

$$f(x) = \frac{x^2 + 1}{x^2 - 9}$$

Vertical $x = -3; x = 3$

$$\lim_{x \rightarrow 3^+} \frac{x^2 + 1}{x^2 - 9} = \frac{10}{0} = \frac{+}{+} = \infty$$

$$\lim_{x \rightarrow -3^-} \frac{x^2 + 1}{x^2 - 9} = \frac{10}{0} = \frac{+}{+} = +\infty$$

Horizontal $y = 1$

$$\lim_{x \rightarrow \infty} \frac{x^2}{x^2} = 1$$

$$f'(x) = \frac{(x^2 - 9)2x - (x^2 + 1)2x}{(x^2 - 9)^2}$$

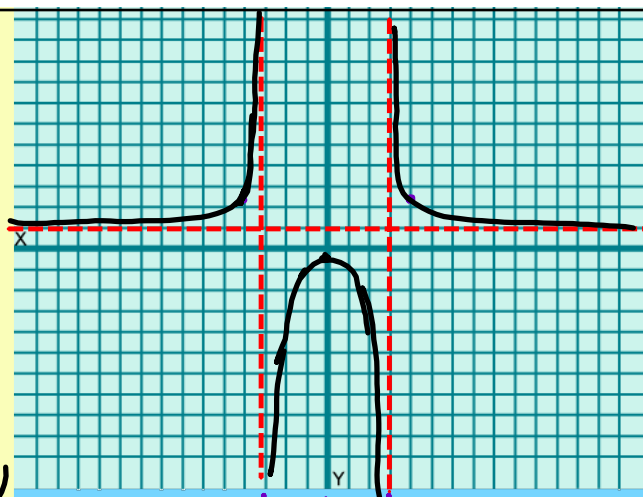
$$= \frac{2x[x^2 - 9 - x^2 - 1]}{(x^2 - 9)^2}$$

$$\Rightarrow \frac{-20x}{(x^2 - 9)^2} = 0$$

$$-20x = 0$$

$$x = 0$$

+	+	+	+
+	+	-	-
-3	0	3	
-4	-1	1	4



$$f''(x) = \frac{(x^2 - 9)^2 \cdot -20 - -20x \cdot 2(x^2 - 9)' \cdot 2x}{(x^2 - 9)^4}$$

$$= \frac{-20(x^2 - 9)[x^2 - 9 - 4x^2]}{(x^2 - 9)^3}$$

$$= \frac{-20[-3x^2 - 9]}{(x^2 - 9)^3}$$

$$\Rightarrow \frac{60[x^2 + 3]}{(x^2 - 9)^3} = 0$$

$$x^2 + 3 = 0$$

$$\sqrt{x^2} = \sqrt{-3}$$

+	+	+	+
+	-	-	+
-1	-3	0	3
			4

$$f(x) = x \cdot e^{-2x} = \frac{x}{e^{2x}}$$

No vertical
Denom $\neq 0$

Horiz.

$$\lim_{x \rightarrow -\infty} x \cdot e^{-2x} = -\infty \cdot \infty = -\infty$$

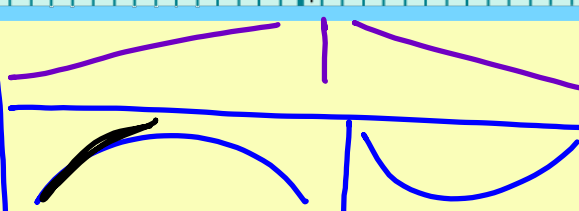
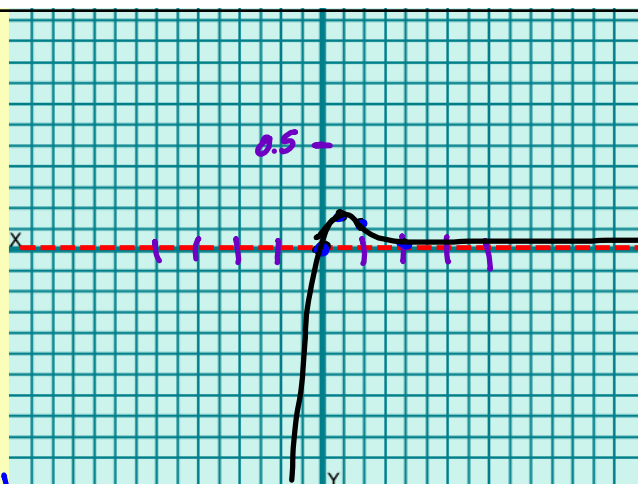
$$\lim_{x \rightarrow \infty} x \cdot e^{-2x} = \infty \cdot 0$$

$$\lim_{x \rightarrow \infty} \frac{x}{e^{2x}} = \frac{\infty}{\infty}$$

$$\lim_{x \rightarrow \infty} \frac{1}{e^{2x} \cdot 2} = \frac{1}{\infty} = 0$$

Horiz: $y = 0$

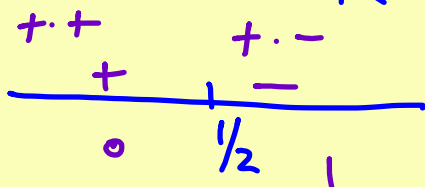
$\frac{1}{2}$	0.18
1	0.13
0	0
2	0.037



$$f'(x) = x \cdot e^{-2x} \cdot -2 + e^{-2x} \cdot 1$$

$$\Rightarrow = e^{-2x}(-2x+1)$$

$$x = \frac{1}{2} \leftarrow \text{crit pt.}$$



$$f''(x) = e^{-2x} \cdot -2 + (-2x+1)e^{-2x} \cdot -2$$

$$= -2e^{-2x} [1 - 2x + 1]$$

$$= -2e^{-2x} [2 - 2x]$$

$$= 4e^{-2x} [x - 1]$$

$$x - 1 = 0$$

$$x = 1$$

