REVISE
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3.28 — Exact calculations with π

Mark schemes for the 3.28 question pack

Spec 1.9.6 — Unit 3

SOLUTIONS · 2025 SPECIFICATION

Mark schemes for the 8 questions in the corresponding revise.wales question pack (50 marks total). Sources: legacy WJEC GCSE papers, WJEC SAM, and custom-authored mark schemes. Pack layout © revise.wales.

11(a)		Allow the use of numerical values of pi for the B2 and M1 marks
$\frac{1}{3}\times\pi\times5^2\times12$ and $\pi\times3^2\times4$	B2	B1 for either of these expressions
(Vol remaining =) $\frac{1}{3}\times\pi\times5^2\times12 - \pi\times3^2\times4$	M1	FT use of $\frac{1}{3}\times\pi\times10^2\times12$
$= 100\pi - 36\pi$ $(= 64\pi\ \text{cm}^3)$	A1	Convincing. Must be in terms of π.
11(b) (Slant length^2 =) $12^2 + 5^2$	M1	
Slant length^2 = 169 OR (Slant length =) $\sqrt{169}$	A1	
(Slant length =) 13 (cm)	A1	May be unsupported
(Surface area =) $\pi\times5^2 - \pi\times3^2 + \pi\times5\times13$	M2	Allow the use of numerical values of pi FT 'their 13' provided Pythagoras attempted M1 for the appropriate addition/subtraction of 2 correct terms
$= 81\pi\ (\text{cm}^2)$	A1	CAO. Must be in terms of π.

10(a) height = 14 × 20 ÷ 8 or 14 × 2·5 or equivalent	M1	Allow M1 for $\frac{\text{height}}{14} = \frac{20}{8}$, OR $\frac{\text{height}}{20} = \frac{14}{8}$
= 35 (cm)	A1	
10(b) (radius =) 15 × 8 ÷ 20 or 15 × 0·4 or equivalent	M1	e.g. 15 × 14 ÷ 35 FT 'their 35'
= 6 (cm)	A1	
(Volume =) $\frac{1}{3} \times \pi \times 6^2 \times 15$	M1	FT 'their 6' provided previous M1 awarded
$= 180\pi$ (cm^3) (ISW)	A1	*Alternative methods:* *If candidates clearly work with similar volumes, then* *B1 for $^3/_4$ or $^4/_3$ or equivalent* *B1 for $(^3/_4)^3$ or $(^4/_3)^3$ or equivalent* *M1 for $^1/_3 \times \pi \times 8^2 \times 20 \times (^3/_4)^3$ or equivalent* *A1 for 180π (cm^3)* *OR* *FT 'their 35' throughout* *B1 for $^{15}/_{35}$ or $^{35}/_{15}$ or equivalent* *B1 for $(^{15}/_{35})^3$ or $(^{35}/_{15})^3$ or equivalent* *M1 for $^1/_3 \times \pi \times 14^2 \times 35 \times (^{15}/_{35})^3$ or equivalent* *A1 for 180π (cm^3)*

14(a) 3π	B1	
14(b) Sight of $\frac{120}{360}\times 2\times\pi\times 4\cdot 5$ OR $\frac{150}{360}\times 2\times\pi\times 3$	B1	Or equivalents
$\frac{120}{360}\times 2\times\pi\times 4\cdot 5 + \frac{150}{360}\times 2\times\pi\times 3$	M1	Or equivalent
$= 3\pi + {}^{5}/_{2}\pi$ OR $3\pi + 2\cdot 5\pi$ OR $\frac{11\pi}{2}$ or $5\cdot 5\pi$	A1	May be implied in further working or final answer
(Length of belt =) $75 + \frac{17\pi}{2}$ or $75 + 8\cdot 5\pi$ or $\frac{150 + 17\pi}{2}$	B1	FT their answer to (a) and 'their $11\pi/2$' provided M1 awarded Needs to be in its simplest form If no marks awarded, SC2 if $3\pi/2$ given in (a), leading to an answer of $75 + 17\pi/4$ or $75 + 4\cdot 25\pi$ SC1 if $3\pi/2$ given in (a), leading to an unsimplified version of $75 + 17\pi/4$
14(c) Use of $\frac{3}{4\cdot 5}$ or $\frac{4\cdot 5}{3}$ or equivalents with 2400	B1	e.g. ratio of 3 : 4·5 or 4·5 : 3 or equivalents B0 if 1·5 (4.5/3) comes from 3 + 1·5 = 4·5
$2400 \times \frac{3}{4\cdot 5}$ or equivalent	M1	
= 1600 (revolutions)	A1	*Alternative method:* *B1 for use of 6/4.5 or 4.5/6 with 1200* *M1 for* $1200 \times \frac{6}{4\cdot 5}$ *or equivalent* *A1 for 1600 (revolutions)*

13. (Sector area =) $\frac{300}{360} \times \pi \times 12^2$ (=120π)	B1	Or equivalent Allow B1 for $\frac{300}{360} \times \pi \times 12^2 \times 2$
(Area of curved surface =) $\frac{300}{360} \times 2 \times \pi \times 12 \times 10$ (=200π)	B1	Or equivalent
$\frac{300}{360}\times\pi\times12^2 + \frac{300}{360}\times2\times\pi\times12\times10 + 2\times12\times10$	M2	Or equivalent M1 for summing at least 3 terms with the equivalent of 2 of these terms correct May be seen in stages
$= 320\pi + 240$ (cm^2) or $80(4\pi + 3)$ (cm^2) or equivalent	A1	CAO Mark final answer

~~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.

10. (Slant height of cone =) $\sqrt{(12^2 + 9^2)}$ $= 15$ (cm)	M1 A1	Method for finding hypotenuse. Accept use of (3,4,5) x 3.
(Curved surface area of cone =) $\pi \times 9 \times 15$ $= 135\,\pi$ (cm^2)	M1 A1	F.T. 'their derived slant height' (not 12). ISW. [For reference, 135 π = 423.9] SC1 for an answer of 108 π (cm^2) [= 339.1(2)] (from taking 12 cm as the slant height) An answer of 216 π (cm^2) [= 678.2(4)] (from including area of circle) gains M1 A1 SC1
(Curved surface area of hemisphere =) $\frac{1}{2} \times (4 \times \pi \times 8^2)$ or equivalent $= 128\,\pi$ (cm^2)	M1 A1	ISW. [128 π = 401.9(2)] SC1 for an answer of 256 π (cm^2) [= 803.8(4)] (from omitting ½) or for an answer of 192 π (cm^2) [= 602.8(8)] (from including area of circle). Penalise -1 once only if any A or SC marks have previously been awarded for (correct) decimal answers.
Cone (has the greater curved surface area)	B1	Do not accept an unsupported statement. F.T. 'their areas' provided at least M1 or SC1 awarded for each solid (regardless of any penalty for decimal answers). (For the cone, either M1 mark can contribute to this FT.)
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

Unit 1: Higher Tier	Mark	Comments
6(a)(i) (Total volume =) $\frac{2}{3} \times \pi \times 6^3$ + $\pi \times 3^2 \times 9$ or equivalent (= 144π) (= 81π) $= 225\pi\ (mm^3)$	M2 A2	Allow values of π from 3.14 to 3.142 for M marks only M1 for $\frac{2}{3} \times \pi \times 6^3$ (+ ….) Allow M1 for $\frac{4}{3} \times \pi \times 6^3$ + $\pi \times 3^2 \times 9$ or equivalent CAO A1 for sight of 144π OR A1 for an answer of 369π (from use of $4/3 \times \pi \times 6^3$) OR A1 for a fully correct method but with an answer of 225 (omitting π) If no marks awarded, SC2 for an answer of 1476π from consistent use of diameters as their radii OR SC1 for $\frac{2}{3} \times \pi \times 12^3$ + $\pi \times 6^2 \times 9$ or equivalent OR SC1 for ($\frac{1}{3} \times \pi \times 6^3$ + $\pi \times 3^2 \times 9$ =) 153π
6(a)(ii) (Reduction in volume =) $9\pi\ (mm^3)$ (Fractional reduction =) $\frac{9(\pi)}{225(\pi)}$ or $\frac{1}{25}$ or equivalent	B1 B1	from $\pi \times 3^2 \times (9 - 8)$ OR $\pi \times 3^2 \times 9 - \pi \times 3^2 \times 8$ or $81\pi - 72\pi$ Implies previous B1 ISW FT 'their 225π' and 'their $\pi \times 3^2 \times 9 - \pi \times 3^2 \times 8$' and both are multiples of π If no marks awarded, SC1 for a numerator of 'their 225π' − 9π, which may be embedded in a final answer of e.g. 216/225 or 24/25 if correct work seen in part (a)(i) Must be from a reduction of 9π in their volume. ISW
6(b) Complete method e.g. 100x = 16.111…, 1000x = 161.111… AND an attempt to subtract both sides $\frac{145}{900}$ or $\frac{1595}{9900}$ or $\frac{16095}{99900}$ or equivalent $\frac{29}{180}$	M1 A1 A1	 Allow A1 for e.g. (10x – x =) 1.45/9, (100x – x =) 15.95/99 etc FT from M1A0 provided at least 1 stage of simplification required

12. (Slant height of cone =) $\sqrt{6^2 + 8^2}$	M1	Method for finding hypotenuse. Accept use of (3,4,5) x 2.
= 10 (cm)	A1	
(Curved surface area of cone =) $\pi \times 6 \times 10$	M1	FT 'their derived slant height' (not 8).
= 60π (cm^2) or equivalent	A1	CAO [For reference, 60π = 188.4] 60π may be implied by later working (e.g. sight of r^2 = 60) For calculating the total surface area of the cone, award M1 A1 SC1 for an answer of 96π (cm^2) [= 301(.44)] (from including the area of the base of the cone)
($\pi r^2 = \pi \times 6 \times 10$) r^2 = 60 or $r = \sqrt{60}$ or equivalent	M1	Isolating r^2 or r. FT for 'their r^2 = 60' or 'their $r = \sqrt{60}$' from πr^2 = 'their 60π'
(r =) $2\sqrt{15}$	A1	FT from $r^2 = k$, provided equivalent difficulty (with r in the form $a\sqrt{b}$, where a and b are integers, and b is as small as possible'). SC1 for r = $\sqrt{6L}$ (where L = slant height) Note: after M0A0M0A0 for use of 8 as the slant height r^2 = 48 or $r = \sqrt{48}$ M1 (r =) $4\sqrt{3}$ A1