided both <1.
12.(b) 15 ÷ 0·02 × 0·18 or 15 × 9 or equivalent = 135	M1 A1	Must be for a complete method e.g. • 15 ÷ 2 = 7·5 7·5 × 18 = 135 • 750 – (450 + 150 + 15) • 0·02 : 0·18 15 : 135 (e.g 0·18 × 750, or 15 × 9) Award M1 A1 for a final answer of 15 : 135. Sight of 135 as a numerator in a fraction < 1 implies M1A0.
13. One correct evaluation $2 \le x \le 3$ 2 correct evaluations $2{\cdot}55 \le x \le 2{\cdot}75$, **(one evaluation < 0, one evaluation > 0)** 2 correct evaluations $2{\cdot}55 \le x \le 2{\cdot}65$, **(one evaluation < 0, one evaluation > 0)** $x = 2{\cdot}6$	 B1 B1 M1 A1	*Correct evaluation regarded as enough to identify if negative or positive.* *If evaluations not seen accept 'too high' or 'too low'.* *Look out for equating* $x^3 - 8x = -3$ $\underline{x}$ $\quad$ $\underline{x^3 - 8x + 3}$ 2 $\quad$ −5 2·1 $\quad$ −4·539 $\quad$ 2·55 $\quad$ −0·818…. 2·2 $\quad$ −3·952 $\quad$ 2·61 $\quad$ −0·1004… 2·3 $\quad$ −3·233 $\quad$ 2·62 $\quad$ 0·0247… 2·4 $\quad$ −2·376 $\quad$ 2.63 $\quad$ 0·1514… 2·5 $\quad$ −1·375 $\quad$ 2.64 $\quad$ 0·2797… **2·6 $\quad$ −0·224 $\quad$ 2·65 $\quad$ 0·409…** **2·7 $\quad$ 1·083** $\quad$ 2·75 $\quad$ 1·796.. 2·8 $\quad$ 2·552 2·9 $\quad$ 4·189 3 $\quad$ 6 Unsupported $x = 2{\cdot}6$ is awarded B0B0M0A0. An answer of $x = 2{\cdot}6$ can only be awarded M1A1, following sight of 2 correct evaluations $2{\cdot}55 \le x \le 2{\cdot}65$ (**one evaluation** < 0, **one evaluation** > 0).
14.(a) 1·2	B2	Mark final answer. Award B1 for one of the following: • sight of 1·1(5519…..). • an answer of 1·20. Do not award B2 or B1 for answers obtained from incorrect work (e.g. rounding and/or estimating).
14.(b) 0·043	B2	Mark final answer. Award B1 for sight of one of the following: • $\frac{1}{23}$ • 1 ÷ 23 • 0·0434(…) • 0·0435 • 0·04.
14.(c)(i) 12	B1	
14.(c)(ii) 5	B1	

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15.(a) (x =) $\sin^{-1}\frac{7\cdot7}{11\cdot3}$ or $\sin^{-1}\frac{7\cdot7 \times \sin 90}{11\cdot3}$ or equivalent Allow an answer between 42·8 and 43(°) ISW	M2 A1	Check diagram for answers Award M1 for one of the following: • $\sin x = \frac{7\cdot7}{11\cdot3}$ (= 0·68(1..)) • $\frac{\sin x}{7\cdot7} = \frac{\sin 90}{11\cdot3}$ or equivalent Allow correct angles given in radians or gradians: Method: $\sin^{-1}\frac{7\cdot7}{11\cdot3}$ — Radians: 0·7496… — Gradians: 47·727…. Method: $\sin^{-1}\frac{7\cdot7 \times \sin 90}{11\cdot3}$ — Radians: 0·655… — Gradians: 47·001
15.(a) Alternative method ***Correct** use of a 'two-step' method.* Allow an answer between 42·8 and 43(°) ISW	*M2* *A1*	*A partial trigonometric method is M0.* *Allow 42·8(…°)* *Allow correct angles given in radians or gradians.*

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15.(b) *DBE* = (90 – 43) = 47(°) OR *BED* = 43(°)	B1	Check diagram for answers. **Strict FT** for *DBE* = 90 – 'their x' or *BED* = 'their x', provided 'their x' ≠ 45°. Note: *DBE* must be acute for B1. May be implied in further work.
Valid method to find the length *DE* *DE* = 13·1 × tan 47 $DE = \frac{13{\cdot}1}{\tan 43}$ $DE = \frac{13{\cdot}1 \times \sin 47}{\sin 43}$	M2	If B1 already awarded for 'their angle *DBE*' but then 'their angle *BED*' is incorrect and 'their *BED*' is then used (or vice versa) for either M2 or M1, then award B0 previously. Or award M2 for correct use of a 'two-step' method (e.g. 'Pythagoras and similar triangles' or 'Pythagoras and correct trigonometric relationship'). FT 'their angle *DBE*' or 'their angle *BED*' provided not 0°, 45°, 90° or 180°. Award M1 for one of the following: • tan 47 = $\frac{DE}{13{\cdot}1}$ • tan 43 = $\frac{13{\cdot}1}{DE}$ • $\frac{DE}{\sin 47} = \frac{13{\cdot}1}{\sin 43}$ or equivalent For all M2 or M1 scenarios, FT their clearly stated or shown angle *BED* or *DBE* where appropriate. For $\frac{13{\cdot}1 \times \sin 47}{\sin 43}$ FT their clearly stated or shown angles *BED* and *DBE* **only** if *BED* + *DBE* = 90°.
DE in the range 14·04 to 14·1 (cm) ISW	A1	Allow 14 from correct workings. FT from M2 only and provided that angle is acute and leads to a positive answer. Award B1M2A0 for any of the following unsupported answers: Method / Radians / Gradians 13·1 × tan 47 / -1·63 to 1… / 11·92 to 12 $\frac{13{\cdot}1}{\tan 43}$ / -8·743 to -5·36 / 16·35 to 16·5 $\frac{13{\cdot}1 \times \sin 47}{\sin 43}$ / -1·95 to 1·08 / 14·1 to 14·21

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16.(a) $\times 0{\cdot}95^4$	B1	
16.(b) Sight of 0·83 OR 83%	B1	Allow (100 –17 =) 83
$\frac{3569}{0{\cdot}83}$ or $\frac{3569}{83} \times 100$ or equivalent	M1	FT 'their 1 – 0·17' provided <1 or 'their 100% – 17%' provided < 100%.
= 4300	A1	Award B1M1A1 for an embedded answer (e.g. $0{\cdot}83 \times 4300 = 3569$ or $\frac{3569}{4300} \times 100 = 83$), BUT only B1M1A0 if contradicted by stating original amount ≠ 4300. Unsupported 4300 is awarded B1M1A1.
17. Method to eliminate one variable e.g. equal coefficients **AND** appropriate intention to add or subtract or use a method of substitution.	M1	Allow one error in one term (not the term with equal coefficients).
First variable found $x = 4{\cdot}3$ or $y = 2{\cdot}6$ or equivalent	A1	CAO Award A0 for expressing the final answers in a form such as $y = \frac{33{\cdot}8}{13}$.
Substitute to find the 2nd variable.	m1	FT substitution of their '1st variable' if M1 gained.
Second variable found	A1	No marks for 'trial and improvement'. No marks for an unsupported answer.
18. $\frac{\pi \times r^2}{2} = 77$ or equivalent	M1	Check diagram for answers.
$r^2 = 49(\cdot 0\ldots)$ or $r^2 = \frac{154}{\pi}$	m1	Sight of 49(·0…) implies M1m1.
$r = 7(\cdot 0\ldots)$	A1	FT 'their r^2' provided M1 awarded. 7 must not be from incorrect working.
(Area of trapezium =) $\frac{2 \times 7(\cdot 0\ldots) + 22}{2} \times 7(\cdot 0\ldots)$ or equivalent	M1	FT 'their derived or stated r'.
= 126·0(…)(cm^2)	A1	Accept 126·1 or 126 (cm^2) Mark final answer.

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GCSE MARKING SCHEME

SUMMER 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.

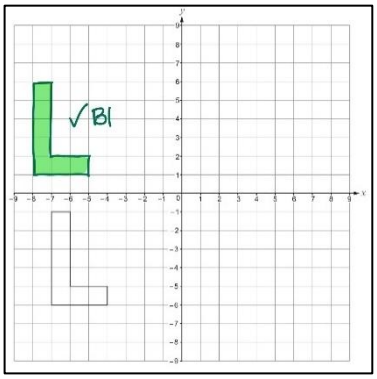
It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

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

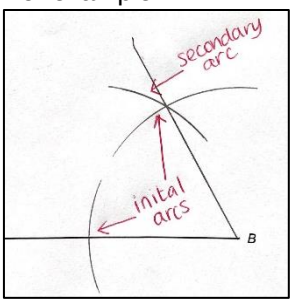
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WJEC GCSE MATHEMATICS

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 • $\begin{matrix}1\\-7\end{matrix}$ (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 2nd 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 × 135 675 = 3 × 225 135 = 5 × 27 135 = 3 × 45) CAO. For sight of the five 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 $(3^3)(5^2)$ 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.

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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*	

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5. $(AC^2 =)\ \ 8^2 + 6^2$ $(AC =)\ \sqrt{8^2 + 6^2}$ or equivalent $(AC =)$ 10 (cm)	 M1 m1 A1	Check diagram. Note: $(AC^2 =)\ \ 64 + 36$ FT from $\sqrt{'their\ 8^{2'} + 'their\ 6^{2'}}$ CAO. Final answer of AC = 100 is M1m0A0.
(Curved length =) • $\frac{6 \times 3{\cdot}14}{2}$ • $\frac{2 \times 3 \times 3{\cdot}14}{2}$ • $3 \times 3{\cdot}14$ • 3π • 9·42 or equivalent	B1	Do not ignore subsequent working e.g. 3 × 3·14 = 9·42, then 9·42 × 2 or 9·42 ÷ 2 would gain B0.
(Perimeter of shape = 8 + 10 + 9·42 =) 27·42(cm)	A1	Allow 27·4(cm). Award A0 for 18 + 3π. FT 'their *AC*' **only** if M1 gained. FT 'their curved length' **only** if B0 awarded **and** for one of the following: • 3·14 used to find the circumference of a circle • area of a semicircle used. For example, M1m1A1 awarded for 10 (cm), B1 for 3 × 3·14 = 9 (cm) A0 for 8 + 10 + 9 = 27 (cm) as B1 previously awarded. Note, if a final answer of: • 33·4(2)(cm) is given (6cm also included) award M1m1A1B1A0 • 36·8(4)(cm) is given (full circumference used) award M1m1A1B0A1 • 32·1(3) (cm) is given (area semicircle used) award M1m1A1B0A1.
Organisation and Communication.	OC1	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
Accuracy of writing.	W1	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

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6. Sight of 4(hr) 35(min) AND 2(hr) 45(min) OR Sight of 275(min) AND 165(min) OR sight of 2 × 5(min) in an appropriate calculation. Valid method e.g. • 4(hr) 35(min) + 2(hr) 45(min)(=6(hr) 80(min)) 275(min) + 165(min) (= 440 (min)) • 6 (hr) 90 (min) – 10 (min) • 7 (hr) 30 (min) – 10 (min) • 4(hr) 40(min) + 2(hr) 50(min) – 10 (min) • 280 (min) + 170 (min) – 10(min) 7 (hr) 20 (min)	B1 M1 A1	Allow incorrect notation for time (e.g. 4:35 for 4(hr) 35(min)). If B0, FT provided unambiguously chosen: '4h 30m ≤ t_1 < 4h 40m' and '2h 40m ≤ t_2 < 2h 50m' OR '270m ≤ t_1 < 280m' and '160m ≤ t_2 < 170m' Allow incorrect notation for time (e.g. 4:35 for 4(hr) 35(min)). CAO. If units are given they must be correct. Award B1M1A0 for a final answer of 6hrs 80min, 6:80 or 7:20.
7.(a) P(Bus =) 1 − 0·25 − 0·45 = 0·3 AND shown on relevant branch. 0·96 shown on <u>all</u> three branches.	M1 A1 B1	Award M1A0 for 0·3 in working space and not on diagram.
7.(b) 0·25 × 0·04 or equivalent = 0·01 or equivalent	M1 A1	CAO
8. (Length) Area None Length Volume Length	B3	*Must use the terminology given in the question.* B3 for all 5 correct. B2 for 3 or 4 correct. B1 for 2 correct. B0 otherwise.
9.(a) $7{\cdot}6 \times 10^{-3}$	B1	
9.(b) 6×10^{5}	B1	
9.(c) $2{\cdot}8 \times 10^{4}$	B2	Mark final answer. Award B1 for one of the following: • sight of 28×10^{3} • sight of 28 000 • equivalent correct value but not in standard form • sight of 23 000 AND 5000 • 'their 28000' is written correctly in standard form, following one place value error in one of the numbers from work seen.

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10.(a) (AOY =) 36(°) (% shaded =) $\frac{36}{360}$ (× 100) or equivalent = 10(%)	B1 M1 A1	Check diagram. FT 'their derived or stated angle AOY' provided not 54°. Award M0A0 for $\frac{360(°)}{36(°)}$ = 10, but award M1A1 if a final answer of 10% is seen. If no marks awarded, award: • SC2 for unsupported 10% (AOY not shown or stated to be 36(°)) • SC1 for a final answer of 15% (from using 54(°)).
10.(b) Statement explaining that, 'The **tangent** at any point on a circle is **perpendicular** (or equivalent) to the **radius** at that point'.	E1	Accept unambiguous similar wording. e.g. 'Radius and tangent 90(°)'. Diameter could be used in place of radius. Must refer to tangent and radius by name (not simply AY and OA or description).
11. (a) $y \ \alpha \ \frac{1}{x}$ OR $y = \frac{k}{x}$ $0{\cdot}2 = \frac{k}{160}$ OR k = 32 $y = \frac{32}{x}$	B1 M1 A1	Allow $y \ \alpha \ \frac{k}{x}$. M1 implies B1. FT from $y \ \alpha \ \frac{1}{x^n}$ with n > 1 and n = integer. (Use of n = 2 leads to k = 5120.) May be seen in part (b).
11. (b) x: 160, 128, **40** y: 0·2, **0·25**, 0·8	 B1 B1	Check working space if table is empty. Table takes precedence over working space. For y-value, accept equivalents to 0·25 including $\frac{32}{128}$. Mark final answer. For x-value, do not accept $\frac{32}{0{\cdot}8}$ or $\frac{320}{8}$. Mark final answer. FT from 'their k' (using $y = \frac{k}{x}$) or FT from $y \ \alpha \ \frac{1}{x^n}$, with n > 1 and n = integer. Use of n = 2 leads to answers of 0·3125 and 80. No FT from continued use of direct proportion from part (a). If no marks in part (a), allow B1 B1 for answers of y = 0·25, x = 40 in part (b).

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12. (Volume of sphere =) 36π (cm^3)	B1	Allow 113·04 (from using π = 3·14).
(Volume of cone =) 300π (cm^3)	B1	Allow 942 (from using π = 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: $\frac{4}{3}\times\pi\times3^3$ OR $\frac{1}{3}\times\pi\times10^2\times9$ (allowing the use of π = 3·14). Calculations may be seen in stages.
3 : 25	B2	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):*		
. $\frac{4}{3}\times\pi\times3^3$ *OR* $\frac{1}{3}\times\pi\times10^2\times9$ *or equivalent*	*B1*	*Calculation for at least one volume (allowing the use of π = 3·14). Calculations may be seen in stages.* *Accept absence of π (in <u>both</u> expressions).*
. $4\times\pi\times3^3$: $\pi\times10^2\times9$ *or equivalent* *OR* $\frac{4}{3}\times3^3$: $\frac{1}{3}\times10^2\times9$ *or equivalent*	*B1*	*Both calculations correct AND one further step (clearing fractions OR eliminating π). Ratio may be implied.*
3 : 25	*B2*	*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.*

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13.(a) (Area of triangle =) $\frac{1}{2} \times 4x \times (2x - 1)$ $\frac{8x^2-4x}{2} = \frac{3}{4}$ 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] $x = \frac{3}{4}$ AND $x = -\frac{1}{4}$	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 $(4x \ldots 3)(4x \ldots 1)$ 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 =)* $\frac{-(-8) \pm \sqrt{(-8)^2-4(16)(-3)}}{2(16)}$ *M1* *For M1, allow one error, in sign or substitution, but not in formula.* $x = \frac{8 \pm \sqrt{25}}{32}$ *A1* $x = \frac{3}{4}$ *or* $x = -\frac{1}{4}$ *(both answers required) A1* Do not allow a trial and improvement method.
13.(b)(ii) ($BC = 2 \times \frac{3}{4} - 1 =$) 0·5 (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 '±½ 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 $y = 3$.

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15. (a) P(BBB 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 or YBY 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 × 7 × 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) *<u>Alternative method</u>:* *1 – P(YYY or YBB or BYB or BBY 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*	*A complete method.* *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° + 62° and 360° – 62°.

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16.(b)(i) Reflection in x-axis with maximum at (270°, +1), minimum at (90°, –1)	B2	Mark clear intention. Must be the correct shape, i.e. a single cycle of a negative sine curve, with x-intercepts at $x = 0$, $x = 180°$ and $x = 360°$, minimum at $x = 90°$, maximum at $x = 270°$. Accept any clear indication of y-coordinates. If not B2, award B1 for one of the following: • Fully correct shape and position (both for $0 \le x \le 180°$ and for $180° \le x \le 360°$) without correct coordinates indicated OR • Correct shape and position either for $0 \le x \le 180°$ or for $180° \le x \le 360°$ (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°, +2), minimum at (270°, 0), with y-intercept at +1.	B2	Mark clear intention. Must be the correct shape, i.e. a single cycle of a sine curve, with consistent y values at $x = 0$, $x = 180°$ and $x = 360°$, maximum at $x = 90°$, minimum at $x = 270°$. Accept any clear indication of y-coordinates. Must have correct points for $x = 180°$ and $x = 360°$. 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 $0 \le x \le 180°$ and for $180° \le x \le 360°$) without correct coordinates indicated OR • Correct shape and position either for $0 \le x \le 180°$ or for $180° \le x \le 360°$ (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 …

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GCSE MARKING SCHEME

SUMMER 2023

GCSE
MATHEMATICS
UNIT 2 – HIGHER TIER
3300U60-1

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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

SUMMER 2023 MARK SCHEME

Unit 2: Higher Tier	Mark	Comments
1.(a) $7 + 5x - 10 = 3x + 8$ or equivalent. $2x = 11$ OR $-11 = -2x$ $x = \frac{11}{2}$ or $5{\cdot}5$ or equivalent.	 B1 B1 B1	FT until 2nd error. Bracket must be expanded or correct division by 5 e.g $x - 2 = \frac{3x}{5} + \frac{1}{5}$ (but not $x - 2 = \frac{3x + 1}{5}$) Or equivalent Correctly simplifying the equation to a single x term and number term (e.g. $2x - 11 = 0$). Mark final answer. Correct answer implies B1B1B1. Do not allow $-x = \frac{-11}{2}$ or $x = \frac{-11}{-2}$ A final answer of '11 ÷ 2' is B1B1B0. If FT leads to a whole number answer, it must be shown as a whole number. Otherwise, accept a fraction. Allow any decimal answer to be rounded or truncated to 1 or more decimal place. Allow B1B1B1 for a correct embedded answer BUT only B1B1B0 if contradicted by $x \neq \frac{11}{2}$ or equivalent. Note: $12x - 24 = 3x + 8$ B0 $9x = 32$ B1 (FT) $x = \frac{32}{9}$ or $3{\cdot}5(55\ldots)$ or $3{\cdot}6$. B1 (FT) If no marks awarded, award SC1 for sight of one of the following: • $5x - 10$ • $12x - 24$.
1.(b) $2f = 13 - h$ or $h - 13 = -2f$ $f = \frac{13 - h}{2}$ or $\frac{h - 13}{-2} = f$ or equivalent	B1 B1	Or equivalent. Or equivalent. Must not come from incorrect working. Mark final answer. FT only from $\pm 2f = \pm 13 \pm h$. Unsupported $f = \frac{\pm 13 \pm h}{\pm 2}$ implies B0B1 unless B2. Award B1B0 for $-f = \frac{h - 13}{2}$ or equivalent. **If no marks**, award SC1 for a final answer of either: • $f = (13 - h) \div 2$ with or without brackets • $f = (h - 13) \div -2$ with or without brackets • $\frac{13 - h}{2}$ ('$f =$' missing). • $\frac{h - 13}{-2}$ ('$f =$' missing).
1.(c) $5(3x - 7y)$	B1	Mark final answer. Allow $-5(-3x + 7y)$ or $5(3x + -7y)$.

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2.(a) P(Bronze) = 0·2 **AND** P (No Prize) = 0·6 or equivalent	B2	The values in the table takes precedence. Award B1 for one of the following: • P(Bronze) = 0·2 (must be clearly identified) • P(No Prize) = 0·6 • P(Bronze) + P(No Prize) = 0·8 • P(Bronze) = ⅓ P(No Prize) provided both <1.
2.(b) 15 ÷ 0·02 × 0·18 or 15 × 9 or equivalent = 135	M1 A1	Must be for a complete method e.g. • 15 ÷ 2 = 7·5 7·5 × 18 = 135 • 750 – (450 + 150 + 15) • 0·02 : 0·18 15 : 135 (e.g 0·18 × 750, or 15 × 9) Award M1 A1 for a final answer of 15 : 135. Sight of 135 as a numerator in a fraction < 1 implies M1A0.
3. One correct evaluation $2 \le x \le 3$ 2 correct evaluations $2{\cdot}55 \le x \le 2{\cdot}75$, **(one evaluation < 0, one evaluation > 0)** 2 correct evaluations $2{\cdot}55 \le x \le 2{\cdot}65$, **(one evaluation < 0, one evaluation > 0)** $x = 2{\cdot}6$	 B1 B1 M1 A1	*Correct evaluation regarded as enough to identify if negative or positive.* *If evaluations not seen accept 'too high' or 'too low'.* *Look out for equating* $x^3 - 8x = -3$ $\underline{x}$ $\quad$ $\underline{x^3 - 8x + 3}$ 2 $\quad$ −5 2·1 $\quad$ −4·539 $\quad$ 2·55 $\quad$ −0·818…. 2·2 $\quad$ −3·952 $\quad$ 2·61 $\quad$ −0·1004… 2·3 $\quad$ −3·233 $\quad$ 2·62 $\quad$ 0·0247… 2·4 $\quad$ −2·376 $\quad$ 2.63 $\quad$ 0·1514… 2·5 $\quad$ −1·375 $\quad$ 2.64 $\quad$ 0·2797… **2·6 $\quad$ −0·224 $\quad$ 2·65 $\quad$ 0·409…** **2·7 $\quad$ 1·083** $\quad$ 2·75 $\quad$ 1·796.. 2·8 $\quad$ 2·552 2·9 $\quad$ 4·189 3 $\quad$ 6 Unsupported $x = 2{\cdot}6$ is awarded B0B0M0A0. An answer of $x = 2{\cdot}6$ can only be awarded M1A1, following sight of 2 correct evaluations $2{\cdot}55 \le x \le 2{\cdot}65$ (**one evaluation** < 0, **one evaluation** > 0).
4.(a) 1·2	B2	Mark final answer. Award B1 for one of the following: • sight of 1·1(5519…..). • an answer of 1·20. Do not award B2 or B1 for answers obtained from incorrect work (e.g. rounding and/or estimating).
4.(b) 0·043	B2	Mark final answer. Award B1 for sight of one of the following: • $\frac{1}{23}$ • 1 ÷ 23 • 0·0434(…) • 0·0435 • 0·04.
4.(c)(i) 12	B1	
4.(c)(ii) 5	B1	

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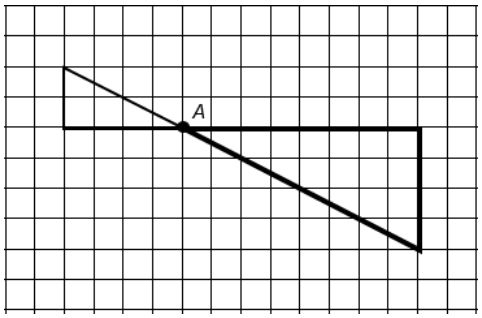
5. Method to eliminate one variable e.g. equal coefficients **AND** <u>appropriate intention to</u> add or subtract or use a method of substitution.	M1	Allow one error in one term (not the term with equal coefficients).
First variable found $x = 4{\cdot}3$ or $y = 2{\cdot}6$ or equivalent	A1	CAO Award A0 for expressing the final answers in a form such as $y = \frac{33{\cdot}8}{13}$.
Substitute to find the 2nd variable.	m1	FT substitution of their '1st variable' if M1 gained.
Second variable found	A1	No marks for 'trial and improvement'. No marks for an unsupported answer.
6.(a) $(x =)$ $\sin^{-1}\frac{7{\cdot}7}{11{\cdot}3}$ or $\sin^{-1}\frac{7{\cdot}7 \times \sin 90}{11{\cdot}3}$ or equivalent	M2	Check diagram for answers Award M1 for one of the following: • $\sin x = \frac{7{\cdot}7}{11{\cdot}3}$ (= 0·68(1..)) • $\frac{\sin x}{7{\cdot}7} = \frac{\sin 90}{11{\cdot}3}$ or equivalent
Allow an answer between 42·8 and 43(°) ISW	A1	Allow correct angles given in radians or gradians: Method: $\sin^{-1}\frac{7{\cdot}7}{11{\cdot}3}$ — Radians: 0·7496… — Gradians: 47·727…. Method: $\sin^{-1}\frac{7{\cdot}7 \times \sin 90}{11{\cdot}3}$ — Radians: 0·655… — Gradians: 47·001
6.(a) *<u>Alternative method</u>* ***Correct** use of a 'two-step' method.*	*M2*	*A partial trigonometric method is M0.*
Allow an answer between 42·8 and 43(°) ISW	*A1*	*Allow 42·8(…°)* *Allow correct angles given in radians or gradians.*

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6.(b) $DBE = (90 - 43) = 47(°)$ OR $BED = 43(°)$	B1	Check diagram for answers. **Strict FT** for $DBE = 90 -$ 'their x' or $BED =$ 'their x', provided 'their x' $\neq 45°$. Note: *DBE* must be acute for B1. May be implied in further work.
Valid method to find the length *DE* $DE = 13{\cdot}1 \times \tan 47$ $DE = \dfrac{13{\cdot}1}{\tan 43}$ $DE = \dfrac{13{\cdot}1 \times \sin 47}{\sin 43}$	M2	If B1 already awarded for 'their angle *DBE*' but then 'their angle *BED*' is incorrect and 'their *BED*' is then used (or vice versa) for either M2 or M1, then award B0 previously. Or award M2 for correct use of a 'two-step' method (e.g. 'Pythagoras and similar triangles' or 'Pythagoras and correct trigonometric relationship'). FT 'their angle *DBE*' or 'their angle *BED*' provided not 0°, 45°, 90° or 180°. Award M1 for one of the following: • $\tan 47 = \dfrac{DE}{13{\cdot}1}$ • $\tan 43 = \dfrac{13{\cdot}1}{DE}$ • $\dfrac{DE}{\sin 47} = \dfrac{13{\cdot}1}{\sin 43}$ or equivalent For all M2 or M1 scenarios, FT their clearly stated or shown angle *BED* or *DBE* where appropriate. For $\dfrac{13{\cdot}1 \times \sin 47}{\sin 43}$ FT their clearly stated or shown angles *BED* and *DBE* **only** if *BED* + *DBE* = 90°.
DE in the range 14·04 to 14·1 (cm) ISW	A1	Allow 14 from correct workings. FT from M2 only and provided that angle is acute and leads to a positive answer. Award B1M2A0 for any of the following unsupported answers: See table below.

Method	Radians	Gradians
$13{\cdot}1 \times \tan 47$	-1·63 to 1…	11·92 to 12
$\dfrac{13{\cdot}1}{\tan 43}$	-8·743 to -5·36	16·35 to 16·5
$\dfrac{13{\cdot}1 \times \sin 47}{\sin 43}$	-1·95 to 1·08	14·1 to 14·21

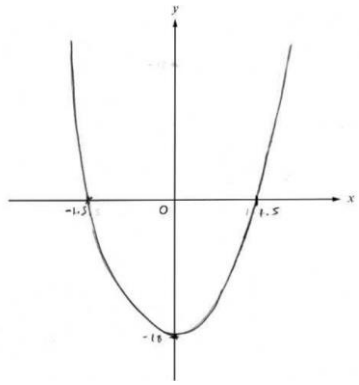
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7.(a) $\times 0{\cdot}95^4$	B1	
7.(b) Sight of 0·83 OR 83%	B1	Allow (100 –17 =) 83
$\frac{3569}{0{\cdot}83}$ or $\frac{3569}{83} \times 100$ or equivalent	M1	FT 'their 1 – 0·17' provided <1 or 'their 100% – 17%' provided < 100%.
= 4300	A1	Award B1M1A1 for an embedded answer (e.g. $0{\cdot}83 \times 4300 = 3569$ or $\frac{3569}{4300} \times 100 = 83$), BUT only B1M1A0 if contradicted by stating original amount ≠ 4300. Unsupported 4300 is awarded B1M1A1.
8.		Check diagram for answers.
$\frac{\pi \times r^2}{2} = 77$ or equivalent	M1	
$r^2 = 49(\cdot 0\ldots)$ or $r^2 = \frac{154}{\pi}$	m1	Sight of 49(·0…) implies M1m1.
$r = 7(\cdot 0\ldots)$	A1	FT 'their r^2' provided M1 awarded. 7 must not be from incorrect working.
(Area of trapezium =) $\frac{2 \times 7(\cdot 0\ldots) + 22}{2} \times 7(\cdot 0\ldots)$ or equivalent	M1	FT 'their derived or stated r'.
$= 126{\cdot}0(\ldots)(\text{cm}^2)$	A1	Accept 126·1 or 126 (cm^2) Mark final answer.
9. 	B2	B1 for 2 correct vertices within a triangle, e.g. A and 1 other vertex OR for a triangle of correct shape, size and orientation in incorrect position OR consistent correct use of an incorrect negative scale factor OR for 3 correct vertices (A implied) in the correct location not joined to form the triangle.

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10.(a) (Reflex angle D =) 180 + 360/5 OR 360 – 3×180/5	M1	Or any other complete method. May be seen in stages.
= 252(°)	A1	Award for sight of 252(°) if not contradicted by further incorrect work.
(Arc length CE =) 252/360 × π × 2 ×11	M1	FT for M1 for 'their derived angle'.
48·3(…) OR 48·4 OR 77π/5 OR $15\frac{2}{5}$π OR 15·4π(cm) o.e.	A1	ISW Accept 48(cm) from correct working. 12089/250 from using 3·14 Allow a FT for this mark provided the angle used is >180°. If no marks award SC1 for sight of 108(°) OR 72(°)
Organisation and Communication	OC1	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
Accuracy of writing	W1	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.
10.(b) $\left(\frac{671}{11}\right)^2$ (= 450241/121) OR 61^2	M1	
= 3721	A1	Answer in the sentence takes precedence. If no marks, allow SC1 for 3721/25 OR $148\frac{21}{25}$ OR 148·84 [from $(671/55)^2$].
11. $x^2(a+1) = b$ OR $-x^2(a+1) = -b$ OR $x^2(-a-1) = -b$	B1	FT until 2nd error. x^2 or $-x^2$ factorised.
$x^2 = \frac{b}{a+1}$ OR $-x^2 = \frac{-b}{-a-1}$	B1	Isolating the x^2 or $-x^2$. Allow a FT from $2x^2 = \frac{b}{a}$.
$x = \pm\sqrt{\frac{b}{a+1}}$	B1	B0 for $\sqrt{[b \div (a+1)]}$ (use of the division sign). Allow omission of $\pm$. Mark final answer. Note: $2x^2 = \frac{b}{a}$ B0 $x^2 = \frac{b}{2a}$ B1 (FT) $x = (\pm)\sqrt{\frac{b}{2a}}$ B1 (FT)

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12.(a) $2(2x+3)(2x-3)$	B3	Award B3−1 for a correct answer followed by further incorrect work. Award B2 for the sight of any one of the following: • $(4x+6)(2x-3)$ • $(4x-6)(2x+3)$ • $8(x+3/2)(x-3/2)$ • $(2x+3)(2x-3)$ • $2(2x+3)(2x+3)$ • $2(2x-3)(2x-3)$ Award B1 for the sight of any one of the following: • $2(4x^2-9)$ • $8(x^2-9/4)$ • $(4x+6)(2x+3)$ • $(4x-6)(2x-3)$ • $(x+3/2)(x-3/2)$ If no marks: Allow SC2 for $(2\sqrt{2}x+3\sqrt{2})(2\sqrt{2}x-3\sqrt{2})$ o.e. OR other valid, equivalent 'factorisation', e.g. $(8x-12)(x+1.5)$ o.e. Allow SC1 for $(\sqrt{8}x+\sqrt{18})(\sqrt{8}x-\sqrt{18})$ o.e.
12.(b) 3/2 AND -3/2	B1	Or equivalent for either roots. FT if possible, provided exactly 2 possible distinct solutions.
12.(c) A <u>positive</u> quadratic curve passing through (0,-18) as a minimum with -18 indicated on the y-axis AND passing through (–3/2,0) and (3/2,0) which are indicated on the x-axis.  	B2	FT for x-axis intersections, provided exactly 2 possible distinct solutions. Award B1 for any one of the following: A positive quadratic curve passing through (0, –18) as a minimum with –18 indicated on the y-axis OR A quadratic curve (either positive or negative) passing through (–3/2,0) and (3/2,0) which are indicated on the x-axis. If the conditions for B2 are met, then only allow B1 for concave and/or convex curvature above the *x*-axis.

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13.(a) $\frac{2}{4}\times\frac{3}{5}\times\frac{3}{6}$ $=\frac{18}{120}$ ISW (= $\frac{3}{20}$ or 0·15) oe	M1 A1	If no marks, award SC1 for: $\frac{a}{4}\times\frac{b}{5}\times\frac{c}{6}$ correctly evaluated with at least two of a, b and c correct OR an answer of $\frac{48}{120}$ (= $\frac{2}{5}$ or 0·4 or equivalent) from assuming that 1 is prime, $\frac{3}{4}\times\frac{4}{5}\times\frac{4}{6}$ OR an answer of $\frac{4}{120}$ (= $\frac{1}{30}$ or 0·03(3…) or equivalent) from excluding 2 as prime, $\frac{1}{4}\times\frac{2}{5}\times\frac{2}{6}$
13.(b) [1 – P(1, 1, 1) – 3×P(1, 1, 2) =] $1-4\times\frac{1}{4}\times\frac{1}{5}\times\frac{1}{6}$ OR $\frac{120-4}{120}$ $=\frac{116}{120}$ ISW $\left(=\frac{29}{30}\right)$ oe	M2 A1	Award M1 for sight of: • $4\times\frac{1}{4}\times\frac{1}{5}\times\frac{1}{6}$ or equivalent (from P(1, 1, 1) + 3×P(1, 1, 2)) OR • $1-2\times\frac{1}{4}\times\frac{1}{5}\times\frac{1}{6}$ or equivalent (from 1 – P(1, 1, 1) – P(1, 1, 2)) OR • $1-3\times\frac{1}{4}\times\frac{1}{5}\times\frac{1}{6}$ or equivalent (from 1 – 3×P(1,1,2)) OR • $1-\frac{1}{4}\times\frac{1}{5}\times\frac{1}{6}$ or equivalent (from 1 – P(1,1,1)), note: this may include further incorrect work, e.g. $\frac{117}{120}\left(=\frac{39}{40}\right)$ from $1-\frac{1}{4}\times\frac{1}{5}\times\frac{1}{6}-\frac{1}{4}\times\frac{1}{5}\times\frac{2}{6}$ or equivalent OR • 120–4 (120 permutations – the 4 permutations not allowed) CAO Allow 0·9ȯ OR 0·966(6…) OR 0·967 oe. Allow 0·97 from correct working. If no marks award SC1 for an answer of $\frac{114}{120}\left(=\frac{19}{20}\right)$ from 1–3×P(1,1,1)–3×P(1,1,2) *Note: award M2 for a <u>fully correct</u> method of listing all the ways leading to totals greater than 4, but M0 for a partial attempt.
14. Sight of 22(cm) OR $\sqrt[3]{10648}$ (cm) $\sqrt{(22^2+22^2+22^2)}$ OR $\sqrt{(1452)}$ = 38·1(…cm) OR $22\sqrt{3}$(cm) OR a value that rounds to 38·1(cm), e.g. 38·09(cm)	B1 M2 A1	FT 'their 22' for M2. May be seen in stages. *(If the answer is completed in stages, then any arithmetic errors in intermediate answers can be ignored, allowing for a FT for the M marks).* M1 for $22^2+22^2+22^2$ (=1452) CAO. Allow 38(cm) from correct working <u>provided their answer would round to 38·1</u>.

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15.		*A correct common denominator may be shown throughout for first 3 marks.* *Also, look out for alternative, correct methods leading to the same quadratic equated to zero.*
$3x - 7 + x - 2 = (x-2)(3x-7)$ oe	B1	For multiplying throughout the numerator of all terms by the common denominator.
Sight of $3x^2 - 7x - 6x + 14$ $3x^2 - 17x + 23 = 0$ OR $-3x^2 + 17x - 23 = 0$	B1 B1	Or equivalent. May be seen in the denominator. '= 0' required, but may be implied by an attempt to use the quadratic formula or if $a = 3, b = -17$, $c = 23$ used in the quadratic formula. FT from B1B0 from one error only.
$x = \frac{-(-17) \pm \sqrt{(-17)^2 - 4 \times 3 \times 23}}{2 \times 3}$.	M1	**This substitution into the formula must be seen for M1, otherwise award M0A0A0.** FT 'their derived quadratic equation equated to 0', (but not $3x^2 - 13x + 14 = 0$), provided of equivalent difficulty (a, b and c must be non-zero). Allow one slip in substitution **<u>for M1 only</u>**, but must be correct formula.
$x = \frac{17 \pm \sqrt{13}}{6}$	A1	Can be implied from at least one correct value of x evaluated.
$x = 3{\cdot}43$ with $x = 2{\cdot}23$	A1	CAO for their quadratic equation. Answers must be given to 2 decimal places. On FT solutions must require rounding.
16. <u>Initially calculating angle **BDC**</u>		
cos BDC = $\frac{5^2 + 7^2 - 11^2}{2\times5\times7}$ (= –47/70)	M2	M1 for $11^2 = 5^2 + 7^2 - 2\times5\times7\times\cos$ BDC
(BDC =) 132(·17…°)	A1	The correct angles given in: Radians (2·3038… to 2·3073…) or Gradians (146·6666… to 146·8888...). Allow a trial and improvement method for M2A1 but length of side BC must be in the range 10·95(cm) to 11·05(cm). Sight of 28(·13…°) OR 132(·17…°) OR 19(·68…°), calculated from <u>one</u> use of the rearranged cosine rule in triangle BCD and attributed to the wrong angle, stated or seen on the diagram, is M0 SC1.
sin BAD = $\frac{7\times\sin[180-132(\cdot17\ldots°)]}{13}$	M2	FT 'their stated or derived BDC'. M1 for $\frac{\sin BAD}{7} = \frac{\sin[180-132(\cdot17\ldots°)]}{13}$ o.e.
(BAD =) Answers in the range 23·4(°) to 23·6(°)	A1	Mark final answer for angle BAD. Allow a correctly rounded answer to a whole number provided an answer in the range 23·4(°) to 23·6(°) is seen.

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Alternative method 1 *16. Initially calculating angle **BCD*** *cos BCD = $\frac{5^2 + 11^2 - 7^2}{2\times5\times11}$ (=97/110)*	*M2*	*M1 for $7^2 = 5^2 + 11^2 - 2\times5\times11\times\cos BCD$*
(BCD =) 28(·13…°)	*A1*	*The correct angles given in:* *Radians (0·4886… to 0·4911…) or* *Gradians (31·1111… to 31·2666...).* *Allow a trial and improvement method for M2A1 but length of side BD must be in the range 6·95(cm) to 7·05(cm).* *Sight of 28(·13…°) OR 132(·17…°) OR 19(·68…°), calculated from one use of the rearranged cosine rule in triangle BCD and attributed to the wrong angle, stated or seen on the diagram, is M0 SC1.*
sin BAD = $\frac{11\times\sin 28(\cdot13\ldots°)}{13}$	*M2*	*FT 'their stated or derived BCD'.* *M1 for $\frac{\sin BAD}{11} = \frac{\sin 28(\cdot13\ldots°)}{13}$ o.e.*
(BAD =) Answers in the range 23·4(°) to 23·6(°)	*A1*	*Mark final answer for angle BAD.* *Allow a correctly rounded answer to a whole number provided an answer in the range 23·4(°) to 23·6(°) is seen.*
Alternative method 2 *16. Multistep method to calculate angle **BDC*** *(First BCD, then CBD or vice versa)* *cos BCD = $\frac{5^2 + 11^2 - 7^2}{2\times5\times11}$ (=97/110) OR* *cos CBD = $\frac{7^2 + 11^2 - 5^2}{2\times7\times11}$ (=145/154)*	*M2*	*A complete, correct method must be seen for the first M2.* *M1 for one of the following:* *$7^2 = 5^2 + 11^2 - 2\times5\times11\times\cos BCD$ OR* *$5^2 = 7^2 + 11^2 - 2\times7\times11\times\cos CBD$*
(BCD =) 28(·13…°) OR (CBD =) 19(·68…°) *sin CBD = $\frac{5\times\sin[28(\cdot13\ldots°)]}{7}$ OR* *sin BCD = $\frac{7\times\sin 19(\cdot68\ldots°)}{5}$* *(CBD =) 19(·68…°) OR (BCD =) 28(·13…°)* *(BDC =) 180 – [28(·13…°)+19(·68…°)]* *= 132(·17…°)*	*A1*	*The correct angles given in:* *Radians (BCD ≈ 0·49 or CBD ≈ 0·34) or* *Gradians (BCD ≈31·2 or CBD ≈ 21.9).*
sin BAD = $\frac{7\times\sin[180-132(\cdot17\ldots°)]}{13}$	*M2*	***This M2 (or M1 below) is for a complete multistep method, i.e. it includes all the previous steps.*** *FT 'their stated or derived BDC'.* *M1 for $\frac{\sin BAD}{7} = \frac{\sin[180-132(\cdot17\ldots°)]}{13}$ o.e.*
(BAD =) Answers in the range 23·4(°) to 23·6(°)	*A1*	*Mark final answer for angle BAD.* *Allow a correctly rounded answer to a whole number provided an answer in the range 23·4(°) to 23·6(°) is seen.*

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Alternative method 3 *16. Multistep method to calculate angle **BDC*** *(First BCD, then BDC OR first CBD, then BDC)* *cos BCD = $\frac{5^2 + 11^2 - 7^2}{2\times5\times11}$ (=97/110) OR* *cos CBD = $\frac{7^2 + 11^2 - 5^2}{2\times7\times11}$ (=145/154)* *(BCD =) 28(·13…°) OR (CBD =) 19(·68…°)* *sin BDC = $\frac{11\times\sin[28(\cdot13\ldots°)]}{7}$ (=47·82…°) OR* *sin BDC = $\frac{11\times\sin 19(\cdot68\ldots°)}{5}$ (=47·82…°)* *(BDC = 180–47(·82…°)) = 132(·17…°)* *sin BAD = $\frac{7\times\sin[180-132(\cdot17\ldots°)]}{13}$* *(BAD =) Answers in the range 23·4(°) to 23·6(°)*	*M2* *A1* *M2* *A1*	*Ambiguous case* *A complete, correct method must be seen for the first M2.* *M1 for one of the following:* *$7^2 = 5^2 + 11^2 - 2\times5\times11\times\cos BCD$ OR* *$5^2 = 7^2 + 11^2 - 2\times7\times11\times\cos CBD$* *The correct angles given in:* *Radians (BCD ≈ 0·49 or CBD ≈ 0·34)* *Gradians (BCD ≈31·2 or CBD ≈ 21.9).* ***This M2 (or M1 below) is for a complete multistep method, i.e. it includes all the previous steps.*** *FT 'their stated or derived BDC'.* *M1 for $\frac{\sin BAD}{7} = \frac{\sin[180-132(\cdot17\ldots°)]}{13}$ o.e.* *Mark final answer for angle BAD.* *Allow a correctly rounded answer to a whole number provided an answer in the range 23·4(°) to 23·6(°) is seen.*

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