GCSE MARKING SCHEME

SUMMER 2025

GCSE
MATHEMATICS
UNIT 2 – HIGHER TIER
3300U60-1

About this marking scheme

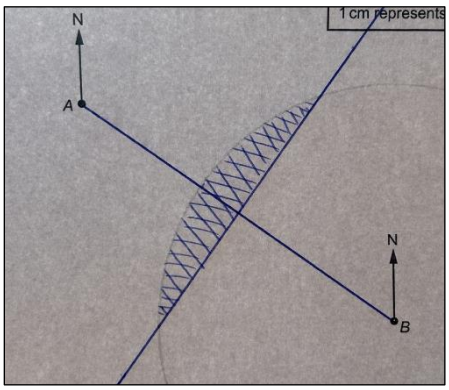
The purpose of this marking scheme is to provide teachers, learners, and other interested parties, with an understanding of the assessment criteria used to assess this specific assessment.

This marking scheme reflects the criteria by which this assessment was marked in a live series and was finalised following detailed discussion at an examiners' conference. A team of qualified examiners were trained specifically in the application of this marking scheme. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners. It may not be possible, or appropriate, to capture every variation that a candidate may present in their responses within this marking scheme. However, during the training conference, examiners were guided in using their professional judgement to credit alternative valid responses as instructed by the document, and through reviewing exemplar responses.

Without the benefit of participation in the examiners' conference, teachers, learners and other users, may have different views on certain matters of detail or interpretation. Therefore, it is strongly recommended that this marking scheme is used alongside other guidance, such as published exemplar materials or Guidance for Teaching. This marking scheme is final and will not be changed, unless in the event that a clear error is identified, as it reflects the criteria used to assess candidate responses during the live series.

WJEC GCSE MATHEMATICS

SUMMER 2025 MARK SCHEME

GCSE Mathematics **Unit 2: Higher Tier**	Mark	Comments
1.		Use tolerances ± 2 mm
Perpendicular bisector of the line *AB*	B1	For B1, the bisector must be of sufficient length that crosses *AB* so as not to be considered a 'point' or a 'notch' i.e. at least 2 cm.
Arc of radius 6 cm from *B*	B2	For B2 or B1, the arc must be of sufficient length so as not to be considered a 'point' or a 'notch' i.e. for a sector of at least 10° at B. Award B1 for the appropriate sight of one of the following: • 6 (cm) • 27 (km) ÷ 4·5 • arc of radius 6 cm from *A* • arc of radius 'their 27 (km) ÷ 4·5' from *B* provided 'their 27 (km) ÷ 4·5' has been seen.
Correct region identified within the map  	B1	Ignore shading outside map. Strict FT for a suitable region bounded by a line crossing *AB* and an arc from either *A* or *B* but outside of tolerances and provided at least B1 previously awarded.

2. (Expected prize money =) $\frac{2}{5}$ × 100 × (£)3 or equivalent	M2	May be seen or implied in later working. May be seen in stages. Award M1 for any one of the following: • $\frac{2}{5}$ × 100 or equivalent • 40 (winners) (allow $\frac{40}{100}$ or '40 out of 100' or as a numerator in a fraction < 1) • $\frac{2}{5}$ × (£)3 or equivalent • (£)1.2(0) • FT 'their derived or stated $\frac{2}{5}$', provided 'their $\frac{2}{5}$' < 1 and number of winners is a whole number • FT 'their stated or derived number of winners' × (£)3 provided the number of winners is a whole number.
(£)120(.00)	A1	CAO.
(Amount taken = £3 × 40 + £130 =) £250(.00)	A1	(£)120 + (£)130. FT 'their (£)120' + (£)130, provided at least M1 previously awarded.
(x = cost for playing the game once = (£3 × 40 + £130) ÷ 100 =) 2.5(0)	A1	Mark final answer. FT ['their (£)120 + (£)130'] ÷ 100 provided that M1 is previously awarded. Allow M2 A1 A1 A1 for a correct embedded answer BUT only M2 A1 A1 A1 –1 (4 marks) if contradicted by $x \neq 2.5$. If no marks, award SC1 for sight of $\frac{2}{5}$ or equivalent.
2. <u>Alternative method - working with groups of 5</u> *(Profit of each group of 5 people) = $5x - 6$*	*B1*	
$(5x - 6) \times 20 = 130$ or equivalent	*M2*	*May be implied in later working (e.g. 6 × 20 + 130 and then 250 ÷ 100)* *Award M1 for $(5x - 6) \times 20$ or equivalent* *FT 'their $(5x - 6)$' × 20, provided 'their $(5x - 6)$'* is in the form $ax \pm b$.
$(100x - 120 = 130)$ or $(5x - 6 = 6{\cdot}5)$		
$100x = 250$ or $5x = 12{\cdot}5$	*A1*	
$(x =)$ 2.5(0)	*A1*	*Mark final answer.*
2. <u>Alternative method 2 - working with winners and losers</u> *(40 winners) = $40 \times (x - 3)$ or equivalent*	*B1*	
(60 losers) = $60 \times x$ or equivalent	*B1*	
$40 \times (x - 3) + 60 \times x = 130$	*M1*	*May be implied in later working (e.g. 6 × 20 + 130 and then 250 ÷ 100).* *FT 'their $40 \times (x - 3)$' + 'their $60 \times x$' = 130, provided B1 previously awarded*
$(100x - 120 = 130)$		
$100x = 250$	*A1*	
$(x =)$ 2.5(0)	*A1*	*Mark final answer.*

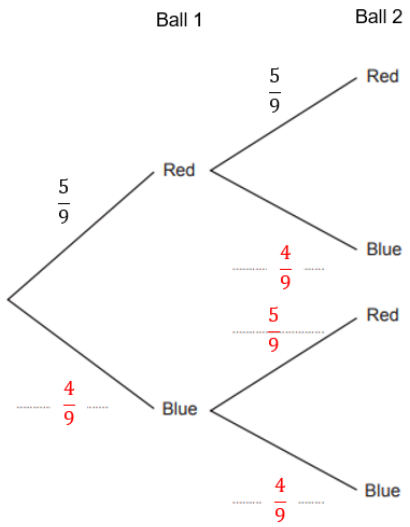
Organisation and Communication.	OC1	For OC1, candidates will be expected to: • present their response in a structured way • explain to the reader what they are doing at each step of their response • lay out their explanation and working in a way that is clear and logical • write a conclusion that draws 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
3. One correct evaluation $2 \le x \le 3$ 2 correct evaluations $2{\cdot}25 \le x \le 2{\cdot}45$, (**one value < 25, one value > 25** *Method 1*) or **(one value < 0, one value > 0** *Method 2*) 2 correct evaluations $2{\cdot}35 \le x \le 2{\cdot}45$, (**one value < 25, one value > 25**) or **(one value < 0, one value > 0** *Method 2*) $x = 2{\cdot}4$	B1 B1 M1 A1	*Correct evaluation regarded as enough to identify if < 25 or > 25 (Method 1) or < 0 or > 0 (Method 2). If evaluations not seen accept 'too high' or 'too low'. Evaluations can be rounded or truncated.* **Method 1** x / x^3+5x / x / x^3+5x 2 / 18 / 2·25 / 22·641 2·1 / 19·761 / **2·35** / **24·728** 2·2 / 21·648 / **2·36** / **24·944** **2·3** / **23·667** / 2·37 / 25·162 **2·4** / **25·824** / 2·38 / 25·381 2·5 / 28·125 / 2·39 / 25·602 2·6 / 30·576 / 2·4 / 25·824 2·7 / 33·183 / 2·41 / 26·048 2·8 / 35·952 / 2·42 / 26·272 2·9 / 38·889 / 2·43 / 26·499 3 / 42 / 2·44 / 26·727 2·45 / 26·956 **Method 2** x / $x^3+5x-25$ / x / $x^3+5x-25$ 2 / -7 / 2·25 / -2.359 2·1 / -5.239 / **2·35** / **-0.272** 2·2 / -3.352 / **2·36** / **-0.056** **2·3** / **-1.333** / 2·37 / 0.162 **2·4** / **0.824** / 2·38 / 0.381 2·5 / 3.125 / 2·39 / 0.602 2·6 / 5.576 / 2·4 / 0.824 2·7 / 8.183 / 2·41 / 1.048 2·8 / 10.952 / 2·42 / 1.272 2·9 / 13.889 / 2·43 / 1.499 3 / 17 / 2·44 / 1.727 2·45 / 1.956 Unsupported $x = 2{\cdot}4$ is awarded B0B0M0A0. An answer of $x = 2{\cdot}4$ can only be awarded B1B1M1A1, following sight of 2 correct evaluations $2{\cdot}35 \le x \le 2{\cdot}45$ with one evaluation < 25, one evaluation > 25) *Method 1* or one evaluation < 0, one evaluation > 0 *Method 2.*

4.(a) $(PQ^2 =)\ 19\cdot3^2 - 16\cdot8^2$ or equivalent $(PQ =)\ \sqrt{19\cdot3^2 - 16\cdot8^2}$ or equivalent $(PQ =)$ 9·5 (cm)	M1 m1 A1	Check diagram for answers. $(PQ^2 =)$ 372·49 – 282·24 (ignore place values for M1) = 90·25 $(PQ =)\ \sqrt{90\cdot25}$ Sight of √'their 90·25' or √'their 90·25' evaluated is awarded m1 provided M1 previously gained. CAO. Mark final answer. Allow 9 or 10 provided 9·5 has been seen. Final answer of PQ = 90·25 is M1m0A0. An unsupported correct answer is awarded M1m1A1.
4.(a) Alternative method ***Correct** use of a two-step trigonometric method* *(PQ =) 9·5 (cm)*	*M2* *A1*	*A partial trigonometric method is awarded M0.* *CAO.* *Mark final answer.* *Allow 9 or 10 provided 9·5 has been seen.*
4. (b) $(x =)\ \sin^{-1}\frac{15\cdot4}{20\cdot5}$ or $\sin^{-1}\ \frac{15\cdot4 \times \sin 90}{20\cdot5}$ or equivalent Correct evaluation in the range 48·6 to 48·7(°)	M2 A1	Check diagram for answers. M1 for any one of the following: • $\sin x = \frac{15\cdot4}{20\cdot5}$ (= 0·75(1..)). • $\frac{\sin x}{15\cdot4} = \frac{\sin 90}{20\cdot5}$ or equivalent Mark final answer. Allow 49 from correct working. Allow correct angles given in radians or gradians. See table below.
4.(b) Alternative method: ***Correct** use of 'two-step' method.* *Correct evaluation in the range 48·6 to 48·7(°).*	*M2* *A1*	*A partial trigonometric method is M0.* *Mark final answer.* *Allow 49 from correct working.* *Allow correct angles given in radians or gradians.*

	Radians	Gradians
$\sin^{-1}\frac{15\cdot4}{20\cdot5}$	0·8499…	54·1068…
$\sin^{-1}\frac{15\cdot4 \times \sin 90}{20\cdot5}$	0·7363…	53·2217…

5. **Method 1: working with the fraction first**		May be seen in stages and in any order.
180.60 ÷ 7 × 3 or equivalent	M1	Award M1 for an appropriate sight of any one of the following: • 77.4 • 25.8 × 3 • 541.8 ÷ 7 • 0·42(857…) × 180.6 or equivalent (e.g. 43% × 180.6)
÷ (4 + 5) × 4 or equivalent	M1	Award M1 for an appropriate sight of any one of the following: • 8.6 × 4 • 309.6 ÷ 9 • FT 'their 77.4' ÷ (4 + 5) × 4.
=(£)34.4(0)	A2	CAO. Award A1 for one of the following, provided at least M1 previously awarded: • appropriate sight of (£)34.4(0), where smaller share not clearly identified. • appropriate sight of (£)77.4(0) • FT 'their derived 77.4(0)' ÷ 9 × 4 correctly evaluated • a rounded or truncated answer (pence), or a decimal that rounds to 34.4 as a final answer.
5. Method 2: working with the ratio first *(Complete method to find the smaller share =)*		*May be seen in stages and in any order.*
180.60 ÷ (4 + 5) × 4 or equivalent	*M1*	*Award M1 for an appropriate sight of any one of the following:* • *20.066... × 4* • *722.4 ÷ 9* • *80.2(666…) rounded or truncated to at least 1dp.*
÷ 7 × 3 or equivalent	*M1*	*Award M1 for an appropriate sight of any one of the following:* • *240.8 ÷ 7* • *11.4(66…) × 3* • *0·42(857…) × 80.2(666…) or equivalent (e.g. 43% × 80.2(666…))* • *FT 'their 80.2(666…) ÷ 7 × 3.*
=(£)34.4(0)	*A2*	*CAO.* *Award A1 for one of the following, provided at least M1 previously awarded:* • *appropriate sight of (£)34.4(0), where smaller share not clearly identified.* • *appropriate sight of 80.2(666…) rounded or truncated to at least 1 dp* • *FT 'their derived 80.2(666…)' ÷ 7 × 3 correctly evaluated* *a rounded or truncated answer (pence), or a decimal that rounds to 34.4 as a final answer.*

*5. **Method 3: working with a product of fractions*** *(Complete method to find the smaller share =)* $\frac{3}{7} \times \frac{4}{9} \times 180.60$ *or equivalent* *=(£)34.4(0)*	*M2* *A2*	*May be seen in stages and in any order.* *Award M1 for an appropriate sight of any one of the following:* • $\frac{3}{7} \times \frac{4}{9}$ *(= 0.42(8…) × 0.44(4…))* • $\frac{12}{63}$ *(= 0.19(0…))* • $\frac{4}{21}$ *or equivalent* *CAO.* *Award A1 for one of the following, provided at least M1 previously awarded:* • *appropriate sight of (£)34.4(0), where smaller share not clearly identified.* • *FT 'their derived 2167.2' ÷ 63 correctly evaluated* • *FT 'their derived 2.8(66…)' × 12 correctly evaluated* • *FT 'their derived 722.4' ÷ 21 or equivalent correctly evaluated* • *a rounded or truncated answer (pence), or a decimal that rounds to 34.4 as a final answer.* •
6. (*AB* =) 7·5 × $\frac{8}{5}$ or $\frac{AB}{7.5} = \frac{8}{5}$ or equivalent OR (*AB* =) 7·5 ÷ $\frac{5}{8}$ or $\frac{7.5}{5} = \frac{AB}{8}$ 12 (cm)	M1 A1	Check diagram for answer. May be seen in stages. M1 for **correct** use of scale factor (e.g $\frac{8}{5}$ or $\frac{5}{8}$ or equivalent). Mark final answer. An unsupported answer of 12 is awarded M1A1.
6.(b) Alternative method: ***Correct** use of 'two-step' method.* *12 (cm)*	*M1* *A1*	*A partial trigonometric method is M0.* *Mark final answer.* *Allow an answer in the range 11·99 ≤AB< 12·01 (cm).*
7. $\frac{84}{80} \times 100$ OR $\frac{84}{0·8}$ or equivalent = 105	M1 A1	May be seen in stages. Accept a **complete** and **convincing** method of trial and improvement. Award M1A1 for an answer of 105 provided not from incorrect working. Award M1A1 for an embedded answer (e.g. 0·8 × 105 = 84 or $\frac{84}{105} \times 100$ = 80%), BUT only M1A0 if contradicted by stating original amount ≠ 105. Unsupported 105 is awarded M1A1.

8.(a) Complete diagram  	B2	Award B1 for any **one** of the following: • $\frac{4}{9}$ or equivalent on 'Blue' Ball 1 branch • 2 out of the 3 correct Ball 2 branches.
8.(b) Sight of $\frac{5}{9} \times \frac{5}{9}$ (= 0.308(6..)) **OR** $\frac{4}{9} \times \frac{4}{9}$ (= 0.197(5..)) or equivalent	B1	Check diagram for answers. 0·55(5…) × 0·55(5…) OR 0·44(4…) × 0·44(4…) Award B1 for an appropriate sight of any one of the following: • $\frac{25}{81}$ or 0·308(6..) or 0·31 or 0·3 • $\frac{16}{81}$ or 0·197(5..) or 0·2 FT 'their $\frac{4}{9}$' from Blue Ball 1 branch, only if between 0 and 1. FT 'their $\frac{4}{9}$' from Blue Ball 2 branch, only if between 0 and 1.
$\frac{5}{9} \times \frac{5}{9} + \frac{4}{9} \times \frac{4}{9}$ or equivalent	M1	0·55(5…) × 0·55(5…) + 0·44(4…) × 0·44(4…) Award M1 for sight of $\frac{25}{81} + \frac{16}{81}$. FT 'their $\frac{5}{9} \times \frac{5}{9}$' + 'their $\frac{4}{9} \times \frac{4}{9}$', provided both less than 1. The addition of both single fractions (or products) can be implied by an appropriate sight of $\frac{sum\ of\ numerators}{sum\ of\ denominators}$.
$\frac{41}{81}$ ISW or 0·506(…) or equivalent	A1	CAO for 'their tree diagram'. Allow answers in the range 0·505 to 0·507 inclusive or equivalent. Allow an answer of 0·51 or equivalent. Only allow 0·5 provided a more accurate answer has been seen (e.g. $\frac{41}{81}$, 0·506(…)). Only FT provided answer is less than 1.

8.(b) Alternative method *1 – $[\frac{5}{9} \times \frac{4}{9} + \frac{4}{9} \times \frac{5}{9}]$ or 1 – $[2 \times \frac{5}{9} \times \frac{4}{9}]$ or equivalent*	*M2*	*Check diagram for answers.* *(= 1 – $[\frac{20}{81} + \frac{20}{81}] = 1 - \frac{40}{81}$ or equivalent)* *FT 'their $\frac{4}{9}$' from Blue Ball 1 branch, only if between 0 and 1.* *FT 'their $\frac{4}{9}$' from Blue Ball 2 branch, only if between 0 and 1.* *Award M1 for any one of the following:* • *1 – $[\frac{5}{9} \times \frac{4}{9}]$ (= $1 - \frac{20}{81}$)* • *1 – $[\frac{4}{9} \times \frac{5}{9}]$ $(= 1 - \frac{20}{81})$* • *$\frac{5}{9} \times \frac{4}{9} + \frac{4}{9} \times \frac{5}{9}$ (= $\frac{20}{81} + \frac{20}{81} = \frac{40}{81}$)* • *$2 \times \frac{5}{9} \times \frac{4}{9}$ $\left(= 2 \times \frac{20}{81} = \frac{40}{81}\right)$ or equivalent* *Allow use of 0·55(5…) and 0·44(4…)*
$\frac{41}{81}$ ISW or 0·506(…) or equivalent	*A1*	*CAO for 'their tree diagram'.* *Allow answers in the range 0·505 to 0·507 inclusive or equivalent.* *Allow an answer of 0·51 or equivalent.* *Only allow 0·5 provided a more accurate answer has been seen (e.g. $\frac{41}{81}$, 0·506(…)).* *Only FT provided answer is less than 1.*

9.		Expressions or equations may be implied by appropriate workings or trials.
A complete method to find the value of x For example: • $12 \times 4{\cdot}5 + 12 \times x + 4{\cdot}5 \times x + 12 \times 4{\cdot}5 + 12 \times x + 4{\cdot}5 \times x = 240$ • $2 \times (12 \times 4{\cdot}5 + 12 \times x + 4{\cdot}5 \times x) = 240$ • $33x + 108 = 240$ • $33x = 132$ • $12 \times 4{\cdot}5 + 12 \times x + 4{\cdot}5 \times x = 120$ • $16{\cdot}5x + 54 = 120$ • $16{\cdot}5x = 66$ or equivalent	M3	Award M2 for any one of the following: • $2 \times (12 \times 4{\cdot}5 + 12 \times x + 4{\cdot}5 \times x)$ or equivalent e.g. $2 \times (12 \times 4{\cdot}5 + 12 \times 2 + 4{\cdot}5 \times 2)$ • $33x + 108$ • $12 \times 4{\cdot}5 + 12 \times x + 4{\cdot}5 \times x = 240$ • $16{\cdot}5x + 54 = 240$ • sum of at least 4 (from 6) correct surface areas **= 240** • sum of at least 2 (from 3) correct surface areas **= 120.** Award M1 for appropriate sight of any of the following: • $12 \times 4{\cdot}5$ **AND** $12 \times x$ **AND** $4{\cdot}5 \times x$ or equivalent e.g. $12 \times 4{\cdot}5$ **AND** 12×2 **AND** $4{\cdot}5 \times 2$ • at least **4** from the six correct surface areas working with 240 (240 need not be seen) $12 \times 4{\cdot}5$ (= 54) $12 \times 4{\cdot}5$ (= 54) $12 \times x$ (= $12x$) $12 \times x$ (= $12x$) $4{\cdot}5 \times x$ (= $4{\cdot}5\,x$) $4{\cdot}5 \times x$ (= $4{\cdot}5\,x$) • at least **2** from the three correct surface areas working with 120 **(120 must be seen)** $12 \times 4{\cdot}5$ (= 54) $12 \times x$ (= $12x$) $4{\cdot}5 \times x$ (= $4{\cdot}5\,x$)
$x = 4$	A1	CAO. May be implied or seen in later working. Award M3 A1 for appropriate sight of a correctly embedded 4 when working with sum of surface areas = 240 (or appropriate 120) with no other trials or stopping at $x = 4$.
(Volume of cuboid =) $12 \times 4 \times 4{\cdot}5$	M1	FT 54 × 'their 4' **provided at least M1 previously awarded** and their volume > 0.
= 216 (cm^3)	A1	CAO. Not from incorrect working. Answer line takes precedence. If answer line is blank, the the volume must be clearly identified in the working space. If no marks, award either: SC2 for supported or unsupported 216 (cm^3) OR SC1 for an unsupported $x = 4$.

10. Angle *BAC* = *x* OR 'Angle *BAC* = Angle *BCA'*	B1	Check diagram for sight of *BAC* = *x*.
Angle *ABC* = 180 – 2*x*	B1	Check diagram. Accept (Angle) *ABC* + 2x = 180 o.e. for this B1 if no further work offered. May be implied from angle *ACD* = 180 – 2*x* AND reference to alternate segment theorem, e.g. angle *ACD* = angle *ABC*
Angle *ACD* = 180 – 2*x*	B1	Check diagram. FT Angle *ACD* = 'their derived Angle *ABC*' (which must be in terms of *x*) provided not equal to *x*.
Reason for angle *ACD:* Alternate segment theorem **AND** at least one of the following: • Reason for angle BAC: Isosceles triangle • Reason for angle *ABC:* Angles in a triangle add up to 180°	E1	Dependent on at least one B1 awarded
Alternative method *Angle BAC* = x OR 'Angle *BAC* = Angle *BCA' o.e.*	*B1*	*Check diagram for sight of BAC* = x
Angle BCE = x	*B1*	*Check diagram.*
Angle ACD = 180 – 2x	*B1*	*Check diagram.*
Reason for angle BCE: Alternate segment theorem ***AND*** at least one of the following: • *Reason for angle BAC: Isosceles triangle* • *Reason for angle ACD: Angles on straight line add up to 180°*	*E1*	*Dependent on at least one B1 awarded*
11.		No misreads are allowed in this question.
Use of 8·5 AND 1·65	B1	Allow 8.4999(9….) All four bounds may be seen in calculations but the correct bounds must be clearly identified, used and indicated as their chosen answer.
$(8{\cdot}5 - 1{\cdot}65)^2$ or $6{\cdot}85^2$	M1	If B0, FT their values, provided unambiguously chosen, with $8 < g \leq 9$ AND $1{\cdot}6 \leq h < 1{\cdot}7$
= 46·9(225) or $\frac{18769}{400}$	A1	CAO Allow 47 provided 46·9(225) previously seen. Check supporting working e.g. note that $(8{\cdot}499 - 1{\cdot}65)^2 = 46{\cdot}9$ gains B0 M1 A0. If no marks: • award SC2 for an unsupported 46·9225 • award SC1 for an unsupported 46·9(…)

12. (a)(i) $y \propto \frac{1}{x^3}$ OR $y = \frac{k}{x^3}$ $0{\cdot}15 = \frac{k}{6^3}$ OR $0{\cdot}15 = k / 216$ OR $k = 32{\cdot}4$ $(y =) \frac{32{\cdot}4}{x^3}$ OR $(y =) \frac{162}{5x^3}$	B1 M1 A1	Allow $y \propto \frac{k}{x^3}$ M1 implies B1 F.T. for B0 M1 from $y \propto \frac{1}{x^n}$ with $n > 0$ and n = integer, with $n \neq 1$. No FT from direct proportion. CAO May be seen (explicitly) in part (ii). For reference, use of $y \propto \frac{1}{x^2}$ gives $y = \frac{5{\cdot}4}{x^2}$ (B0M1A0)
12. (a)(ii) x | 0·2 | **3** | 6 y | **4050** | 1·2 | 0·15	B2	Check working space (if table left blank). B1 for one correct value. F.T. for consistent use, in parts (i) and (ii), of inverse proportion only, including $1 / x$ For reference, use of: $y \propto \frac{1}{x}$, $\left(y = \frac{0.9}{x}\right)$, gives $y = 4{\cdot}5$ and $x = 0{\cdot}75$ $y \propto \frac{1}{x^2}$, $\left(y = \frac{5.4}{x^2}\right)$, gives $y = 135$ and $x = \sqrt{\frac{9}{2}} = \frac{3\sqrt{2}}{2} = 2{\cdot}12\ldots..$
12.(b) c is multiplied by	B1	
13. (Area =) $\frac{x}{360} \times \pi \times 29^2$ (= 756) $(x =) \frac{756 \times 360}{\pi \times 29^2}$ $= 103(\cdot00977\ldots°)$	M1 M1 A1	Correct expression for area of sector. Isolating x. May be seen in stages. Accept answers in the range 102·996(°) to 103·1(°) Award all 3 marks for a correct answer from a trial and improvement method (with correct working).
14. $xw^2 + 6 = y(5 - 3w^2)$ $xw^2 + 3yw^2 = 5y - 6$ or $6 - 5y = -xw^2 - 3yw^2$ $w^2(x + 3y) = 5y - 6$ or $6 - 5y = w^2(-x - 3y)$ $w^2 = \frac{5y-6}{x+3y}$ or $w^2 = \frac{6-5y}{-x-3y}$ $w = \pm\sqrt{\frac{5y-6}{x+3y}}$ or $w = \pm\sqrt{\frac{6-5y}{-x-3y}}$ or equivalent	 B1 B1 B1 B1 B1	FT until 2nd error, provided equivalent difficulty. Clearing fraction. May be implied by further working. Allow B1 for $xw^2 + 6 = y \times 5 - 3w^2$ OR $xw^2 + 6 = 5 - 3w^2 \times y$ (missing brackets) Expanding brackets **and** collecting terms in w^2. Factorising. Isolating w^2. Taking square root. Mark final answer. Allow omission of $\pm$.

15. (a) $(2x + 1)^2 = x^2 + 6^2 - 2\times x\times 6\times \cos 60°$ or equivalent $4x^2 + 2x + 2x + 1$ OR $4x^2 + 4x + 1$ $4x^2 + 2x + 2x + 1 = x^2 + 36 - 2\times x\times 6\times 0{\cdot}5$ OR $4x^2 + 4x + 1 = x^2 + 36 - 6x$ or equivalent leading to: $3x^2 + 10x - 35 = 0$	B1 B1 B1	Radians: cos 60 = −0·952, gradians: cos 60 = 0·587 Correct expansion of $(2x + 1)^2$ Correct solution only. Correct collection of terms. Must be convincing.
15. (b) $(x =)\ \frac{-10 \pm\sqrt{10^2-4(3)(-35)}}{2(3)}$ $(x =)\ \frac{-10 \pm\sqrt{520}}{6}\ \left(= \frac{-5 \pm\sqrt{130}}{3}\right)$ $(x =)$ –5·47 AND 2·13	 M1 A1 A1	Solution may be seen in part (a). If seen in both, the work in the answer space for part (b) takes precedence. **Evidence of this substitution into the formula must be seen for M1, otherwise award M0A0A0.** Allow one slip in substitution **for M1 only**, but must be correct formula. Can be implied from at least one correct value of x evaluated, provided M1 awarded. Sight of this alone is insufficient evidence of substitution into the formula. Both solutions required (but ISW for discarding the negative root). Award M0A0A0 for use of trial and improvement. An unsupported answer gains zero marks.
15. (c) Unique answer of: (PQ = 2×2·13 + 1 =) 5·26 (cm) Length cannot be negative / must be positive.	 B1 E1	Solution may be seen in part (a) or (b). If seen in both, the work in the answer space for part (c) takes precedence. F.T. 'their derived x' provided one positive and one negative solution. Use of x = 2·1339… leads to an answer of 5·2678…. or 5·27 (cm). Allow 5·3 (cm) Award B0 if both a positive and negative answer is offered for PQ, unless corrected in the explanation. Accept any valid explanation, e.g. '(Length cannot be negative as) x cannot be negative' e.g. $x > 0$ (or allow $x > -½$). Ignore additional, spurious or invalid comments.
16.(a) (i) (6, –12)	B1	
16.(a) (ii) (4, –3)	B1	
16.(b) $(y =)\ -f(x)$	B1	Allow $(y =)\ -1f(x)$

17. Use of sine rule followed by 'Area = ½ ab sin C'.	S1	Award S1 for an equivalent **full** method attempted e.g. angle *EHF* = 66(°), followed by finding *EF* (using sine rule) followed by finding *FH* (using cosine rule) followed by 'Area = ½ ab sin C'.
FH = $\frac{4{\cdot}3 \times \sin 61(^\circ)}{\sin 53(^\circ)}$	M2	M1 for $\frac{FH}{\sin 61(^\circ)} = \frac{4{\cdot}3}{\sin 53(^\circ)}$ or equivalent (correct equation without isolating *FH*)
FH = 4·7(09… cm) or 4·71 (cm)	A1	May be implied by further working. Award M2A1 if correct answer seen, and no further marks awarded, but award M2A0 if an incorrect value is used in further work and at least a further M1 is awarded. Radians = −10·492…(cm) Gradians = 4·756…(cm)
(Area of triangle *FGH* =) ½ × 4·709… × 5·9 × sin 48(°)	M1	FT 'their derived *FH*'.
= 10·3(….) (cm^2)	A1	Mark final answer, but ignore further work involving the addition of area of triangle *EFH.* Allow 10(cm^2) if 10·3(cm^2) previously seen. Radians = 23·780…(cm^2) Gradians = 9·605…(cm^2)
18. Sight of r^3 AND $\frac{2\pi r^3}{3}$ o.e.	B1	Allow $\frac{1}{2} \times \frac{4\pi r^3}{3}$ for the volume of the hemisphere.
Convincing argument, e.g.: • $\frac{2\pi}{3} \neq 1$ or equivalent, e.g. $\frac{2\pi}{3}$ = 2·09(…) (≠ 1) • π = 1·5 (or equivalent), which is not true. • a rational number cannot be equal to an irrational number, for example, $2\pi \neq 3$ • $\frac{2\pi r^3}{3} > r^3$ with further explanation, e.g. $2\pi > 3$ or $r^3 < 2.09r^3$ or $r^3 \neq 2.09r^3$	E1	E1 depends on B1 having been awarded. Do not allow, e.g.: • 'they are not equal to each other' • $\frac{2\pi r^3}{3} > r^3$ without further explanation