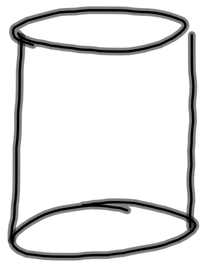
4.4.2

1. minimize SA



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

$$V=2197=\pi r^2 h$$

$$\frac{2197}{\pi r^2}=\frac{\pi r^2 h}{\pi r^2}$$

$$h=\frac{2197}{\pi r^2}$$

$$S=\pi r^2+2\cancel{\pi r}\left(\frac{2197}{\cancel{\pi r^2}}\right)$$

$$S=\pi r^2+\frac{4394}{r}$$

$$S'=\frac{2\pi r^3}{r^2}-\frac{4394}{r^2}=0$$

$$2\pi r^3-4394=0$$

$$r^3=\frac{2197}{\pi}$$

$$r=\sqrt[3]{\frac{2197}{\pi}}$$

$$\boxed{r=\frac{13}{\sqrt[3]{\pi}}}$$

$$\boxed{h=\frac{2197}{\pi\left(\frac{13}{\sqrt[3]{\pi}}\right)^2}}$$

2. $P(x) = R(x) - C(x)$

$$P(x) = \frac{x^2}{x^2+1} - \left(\frac{(x-1)^3}{3} - \frac{1}{3}\right)$$

$$P(x) = \frac{x^2}{x^2+1} - \frac{1}{3}(x-1)^3 + \frac{1}{3}$$

$$P'(x) = \frac{(x^2+1)(2x) - x^2(2x)}{(x^2+1)^2} - 1(x-1)^2 \cdot 1$$

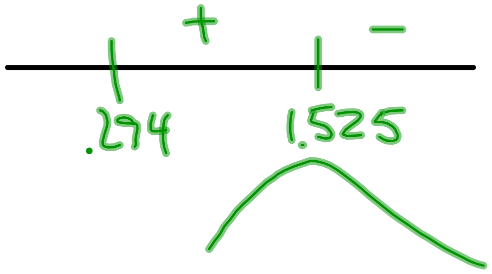
$$= \frac{\cancel{2x^3} + 2x - \cancel{2x^3}}{(x^2+1)^2} - (x-1)^2$$

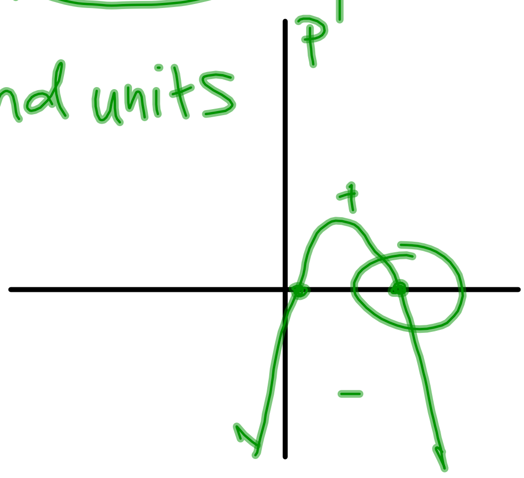
$$= \frac{2x}{(x^2+1)^2} - \frac{(x-1)^2(x^2+1)^2}{(x^2+1)^2} = 0$$

$$2x - (x-1)^2(x^2+1)^2 = 0$$

Zeros: $x \approx .294, 1.525$

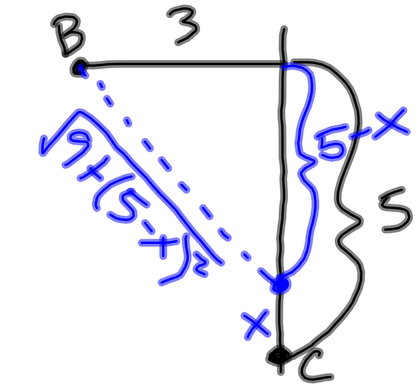
1.525 thousand units





Dec 2-1:14 PM

3.



$$d = rt$$

$$t = \frac{d}{r}$$

$$t = \frac{d_r}{r} + \frac{d_l}{r}$$

$$t = \frac{\sqrt{9+(5-x)^2}}{3} + \frac{x}{4}$$

$$t = \frac{\sqrt{9+25-10x+x^2}}{3} + \frac{x}{4}$$

$$t = \frac{1}{3}\sqrt{(34-10x+x^2)} + \frac{1}{4}x$$

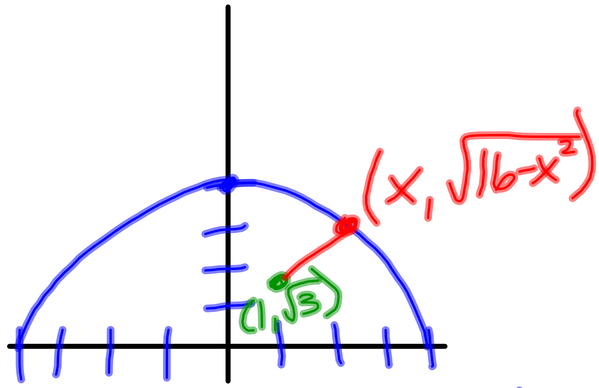
$$t' = \frac{1}{3}\left(\frac{1}{2\sqrt{34-10x+x^2}}\right)(2x-10) + \frac{1}{4}$$

$$\frac{(2x-10)}{(6\sqrt{(34-10x+x^2)})} + \frac{1}{4} = 0$$

zeros: $x \approx 1.598$ mi

Dec 2-1:23 PM

4. $y=\sqrt{16-x^2}$ $\quad (1,\sqrt{3})$



$d=\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$

$d=\sqrt{(x-1)^2+(\sqrt{16-x^2}-\sqrt{3})^2}$

$d^2=(x-1)^2+(\sqrt{16-x^2}-\sqrt{3})^2$

$(\sqrt{16-x^2}-\sqrt{3})(\sqrt{16-x^2}-\sqrt{3})$

$d^2=\cancel{x^2}-2x+1+16-\cancel{x^2}-2\sqrt{3}\sqrt{16-x^2}+3$

$d^2=-2x+20-(2\sqrt{3})(\sqrt{16-x^2})$

$(d^2)'=-2-2\sqrt{3}\left(\frac{1}{\cancel{2}\sqrt{16-x^2}}\right)(-\cancel{2}x)$

$=-2+\frac{2\sqrt{3}x}{\sqrt{16-x^2}}=0$

$\left(\frac{2\sqrt{3}x}{\sqrt{16-x^2}}\right)^2=(2)^2$

$\frac{12x^2}{16-x^2}=\frac{4}{1}$

$64-4x^2=12x^2$

$64=16x^2$

$x^2=4$

$x=2$

Plug into dist eq.

$d=\sqrt{(2-1)^2+(\sqrt{16-4}-\sqrt{3})^2}$

$=\sqrt{1+(\sqrt{12}-\sqrt{3})^2}$

$=\sqrt{1+(2\sqrt{3}-\sqrt{3})^2}$

$\sqrt{1+(\sqrt{3})^2}$

$\sqrt{1+3}=2$