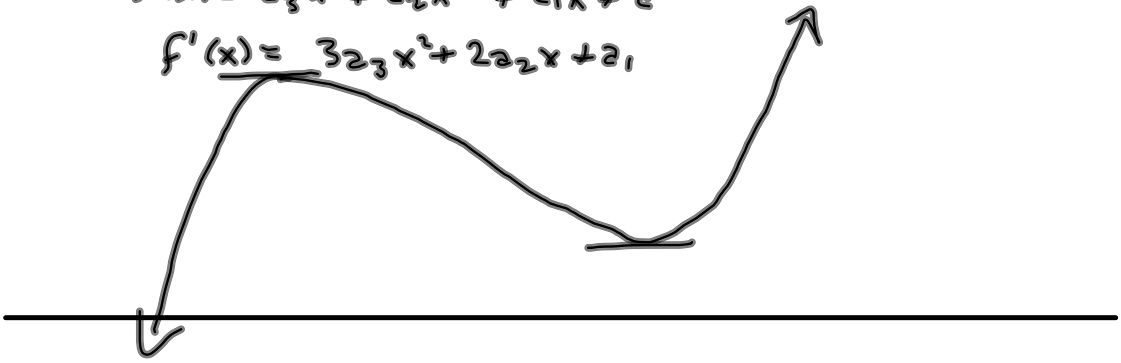
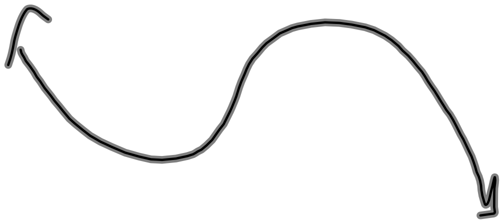
$f(x) = a_3x^3 + a_2x^2 + a_1x + a$

$f'(x) = 3a_3x^2 + 2a_2x + a_1$





MVT

f is ...

... cont^{s} on $[a,b]$

... dif'b^{l} .. (a,b)

$\sin\left(\frac{1}{x}\right)$

$$\begin{cases} \frac{\sin x}{x} & -\pi \le x < 0 \\ 0 & x = 0 \end{cases}$$

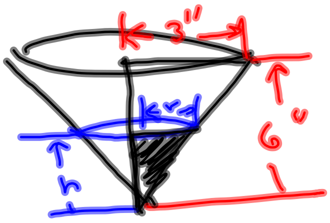
$[a,b] = [-\pi, 0]$

$$\lim_{x \to c} f(x) = f(c)$$

$$\lim_{x \to 0^-} f(x) = \lim_{x \to 0^-} \frac{\sin x}{x}$$

$$= 1 \neq 0 = f(0)$$

Oct 10-12:14 PM



Want $\left.\frac{dh}{dt}\right|_{h=5''}$

Given $\frac{dV}{dt} = -10 \frac{in^3}{min}$

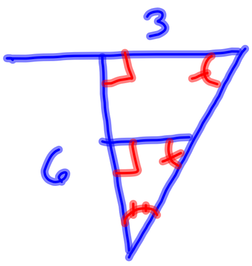
$V = \frac{1}{3}\pi r^2 h$

2.5'' ? 5 2.5 ?

$$\frac{dV}{dt} = 10 = \frac{2}{3}\pi r \frac{dr}{dt} h + \frac{1}{3}\pi r^2 \frac{dh}{dt}$$

Too many unknowns.

Eliminate r:



Similar triangles says

$r = \frac{1}{2} h$, so

$V = \frac{1}{3}\pi \left(\frac{1}{2}h\right)^2 h$

$V = \frac{1}{12}\pi h^3$

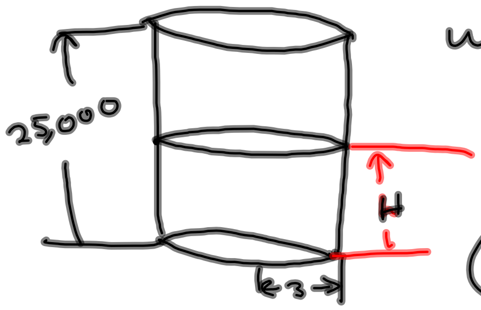
$$\left.\frac{dV}{dt}\right|_{h=5} = \left.\frac{1}{4}\pi h^2 \frac{dh}{dt}\right|_{h=5} = 10 \Big|_{h=5}$$

$r=3$
$h=6$
$\frac{r}{h} = \frac{1}{2}$
$r = \frac{1}{2}h$

Oct 10-12:23 PM

$$= \frac{1}{4}\pi(25)\frac{dh}{dt} = 10$$

$$\Longrightarrow \frac{dh}{dt} = \frac{40}{25\pi}\ \frac{in}{min}$$



Want $\left.\frac{dh}{dt}\right|_{h=5^-}$ (in the cone)

Given

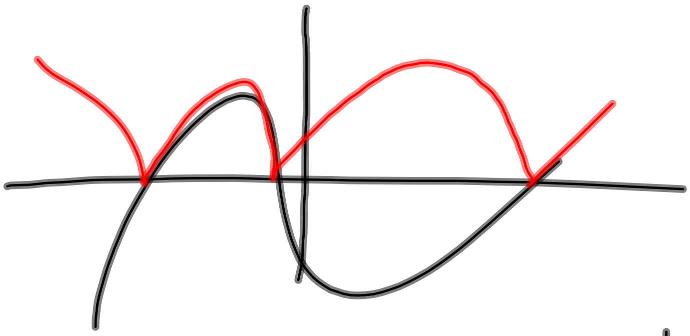
$$\frac{dV}{dt} = 10\ \frac{in^3}{min}$$

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

$$V = 9\pi H$$

$$\left.\frac{dV}{dt}\right|_{h=5} = \left. 9\pi \frac{dH}{dt}\right|_{h=5} = 10$$

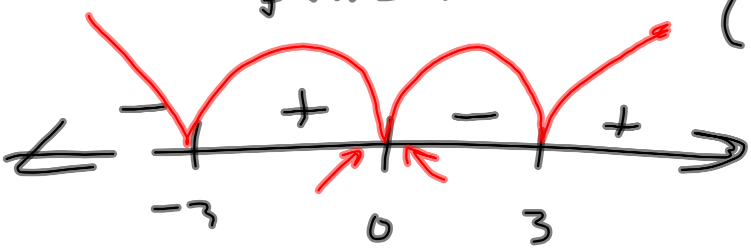
$$\left.\frac{dH}{dt}\right|_{h=5} = \frac{10}{9\pi}\ \frac{in}{min}$$



$$|f| = \begin{cases} f & f \geq 0 \\ -f & f < 0 \end{cases}$$

$$x(x^2-9) = (x)(x-3)(x+3)$$

$$f(x) = |x^3-9x| = \begin{cases} x^3-9x & x^3-9x \geq 0 \\ -x^3+9x & x^3-9x < 0 \end{cases}$$



$$x^3-9x$$
$$= x(x-3)(x+3)$$

$$|x^3-9x| = \begin{cases} x^3-9x & -3 \leq x \leq 0 \text{ OR } x \geq 3 \\ -x^3+9x & -\infty < x < -3 \text{ OR } 0 < x < 3 \end{cases}$$

(2) $f'(0)\ \exists$?

$$f'(x) = \begin{cases} 3x^2-9 & -3 < x < 0 \text{ OR } x > 3 \\ -3x^2+9 & -\infty < x < -3 \text{ OR } 0 < x < 3 \end{cases}$$

$$f'(0) = \lim_{h \to 0} \frac{f(0+h)-f(0)}{h}$$

$$* \quad \lim_{h \to 0^+} \frac{f(0+h)-f(0)}{h} = \lim_{h \to 0^-} \frac{f(0+h)-f(0)}{h} \quad *$$

$$-3(0)^2+9 = 9 \stackrel{?}{=} 3(0)^2-9 \ ?$$

$$9 \neq -9$$

$$f'_+(0) \stackrel{?}{=} f'_-(0)$$

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

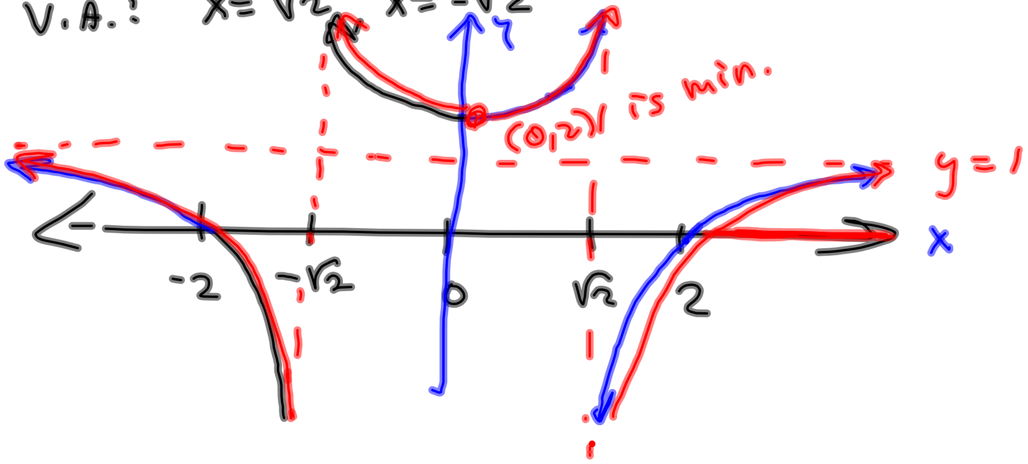
y-int: $(0,2)$

x-int: $(2,0)$, $(-2,0)$

H.A.: $y=1$

~~O.A.:~~ None

V.A.: $x=\sqrt{2}$, $x=-\sqrt{2}$



$$y = \frac{x^2-4}{x^2-2} \Longrightarrow y' = \frac{2x(x^2-2)-(x^2-4)(2x)}{(x^2-2)^2}$$

$$= \frac{2x^3-4x-(2x^3-8x)}{(\quad)^2} = \frac{2x^3-4x-2x^3+8x}{(\quad)^2}$$

$$= \frac{4x}{(x^2-2)^2} = \frac{4x}{(x-\sqrt{2})^2(x+\sqrt{2})^2}$$

Cp's: $x = -\sqrt{2}, 0, \sqrt{2}$