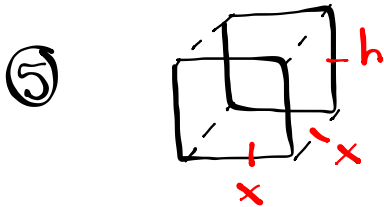


## Exercise 3.2



$$V = x^2 h$$

$$81 = x^2 h$$

$$\frac{81}{x^2} = h$$

$$h = \frac{81}{(4.3)^2} = 4.3$$

Dimensions:

$$4.3\text{cm} \times 4.3\text{cm} \times 4.3\text{cm}$$

$$A = 2x^2 + 4xh$$

$$A = 2(4.3)^2 + 4(4.3)(4.3)$$

$$A = 110.94 \text{ cm}^2$$

$$A = 2x^2 + 4xh$$

$$A = 2x^2 + 4x\left(\frac{81}{x^2}\right)$$

$$A = 2x^2 + 324x^{-1}$$

$$A' = 4x - 324x^{-2}$$

$$A' = 4x - \frac{324}{x^2}$$

$$0 = 4x - \frac{324}{x^2}$$

$$x^2 \cdot \frac{324}{x^2} = 4x \cdot x^2$$

$$324 = 4x^3$$

$$81 = x^3$$

$$4.33 = x$$

## Exercise 3.2

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

$$169.56 = 2\pi r^2 + 2\pi r h$$

$$\frac{169.56 - 2\pi r^2}{2\pi r} = \frac{2\pi r h}{2\pi r}$$

$$\frac{169.56 - 2\pi r^2}{2\pi r} = h$$

$$h = \frac{169.56 - 2\pi(3)^2}{2\pi(3)}$$

$$h = \frac{113.04}{18.84}$$

$$h = \underline{\underline{6\text{cm}}}$$

Max Volume:

$$V = \pi r^2 h$$

$$V = \pi(3)(6)$$

$$V = 169.56 \text{ cm}^3$$

$$V = \pi r^2 h$$

$$V = \pi r^2 \left[ \frac{169.56 - 2\pi r^2}{2\pi r} \right]$$

$$V = \frac{169.56r - 2\pi r^3}{2}$$

$$V = 84.78r - \pi r^3$$

$$V = 84.78 - 3\pi r^2$$

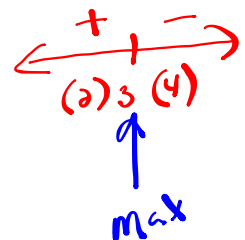
$$0 = 84.78 - 3\pi r^2$$

$$3\pi r^2 = 84.78$$

$$r^2 = 9$$

$$r = \pm 3$$

$$r = \underline{\underline{3\text{cm}}}$$



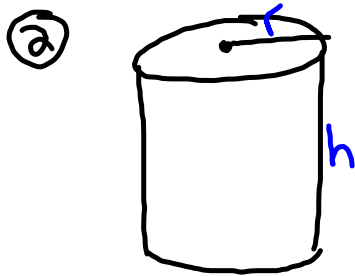
$$\textcircled{1} \text{c) } y = x^5 + 8x^3 + x$$

$$y' = 5x^4 + 24x^2 + 1$$

increasing on  $(-\infty, \infty)$

←  $y'$  is always positive.

The function is always increasing



Let  $r$  = the radius

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

Express with a single variable

$$V = \pi r^2 h$$

$$1000 = \pi r^2 h$$

$$h = \frac{1000}{\pi r^2}$$

$$A = 2\pi r^2 + 2\pi r \left[ \frac{1000}{\pi r^2} \right]$$

$$A = 2\pi r^2 + 2000r^{-1}$$

$$A' = 4\pi r - \frac{2000}{r^2}$$

$$\frac{2000}{r^2} = 4\pi r$$

$$4\pi r^3 = 2000$$

$$r^3 = \frac{500}{\pi}$$

$$r = \sqrt[3]{\frac{500}{\pi}} \approx 5.41 \text{ cm}$$

$$\textcircled{4} \text{ a) } f(x) = 5x^4 + 20x^3 - 40x^2 + 8, \quad -5 \leq x \leq 2$$

$$f'(x) = 20x^3 + 60x^2 - 80x$$

$$f'(x) = 20x(x^2 + 3x - 4)$$

$$f'(x) = 20x(x+4)(x-1)$$

$$\text{CV: } x = -4, 0, 1$$

Find  $f(-5)$ ,  $f(-4)$ ,  $f(0)$ ,  $f(1)$ , and  $f(2)$

$$f(x) = 5x^4 + 20x^3 - 40x^2 + 8$$

$$f(-5) = 5(-5)^4 + 20(-5)^3 - 40(-5)^2 + 8 = -367 \quad (-5, -367)$$

$$f(-4) = 5(-4)^4 + 20(-4)^3 - 40(-4)^2 + 8 = -632 \quad \boxed{(-4, -632)} \text{ min}$$

$$f(0) = 5(0)^4 + 20(0)^3 - 40(0)^2 + 8 = 8 \quad (0, 8)$$

$$f(1) = 5(1)^4 + 20(1)^3 - 40(1)^2 + 8 = -7 \quad (1, -7)$$

$$f(2) = 5(2)^4 + 20(2)^3 - 40(2)^2 + 8 = 88 \quad \boxed{(2, 88)} \text{ max}$$

$$\textcircled{5} f(x) = 3x^4 - 16x^3 + 18x^2 + 1$$

$$f'(x) = 12x^3 - 48x^2 + 36x$$

$$f'(x) = 12x(x^2 - 4x + 3)$$

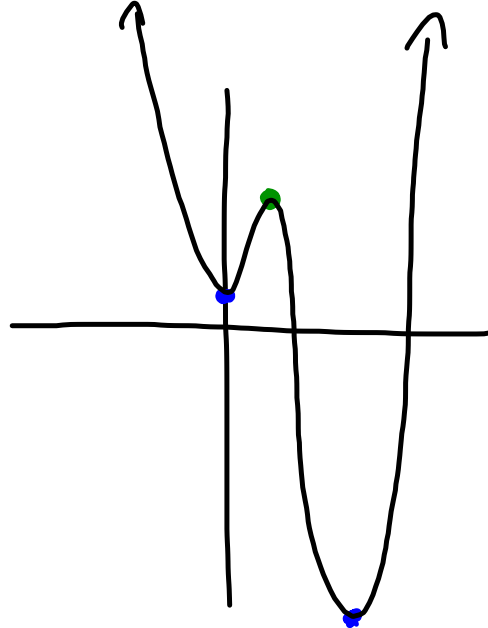
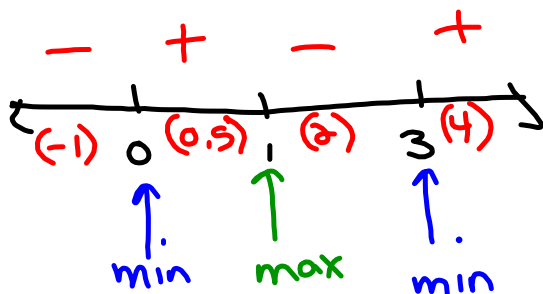
$$f'(x) = 12x(x-1)(x-3)$$

$$\text{CV: } x = 0, 1, 3$$

$$f(0) = 1 \quad (0, 1)$$

$$f(1) = 6 \quad (1, 6)$$

$$f(3) = -26 \quad (3, -26)$$

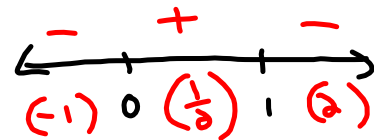


$$5) b) f(x) = 1 + 3x^2 - 2x^3$$

$$f'(x) = 6x - 6x^2$$

$$f'(x) = 6x(1-x)$$

$$CV: x=0, 1$$

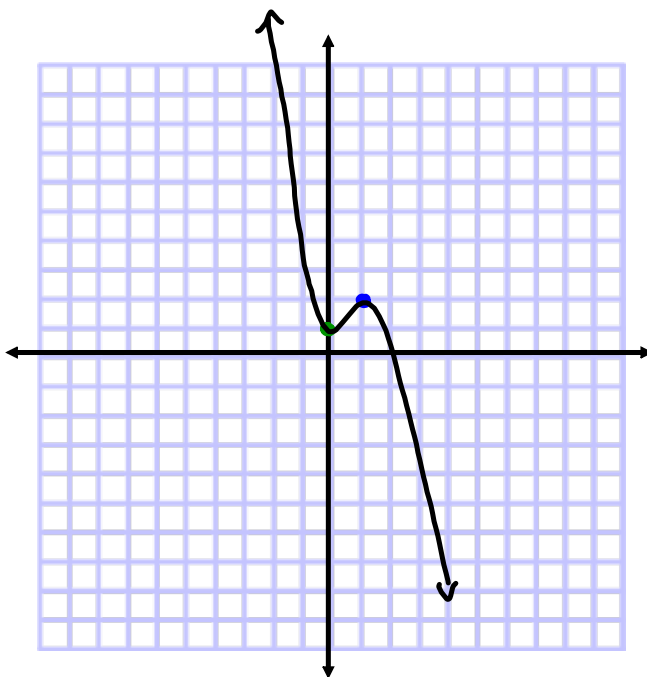


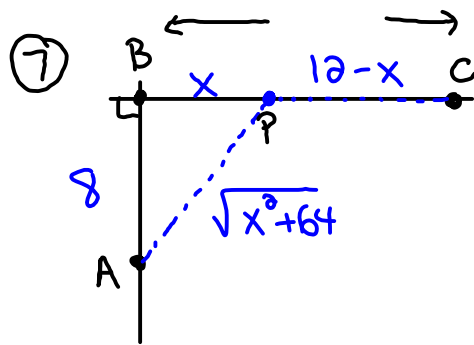
$$f(0) = 1 + 3(0)^2 - 2(0)^3 = 1$$

$(0, 1)$  local min

$$f(1) = 1 + 3(1)^2 - 2(1)^3 = 2$$

$(1, 2)$  local max





Let  $x$  = the distance from B to P

$$T = \frac{d}{s}$$

$$T = \frac{\sqrt{x^2 + 64}}{2} + \frac{12 - x}{6}$$

$$T = \frac{1}{2}(x^2 + 64)^{\frac{1}{2}} + \frac{12}{6} - \frac{1}{6}x$$

$$T' = \frac{1}{4}(x^2 + 64)^{-\frac{1}{2}}(2x) - \frac{1}{6}$$

$$T' = \frac{x}{2\sqrt{x^2 + 64}} - \frac{1}{6}$$

$$0 = \frac{x}{2\sqrt{x^2 + 64}} - \frac{1}{6}$$

$$\frac{1}{6} = \frac{x}{2\sqrt{x^2 + 64}}$$

$$2\sqrt{x^2 + 64} = 6x$$

$$4(x^2 + 64) = 36x^2$$

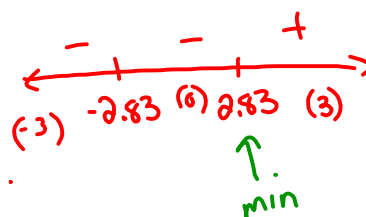
$$4x^2 + 256 = 36x^2$$

$$256 = 32x^2$$

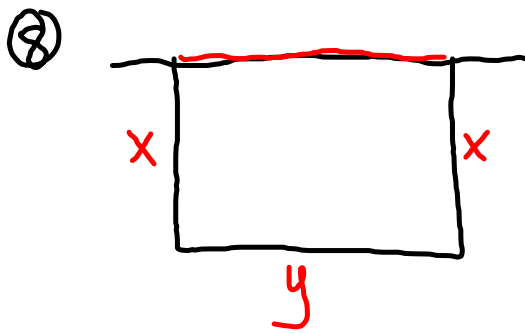
$$8 = x^2$$

$$x = \pm 2.83$$

∴ Head to a point  
2.83 Km East of A







$$P = 2x + y$$

$$500 = 2x + y$$

$$500 - 2x = y$$

$$500 - 2(125) = y$$

$$500 - 250 = y$$

$$250\text{m} = y$$

$$\therefore 125\text{m} \times 250\text{m}$$

$$A = xy$$

Express as a single variable

$$A = x(500 - 2x)$$

$$A = 500x - 2x^2$$

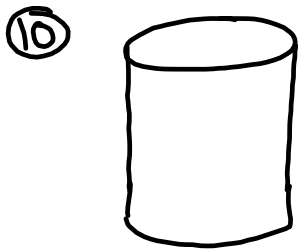
$$A' = 500 - 4x$$

$$4x = 500$$

$$x = 125\text{m}$$

+	↓ max	-
(1)	125	(200)

Ex. 3.2



$$A = 169.56 \text{ cm}^2$$

$$2\pi r^2 + 2\pi rh = 169.56$$

$$2\pi rh = 169.56 - 2\pi r^2$$

$$h = \frac{169.56 - 2\pi r^2}{2\pi r}$$

$$h = \frac{169.56 - 2\pi(3)^2}{2\pi(3)}$$

$$h = 6 \text{ cm}$$

$$V = \pi r^2 h$$

$$V = \pi r^2 \left[ \frac{169.56 - 2\pi r^2}{2\pi r} \right]$$

$$V = \frac{169.56r - 2\pi r^3}{2}$$

$$V = 84.78r - \pi r^3$$

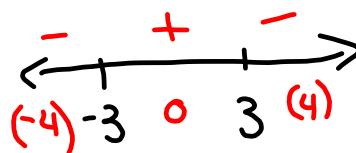
$$V' = 84.78 - 3\pi r^2$$

$$0 = 84.78 - 3\pi r^2$$

$$3\pi r^2 = 84.78$$

$$r^2 = 9$$

$$r = \pm 3$$



↑  
max

$$r = 3 \text{ cm}$$

$$\begin{aligned} \text{Max Volume} &= \pi r^2 h \\ &= \pi (3)^2 (6) \\ &= 54\pi \\ &= 169.56 \text{ cm}^3 \end{aligned}$$

