

a)

$$V = \pi r^2 h + \frac{2}{3} \pi r^3$$

$$A = 2\pi r h + 3\pi r^2$$

$$\frac{dV}{dr} = \pi(2rh + \frac{dh}{dr} r^2) + 2\pi r^2 = 0$$

$$= 2\pi r h + \frac{dh}{dr} \pi r^2 + 2\pi r^2 \Rightarrow \frac{dh}{dr} = \frac{-2\pi r h - 2\pi r^2}{\pi r^2}$$

$$= \frac{-2h}{r} - 2$$

$$= -2\left(\frac{h}{r} + 1\right)$$

$$= -2 \frac{h+r}{r}$$

$$\frac{dA}{dr} = 2\pi\left(h + r \frac{dh}{dr}\right) + 6\pi r = 0$$

$$= 2\pi h + 2\pi r \frac{dh}{dr} + 6\pi r$$

$$= 2\pi h - 4\pi(h+r) + 6\pi r$$

$$= -2\pi h + 2\pi r$$

$$\Downarrow$$

$$\boxed{\frac{h}{r} = 1}$$

b)

$$V = \pi r^2 h + \frac{2}{3} \pi r^3$$

$$A = 2\pi r h + 2\pi r^2$$

$$\frac{dV}{dr} = -2 \frac{h+r}{r} \left. \vphantom{\frac{dV}{dr}} \right\} \text{ same as last time}$$

$$\frac{dA}{dr} = 2\pi\left(h + r \frac{dh}{dr}\right) + 4\pi r = 0$$

$$= 2\pi h - 4\pi(h+r) + 4\pi r$$

$$= -2\pi h$$

$$\Downarrow$$

$$\boxed{h=0}$$