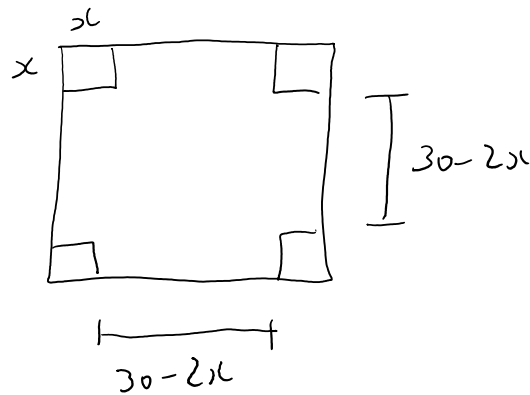


①



$$V = (30 - 2x)^2 x$$

$$\begin{aligned} V' &= (30 - 2x)^2 + x [2(30 - 2x)(-2)] \\ &= (30 - 2x)(30 - 2x - 4x) \\ &= (30 - 2x)(30 - 6x) \end{aligned}$$

Set $V' = 0$: $x = 15$ or $x = 5$

↗
box has zero volume

The height is $x = 5$ cm.

②

a) $dV = 2\pi r^2 dr$

b)
$$\frac{dV}{V} = \frac{2\pi r^2 dr}{\left(\frac{2}{3}\pi r^3\right) r}$$

$$= \frac{3 dr}{r} \quad \text{or} \quad 3\left(\frac{dr}{r}\right)$$

$$c) \text{ Sub } \frac{dr}{r} = 0.07 :$$

$$\frac{dV}{V} = 0.21 \text{ or } 21\%$$

$$(3) \quad a) \quad y = 7 [\sin(1+x^4)]^2$$

$$\begin{aligned} \frac{dy}{dx} &= 14 \sin(1+x^4) [\cos(1+x^4) \cdot 4x^3] \\ &= 56x^3 \sin(1+x^4) \cos(1+x^4) \end{aligned}$$

$$b) \quad y = 3 \sec(1+4x)$$

$$\begin{aligned} \frac{dy}{dx} &= 3 \sec(1+4x) \tan(1+4x) \cdot 4 \\ &= 12 \sec(1+4x) \tan(1+4x) \end{aligned}$$

$$c) \quad y = \tan^{-1} x^2$$

$$\begin{aligned} \frac{dy}{dx} &= \frac{1}{1+(x^2)^2} \cdot 2x \\ &= \frac{2x}{1+x^4} \end{aligned}$$

$$\textcircled{4} \quad \text{a) } f(x) = \log_7 (8x^2 + 3)$$

$$f'(x) = \frac{1}{\ln 7} \cdot \frac{1}{8x^2 + 3} \cdot 16x$$

$$\text{or } \frac{16x}{(\ln 7)(8x^2 + 3)}$$

$$\text{b) } f(x) = \ln \left(\frac{1}{x^2} \right)$$

$$= \ln x^{-2}$$

$$= -2 \ln x$$

$$\text{c) } f(x) = 4^{2-3x}$$

$$f'(x) = \ln 4 \cdot 4^{2-3x} \cdot (-3)$$

$$= (-3 \ln 4) 4^{2-3x}$$