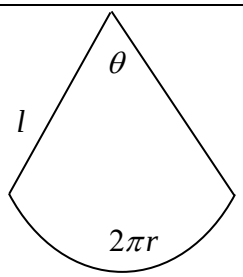
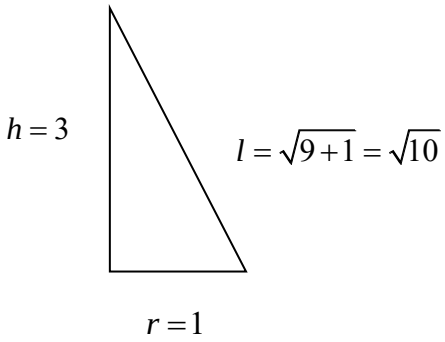
Question Number	Scheme	Marks
10(a)	Circumference of base = $2\pi r$ 	B1
	$l\theta = 2\pi r \Rightarrow \theta = \dfrac{2\pi r}{l}$	B1
	$A = \dfrac{1}{2}l^2\theta = \dfrac{1}{2}l^2\dfrac{2\pi r}{l} = \pi rl$	M1A1 (4)
(b)	$A = \pi rl$	
	$l = r\sqrt{10} \Rightarrow A = \pi r^2\sqrt{10}$	B1
	$\dfrac{\mathrm{d}A}{\mathrm{d}r} = 2\pi r\sqrt{10} \Rightarrow k = 2\sqrt{10}$	M1A1 (3)
(c)	$\dfrac{\mathrm{d}V}{\mathrm{d}t} = 1.5\ \left(\mathrm{cm}^3/\mathrm{s}\right)$	B1
	$\dfrac{\mathrm{d}A}{\mathrm{d}t} = \dfrac{\mathrm{d}A}{\mathrm{d}r} \times \dfrac{\mathrm{d}r}{\mathrm{d}V} \times \dfrac{\mathrm{d}V}{\mathrm{d}t}$	M1
	$V = \dfrac{1}{3}\pi r^2 h = \dfrac{1}{3}\pi r^2 \times 3r = \pi r^3$	B1
	$\dfrac{\mathrm{d}V}{\mathrm{d}r} = 3\pi r^2$	B1ft
	$\therefore \dfrac{\mathrm{d}A}{\mathrm{d}t} = 2\pi \times 8\sqrt{10} \times 1.5 \times \dfrac{1}{3\times 64\pi} = 0.3952... = 0.395\ \mathrm{cm}^2/\mathrm{s}$	A1 (5)
		[12]

Part	Mark	Notes	
(a)	B1	For the circ of the base $L = 2\pi r$	
	B1	$R = l$ and $l = r\theta$ Therefore $l\theta = 2\pi r \Rightarrow \theta = \dfrac{2\pi r}{l}$	$R = l$
	M1	$A = \dfrac{1}{2}l^2\theta$ and substituting their expression for θ to give $A = \dfrac{1}{2}l^2\theta = \dfrac{1}{2}l^2\dfrac{2\pi r}{l}$	Uses the formula $A = \dfrac{1}{2}RL$ $A = \dfrac{1}{2}\times l \times 2\pi r \Rightarrow \left(A = \pi rl\right)$
	A1	For the required expression for A, $A = \pi rl$ with no errors.	

(b)	B1	For finding that the slant height is $\sqrt{10}$ times the radius of the cone  So $l=r\sqrt{10}$
	M1	Substitutes $l=r\sqrt{10}$ into the given expression $A=\pi rl$ and differentiates their resulting expression to find $\frac{\mathrm{d}A}{\mathrm{d}r}$ $A=\pi r^2\sqrt{10}$ so $\frac{\mathrm{d}A}{\mathrm{d}r}=2\pi r\sqrt{10}$
	A1	Therefore $k=2\sqrt{10}$
(c)	B1	States $\frac{\mathrm{d}V}{\mathrm{d}t}=1.5\ \left(\mathrm{cm}^3/\mathrm{s}\right)$ Award if it seen explicitly in (b) **and used** in (c)
	M1	States (or uses) a correct chain rule $\frac{\mathrm{d}A}{\mathrm{d}t}=\frac{\mathrm{d}A}{\mathrm{d}r}\times\frac{\mathrm{d}r}{\mathrm{d}V}\times\frac{\mathrm{d}V}{\mathrm{d}t}$
	B1	For finding the volume of a cone in terms of r only $V=\frac{1}{3}\pi r^2h=\frac{1}{3}\pi r^2\times 3r=\pi r^3$
	B1ft	Differentiates their expression for the volume of a cone provided it is in terms of V and r only. $\frac{\mathrm{d}V}{\mathrm{d}r}=3\pi r^2$
	A1	For combining all required terms into their chain rule and evaluating to 3 significant figures, $\frac{\mathrm{d}A}{\mathrm{d}t}=2\pi\times 8\sqrt{10}\times 1.5\times\frac{1}{3\times 64\pi}=0.3952...=0.395\ \mathrm{cm}^2/\mathrm{s}$
	ALT – in terms of h	
	B1	States $\frac{\mathrm{d}V}{\mathrm{d}t}=1.5\ \left(\mathrm{cm}^3/\mathrm{s}\right)$ Award if it seen explicitly in (b) **and used** in (c)
	M1	States (or uses) a correct chain rule $\frac{\mathrm{d}A}{\mathrm{d}t}=\frac{\mathrm{d}A}{\mathrm{d}h}\times\frac{\mathrm{d}h}{\mathrm{d}t}$ and $\frac{\mathrm{d}V}{\mathrm{d}t}=\frac{\mathrm{d}V}{\mathrm{d}h}\times\frac{\mathrm{d}h}{\mathrm{d}t}$
	B1	For finding the area and volume of a cone in terms of h $r=\frac{h}{3},\ A=\pi r^2\sqrt{10}\Rightarrow A=\frac{\sqrt{10}}{9}\pi h^2$ and $V=\frac{1}{3}\pi r^2h\Rightarrow V=\frac{1}{27}\pi h^3$
	B1ft	Differentiates their expressions for the area and volume of a cone provided they are both in terms of h only. $\frac{\mathrm{d}A}{\mathrm{d}h}=\frac{2\sqrt{10}}{9}\pi h$ and $\frac{\mathrm{d}V}{\mathrm{d}h}=\frac{3}{27}\pi h^2$
	A1	Combines the required terms into their chain rules and evaluating to 3 significant figures $\frac{\mathrm{d}A}{\mathrm{d}t}=0.395\ 102$