GCSE MARKING SCHEME

SUMMER 2022

GCSE
MATHEMATICS
UNIT 2 – HIGHER TIER
3300U60-1

INTRODUCTION

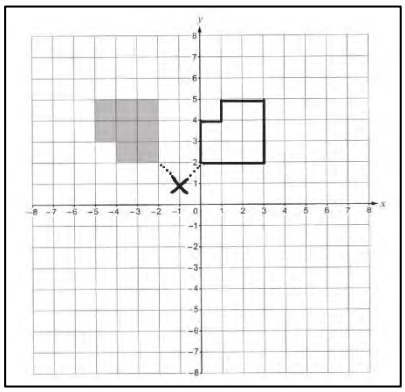
This marking scheme was used by WJEC for the 2022 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

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

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

WJEC GCSE MATHEMATICS

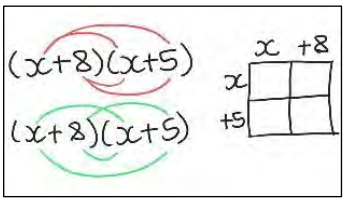
SUMMER 2022 MARKING SCHEME

Unit 2 Higher Tier	Mark	Comments
1. Correct rotation. 	B2	B1 for either a: • 90° anticlockwise rotation about (−1,1) • 90° clockwise rotation about (1,-1).
2. (a) $8m = w + 3$ or $w + 3 = 8m$ or $-8m = -w - 3$ $m = \frac{w+3}{8}$ or $\frac{w+3}{8} = m$ or $m = \frac{-w-3}{-8}$	B1 B1	Allow $-8m = -(w + 3)$. FT only from $\pm 8m = \pm w \pm 3$, stated or implied. (note: $8m = w + 3$ or $-8m = -w - 3$ will have already gained the previous B1). B1B0 for $-m = \frac{-3 - w}{8}$ or equivalent. Mark final answer. Note Allow B1B0 for $m = (w + 3) \div 8$ with or without brackets. Allow B1B0 for $\frac{w+3}{8}$ ('$m =$' missing).

2. (b)	$y^2 + y - 20$ ISW	B2	Allow $y^2 + 1y - 20$. Award B1 for one of the following: • $y^2 + 5y - 4y - 20$ • $y^2 + 5y \ - 4y + - 20$ • $y^2 + 5y + - 4y - 20$ • $y^2 + 5y + - 4y + - 20$ • $y^2 + ky - 20$ (where $k \neq 0$ or 1) • $y^2 + (1)y + t$ (where $t \neq -20$) • for sight of y^2 AND $+5y$ AND $-4y$ AND -20 but not in an expression.

3. (Diameter =) $24{\cdot}8 \div 2 \times 3$ OR (Radius =) $24{\cdot}8 \div 2 \times 3 \div 2$ or equivalent	M1	
(Diameter =) 37·2 (cm) OR (Radius =) 18·6 (cm)	A1	Sight of 1086 to 1087 (cm^2) (base area calculated with radius 18·6) OR 4345 to 4348 (cm^2) (base area calculated with diameter) implies first M1 A1. If diameter AND radius given and radius ≠ 18·6 either: • award M1A0 (for sight of diameter = 37·2) if their stated radius is then used to find the volume of the cylinder (2nd M mark is awarded) or • award M1A1 (for sight of diameter = 37·2) if their incorrect radius is not used to find the volume of the cylinder (2nd M mark is not awarded).
$\pi \times \left(\frac{37.2}{2}\right)^2 \times 24{\cdot}8$ or $\pi \times 18{\cdot}6^2 \times 24{\cdot}8$	M1	May be seen in parts. Accept $3{\cdot}14 \times 18{\cdot}6^2 \times 24{\cdot}8$ or equivalent. FT 'their stated radius' OR 'their stated diameter', provided it is halved at the appropriate stage.
= 27 000 (cm^3)	A2	For A2, must be correct to 2sf. A1 for an answer between 26 940 and 26 960 (cm^3) inclusive. <u>Note:</u> (Diameter =) $24{\cdot}8 \div 5 \times 3$ OR (Radius =) $24{\cdot}8 \div 5 \times 3 \div 2$ M0 (Diameter =) 14·88 (cm) OR (Radius =) 7·44 (cm) A0 $\pi \times 7{\cdot}44^2 \times 24{\cdot}8$ M1 4300 (cm^3) A2 A1 for answer between 4310 and 4314 (cm^3) inclusive If M0 (2nd M mark) then award SC1 for an answer of either: • 110 000 (cm^3) (from use of $\pi \times 37{\cdot}2^2 \times 24{\cdot}8$ rounded correctly) OR • 17 000 (cm^3) (from use of $\pi \times 14{\cdot}88^2 \times 24{\cdot}8$ rounded correctly). FT 'their stated diameter' correctly rounding to 2sf for this SC1.

4. (BC^2 =) $9{\cdot}6^2 + 12{\cdot}8^2$ or equivalent	M1	note: (BC^2 =) 92·16 + 163·84 (ignore place values for M1) *Award M1 for the correct values substituted into the Cosine rule.*
(BC^2 =) 256 or (BC =) $\sqrt{256}$	A1	
(BC =) 16 (cm)	A1	Allow (BC =) ±16 (cm). FT from M1 for the correctly evaluated square root of 'their 256' provided their answer > 12·8.
$CD = 2 \times 60 \div 16$ or equivalent	M2	FT 'their derived BC' **OR** 'their stated 16' (not derived) provided 12·8 < 'their stated 16' < 22·4. Award M1 for 60 = ½ × 16 × CD or equivalent.
(CD =) 7·5 (cm)	A1	Allow M2A1 for a correct embedded answer BUT M2A0 if contradicted by CD ≠ 7·5 (cm).
4. Alternative method: ***Correct** use of 'two-step' method*	*M2*	*A partial trigonometric method is M0.*
(BC =) 16 (cm)	*A1*	
CD = 2 × 60 ÷ 16 or equivalent	*M2*	*FT 'their derived BC' **OR** 'their stated 16' (not derived) provided 12·8 < 'their stated 16' < 22·4. Award M1 for 60 = ½ × 16 × CD or equivalent.*
(CD =) 7·5 (cm)	*A1*	*Allow M2A1 for a correct embedded answer BUT M2A0 if contradicted by CD ≠ 7·5 (cm).*
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

5. (a) $2x(4x + 3y)$	B2	Award B1 for $2x(4x \pm \ldots\ldots..)$ or $2x(\ldots\ldots + 3y)$ Award B1 for a partial factorisation. i.e. $2(4x^2 + 3xy)$ or $x(8x + 6y)$. Mark final answer.
5. (b)(i) $(x + 8)(x + 5)$ ISW	B2	B1 for $(x \ldots 8)(x \ldots 5)$.
5. (b)(ii) Any valid explanation e.g. "you could expand the two brackets" "expanding is the opposite of factorising" "multiply the brackets together" "solve $(x + 8)(x + 5) = 0$, and then substitute the value(s) of x into $x^2 + 13x + 40$. It should give 0." "replace x in the brackets and expression with the same value. You should get the same answer."	E1	Allow "the two numbers need to add to 13, but multiply to make 40" "Use FOIL (CAMO) to check" or other names explaining the method. Allow method shown to expand brackets for example:  Do not accept "$(x + 8)(x + 5) = x^2 + 13x + 40$" without further working "taking out the brackets" "reverse the calculation"
6. $3{\cdot}648 \times 10^4$	B1	
7. (a) $(x =)$ $14{\cdot}5 \times \sin 42$ $= 9{\cdot}7(02\ldots.)$	M2 A1	Award M2 for $14{\cdot}5 \times \cos 48$ or $\frac{14{\cdot}5 \times \sin 42}{\sin 90}$ M1 for $\sin 42 = \frac{x}{14{\cdot}5}$ or $\cos 48 = \frac{x}{14{\cdot}5}$ or $\frac{x}{\sin 42} = \frac{14{\cdot}5}{\sin 90}$ Allow 10 from correct working. Award M2 A0 for an unsupported answer of –13·2895… (radians) or 8·88715…. (gradians).
7. (a) Alternative method: ***Correct** use of 'two-step' method.* *$(x) = 9{\cdot}7(02\ldots)(cm)$*	*M2* *A1*	*A partial trigonometric method is M0.* *Accept an answer that rounds to 9·7(cm)* *Award M2 A0 for an answer of -13·2895… (radians) or 8·88715…. (gradians).*
7. (b) $(y =) \cos^{-1} \frac{13{\cdot}5}{15{\cdot}8}$ Correct evaluation in the range 31·3 to 31·4	M2 A1	M1 for $\cos y = \frac{13{\cdot}5}{15{\cdot}8}$ (= 0·854..) Allow 31 from correct working. Allow correct angles given in radians (0·5463..) or gradians (34·7812….) Note: $\cos y = 0{\cdot}85$ $y = 31{\cdot}788\ldots$ is awarded M2A0.
7. (b) Alternative method: ***Correct** use of 'two-step' method.* *Correct evaluation in the range 31·3 to 31·4*	*M2* *A1*	*A partial trigonometric method is M0.* Allow 31 from correct working. *Allow correct angles given in radians (0·5463..) or gradians (34·7812….)*

8. (a) Any intention of length × width × height = 132 e.g. $5x(x^2+3) = 132$ $5 \times x \times (x^2+3) = 132$ or $5x \times (x^2+3) = 132$ or equivalent	B1	Must be = 132. May be seen in parts. Do not allow missing brackets e.g. $5 \times x \times x^2 + 3 = 132$.
8. (b)(i) One correct evaluation $2 \le x \le 3$ 2 correct evaluations $2{\cdot}55 \le x \le 2{\cdot}75$, (one value < 132, one value > 132) 2 correct evaluations $2{\cdot}55 \le x \le 2{\cdot}65$, (one value < 132, one value > 132) $x = 2{\cdot}6$	 B1 B1 M1 A1	*Correct evaluation regarded as enough to identify if <132 or >132. If evaluations not seen accept 'too high' or 'too low'.* *Look out for testing* $5x^3 + 15x - 132 = 0$ *or* $x^3 + 3x = 26{\cdot}4$ *or equivalent* x $5x^3 + 15x$ 2 70 2.1 77.805 2.2 86.24 2.3 95.335 2.4 105.12 2.5 115.625 **2.6 126.88** **2.7 138.915** 2.8 151.76 2.9 165.445 3 180 2.55 121.1568… **2.65 132.798…..** 2.75 145.234…...
8. (b)(ii) An answer in the range 9·76 to 10·16 (cm)	 B1	Answer may be shown on the diagram. FT 'their $2{\cdot}6'^2 + 3$. FT $132 \div (5 \times$ 'their x').
9. (Area of circular face=) $\pi \times 34^2$ $(= 1156\pi)$ (Curved surface area of hemisphere=) $2 \times \pi \times 34^2$ o.e. (Total surface area=) 3468 π (cm^2) or answers in the range: 10 889·4 (cm^2) to 10 896·6 (cm^2)	M1 M2 A1	Accept values between 3629.8 and 3632.2 if $\pi \times 34^2$ or 1156π not seen. 2312π or values between 7259·6 and 7264·4 M1 for sight of $4 \times \pi \times 34^2$ or 4624π or values between 14519 and 14529. Sight of $3 \times \pi \times 34^2$ implies M1 M2. CAO. Mark final answer. Allow an answer of 10 900 from correct working. If no marks awarded, award SC2 for an unsupported $5 \times \pi \times 34^2$ (5780π or values between 18 149 and 18 160·8).

10. $\frac{97{\cdot}5}{0{\cdot}55}$ = 177·3	M2 A1	If many attempts are offered without a method/answer being identified, then mark the final attempt. If M2 not gained, award M1 A0 for correct use of values 97·5 ≤ t < 98 and 0·5 < w ≤ 0·55. CAO. Must be to 1 decimal place. Mark final answer. An unsupported answer of 177·3 gains full marks. SC2 for an unsupported answer of 177·27(2727…), fractional equivalent = 1950/11 SC1 for an unsupported answer of 177 or 177·2 or for sight of 97·5 and 0·55 used within the same calculation.
11. sin BAD = $\frac{2\times112}{10\times27}$ or equivalent (BAD=) 56(·06…°) (Area of shaded region=) $112 - \frac{56(\cdot06\ldots)}{360}\times\pi\times10^2$ (Area of shaded region =) 63(·077… cm^2) or answers in the range: 63 to 63·2 (cm^2)	M2 A1 M2 A1	M1 for the correct use of the formula when sin BAD is not the subject e.g. 112 = ½ ×10×27×sin BAD. Accept 56·1(°). Allow correct angles given in radians (0·9784..) or gradians (62·2896….) F.T. their derived or stated value of angle BAD. M1 for $\frac{56(\cdot06\ldots)}{360}\times\pi\times10^2$ (=48·92 cm^2)
Alternative method for the first 3 marks *Correct use of a two-step method.* *(BAD=) 56(·06…°)*	*M2* *A1*	*Example* *(Perpendicular height of triangle=) 112×2÷27 = 8·2(96…) or 8·3* *(BAD=) $\sin^{-1}$[8·2(96…)÷10]* *Allow correct angles given in radians (0·9784...) or gradians (62·2896...)*
12. $4(2x+9)+5(3x-7)$ $[=8x+36+15x-35]$ as a numerator within a single fraction $(3x-7)(2x+9)$ as a denominator = $\frac{23x+1}{(3x-7)(2x+9)}$ or $\frac{23x+1}{6x^2+13x-63}$	M1 M1 A1	Accept intention of brackets. e.g. $4\times2x+9+5\times3x-7$ CAO. Mark final answer. (If expanded, the denominator must be correct.) If no marks awarded, then SC1 for sight of $23x+1$.
13. $\frac{2}{5}\times\frac{2}{5}\times\frac{2}{5}$ $= \frac{8}{125}$ (=0·064) ISW	M1 A1	Or equivalent, e.g. 0·4×0·4×0·4 SC1 for 27/125 (=0·216) for a correct evaluation of three odd numbers chosen.

14. (Area=) $\frac{1}{2}$ × [12+0+2(12+10+6)]	M2	Award M1 for 4 or more values correct and up to 1 incorrect OR all values correct but $h \neq 1$.
= 34	A1	F.T. from M1 provided h is correct. Ignore units. Condone 34^2 if offered as a final answer.
14. Alternative method: *(Area=)* $\frac{(12+12)\times1}{2} + \frac{(12+10)\times1}{2} + \frac{(10+6)\times1}{2} + \frac{(6+0)\times1}{2}$ *(= 12 + 11 + 8 + 3)*	*M2*	*×1 not required.* *Each area may be seen as the sum of the area of a rectangle and a triangle.* *M1 for the sum of these 4 areas with 1 error (may be repeated) in the substitution of these values.* *Condone missing brackets for M2 or M1 provided subsequent working leads to the appropriate values.*
= 34	*A1*	*F.T. from M1 provided h is correct.* *Ignore units.* *Condone 34^2 if offered as the final answer.* *Treat splitting area into 8 parts as MR-1.* *If no marks awarded, award SC1 for sight of 12, 11, 8 and 3 (not in a sum).*
15. (cos XYZ =) $\frac{34^2 + 55^2 - 73^2}{2\times34\times55}$ ($=-\frac{287}{935}$ OR –0·30695…)	M2	Award M2 for use of cosine rule to find YXZ (= 45·8…°) or XZY (= 26·3…°) AND subsequent use of the sine rule to find the angle XYZ. Award M1 for $73^2 = 34^2 + 55^2 - 2\times34\times55\times\cos XYZ$
(XYZ =) 107·8(75…°) or 107·9(°) or 108(°)	A1	If no marks awarded, award SC1 for one of the following: • The correct evaluation of either of the two other angles. YXZ = 45·8(…°) and XZY = 26·3(…°) • An answer of XYZ = 72·1(…°) (from 1 slip using the cosine rule).

Degrees	Radians	Gradians
107·875…	1·882…	119·861…
72·1…	1·258…	80·138…
45·8…	0·799…	50·901…
26·3…	0·459…	29·236…

16. (Sight of $2x(5x + 1)$ =) $10x^2 + 2x$ OR (Sight of $(7 – 2x)^2$ =) $49 - 14x - 14x + 4x^2$ OR $2x(5x + 1) = (7 – 2x)^2$	B1	Or equivalent. Or equivalent. $2x(5x + 1) = (7 – 2x)^2$ may be implied in later working.
$10x^2 + 2x = 49 - 14x - 14x + 4x^2$	B1	
$6x^2 + 30x - 49 = 0$	B1	F.T. expansions of equivalent level of difficulty provided B1 previously awarded. '= 0' required, but may be implied by an attempt to use the quadratic formula.
$x = \frac{-30\pm\sqrt{30^2-4\times6\times-49}}{2\times6}$ or $x = \frac{-30+\sqrt{30^2-4\times6\times-49}}{2\times6}$	M1	Substitution into the formula must be seen for M1. F.T. 'their derived quadratic equation' equated to zero of equivalent difficulty (a, b and c must be non-zero). Allow one slip in substitution **for M1 only**, but must be correct formula.
$x = \frac{-30\pm\sqrt{2076}}{12}$ or $x = \frac{-30+\sqrt{2076}}{12}$ or $x = \frac{-15\pm\sqrt{519}}{6}$ or $x = \frac{-15+\sqrt{519}}{6}$	A1	Can be implied from at least one of their two values of x correctly evaluated (x=1·29… or x=–6·29…)
$x = 1.3$ (answer to 1 d.p.)	A1	FT for A1 for their quadratic equation provided: • rounding required to 1 d.p. AND • one positive and one negative root. Do not allow 1·30. Do not penalise if negative solution also shown ($x = -6.3$ or $-6.29(\ldots)$) Note: sight of a correct answer does not imply full marks without working.
Using trial and improvement for the final 3 marks *Two correct evaluations $1.25 \leq x \leq 1.35$,* *(one value < 0, one value > 0)*	*M2*	*Two correct evaluations must be seen, otherwise M0.* *F.T. 'their derived quadratic equation' (=0 or ='their constant') of equivalent difficulty (a, b and c must be non-zero) and their x involves rounding to 1 d.p.*
$x = 1.3$ *(answer to 1 d.p.)*	*A1*	*FT for A1 for their quadratic equation.*

17. Method using the linear scale factor (Linear scale factor=) $\sqrt[3]{\frac{4913}{8000}}$ OR $\frac{\sqrt[3]{4913}}{\sqrt[3]{8000}}$ (= 0·85 or $\frac{17}{20}$)	B1	Or equivalent.
(Height of Solid B=) $\sqrt[3]{\frac{4913}{8000}} \times 30$ = 25·5 (cm)	M1 A1	F.T. their derived linear scale factor (from $\sqrt[3]{}$) CAO.
17. Alternative method using the linear scale factor *(Linear scale factor=)* $\sqrt[3]{\frac{8000}{4913}}$ *OR* $\frac{\sqrt[3]{8000}}{\sqrt[3]{4913}}$ *(=1·17647…* or $\frac{20}{17}$ *)*	*B1*	*Or equivalent.*
(Height of Solid B=) $30 \div \sqrt[3]{\frac{8000}{4913}}$ *= 25·5(cm)*	*M1* *A1*	*F.T. their derived linear scale factor (from $\sqrt[3]{}$)* CAO
17. Method using the volume scale factor $\frac{h^3}{30^3} = \frac{4913}{8000}$ *(=0·614…)*	*B1*	*Must include* $\frac{h^3}{30^3}$ *or equivalent, e.g.* $\left(\frac{h}{30}\right)^3 = \frac{4913}{8000}$
(Height of solid B=) $\sqrt[3]{30^3 \times \frac{4913}{8000}}$ *OR* $\sqrt[3]{30^3 \div \frac{8000}{4913}}$ *= 25·5 (cm)*	*M1* *A1*	*CAO*
17. Alternative method using the volume scale factor $\frac{30^3}{h^3} = \frac{8000}{4913}$ *(=1·628…)*	*B1*	*Must include* $\frac{30^3}{h^3}$ *or equivalent, e.g.* $\left(\frac{30}{h}\right)^3 = \frac{8000}{4913}$
(Height of solid B=) $\sqrt[3]{30^3 \div \frac{8000}{4913}}$ *OR* $\sqrt[3]{30^3 \times \frac{4913}{8000}}$ *= 25·5 (cm)*	*M1* *A1*	*CAO*