GCSE MARKING SCHEME

SUMMER 2023

GCSE
MATHEMATICS – NUMERACY
UNIT 2 – HIGHER TIER
3310U60-1

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.

WJEC GCSE MATHEMATICS - NUMERACY

SUMMER 2023 MARK SCHEME

Unit 2: Higher Tier	Mark	Comments
1. 1.34 × 8 ÷ 5 or × 1.6 (to convert miles to km)	M1	May be seen in any order Allow × 1.61 or × 1.609 Do not accept × 1.5
× 1000 (to convert km to m)	M1	(= 2144 m) Accept embedded '× 1000', e.g. sight of 1340, (1.34 × 1200 =) 1608, (1.34 × 1500 =) 2010 (i.e. × 1500 is awarded M0 M1)
÷ 84 (to find number of minutes)	M1	(= 25.52…minutes) (Note: sight of ÷ 0.084 is equivalent to × 1000 (M1) and ÷ 84 (M1)) Ignore further incorrect stages of working, provided they do not involve multiplication or division by 1.6, 1000 or 84
(Time correct to the nearest minute) 2(:) 26 p.m. or 14(:)26	A2	CAO A2 awarded only if there is no incorrect working Depends on M1 M1 M1 previously awarded, for rounding time to nearest minute and adding to 2 p.m. Allow 2.26 p.m. or 14.26(p.m.) Award A1 for any one of the following: • 2(:) 25(.5...) p.m. or 14(:)25(5...) • 2(:)26 or 2(:)26 a.m. or 02(:)26 or 02(:)26 p.m. • 26 (minutes) • FT from M2 (or M3) for 'their correctly rounded time to the nearest minute' added to 2 p.m. expressed with p.m. or correct 24-hr notation, provided 1 < 'their whole number of minutes' < 60 • FT from M0 M1 M1 o for use of ×1500m to give 2(:)24 p.m. or 14(:)24 o for 1.34 × 1000 ÷ 84 = 15.952…to give 2(:)16 p.m. or 14(:)16 ** ** 84 × 16 = 1344 is awarded M0 M1 M1, with possible FT A1 for 2(:)16 p.m. or 14(:)16)
1. <u>Alternative method:</u> 84 ÷ 1.6 (km to miles) ÷ 1000 (metres to km) 1.34 ÷ (84 ÷ 1.6 ÷ 1000) (time taken) (Time correct to the nearest minute) 2(:) 26 p.m. or 14(:)26	*M1 M1 M1 A2*	*Initial 2 method marks may be in either order Or ÷ 1.61 or ÷ 1.609 ÷ 1500 is M0 M1 CAO. Answer space takes precedence A2 awarded only if there is no incorrect working Depends on M1 M1 M1 previously awarded, for rounding time to nearest minute and adding to 2 p.m. Allow 2.26 p.m. or 14.26(p.m.) A1 as shown above FT from M0 M1 M1 and M2 as shown above*

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.
2a(i) (Median group) $166 \leq h < 174$	B1	Accept '166 to 174' or '166 – 174' or 'third group' or 'group 3' or similar Do not accept 9 or 14 or 170
Reason, e.g. '14th height'	E1	Depends on B1 previously awarded or previous B0 was due to giving the answer '9', '14' or '170' E1 for clear indication that median height is the 14^{th} Allow, e.g. sight of 14, 'middle person', 'middle height', 'by counting the frequencies, ½ the people are taller', 'half the people are taller', '13.5(th) (musician)', 'total of 27 (people), the middle of that is in the group' Do not accept, e.g. 'middle group', 'in the middle', 'middle', 'middle number', 'groups are not specific', 'because the median (height) is 174'
2(a)(ii) Indicates unambiguously 'No' with a valid reason, such as 'only know the group' 'it doesn't show raw data' 'the actual heights are not given', 'the 3 people could be anywhere in the group 150cm to (less than) 158cm', 'no way of knowing individual heights'	E1	Ignore spurious additional comments Allow 'No' with, e.g. 'don't know the height of these 3 people ', 'all 3 people could all be 155cm tall', 'everyone in group 150cm to 158cm could be 157cm', 'could all be taller than 154(cm)', '3 of them from 150 to 158 but not certain of height', 'we only know they are between 150 and 158', 'of the 3 people there may be, (but it is not certain)', '(data is) not specific', 'little chance as there are only 3 people in the group', 'the groups are not that specific', 'it's not specific enough', 'there is a possibility that there is one person shorter than 154cm as the midpoint is 154cm' Do not accept, e.g. 'everyone in the group 150cm to 158cm could be 158cm tall'

2(b) Midpoints 154, 162, 170, 178, (186,) 194 154×3 + 162×10 + 170×9 + 178×4 (+186×0) + 194×1 (= 462 + 1620 + 1530 + 712 + 0 + 194 = 4518) ÷ 27 167(.333.... cm) or equivalent	B1 M1 m1 A1	 186×0 may not be seen FT 'their midpoints' or at the bounds of the appropriate groups, provided no more than one of 'their midpoints' lies outside the group ISW Treat an error of e.g. 186 × 0 written as 186, leading to total 4704, 4704 ÷ 27 = 174(.222….) as follows: B1 M1 m1 possible but A0 or equivalents on FT
3. 1800×1.02^{28} 3133 (steps) or 3134 (steps)	M2 A2	M1 for any one of the following: • sight of 1800 × 1.02 • (1800 × 1.02 =) 1836 • from non-compound: ○ (1800 + 36 × 28 =)1800 + 1008 ○ (28 × 2% = 56% so) 1.56 × 1800 ○ a final answer of 2808 CAO A1 for 3133.8(... steps) If no marks, award SC1 for 1800×1.02^{27} or 1800×1.02^{29} or 3072.3(9…) or 3196.5(2…) **OR** SC2 for 3072 or 3073 (steps) or 3196 or 3197 (steps) respectively
4(a) A1	B1	
4(b) 59.4 × 42(.0) ÷ (100 × 100) or 0.594 × 0.42 × 120 29.9376(g) or 29.94(g) or an answer in the range 29.8 (g) to 30 (g)	M2 m1 A1	For a product using the correct place value in the conversion of units (= 0.249(48 m^2) or 0.25 (m^2)) Do not accept use of 59 instead of 59.4 for M2 M1 for a calculation including the product of digits 59(.4) and 42(.0), which may include error(s) due to place value FT from M2 or M1 CAO. Statement answer space takes precedence If incorrect size of paper selected, award SC2 for the following answers, allow suitable rounding, or truncation at 1 or more decimal place(s): A0* | A1 | A3 | A4 119.993..(g)* | 59.946…(g) | 14.9688(g) | 7.4844(g) *Paper size A0 appropriate working or 119.9(…) **must** be seen OR Award SC1 for the appropriate digits with a place value error

4(c) (Diagonal A4^2 =) $21^2 + 29.7^2$ Diagonal^2 = 1323.09 or (Diagonal =) $\sqrt{1323.09}$ (Diagonal A4 =) 36 (cm) or 36.3(7... cm) or 36.4 (cm) (Diagonal A5) 36.37... × 21(.0) ÷ 29.7 or 36.37... × 0.7(0....) or 36.37... ÷ (29.7 ÷ 21(.0)) or 36.37… ÷ 1.4(1…) Answer in the range 25.2 (cm) to 26(cm)	M1 A1 A1 M1 A1	May be shown in further working FT from M1 for the correctly evaluated square root of 'their 1323.09' provided 'their answer' > 29.7 (cm) Must be from correct working FT 'their derived diagonal' or 'their stated diagonal' provided ≠ 21 or ≠ 29.7 Answer must be from correct working.
4(c) <u>Alternative method</u>: *(Side of A5) 21(.0) × 21(.0) ÷ 29.7* *or 21 × 0.7(0...)* *or 21 ÷ 1.4(1...)* *or 29.7 ÷ 2* *Answer in the range 14.7 (cm) to 15(cm)* *(Diagonal A5^2 =) 21(.0)^2 + 14.848...^{2}* *Diagonal^2 = 661.4775.... or (Diagonal =) √661.4775...* *(Diagonal A5) Answer in the range* *25.2 (cm) to 26(cm)*	*M1* *A1* *M1* *A1* *A1*	*May be shown in further working* *Must be from correct working* *FT 'their derived side of A5' or 'their stated side of A5' provided ≠* 21 or ≠ 29.7 *Answer must be from correct working.* *FT from M1 for the correctly evaluated square root of 'their 661.4775...' provided 'their answer' > 21 (cm)* *Note:* *Side A5* / *Diagonal^2* / *Answer, in cm* *14* / *637* / *25.23…* *14.7* / *657.09* / *25.63…* *14.8* / *660.04* / *25.69.. or 25.7* *14.84* / *661.2256* / *25.71...* *14.85* / *661.5225* / *25.72…* *14.9* / *663.01* / *25.748… or 25.75* *15* / *666* / *25.8…*
4(d) Sight of 84.15(cm) or 841.5(mm) **and** 59.45 (cm) or 594.5(mm) or equivalents in m 2 × (84.15 + 59.45) or 2 × (84.1 + 59.4) + 4 × 0.05 or equivalent 2872 (mm) or 287.2 (cm) or 2.872 (m)	B1 M1 A1	<u>Penalise incorrect unit -1 once (withhold B or A mark)</u> Award B1 for sight of 4 × 0.05 in an appropriate calculation Allow 0.04999(....) for 0.05, must clearly be a recurring 9 digit Or equivalent in mm or m If B0, FT provided unambiguously chosen: 84.1 < 'their 84.15' ≤ 84.2 and 59.4 < 'their 59.45' ≤ 59.5 CAO. Allow 287.1999 (cm) or equivalent (Note: Not using bounds leads to an incorrect answer of 287cm B0 M0 A0) If incorrect size of paper selected, award SC1 for the following answers, or equivalents: A0 / A2 / A3 / A4 406.2 (cm) / 203 (cm) / 143.6 (cm) / 101.6 (cm)

5. (Length of the package, x + y) (x =) 17.5 × cos34° or (x =) 17.5 × sin56° AND (y =) 11.1 × cos56° or (y =) 11.1. × sin34°	M3	Or alternative full method M2 for any 1 of these statements correct or as appropriate from an alternative method OR M1 for .../17.5 = cos34° or .../17.5 = sin56°, or .../11.1 = cos56° or .../11.1 = sin34°
Sight of 14.5(08... cm) and 6.2(07.... cm) or for the sum of these: 20.7(… cm) or 21 (cm)	A2	Must be from correct working (not from $11.1^2 + 17.5^2$) A1 for 14.5(08... cm) or 6.2(07.... cm)
(Volume =) 19 × 6.7 × (14.5(08...) + 6.2(07....)) or 19 × 6.7 × 20.7 or 19 × 6.7 × 21	M1	FT 'their x + y' provided some use of trigonometry attempted previously (including incorrect use) and both x > 0 and y > 0. Award M1 for an unsupported correct volume, or 'their FT volume' provided FT criteria met
Answer in the range 2635 (cm^3) to 2673.5 (cm^3) AND Cost (£)14.85	A1	Answer space takes precedence FT from truncation or rounding FT for appropriate cost for 'their volume' provided it is ≤10 000 (cm^3) FT is 127.3 × 'their x + their y' correctly evaluated Volume (cm^3) / Cost 0 to 1000 / £12.55 greater than 1000, up to 2000 / £13.60 greater than 2000, up to 4000 / £14.85 greater than 4000, up to 10 000 / £16.25 If 'y' not considered, possible M2, A1 then also award SC1 for a volume of 1845 (cm^3) to 1847.2 (cm^3) AND cost (£)13.6(0) If 'x' not considered, possible M2, A1 then also award SC1 for a volume of 789 (cm^3) to 790.6 (cm^3) AND cost (£)12.55 If no marks, award SC1 for an answer in the range 2635 (cm^3) to 2673.5 (cm^3) AND Cost (£)14.85 from use of 20.7…(cm) from $\sqrt{(11.1^2 + 17.5^2)}$

6. (Surface area) π × 0.18 × 2.5 or equivalent	M2	<u>Accept equivalents in cm throughout</u> Must be the complete method M1 for any one of the following provided it is not embedded in further incorrect working: • π × 0.18 (= 0.565... m) • π × 18 cm (= 56.5... cm) • π × 18 cm × 2.5 (m) • π × 0.18 × 250 cm • ** π × 0.18 × 2.5 + (2 ×) π × 0.09^2 or equivalent Allow M1 for any one of the following provided it is not embedded in further incorrect working: • π × 2 × 0.18 × 2.5 or π × 0.36 × 2.5 (= 2.827…) • π × $\frac{0.18}{2}$ × 2.5 or π × 0.09 × 2.5 (= 0.706…) or equivalent
1.41 (m^2) or 14100 cm^2	A2	Mark final answer. Must be correct to 3 significant figures. A1 for any one of the following: • 1.4(13... m^2), correct but not to 3 sig. figs. • 1.4(... m^2) from premature approximation • ** 1.44 (m^2), from including 1 end • ** 1.46 (m^2), from including 2 ends **No other FT allowed from M1
7(a) Frequency densities of 0.4, 0.28, 0.48, 0.16, 0.07	B2	If table is blank, check histogram B1 for any 3 correct
Correct bars drawn	B1	FT their frequency densities provided B1 previously awarded
7(b) $\frac{3}{5}$×10 + 10 + 7 + 12 + 8 + 7 (=50) or equivalent OR 6 + $\frac{2}{5}$×10 (=10) or equivalent	B1	15×0.4 may be used instead of 3/5×10 40×0.4 may be used instead of 3/5×10 + 10 10×0.4 may be used instead of 2/5 ×10
(100 ×) $\frac{3/5×10 + 10 + 7 + 12 + 8 + 7}{6 + 10 + 10 + 7 + 12 + 8 + 7}$ OR (100 ×) $\frac{(60 – (6 + 2/5×10))}{60}$ or (100) × $\frac{50}{60}$	M1	FT for a numerator /'their 6+10+10+7+12+8+7' where 44 < numerator < 54 for B0M1A0 If their denominator ≠ 60, then 6+10+10+7+12+8+7 or 5×12 must be seen leading to their incorrect denominator If their fraction is for the number of months where there was less than 60mm rainfall, FT for a numerator /'their 6+10+10+7+12+8+7' where 6 < numerator < 16 for B0M1A0 provided an attempt is subsequently made to subtract this from 100%
= 83.3(3…) or $83\frac{1}{3}$ (%)	A1	CAO. Accept 83 (%) from correct working

8(a) $\frac{30}{360} \times \pi \times 400^2$ or equivalent = 41 866 to 41 893.4 (m^2)	M1 A1	 Or $\frac{40000\pi}{3}$
8(b) $\frac{\text{Angle}}{360} \times 2 \times \pi \times 400 = 1067.6$ (Angle =) $\frac{1067.6 \times 360}{2 \times \pi \times 400}$ or equivalent = 152.9 to 153 (º)	M1 m1 A1	May be implied in further work For isolating the angle If no marks, award SC1 for an answer of 305.8 to 306 (º) from using the calculation $\frac{1067.6 \times 360}{\pi \times 400}$
8(c) Valid reason e.g. 'More area to water the further away from the pivot you are', 'The outer tower will be moving faster' 'It has to cover a larger distance', 'The part closest to the pivot needs to deliver less water or it would flood'	E1	Ignore spurious additional comments Accept e.g. 'To cover more area' Allow e.g. 'So all the crops get the same amount of water' Do not accept e.g. 'The crops furthest away need more water', 'To keep up with the tower closest to the pivot as this doesn't move so far', 'So the water will spray at a constant speed'

9(a) (Monthly rate =) 0.25% or 0.0025	B1	B0 for 0.0025%. May be implied in further work
$10\,000 \times 1.0025^n$	B1	For use of 'n' or for use of any value of n
$10\,000 \times 1.0025^{20}$ (= (£)10 512(.055…))	M1	Allow (£)$10\,000 \times 1.0025^{19}$ (= (£)10 485(.84…) or (£)10 486) with convincing work that over (£)10 500 will be reached in a months' time An answer of (n=) 20 (months) implies B1B1M1 provided no incorrect work seen
(Date =) 30th November 2024	A1	CAO Allow 31st November 2024 or 1st December 2024 If only the first B1 awarded and using the calculation $(10000\times1.03) \times 1.0025^8$ or 10300×1.0025^8, award a further SC1 for (£)10507(.81…) or (£)10508 AND 30th November (allowing 31st) or 1st December 2024 If no marks awarded and from using a multiplier of 1.03^2, award SC1 for (£)10 609 AND 31st May (allowing 30th) or 1st June (2023), OR If no marks awarded and from using a multiplier of 1.025^2, award SC1 for (£)10 506(.25) AND 31st May (allowing 30th) or 1st June (2023)
9(a) Alternative method: *(Monthly rate =) 0.25% or 0.0025*	*B1*	*B0 for 0.0025%. May be implied in further work*
$10\,000 \times 1.0025^n = 10500$	*B1*	*Or $1.0025^n = \frac{10500}{10000}$ or equivalent*
(Number of months =) *$\frac{\log(10500/10000)}{\log 1.0025}$ or $\frac{\log 1.05}{\log 1.0025}$ or $\log_{1.0025}(1.05)$*	*M1*	*Implies previous B1B1* *Note: The logs in the first 2 possibilities for M1 can be to any base* *An answer of (n=) 19.5(404…) or 20 (months) implies B1B1M1 provided no incorrect work seen*
(= 19.5(404…) or 20 months)		
(Date =) 30th November 2024	*A1*	*CAO* *Allow 31st November 2024 or 1st December 2024* *If no marks awarded and from using 1.03 instead of 1.0025, award SC1 for 1.6(506…) or 2 (months) AND 31st May (allowing 30th) or 1st June (2023), OR* *If no marks awarded and from using 1.025 instead of 1.0025, award SC1 for 1.9(759…) or 2 (months) AND 31st May (allowing 30th) or 1st June (2023)*
9(b) (AER =) $\left(1+\frac{0.03}{12}\right)^{12}-1$	M1	M0A0 if n ≠ 12 substituted into the AER formula
= 3.04 (%)	A1	Allow an answer of 3.04(…) % An unsupported 3.04% is awarded M1A1

10(a) Strategy of attempting to use the sine rule followed by 0.5absinC or right-angled trigonometry	S1	
(left side =) $\frac{6.2 \times \sin 50}{\sin(180-50-35)}$ or $\frac{6.2}{\sin 95} \times \sin 50$	M2	M1 for $\frac{\text{left side}}{\sin 50} = \frac{6.2}{\sin(180-50-35)}$ or equivalent
= 4.76(…) or 4.77 or 4.8 (m)	A1	
(Area of triangle =) $\frac{1}{2} \times 4.76(\ldots) \times 6.2 \times \sin 35$	M1	FT 'their 4.76(…)' provided sine rule attempted Note: This calculation may come from use of right-angled trigonometry to find height = 4.76(…) x sin35 and then use of ½ × base × height
= 8.44 to 8.56 (m^2)	A1	
(Volume of room =) 67.5 to 68.5 (m^3)	B1	FT 'their 8.44 to 8.56' × 8 provided at least M1M1 (not M2M0) previously awarded
10(a) Alternative method 1: *Strategy of attempting to use the sine rule followed by 0.5absinC or right-angled trigonometry*	*S1*	
(right side =) $\frac{6.2 \times \sin 35}{\sin(180-50-35)}$ or $\frac{6.2}{\sin 95} \times \sin 35$	*M2*	*M1 for* $\frac{\text{right side}}{\sin 35} = \frac{6.2}{\sin(180-50-35)}$
= 3.56(…) or 3.57 or 3.6 (m)	*A1*	
(Area of triangle =) $\frac{1}{2} \times 3.56(\ldots) \times 6.2 \times \sin 50$	*M1*	*FT 'their 3.56(…)' provided sine rule attempted* *Note: This calculation may come from use of right-angled trigonometry to find height = 3.56(…) x sin50 and then use of ½ × base × height*
= 8.44 to 8.56 (m^2)	*A1*	
(Volume of room =) 67.5 to 68.5 (m^3)	*B1*	*FT 'their 8.44 to 8.56' × 8 provided at least M1M1 (not M2M0) previously awarded*
10(a) Alternative method 2: *Strategy of attempting to use the sine rule followed by 0.5absinC or right-angled trigonometry*	*S1*	
(left side =) $\frac{6.2 \times \sin 50}{\sin(180-50-35)}$ *or* $\frac{6.2}{\sin 95} \times \sin 50$ *OR*	*M2*	*M1 for* $\frac{\text{left side}}{\sin 50} = \frac{6.2}{\sin(180-50-35)}$ *or equivalent OR*
(right side =) $\frac{6.2 \times \sin 35}{\sin(180-50-35)}$ *or* $\frac{6.2}{\sin 95} \times \sin 35$		*M1 for* $\frac{\text{right side}}{\sin 35} = \frac{6.2}{\sin(180-50-35)}$ *OR* *M1 for correct full method to calculate their 2nd side using sine or cosine rules following an incorrect method to initially calculate the left or right side*
left side = 4.76(…) or 4.77 or 4.8 (m) AND *right side = 3.56(…) or 3.57 or 3.6 (m)*	*A1*	
(Area of triangle =) $\frac{1}{2} \times 4.76(\ldots) \times 3.56(\ldots) \times \sin 95$	*M1*	*FT 'their 4.76(…)' AND 'their 3.56(…)' AND 'their 95' provided sine rule attempted twice or the sine rule followed by the cosine rule attempted*
= 8.44 to 8.61 (m^2)	*A1*	
(Volume of room =) 67.5 to 68.5 (m^3)	*B1*	*FT 'their 8.44 to 8.5625' × 8 provided at least M1M1 (not M2M0) previously awarded* *Note: An area of e.g. 8.61 leads to a volume of 68.88 which is outside the acceptable range and is B0*

10(b)(i) Strategy of attempting to use 3D Pythagoras	S1	Must be for carrying through an initial Pythagoras step from one plane into a second plane
$1^2 + 0.7^2$ OR $1^2 + 1.2^2$ OR $0.7^2 + 1.2^2$ or $\sqrt{1^2 + 0.7^2}$ OR $\sqrt{1^2 + 1.2^2}$ OR $\sqrt{0.7^2 + 1.2^2}$ (=1.22…) (=1.56…) (=1.389…)	M1	FT 'their 2.4 ÷ 2' May be embedded in further working
(Total length of lead =) $\sqrt{1^2 + 0.7^2 + 1.2^2}$ (×2) or (= $\sqrt{2.93}$ (×2))	M2	Implies S1 and previous M1 Note: $\sqrt{2.93}$ = 1.71(1…) and may come from sight of $\sqrt{1.93 + 1}$ or $\sqrt{2.44 + 0.49}$ or $\sqrt{1.49 + 1.44}$ M1 for $1^2 + 0.7^2 + 1.2^2$ or 1 + 0.49 + 1.44
(Total length of lead needed =) 3.4 to 3.5 (m)	A1	Do not accept answers outside this range that round to 3.4 or 3.5 i.e. needs to come from 2 × ($\sqrt{2.89}$ to $\sqrt{3.0625}$)
10(b)(ii) (Area of a curved surface =) $\pi \times 9.2 \times 30$ OR $\pi \times 8 \times 30$ (= 866.6 to 867.2 or 276π cm^2) (= 753.6 to 754.1 or 240π cm^2)	B1	Or equivalents. Do not award if they go on to multiply by another length creating a volume
(Area of a semicircular ring =) $\frac{\pi \times 9.2^2}{2} - \frac{\pi \times 8^2}{2}$ or equivalent (= 32.4 to 32.43 or $10.3(2)\pi$ cm^2)	B1	May be implied by sight of double these values i.e. 64.8 to 64.86 or $20.6(4)\pi$ Do not award if they go on to multiply by another length creating a volume
(Total surface area =) $\pi \times 9.2 \times 30 + \pi \times 8 \times 30 + 1.2 \times 30 + 1.2 \times 30 + \left(\frac{\pi \times 9.2^2}{2} - \frac{\pi \times 8^2}{2}\right) + \left(\frac{\pi \times 9.2^2}{2} - \frac{\pi \times 8^2}{2}\right)$ (= (866.6 to 867.2) + (753.6 to 754.1) + 36 + 36 + (32.4 to 32.43) + (32.4 to 32.43))	M2	Must be 6 correct areas and no further incorrect areas added/subtracted M1 for the sum of 4 or 5 correct surface areas
= 1756.9 to 1758.3 (cm^2)	A1	(Or $536.6(4)\pi + 72$) For an answer in this range only, and must come from M2

10(c) Statements required: • Number the tiles from 0001 to 2000 • Consider successive 4-digit numbers • Do not use numbers outside the range • Ignore repeats (Working in rows would give tiles) 1924, 1521, 1205, (0)114, ~~1521~~, 1098, (0)769, 1003 ISW, OR (Working in columns would give tiles) (0)114, 1098, 1924, 1003, 1521, (0)769, ~~1003~~, 1205 ISW	E2 B1	All 4 needed for E2 E1 for any 2 or 3 correct statements Allow (000)1 to 2000 Allow an equivalent numbering system e.g. (000)0 to 1999 Allow this statement to be implied by their numbering of the tiles (from 0001) AND their use of 4-digit numbers in their answer OR 4-digit numbers used in their answer and 0114 or 0769 seen e.g. Do not use 0000 and 2001 – 9999, OR Use the numbers (000)1 to 2000 Do not allow 'Use numbers less than 2000' if they have numbered the tiles from 0001 to 2000 Allow in any order provided no repeats
10(c) <u>Alternative method:</u> *Statements required:* • *Number the tiles from 0001 to 2000* • *Consider successive 4-digit numbers* • *Divide each number by 2000 and use the remainder to choose a tile* • *Ignore repeats* *(Working in rows would give tiles)* *1205, (000)2, 1924, 1521, (0)735, ~~1205~~,(0)114, 1533 ISW OR* *(Working in columns would give tiles)* *1205,(0)114,(0)377, 1533, (000)2, ~~1533~~, 1098, (0)788 ISW*	*E2* *B1*	*All 4 needed for E2* *E1 for any 2 or 3 correct statements* *Allow (000)1 to 2000* *Allow an equivalent numbering system* *e.g. (000)0 to 1999* *Their numbering system can be implied by the range of numbers they state they will choose from* *Allow this statement to be implied by their numbering of the tiles (from 0001) AND their use of 4-digit numbers in their answer* *OR* *4-digit numbers used in their answer and e.g. 0002, 0735 or 0114 seen* *0000 or remainder of 0 means tile 2000 is chosen* *If (000)0 to 1999 is used, when the remainder is 0, tile 0000 is selected* *Allow in any order provided no repeats*