

Question		Answer	Marks	AO	Guidance	
7	(a)	$(V =) \frac{1}{2}x(2x)y = x^2y$ Slant height of the roof is $x\sqrt{2}$ $(S =) 2xy + 2\left(\frac{1}{2}(2x)x\right) + 2(yx\sqrt{2})$ $y = \frac{600 - 2x^2}{2x(1 + \sqrt{2})} \Rightarrow V = x^2 \left(\frac{300 - x^2}{x(1 + \sqrt{2})} \right)$ $V = x(300 - x^2) \left(\frac{(1 - \sqrt{2})}{(1 + \sqrt{2})(1 - \sqrt{2})} \right)$ $V = x(300 - x^2) \left(\frac{1 - \sqrt{2}}{1 - 2} \right) = (\sqrt{2} - 1)x(300 - x^2)$	B1 B1 M1* M1dep* M1 A1 [6]	1.1 3.1a 2.1 3.3 1.1 2.2a	Correct simplified expression for the volume Allow $\sqrt{2x^2}$ Attempt at surface area with at least three of the five faces correct – can be unsimplified Rearranges and makes y the subject and substitutes to give an expression for V in terms of x only Rationalises the denominator correctly $a = 2, b = -1$	
7	(b)	$\frac{dV}{dx} = k(300 - 3x^2)$ $(k)(300 - 3x^2) = 0 \Rightarrow x = \dots$ $x = 10 \text{ cm}$	M1* A1 M1dep* A1 [4]	1.1 1.1 1.1 1.1	M1 for attempt at differentiation – both powers reduced by 1 Sets $\frac{dV}{dx} = 0$ and attempts to find x	Allow full marks ft their values of a and b
7	(c)	$V = 828\text{cm}^3$	B1 [1]	3.4	cao	828.4271247...
7	(d)	V (or y) must be positive or $300 - x^2 > 0$ so x cannot exceed $\sqrt{300}$ cm	M1 A1 [2]	3.5b 1.1	Explanation for constraint on x Correct value; accept e.g. 17.3 or better	