Question	Scheme	Marks
5(a)	$V = x \times 4x \times h \Rightarrow 4x^2h = 75 \Rightarrow h = \dfrac{75}{4x^2}$	B1
	$S = 2\left(4x^2 + xh + 4xh\right) = \left[8x^2 + 2xh + 8xh\right] \Rightarrow S = 8x^2 + 10xh$	M1
	$\Rightarrow S = 8x^2 + 10x \times \dfrac{75}{4x^2} \Rightarrow S = 8x^2 + \dfrac{375}{2x}$ *	M1A1 cso
		[4]
(b)(i)	$\dfrac{dS}{dx} = 16x - \dfrac{375}{2x^2} = 0$	M1
	$\Rightarrow 16x = \dfrac{375}{2x^2} \Rightarrow x^3 = \dfrac{375}{32} \Rightarrow x = 2.2714... \approx 2.27 \text{ (cm)}$	M1A1
(ii)	$\dfrac{d^2S}{dx^2} = 16 + 375x^{-3} \approx 48$	M1
	Conclusion: (As x is always positive) $\dfrac{d^2S}{dx^2} > 0 \Rightarrow$ minimum	A1ft [5]
(c)	$S = 8 \times '2.27'^2 + \dfrac{375}{2 \times '2.27'} = 123.822... \approx 124 \text{ (cm}^2\text{)}$	M1A1 [2]
		Total 11 marks

Part	Mark	Notes
(a)	**B1**	For finding the correct expression for h in terms of x Accept this mark seen anywhere in part (a) Accept also for example, $xh = \dfrac{75}{4x}$ or any equivalent that can be substituted into an expression for S.
	M1	For finding an expression for S is terms of x and h. Accept as a minimum $Ax^2 + Bxh$ where A and B are constants. Accept other letters for S at this stage. E.g SA etc. or even no letter at all.
	M1	For substituting their h into their S
	A1	For the correct expression for S as shown in the question. You must see $S = 8x^2 + \dfrac{375}{2x}$ including S although S seen at the top of a column of working is also fine.
(b)	**M1**	For an attempt to differentiate the given S which as a minimum must be of the form

		$\frac{dS}{dx} = 16x - \frac{k}{x^2}$ where k is a constant.
	M1	For setting their $\frac{dS}{dx} = 0$ and attempting to solve the equation and reaching a value of x. It must be a clearly differentiated expression even if they do not score the first M mark in (b). That is, they must reduce the power of at least one term by 1.
	A1	For awrt $x = 2.27$
	M1	For an attempt to differentiate their $\frac{dS}{dx}$ to find $\frac{d^2S}{dx^2}$ which must be as a minimum $\frac{d^2S}{dx^2} = 16 + lx^{-3}$ where l is a constant **Other methods** Please send to Review any examples of candidates who test the gradient on either side of the minimum, or who draw a sketch.
	A1ft	Concludes that as $x > 0$ so $\frac{d^2S}{dx^2} > 0$ and therefore S is a minimum when $x = 2.27$ Dependent on correct method seen. Follow through their value of x provided it is positive. **NB:** They do not need to evaluate $\frac{d^2S}{dx^2}$ to score this mark. [See above] However, if they use the correct [2.27] or an incorrect positive value of x, provided substitution is seen award the mark even if the final evaluation is incorrect. If no substitution is seen and either the value of x is incorrect or they do not obtain approximately 48, withhold this mark.
(c)	**M1**	Substitutes their $x = 2.27$ into the given S Follow through their value of x provided it is a positive value. Use of a negative value of x is M0. If the final value of S is incorrect following an incorrect value of x award this mark only for explicit substitution seen.
	A1	For awrt $S = 124$ (cm^2)