L'Hôpital says if

$$\lim_{x \to c} \frac{f(x)}{g(x)} = \frac{0}{0} \text{ OR } \frac{\infty}{\infty}, \text{ then}$$

$$\lim_{x \to c} \frac{f(x)}{g(x)} = \lim_{x \to c} \frac{f'(x)}{g'(x)} = \lim_{x \to 0} \frac{\ln(10)\,10^x}{1} = \ln(10) \cdot 10^0$$

$$= \ln(10)$$

$$\lim_{x \to 0} \frac{10^x - 1}{x} = \frac{0}{0}$$

```
Y1(.000001
        2.3025877
Y1(.000000000000
000001
                0
ln(10
      2.302585093
```

$$\frac{d}{dx}(10^x) = \frac{d}{dx}\left(e^{\ln 10}\right)^x = \frac{d}{dx}\left[e^{(\ln 10)x}\right]$$

$$= (\ln(10))e^{(\ln 10)x} = (\ln(10))\,10^x$$

I'm pretty careful about writing what I MEAN.

$$\lim_{x\to\infty}\sqrt{\frac{8x^2-3}{2x^2+x}} = \lim_{x\to\infty}\sqrt{\frac{8x^2+\text{smaller}}{2x^2+\text{smaller}}} = \sqrt{\frac{8}{2}}$$

$$\sqrt{\frac{8x^2-3}{2x^2+x}} = \sqrt{\frac{x^2\left(8-\frac{3}{x^2}\right)}{x^2\left(2+\frac{1}{x}\right)}} \xrightarrow{x\to\infty} \sqrt{\frac{8}{2}}$$

$$\sqrt{\frac{8x^2-3}{2x^2+x}} \xrightarrow{x\to\infty} \sqrt{\frac{8}{2}} = 2$$

Sep 11-12:19 PM

$$\frac{\cancel{x-5}^{\,1}}{\cancel{(x-5)}_{1}(x+5)} = \frac{1}{x+5} \xrightarrow{x \to 5} \frac{1}{5+5} = \frac{1}{10}$$

$$g(u) = \frac{u^4-1}{u^3-1} \quad \text{want } \lim_{u \to 1} g(u)$$

$$f(x) = \frac{\sqrt{x}-3}{x-9} \quad \text{want } \lim_{x \to 9} f(x)$$

$$= \frac{\sqrt{x}-3}{(\sqrt{x}-3)(\sqrt{x}+3)} = \frac{1}{\sqrt{x}+3} \xrightarrow{x \to 9} \frac{1}{3+3} = \frac{1}{6}$$

$$x = (\sqrt{x})^2$$
$$9 = 3^2$$

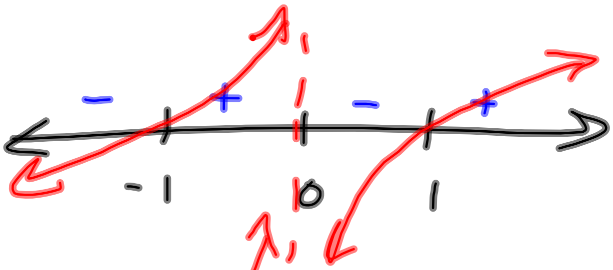
$$x - 9 = (\sqrt{x})^2 - 3^2$$

A bit hinky when you consider $x < 0$ doesn't work, but we have $\sqrt{x}$ upstairs, which ~~tells~~ tells us $x \geq 0$.

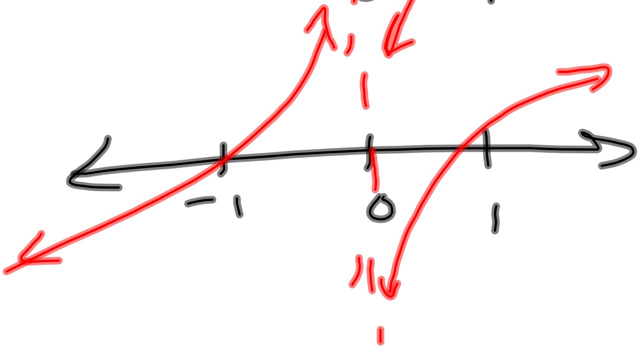
104 S2.5 $y = \frac{3}{2}\left(x - \frac{1}{x}\right)^{2/3}$

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

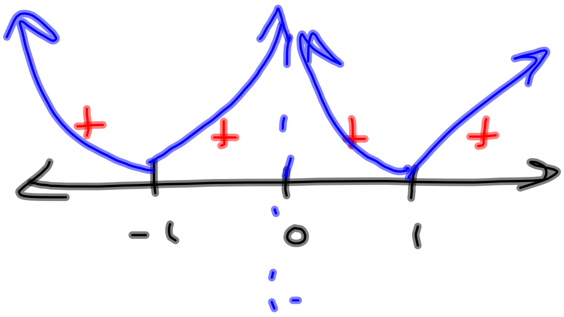
$$\frac{(x-1)(x+1)}{x}$$



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



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



§2.6 #99

$\frac{x^2}{x-1}$ Graph it

zeros: $x=0$ $m=2$

V.A.: $x=1$

H.A.: None.

O.A.:

$$x-1\overline{)\,x^2+0x+0}$$

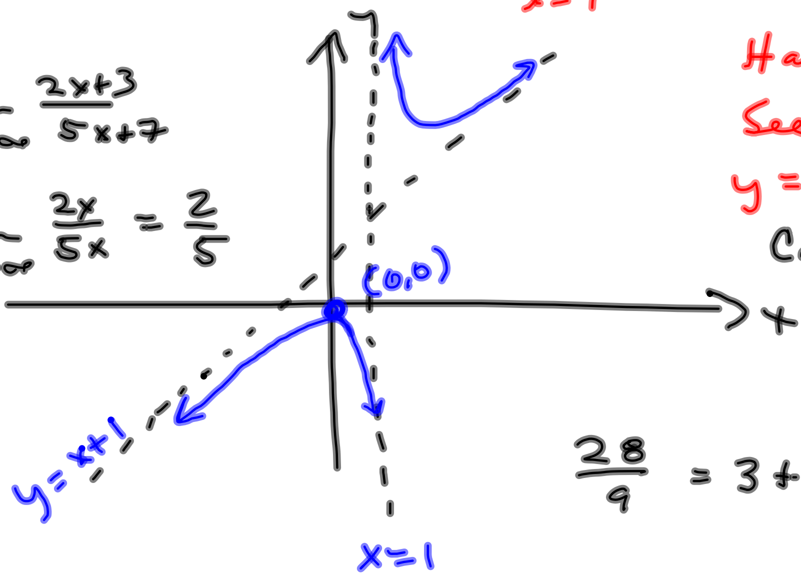
$$\begin{array}{r|rrr} 1 & 1 & 0 & 0 \\ & & 1 & 1 \\ \hline & 1 & 1 & 1 \\ & x^1 & x^0 & r \end{array}$$

$$\Longrightarrow \frac{x^2}{x-1} = x+1+\frac{1}{x-1}$$

$\boxed{y=x+1 \text{ is O.A.}}$

$$\lim_{x\to\infty} \frac{2x+3}{5x+7}$$

$$=\lim_{x\to\infty} \frac{2x}{5x} = \frac{2}{5}$$



Hard-core: See if $y=x+1$, anywhere.

Calculus: See if its slope changes.

$$\frac{28}{9} = 3+\frac{1}{9}$$