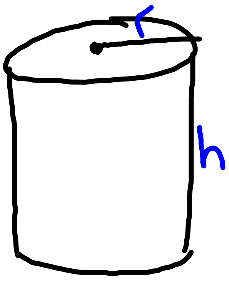
① c) $y = x^5 + 8x^3 + x$

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

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

y' is always positive.
The function is always increasing

2



Let r = the radius

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

Express with a single variable

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

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

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

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

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

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

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

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

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

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

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

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

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

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

CV: $x=-4, 0, 1$

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

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

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

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

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

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

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

5a) $f(x) = 3x^4 - 16x^3 + 18x^2 + 1$

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

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

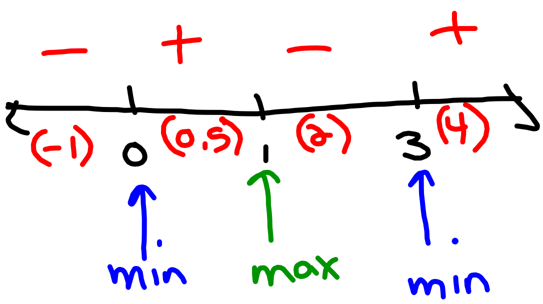
$f'(x) = 12x(x-1)(x-3)$

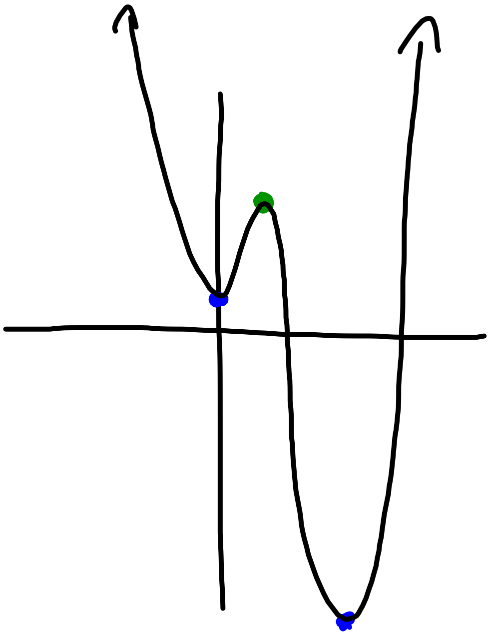
CV: $x = 0, 1, 3$

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

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

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





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

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

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

CV: $x = 0, 1$

$-$ $+$ $-$

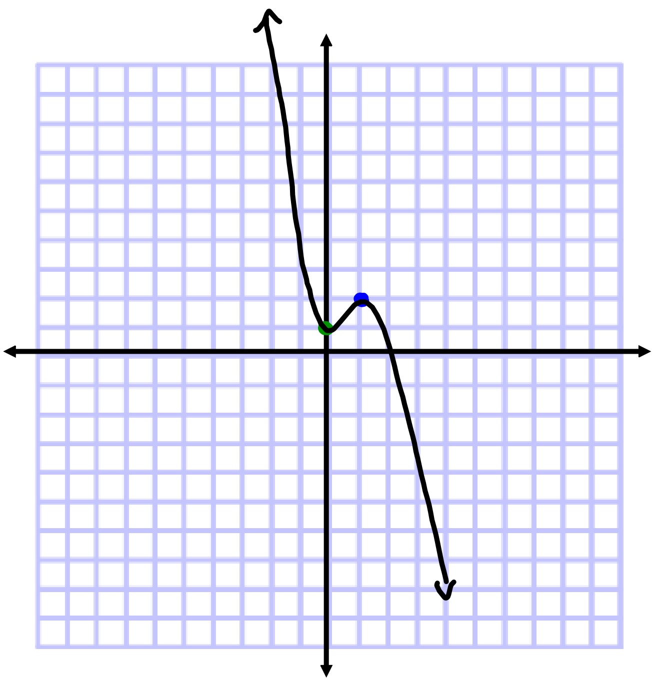
(-1) 0 $\left(\frac{1}{2}\right)$ 1 (2)

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

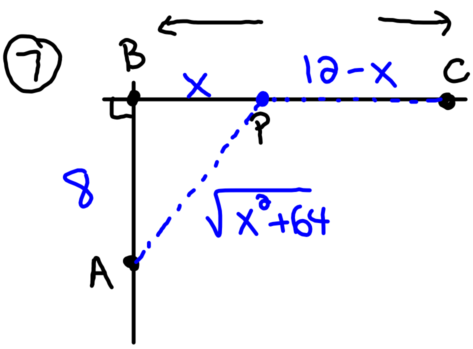
(0,1) local min

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

(1,2) local max



7)



Let x = the distance from B to P

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

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

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

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

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

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

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

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

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

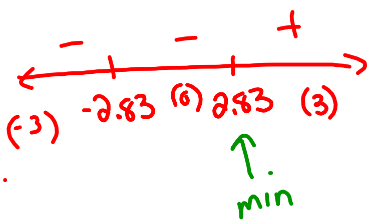
$$4x^2+256 = 36x^2$$

$$256 = 32x^2$$

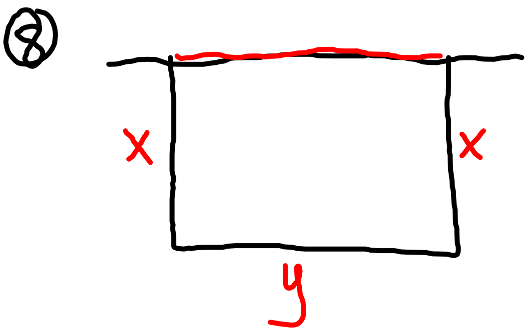
$$8 = x^2$$

$$x \doteq \pm 2.83$$

∴ Head to a point 2.83 Km East of A



(8)



$P = 2x + y$

$500 = 2x + y$

$\boxed{500 - 2x = y}$

$A = xy$ ← Express as a single variable

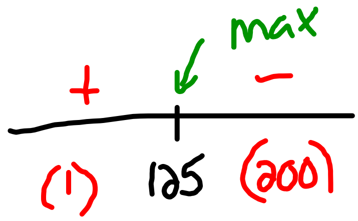
$A = x(500 - 2x)$

$A = 500x - 2x^2$

$A' = 500 - 4x$

$4x = 500$

$x = 125\text{ m}$



$500 - 2(125) = y$

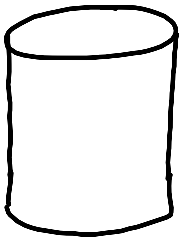
$500 - 250 = y$

$250\text{ m} = y$

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

Ex. 3.2

10



$A = 169.56\ cm^2$

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

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

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

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

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

$V = \pi r^2 \underline{h}$

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

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

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

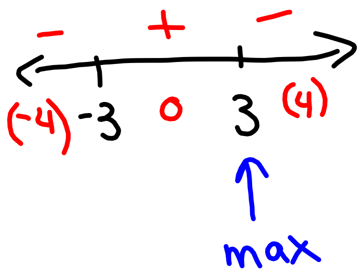
$V' = 84.78 - 3\pi r^2$

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

$3\pi r^2 = 84.78$

$r^2 = 9$

$r = \pm 3$



$\boxed{r = 3cm}$

Max Volume $= \pi r^2 h$

$= \pi(3)^2(6)$

$= 54\pi$

$= 169.56\ cm^3$