REVISE
.wales

2.19 — Similarity & congruence

Mark schemes for the 2.19 question pack

Spec 3.9.1, 3.9.2, 3.9.3, 3.9.5, 3.9.6 — Unit 3

SOLUTIONS · 2025 SPECIFICATION

Mark schemes for the 29 questions in the corresponding revise.wales question pack (101 marks total). Sources: legacy WJEC GCSE papers, WJEC SAM, and custom-authored mark schemes. Pack layout © revise.wales.

1(a)	$y = 5b/6x$	B1	
1(b)	$2.6 \times 33.6/2.1$ or 2.6×16 41.6 (cm)	M1 A1	CAO *Award M1, A0 for an answer of 40.32 from PA (33.6 × 1.2 = 40.32)*

17. Linear scale factor $= \sqrt{\frac{700}{140}}$ $(=\sqrt{5})$ OR $\sqrt{\frac{140}{700}}$ $(=\frac{\sqrt{5}}{5})$		B1	Or equivalent.
$83\times\sqrt{5}$ OR $83\div\frac{\sqrt{5}}{5}$		M1	FT their linear scale factor.
$= 185(.59\ldots)$ cm) or $83\sqrt{5}$		A1	

13.(a) True False	B1	
13.(b) (lengths in ratio) 24 : 30 (= 4 : 5)	B1	Ratio can be reversed Or equivalent (e.g. scale factor = 1·25 or 30/24 OR 0·8 or 24/30)
(volumes in ratio) 13824 : 27000 (= $4^3 : 5^3$)	B1	Ratio can be reversed Or equivalent (e.g. 'Volume scale factor' = 1·9(53125) or $1·25^3$ or $(30/24)^3$ OR 0·512 or $0·8^3$ or $(24/30)^3$
Statement e.g. '125 is not double 64 (so the increase is not double)', or '64 is not half of 125', or 'Increase is 95(·3125)%'	E1	Depends on B2 provided 4^3 and 5^3 have been evaluated correctly or $1·25^3$, $(30/24)^3$, $0·8^3$ or $(24/30)^3$ evaluated correctly
13.(c) (Scale factor of heights =) $\sqrt{4}$ or 2 OR $\sqrt{\frac{1}{4}}$ or 0·5	B1	
$24 \div \sqrt{4}$ OR $24 \times \sqrt{\frac{1}{4}}$	M1	
= 12 (cm)	A1	*Alternative method:* *M1 for* $24^2 \div 4$ *A1 for* $height^2 = 144$ *or* $(height =) \sqrt{144}$ *A1 for 12 (cm)*

	(ii) (y =) 8		B1	provided it is of equivalent difficulty.
14.(a)	not necessarily congruent		B1	
14.(b)	definitely not congruent		B1	
14.(c)	SAS		B1	

		both answers are correct.
14. Missing angle(s) is/are 59° or 84° AND statement B (identified or implied)	B1	(Check diagrams) If two angles are given, they must both be correct.
Explanation that having equal angles is not a sufficient condition for congruency or Explanation that the (corresponding) side lengths could be different / same (even though the angles are equal)	E1	Accept valid alternatives e.g. the triangles are similar but not necessarily congruent or e.g. if (a pair of corresponding) side lengths were known, we could apply ASA to test for congruency

15. (Linear scale factor=) $\sqrt[3]{}(3100/3970)$ OR $\sqrt[3]{}3100/\sqrt[3]{}3970$ (= 0.92…)	B1	Or equivalent.
$\sqrt[3]{}(3100/3970)\times 25$ = 23(.021…cm)	M1 A1	FT their derived linear scale factor (from $\sqrt[3]{}$). Accept answer in the range of 22.9 to 23.05. Do not award this mark if an answer outside of this range is then rounded to 23. *Alternative method (using reciprocal of volume SF)* *$\sqrt[3]{}(3970/3100)$ (= 1.0859…) B1* *$25\div\sqrt[3]{}(3970/3100)$ OR $1/\sqrt[3]{}(3970/3100)\times 25$ M1* *= 23(.02..cm) A1*

2.(c) 280°	B1	
3. One correct evaluation $4 \le x \le 5$ 2 correct evaluations $4{\cdot}25 \le x \le 4{\cdot}45$, one < 0, one > 0. 2 correct evaluations $4{\cdot}25 \le x \le 4{\cdot}35$, one < 0, one > 0. (x =) 4·3	 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 $x^3 - 7x = 51$* x $x^3 - 7x - 51$ 4 −15 4·1 −10·779 4·2 − 6·312 4·25 −3·984... 4·3 − 1·593 4·34 0·366... 4·4 3·384 4·35 0·862... 4·5 8·625 4·45 5·971... 4·6 14·136 4·7 19·923 4·8 25·992 4·9 32·349 5 39 *For this question A1 can only be awarded if M1 given.*
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
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.

= 0·147 or equivalent. ISW	A1	
7.(a) $x = 3{\cdot}2 \times \frac{8{\cdot}4}{5{\cdot}6}$ OR $\frac{x}{3{\cdot}2} = \frac{8{\cdot}4}{5{\cdot}6}$ or equivalent. x = 4·8	M1 A1	M1 for correct use of linear ratio.
7.(b) $y = 6{\cdot}3 \times \frac{5{\cdot}6}{8{\cdot}4}$ OR $\frac{y}{6{\cdot}3} = \frac{5{\cdot}6}{8{\cdot}4}$ or equivalent. y = 4·2	M1 A1	M1 for correct use of linear ratio. FT a slip in the calculation (not a misuse) of the scale factor in part (a) if used again in (b).
7.(c) Correct strategy of comparing corresponding ratio of lengths. Indicates that $\frac{3{\cdot}9}{6{\cdot}5}$ (= 0·6) is not equal to $\frac{5{\cdot}6}{8{\cdot}4}$ (= 0·666…) or equivalent.	S1 B1	Sight of 3·9 / 6·5 (or 6·5 / 3·9) along with any pair of corresponding lengths or scale factor used (or corresponding FT lengths from their answers in 7(a) or 7(b)). Allow using FT values from 7(a) or 7(b).
Alternative method 1 *(If CD = 3·9 then) RS = 3·9 × 1·5* *= '5·85 (cm)' or/and 'which is not 6·5'*	*S1* *B1*	
Alternative method 2 *(If RS = 6·5 then) CD = 6·5 × 2/3* *= '4·3… (cm)' or/and 'which is not 3·9'*	*S1* *B1*	

12. In either order: A and G (in either order) Condition: SAS OR 2 sides and included angle D and E (in either order) Condition: SSS OR 3 sides	 B1 E1 B1 E1	E marks depend on B marks

12. (Scale factor =) $\sqrt{\frac{3600}{400}}$ OR $\sqrt{\frac{400}{3600}}$	M1	Or equivalent
= 3 OR 1/3 or equivalent	A1	
(Height =) 16 (cm)	B1	FT provided M1 previously awarded *Alternative method e.g.* *M1 for (Lengths in ratio) √400 : √3600* *A1 for 1 : 3 or equivalent* *B1 for (Height =) 16 (cm)*

4(a) (Jade saves each week) 72 × 0.21 or 7.2(0) + 7.2(0) + 0.72 (= £ 15.12) (Total savings 15.12) × 20 (£) 302.4(0) (Jade's father pays £350 – 302.40 =) (£) 47.6(0) Organisation and communication Writing	M1 M1 A1 B1 OC1 W1	Do not accept '1512' without indication of pence, unless used correctly in working These 2 M marks can be awarded in either order, i.e. 72 × 20 (=1440), followed by × 0.21 CAO FT 'their £302.40' provided • a percentage calculation using 72 has been involved AND • provided their answer is < (£) 350 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 explanations 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.
4(b)(i) $100 - \frac{3}{25} \times 100$ or $\frac{(25-3)}{25} \times 100$ 88(%)	M1 A1	Or equivalent Allow M1 for 88/100 If no marks, award SC1 for an answer of or sight of 12(%) provided it is not from incorrect working
4(b)(ii) $abc + \pi a^2 c$	B1	
4(c) 35 × 9 ÷ 45 or 35 ÷ 5 or equivalent 7 (cm) or 70 mm	M1 A1	Allow with incorrect place value from conversion of units CAO. Do not accept an answer of: • 70 without units (mm) • 7 or 70 with incorrect units

2(a)(i) (Volume) $\pi \times 3.6^2 \times 9.3$ Answer in the range 378.4 (cm^3) to 378.7 (cm^3) or 379 (cm^3)	M1 A1	Mark final answer
2(a)(ii) 189 (g) or an answer in the range 189.2 (g) to 189.5 (g)	B1	Allow rounding or truncation to whole number or a number of decimal places FT, for a similar range, 'their 379' accurately divided by 2
2(b) (Height is) $9.3 \times 4.2 \div 3.6$ or $1.16666... \times 9.3$ or $9.3 \div (3.6 \div 4.2)$ or equivalent 10.85 (cm)	M1 A1	Allow M1 for 1.16×9.3 or 1.17×9.3 or $9.3 \div 0.85(7...)$ Allow answers in the inclusive range 10.78 (cm) to 10.95 (cm)

2(c) Comparison of salt and sugar, e.g. • (Salt) $\frac{6}{1.85}$ AND (Sugar) $\frac{90}{11.7}$ • (Salt)(100×) $\frac{1.85}{6}$ AND (Sugar)(100×) $\frac{11.7}{90}$ • (Recommend) 1 : 15 AND (Beans)1 : 11.7÷1.85 Conclusion SALT and an accurate calculation of comparison, e.g. 3(.24...) AND 7(.69...), 0.3(083...) AND 0.13, 30(.83....%) AND 13(%), 31(%) AND 13(%), 0.31 AND 0.13 1 : 15 AND 1 : 6(.32...)	B1 B2	Or equivalent Ignore any units given Ignore any units given and any additional statements if SALT unambiguously concluded with appropriate calculations evaluated correctly Accept rounded or truncated answers Ignoring units, B1 for an accurate calculation of comparison, e.g. 3(.24...) AND 7(.69...), 0.3(083...) AND 0.13, 30(.83....%) AND 13(%), 31(%) AND 13(%) 1 : 15 AND 1 : 6(.32...) OR B1 for SALT with one of the two comparative values correct (i.e. as above with 'OR')
2(c) Alternative method 1: *Conclusion SALT with evidence of a full method looking at the same number of portions, including ratio methods, e.g.* *1.85 × 3 (portions) ≈ 6 (g)* *AND 11.7 × 8 (portions) ≈ 90 (g)*	*B3*	*Allow approximately or similar words for '≈'* *B2 for evidence of, e.g.* *1.85 × 3(portions) ≈ 6(g)* ***and*** *11.7 × 8(portions) ≈ 90(g)* *OR* *B1 for evidence of, e.g.* *1.85 × 3 (portions) ≈ 6 (g)* ***or*** *11.7 × 8 (portions) ≈ 90 (g)*
2(c) Alternative method 2: *Full method with one calculated proportion, compared with same proportion of the other ingredient, e.g.* • *31% salt with 0.31 × 90* • *13% sugar with 0.13 × 6* *Conclusion SALT and an accurate calculation of comparison, e.g.* • *27.9 (g) (sugar which is > 11.7 g in a portion)* • *0.78 (g) (salt which is < 1.85 g in a portion)*	*B1* *B2*	*Ignore any units given and any additional statements if SALT unambiguously concluded with appropriate calculations evaluated correctly* *B1 for appropriate calculations evaluated correctly, with no or incorrect conclusion*

8(a) (radius =) $15 \times 33 \div (22 + 33)$ or $15 \times {}^{3}/_{5}$ (= 9) or equivalent	B2	Working MUST be shown here May be seen with appropriate tangent ratios If Pythagoras used, appropriate use of the scale factor would be needed Allow B1 for sight of ${}^{33}/_{55}$ or equivalent OR ${}^{55}/_{33}$ or equivalent
Sight of $1/3\times\pi\times15^2\times55$ OR $1/3\times\pi\times9^2\times33$	B1	(12952 to 12961 OR 2797.7 to 2800)
$1/3\times\pi\times15^2\times55 - 1/3\times\pi\times9^2\times33$	M1	
$= 4125\pi - 891\pi\ (= 3234\pi\ (\text{cm}^3))$	A1	Accept values in the range 10154.7 to 10161.2 (cm^3)

8(b) (Scale factor =) $\frac{28.6}{22}$ (=1.3) OR $\frac{22}{28.6}$ (=0.769…)	B1	
(Volume factor =) $(28.6/22)^3$ or 1.3^3 OR $(22/28.6)^3$ or $0.769…^3$	B1	Or 2.197 Or 0.455…
$3234\pi \times (28.6/22)^3$ or $\div (22/28.6)^3$ OR $\frac{3234\pi \times 1.75}{8 \times 1000}$	M1	Accept numerical values for 3234π (10154.7 to 10161.2) Allow use of the conversion 1 litre = 1.75 to 1.76 pints
= 22309 to 22324.3 (or $7105(.098)\pi$ to 7105.1π) OR = 2.22 to 2.26 (or 0.707π to 0.719π)	A1	
$\frac{\times 1.75}{8 \times 1000}$ OR $\times (28.6/22)^3$ or $\div (22/28.6)^3$	M1	Allow use of the conversion 1 litre = 1.75 to 1.76 pints FT 'their derived 22309 to 22324.3' OR FT 'their 2.2(2…)' from use of 3234π
= 4.8(8…) to 4.96(…) (gallons)	A1	Allow an answer of 5 (gallons) from correct working Allow 1.55π to 1.58π (gallons). Do not accept 1.6π Allow the conversion into gallons for the M1 mark from any of the following also 1 pint = 567 to 570 ml ÷ 8 ÷ (567 to 570) 1 gallon = 4.5 to 4.55 litres ÷ 1000 ÷ (4.5 to 4.55) 1 litre = 0.219 to 0.22 gallons ÷ 1000 × (0.219 to 0.22)
Alternative method: *(Scale factor =) $\frac{28.6}{22}$ (=1.3)*	*B1*	
Dimensions of 19.5, 71.5, 11.7, 42.9	*B1*	*Allow B1 for any 3 correct dimensions*
$1/3\times\pi\times19.5^2\times71.5 - 1/3\times\pi\times11.7^2\times42.9$	*M1*	*(28456 to 28475) – (6146 to 6151)*
= 22 309 to 22 324.3 (cm^3)	*A1*	*Or $7105(.098)\pi$ to 7105.1π*
(22 309 to 22 324.3) $\times \frac{1.75}{8 \times 1000}$	*M1*	Allow use of the conversion 1 litre = 1.75 to 1.76 pints *FT 'their derived 22309 to 22324.3'*
= 4.8(8…) to 4.96(…) (gallons)	*A1*	*Allow an answer of 5 (gallons) from correct working* *Allow 1.55π to 1.58π (gallons). Do not accept 1.6π* *Allow the conversion into gallons for the M1 mark from any of the following also* *1 pint = 567 to 570 ml ÷ 8 ÷ (567 to 570)* *1 gallon = 4.5 to 4.55 litres ÷ 1000 ÷ (4.5 to 4.55)* *1 litre = 0.219 to 0.22 gallons ÷ 1000 × (0.219 to 0.22)*

or equivalent		
12. Values given for any **two** missing angles.	B1	(Check diagrams) Missing angle(s) is/are 32° or 83° and 65° If all three angles are given, they must all be correct.
Explanation that the triangles are congruent due to angle, side, angle or ASA or equivalent.	E1	Or equivalent. No FT from incorrect angles. Dependent on at least one correct angle found.

12. $6(2x+1)-4(3x-5)$ as a numerator within a single fraction $(3x-5)(2x+1)$ as a denominator h26 / $(3x-5)(2x+1)$	M1 M1 A1	Allow intention of brackets, e.g. $6\times 2x+1-4\times 3x-5$ CAO. Allow $26/(6x^2-7x-5)$ (If expanded, the denominator must be correct.) If M1 M1 A1, penalise further incorrect work –1. If no marks awarded, then SC1 for sight of 26.
13. (Linear scale factor =) $\sqrt[3]{}$ (1280 / 20) (= 4) $\sqrt[3]{}$ (1280 / 20) × 2·3 = 9·2 (cm)	B1 M1 A1	Or equivalent. Accept a method based on ratios e.g. 1 : 4 (from 20 : 1280 = 1 : 64 = 1 : 4^3) FT their derived scale factor (from $\sqrt[3]{}$). SC1 for an answer of 18.4 (using s.f. of 8, from $\sqrt{64}$).
Alternative method (using reciprocal scale factor) *(Linear scale factor =) $\sqrt[3]{}$(20 / 1280) (= 1 / 4)* 2·3 ÷$\sqrt[3]{}$(20 / 1280) OR 1 / $\sqrt[3]{}$(20 / 1280) × 2·3 = 9·2 (cm)	*B1* *M1* *A1*	*Or equivalent.* *Accept a method based on ratios.* *FT their derived scale factor (from $\sqrt[3]{}$).*
14. (a) 10x = 8·121212..... and 1000x = 812·1212.... with an attempt to subtract on both sides 804/990 (= 402/495 = 134/165)	M1 A1	Or x and 100x, or equivalent. Or a complete alternative method. An answer of 80·4/99 gains M1 only. ISW
Alternative method *0·8 + 0·0121212..... = 8/10 + 12/990 or equivalent* *804/990 (= 402/495 = 134/165)*	*M1* *A1*	*ISW*
14. (b) $6\sqrt{2}$	B1	
14. (c) $7\times 3+7\sqrt{5}-3\times 2\sqrt{5}-2(\sqrt{5})^2$ or equivalent = 11 + $\sqrt{5}$	M1 A1	 Mark final answer. Accept 11 + 1$\sqrt{5}$. If no marks awarded, SC1 for 3 correctly simplified terms i.e. 21, 7$\sqrt{5}$, – 6$\sqrt{5}$, – 10.
15. • *FG* = *HG* (since *G* is the midpoint of *FH*) • *EG* is a common side • Angle *EGF* = Angle *EGH* (since *EG* and *FH* are perpendicular) SAS (or two sides and the included angle) so that EFG and EHG are congruent triangles.	B1 B1 B1 B1	Do not accept indications on the diagram. FT from B2 previously awarded. Must be convincing. Do not allow 'two sides and an angle'.
Allow alternative method • *FG = HG (since G is the midpoint of FH)* • *EG is a common side* • *EF = EH using Pythagoras* *SSS (or all corresponding sides equal) so that EFG and EHG are congruent triangles.*	*B1* *B1* *B1* *B1*	*Do not accept indications on the diagram.* *Must be convincing. An unsupported statement that EF = EH, or that triangle is 'isosceles', is insufficient.* *FT from B2 previously awarded. Allow RHS.* *Must be convincing.*

12. $6(2x+1)-4(3x-5)$ as a <u>numerator</u> within a single fraction $(3x-5)(2x+1)$ as a <u>denominator</u> h26 / $(3x-5)(2x+1)$	M1 M1 A1	Allow intention of brackets, e.g. $6\times 2x+1-4\times 3x-5$ CAO. Allow $26/(6x^2-7x-5)$ (If expanded, the denominator must be correct.) If M1 M1 A1, penalise further incorrect work –1. If no marks awarded, then SC1 for sight of 26.
13. (Linear scale factor =) $\sqrt[3]{}$ (1280 / 20) (= 4) $\sqrt[3]{}$ (1280 / 20) × 2·3 = 9·2 (cm)	B1 M1 A1	Or equivalent. Accept a method based on ratios e.g. 1 : 4 (from 20 : 1280 = 1 : 64 = 1 : 4^3) FT their derived scale factor (from $\sqrt[3]{}$). SC1 for an answer of 18.4 (using s.f. of 8, from $\sqrt{64}$).
<u>Alternative method</u> (using reciprocal scale factor) *(Linear scale factor =) $\sqrt[3]{}$(20 / 1280) (= 1 / 4)* 2·3 ÷$\sqrt[3]{}$(20 / 1280) OR 1 / $\sqrt[3]{}$(20 / 1280) × 2·3 = 9·2 (cm)	*B1* *M1* *A1*	*Or equivalent.* *Accept a method based on ratios.* *FT their derived scale factor (from $\sqrt[3]{}$).*
14. (a) 10x = 8·121212..... and 1000x = 812·1212.... <u>with</u> an attempt to subtract on both sides 804/990 (= 402/495 = 134/165)	M1 A1	Or x and 100x, or equivalent. Or a <u>complete</u> alternative method. An answer of 80·4/99 gains M1 only. ISW
<u>Alternative method</u> *0·8 + 0·0121212..... = 8/10 + 12/990 or equivalent* *804/990 (= 402/495 = 134/165)*	*M1* *A1*	 *ISW*
14. (b) $6\sqrt{2}$	B1	
14. (c) $7\times 3+7\sqrt{5}-3\times 2\sqrt{5}-2(\sqrt{5})^2$ or equivalent = 11 + $\sqrt{5}$	M1 A1	 Mark final answer. Accept 11 + 1$\sqrt{5}$. If no marks awarded, SC1 for 3 correctly simplified terms i.e. 21, 7$\sqrt{5}$, – 6$\sqrt{5}$, – 10.
15. • *FG* = *HG* (since *G* is the midpoint of *FH*) • *EG* is a common side • Angle *EGF* = Angle *EGH* (since *EG* and *FH* are perpendicular) SAS (or two sides and the <u>included</u> angle) so that EFG and EHG are congruent triangles.	B1 B1 B1 B1	Do not accept indications on the diagram. FT from B2 previously awarded. Must be convincing. Do not allow 'two sides and an angle'.
<u>Allow alternative method</u> • *FG = HG (since G is the midpoint of FH)* • *EG is a common side* • *EF = EH using Pythagoras* *SSS (or all corresponding sides equal) so that EFG and EHG are congruent triangles.*	*B1* *B1* *B1* *B1*	*Do not accept indications on the diagram.* *Must be convincing. An unsupported statement that EF = EH, or that triangle is 'isosceles', is insufficient.* *FT from B2 previously awarded. Allow RHS.* *Must be convincing.*

5. (a) (CE =) $8 \times \frac{15}{10}$ or $8 \div \frac{10}{15}$ = 12 (cm)	M1 A1	Or equivalent M1 for correct use of linear ratio.
5.(b) (AB =) $10{\cdot}5 \times \frac{10}{15}$ or $10{\cdot}5 \div \frac{15}{10}$ or equivalent = 7 (cm)	M1 A1	Or equivalent M1 for correct use of linear ratio. FT 'their scale factor' from (a) provided not 1.

17.(b) Alternative method #2 *P(one blue, two not blue OR two blue, one not blue OR three blue)*	*S1*	*May be implied by subsequent working.*
$= \frac{5}{10}\times\frac{5}{9}\times\frac{4}{8} \times 3 + \frac{5}{10}\times\frac{4}{9}\times\frac{5}{8} \times 3 + \frac{5}{10}\times\frac{4}{9}\times\frac{3}{8}$	*M1*	*Complete method. (Missing x3 is S1 M0 A0.)*
$= \frac{660}{720}$ *(* $= \frac{11}{12}$ *) or equivalent*	*A1*	*ISW* *FT from part (a) consistent use of a wrongly calculated denominator.* *If no other marks awarded,* *SC1 for sight of* $\frac{875}{1000}$ *or* $\frac{660}{1000}$ *or equivalent.*

Unit 1: Higher Tier	Mark	Comments
1(a) (North orchard, number of pear trees is) $3 \times 35 \div (4 + 3)$ or 3×5 or equivalent	M1	
15 (pear trees)	A1	
(West orchard number of pear trees is 2×15) 30 (pear trees)	B1	FT 'their derived 15'
(West orchard number of cherry trees is) $11 \times 30 \div 5$	M1	FT 'their derived number of pear trees' Allow M1 for a final answer of 88 (cherry trees from use of 40 apple trees as pear trees), but A0
66 (cherry trees)	A1	FT answer must be evaluated correctly and lead to a whole number
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 explanations and working in a way that is clear and logical • write a conclusion that draws together their results and explains what their answer means
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.
1(b) (Mass of apples to make juice) 5280		Method may be seen in either order
$\div 6$	M1	M0 for statement '1/6 of 5280' without calculation
$\div 2.2$	M1	
400 (kg)	A2	Ignore incorrect units given May be seen or implied in later working A1 for any one of the following: • (5280 ÷ 2.2 =) 2400 • (5280 ÷ 6 =) 880 • a correct evaluation of 'their 2400' ÷ 6 • a correct evaluation of 'their 880' ÷ 2.2
(Number of litres of juice produced) $400 \times 2 \div 5$ or $2 \div (5 \div 400)$ or $2 \times \frac{400}{5}$	M1	FT 'their derived 400(kg)' (not 5280) If 'their derived 400' is used as g (rather than kg) allow M1 for 'their derived 400' × 2 ÷ 5000 or 2 ÷ (5000 ÷ 'their derived 400'), but A0
160 (litres)	A1	
1(b) Alternative method *(Mass of apples used to make juice) 5280 ÷ 6*	*M1*	
880 (lbs)	*A1*	
(Mass of apples in 2 litres) 5 × 2.2	*M1*	
11 (lbs)	*A1*	
(Number of litres of juice produced) 2 × 880 ÷ 11	*M1*	*FT 'their derived 880' and 'their derived 11'*
160 (litres)	*A1*	

1(c) 3 × 48 ÷ 8 or equivalent 18 (cm)		M1 A1	

13. *AE* = *CE* (Given) *BE* = *DE* (Given) Angle *AEB* = Angle *CED* (Vertically opposite angles)	B2	All 3 stated. 'Notches' or 'arcs' (or labelling) on the diagram are insufficient. B1 for 1 or 2 stated. Additional (correct or incorrect) statements may be ignored.
SAS (therefore triangle *ABE* and triangle *CDE* are congruent)	E1	FT provided at least B1 awarded. Allow an equivalent statement e.g. 'two sides and the included angle' (but not e.g. 'two sides and an angle').

		trial and improvement method used correctly.
13. (Area scale factor =) $(719/241)^2$ OR $(241/719)^2$	B1	Or equivalent.
$2063 \times (719/241)^2$ OR $2063 \div (241/719)^2$	M1	FT 'their linear scale factor squared'.
$=18362(\cdot 124\ldots cm^2)$	A1	CAO allowing only these values: 18000 OR 18300 up to 18800 OR 19000
$= 1\cdot 8(\ldots m^2)$	B1	Strict FT of a correct conversion of 'their area' to m^2. Allow $1\cdot 9(\ldots m^2)$ from correct working.
Alternative method *(Area of smaller shape = 2063÷10000 =) 0.2063 (m^2)*	*B1*	
(Area scale factor =) $(719/241)^2$ OR $(241/719)^2$	*B1*	*Or equivalent.*
$0.2063 \times (719/241)^2$ OR $0.2063 \div (241/719)^2$	*M1*	*FT 'their linear scale factor squared' AND Strict FT of 'their conversion of the smaller area' to m^2.*
$1\cdot 9(\ldots m^2)$	*A1*	*Allow $1\cdot 9(\ldots m^2)$ from correct working*

6. Sight of $(5x+3)(2x-1)$ or $2(5x+3)(2x-1)$ or equivalent	S1	Intention to (2 ×) width × length. Allow 4 × width × length or equivalent for S1. May be implied in later working if B2 or B1 awarded.
(total area of both rectangles = $20x^2+2x-6$ (cm^2)	B2	Mark final answer for B2. Allow $20x^2+2x+-6$ for B2. Award B1 for sight of one of the following: • $20x^2+12x-10x-6$ with at least three terms out of the four correct (must have x^2 term) • $10x^2+6x-5x-3$ • $2(10x^2+x-3)$ • $10x^2+x-3$ • $40x^2+4x-12$. If no marks, award SC1 for one of the following: • $40x^2+24x-20x-12$. • $20x^2+22x+6$ from $2(5x+3)(2x+1)$ • $20x^2-2x-6$ from $2(5x-3)(2x+1)$ • $20x^2-22x+6$ from $2(5x-3)(2x-1)$.

6(a) $150 \div (22+3) \times 22$ OR $150 \div (22+3) \times 3$ (Volume of copper =) 132 (cm^3) AND (Volume of tin =) 18 (cm^3)	M1 A1	May be implied in further working
(Mass of statue =) $132 \times 8.96 + 18 \times 7.31$ (1182.72 + 131.58)	m1	Allow m1, but A0, for use of rounded or truncated values of 8.96 and 7.31 FT 'their 132' and 'their 18'
(Mass of statue =) 1314(.3) (g)	A1	ISW FT provided one of their volumes is correct. Accept 1.3(143) kg from sight of 1314(.3) (g) or 1.314(3) (kg)
6(a) Alternative method calculating mass directly: *(Mass of statue =)* *$150 \div (22+3) \times 22 \times 8.96 + 150 \div (22+3) \times 3 \times 7.31$*	*M2*	*Allow M2, and possible A1 only, for use of rounded or truncated values of 8.96 and 7.31* *M1 for $150 \div (22+3) \times 22 \times 8.96$ (=1182.72) OR $150 \div (22+3) \times 3 \times 7.31$ (=131.58)*
(Mass of statue =) 1314(.3) (g)	*A2*	*ISW* *Accept 1.3(143) kg from sight of 1314(.3) (g) or 1.314(3) (kg)* *Award A1 for* • *1182.7(2) or 1183 OR* • *131.5(8) or 131.6 or 132*
6(b) (Volume factor =) $\left(\frac{21.6}{12}\right)^3$ OR $\left(\frac{12}{21.6}\right)^3$ or 1.8^3 OR $0.555\ldots^3$ (=5.832) (=0.171…) (Volume of bigger statue =)	B1	or $\left(\frac{9}{5}\right)^3$ OR $\left(\frac{5}{9}\right)^3$
$150 \times \left(\frac{21.6}{12}\right)^3$ OR $150 \div \left(\frac{12}{21.6}\right)^3$	M1	Implies the previous B1
= 874(.8) or 875 (cm^3)	A1	

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

15. Formally identifying (in writing) two appropriate pairs of equal angles e.g. *BAC* = *DAE* and *BCA* = *DEA* (*CA* = *AE* given) or *BAC* = 79° and *DEA* = 27° (*CA* = *AE* given) AND Explanation that the triangles are congruent due to angle, side, angle or ASA or equivalent.	E2	(Check diagram) If all three angles are used, they must all be correct. For reference: *BAC* = *DAE* = 79° (vertically opposite angles) *BCA* = *DEA* = 27° (alternate angles) *ABC* = *ADE* = 74° (angles in a triangle with alternate angles) Award E1 for one of the following: • formally identifying at least one correct pair of angles AND explanation that the triangles are congruent due to angle, side, angle or ASA or equivalent. OR • a correctly completed diagram (at least two pairs of angles) AND Explanation that the triangles are congruent due to angle, side, angle or ASA or equivalent. OR • formally identifying (in writing) two pairs of matching angles (with no incorrect angles) e.g. *BAC* = *DAE* and *BCA* = *DEA* (*CA* = *AE* given) or *BAC* = 79° and *DEA* = 27° (*CA* = *AE* given)

Unit 1: Higher Tier	Mark	Comments
5(a)(i) 1×10^5	B1	
5(a)(ii) A suitable calculation, including an appropriate approximation, e.g. $\frac{3\,100\,000}{21\,000}$ or $\frac{3\,100\,000}{20\,000}$ or $\frac{3\,000\,000}{20\,000}$ or $\frac{3\,000\,000}{21\,000}$ or equivalent	M2	Place value must be correct Must include an approximation M1 for the idea to divide (in the correct order), that may also include one place value error, e.g. $\frac{3.1\ million}{20\,735}$, $\frac{31\,000\,000}{20\,000}$, $\frac{3\,100\,000}{20\,700}$
Answer in the range 142 (people/km^2) to 155 (people/km^2)	A1	ISW. Allow 142.8, 142.9 and 143 rounded to 140 Accept equivalents, e.g. 150 written as 1.5×10^2
5(b) Idea that 360 000 is 120%	B1	Accept from sight of trial to increase 'their value' by 20% provided 'their value' <360 000
360 000 ÷ 1.2 or equivalent	M1	Award of M1 also implies previous B1
300 000 (people)	A1	
5(c) (Length) 6.6 ÷ (4.2 ÷ 1.4) or 6.6 ÷ 3 or equivalent	M1	
Length 2.2 (cm)	A1	
(Height) 4.2 × (9.9 ÷ 6.6) or 4.2 × 1.5 or 1.4 × (9.9 ÷ 2.2) or equivalent	M1	FT 1.4 × (9.9 ÷ 'their derived length')
Height 6.3 (cm)	A1	Note: Length (from *9.9 – 6.6* =) *3.3*(cm) M0 A0 Height (from 1.4 × (9.9 ÷ *3.3*) =) 4.2(cm) M1 A1 (FT) Allow answers reversed in the answer space
5(c) Alternative method *(Height) 4.2 × (9.9 ÷ 6.6) or 4.2 × 1.5 or equivalent*	*M1*	
Height 6.3 (cm)	*A1*	
(Length) 6.6 ÷ (4.2 ÷ 1.4) or 6.6 ÷ 3 or 9.9 ÷ (6.3 ÷ 1.4) or equivalent	*M1*	*FT 9.9 ÷ ('their derived height' ÷ 1.4)*
Length 2.2 (cm)	*A1*	*Allow answers reversed in the answer space*

Unit 2: Higher Tier	Mark	Comments
7.(a) $\frac{x}{13.3} = \frac{5.2}{3.8}$ or $\frac{x}{5.2} = \frac{13.3}{3.8}$ or equivalent $x = 18{\cdot}2$	M1 A1	M1 for correct use of scale factor 3·5 or equivalent e.g. $x = 5{\cdot}2 \times \frac{7}{2}$ An unsupported answer of 18·2 is awarded M1A1.
7.(b) A and C Valid **correct** reason e.g. • For each (of A and C) the length is 1·5 times the width • For each (of A and C) the length is 3/2 times the width • For each (of A and C) the width is 2/3 times the length • The scale factor (of enlargement from A to C) is 2·5 (or equivalent) • The scale factor (of enlargement from C to A) is 0·4 (or equivalent) • The sides are in equal ratios e.g. $\frac{15}{6} = \frac{10}{4}$ (= 2·5) OR $\frac{6}{4} = \frac{15}{10}$ (= 1·5) or equivalent inverse ratios shown to be equal • The (corresponding) lengths and widths are in the same ratio of 5 : 2 • The ratio of the length to the width is 3 : 2 (for each of the rectangles A and C) • 6 × 2·5 = 15cm 4 × 2·5 =10cm.	B1 E1	Answer line takes precedence. Dependent on B1. Allow: Both width and height increase by a factor of 2·5 Do not allow: They have the same scale factor The scale factor is 1·5 The scale factor is 3 : 2.

Unit 2: Higher Tier	Mark	Comments
18. Area scale factor: $\left(\sqrt[3]{3821/569}\right)^2$ (= 3·559…) OR $\left(\sqrt[3]{569/3821}\right)^2$ (= 0·280…) or equivalent.	M2	May be seen in parts. Allow $\left(\sqrt[3]{3821}\right)^2 : \left(\sqrt[3]{569}\right)^2$, or equivalent (written as a ratio). Award M1 for: • $\sqrt[3]{3821/569}$ (= 1·886…) • $\sqrt[3]{569/3821}$ (= 0·530…) • $(3821/569)^2$ (= 45·095…) • $(569/3821)^2$ (= 0·022...) • $\left(\sqrt[3]{3821}\right)^2$ (= 244·409…) AND $\left(\sqrt[3]{569}\right)^2$ (= 68·665…)
Cross-sectional area of larger solid = $29 \times \left(\sqrt[3]{3821/569}\right)^2$ OR $29 \div \left(\sqrt[3]{569/3821}\right)^2$ or equivalent.	m1	Must be from M2.
103·2(…cm^2)	A1	CAO. Accept answers in the range 103·2(cm^2) to 103·3(cm^2). Allow 103 provided not from premature approximation.
18. Alternative method *Height of larger solid:* $569/29 \times \sqrt[3]{3821/569}$ *OR* $569/29 \div \sqrt[3]{569/3821}$ *(= 37·017…)*	*M2*	*May be seen in parts.* *Award M1 for a linear scale factor:* $\sqrt[3]{3821/569}$ *(= 1·886…) OR* $\sqrt[3]{569/3821}$ *(= 0·530…) or equivalent.*
Cross-sectional area of larger solid = *3821 ÷ 37·017…*	*m1*	*Award using 'their 37·017…'* Must be from M2.
103·2(…cm^2)	*A1*	*CAO.* *Accept answers in the range 103·2(cm^2) to 103·3(cm^2).* *Allow 103 provided not from premature approximation.*

3(a) (Length of the flagpole below the rod =) $3.8 \times \sin 55°$ or $3.8 \times \cos(90° - 55°)$ or $380 \times \sin 55°$ or $380 \times \cos(90° - 55°)$	M2	Or alternative full method M1 for correct working without isolating 'length' $\sin 55° = \frac{\text{length}}{3.8}$ or $\cos(90° - 55°) = \frac{\text{length}}{3.8}$ or $\sin 55° = \frac{\text{length}}{380}$ or $\cos(90° - 55°) = \frac{\text{length}}{380}$
3.11(2…m) or 311(.2.. cm)	A1	Allow 3.1 (m) or 310 (cm)
(Total length 1.5 + 3.11 =) 4.61 (m) or 461 (cm)	A1	Must be to the nearest cm FT provided at least M1 previously awarded, i.e. for 1.5 + 'their 3(.)11' correctly evaluated, to nearest cm, and 'their 3.11' is to at least 2 decimal places If units are given they must be correct
3(b)(i) $120 \times 64 \div 80$ or 64×1.5 or 120×0.8 or $120 \div 1.25$ or $64 \div \frac{2}{3}$ or equivalent	M1	
96 (cm)	A1	Answer space takes precedence
3(b)(ii) $75 \times 80 \div 120$ or $75 \div 1.5$ or $75 \times \frac{2}{3}$ or $80 \div 1.6$ or 80×0.625 or $64 \times 75 \div 96$ or equivalent	M1	FT from (b)(i) $64 \times 75 \div$ 'their 96' or equivalent
50 (cm)	A1	Answer space takes precedence

5. $(w =)\ 18{\cdot}9 \times \frac{6}{9}$ OR $\frac{w}{18{\cdot}9} = \frac{6}{9}$ or equivalent OR $(w =)\ 18{\cdot}9 \div \frac{9}{6}$ OR $\frac{18{\cdot}9}{9} = \frac{w}{6}$ or equivalent	M1	May be seen in stages. M1 for <u>correct use</u> of scale factor $\frac{2}{3}$ or equivalent.
= 12·6	A1	An unsupported answer of 12·6 is awarded M1A1

End of solutions