

Question number	Scheme	Marks
9	$\frac{dA}{dt} = 0.45$ $V = x^3 \Rightarrow \frac{dV}{dx} = 3x^2$ $A = 6x^2 \Rightarrow \frac{dA}{dx} = 12x$ $384 = 6x^2 \Rightarrow x = 8$ $\frac{dV}{dt} = \frac{dV}{dx} \times \frac{dx}{dA} \times \frac{dA}{dt}$ $\frac{dV}{dt} = 3x^2 \times \frac{1}{12x} \times 0.45 \left[= \frac{9x}{80} \right] \text{ oe}$ $\text{When } x = 8 \quad \frac{dV}{dt} = 0.9 \text{ cm}^3/\text{s}$	<p>B1</p> <p>B1</p> <p>B1</p> <p>M1</p> <p>M1</p> <p>dM1</p> <p>A1</p>
Total 7 marks		

Mark	Notes
B1	For $\frac{dA}{dt} = 0.45$ seen anywhere in their working Accept other letters, for example S for the area $\frac{dS}{dt} = 0.45$
B1	For $\frac{dV}{dx} = 3x^2$ Accept also other letters in place of x such as r for example.
B1	For $\frac{dA}{dx} = 12x$ Accept also other letters in place of x such as r for example.
M1	For setting $384 = 6x^2$ and proceeding to a correct method leading to a value of x Award this mark when they obtain $x^2 = 64 \Rightarrow x = \dots$
M1	For a correct expression of the chain rule seen or implied. i.e., $\frac{dV}{dt} = \frac{dV}{dx} \times \frac{dx}{dA} \times \frac{dA}{dt}$ They may complete this in two stages. So you may see for example: $\frac{dx}{dt} = \frac{1}{\frac{dA}{dx}} \times \frac{dA}{dt}$ AND $\frac{dV}{dt} = \frac{dx}{dt} \times \frac{dV}{dx}$
dM1	For substituting their values into a correct chain rule. $\frac{dV}{dt} = 3(8)^2 \times \frac{1}{12(8)} \times 0.45$ This mark is dependent on the previous M mark scored.
A1	For $0.9 \text{ (cm}^3/\text{s)}$