

Question number	Scheme	Marks
7 (a)	(Surface area =) $12x^2 + 4xy + 3xy + 5xy = 144$ oe	M1
	$12x^2 + 12xy = 144$ oe leading to $\frac{144 - 12x^2}{12x}$ oe	A1
	$V = \frac{1}{2} \times 3x \times 4x \times y (= 6x^2 y)$	M1
	$= 6x^2 \times \frac{144 - 12x^2}{12x} = 6x(12 - x^2)$	M1
	$= 72x - 6x^3$ *	A1 cso [5]
(b)	$\left(\frac{dV}{dx}\right) = 72 - 18x^2$	M1
	$\left(\frac{dV}{dx} = \right) "72 - 18x^2" = 0$	M1 (A1 on ePen)
	$\Rightarrow x =$ $x = 2$	A1 (M1 on ePen)
	$\left(\frac{d^2V}{dx^2}\right) = -36x$	B1 (A1 on ePen)
	$x = 2 \quad \frac{d^2V}{dx^2} < 0$ Therefore maximum	[4]
(c)	$V = 72 \times 2 - 6 \times 2^3 = 96$	M1 A1 [2]
Total 11 marks		

Part	Mark	Notes
(a)	M1	For surface area as an equation in x and y (correct and unsimplified)
	A1	For $12x^2 + 12xy = 144$ oe and correctly making y the subject $\frac{144 - 12x^2}{12x}$ (oe)
	M1	$V = \frac{1}{2} \times 3x \times 4x \times y (= 6x^2y)$
	M1	For correct substitution of their expression for y , which must be in terms of x only, into their formula for V .
	A1*cs0	Obtains the given expression
(b)	M1	For attempting to differentiate V wrt x At least one term must be fully correct, the other – follow general guidance
	M1 (A1 on ePen)	For setting their derivative (which must involve a changed expression) $= 0$ and a complete solution to find the value of x
	A1 (M1 on ePen)	For $x = 2$ only
	B1 (A1 on ePen)	For a correct second derivative and correct justification that this is a maximum, with some form of conclusion. All work to be correct for this mark. i.e it is acceptable, as this is a simple substitution to state if $x = 2$, $\frac{d^2V}{dx^2} < 0$, but if a substitution of $x = 2$ is made, the value for the second derivative must be given as -72 .
ALT final B1	B1 (A1 on ePen)	Testing and substituting into the correct second derivative with appropriate values either side of $x = 2$. For correct justification that this is a maximum, with some form of conclusion. All work to be correct for this mark
(c)	M1	For correct substitution of their x into V
	A1	96