$f(x) = \dfrac{x^2+1}{x^2-9}$ ⟵ $x \neq 3, -3$

<u>Vertical</u>

$\lim_{x \to \#} f(x) = \pm\infty$

Where denom = 0

<u>Horiz.</u>

$\lim_{x \to \pm\infty} f(x) = \#$

$\boxed{\lim_{x \to \infty} \dfrac{x^2}{x^2} = 1}$

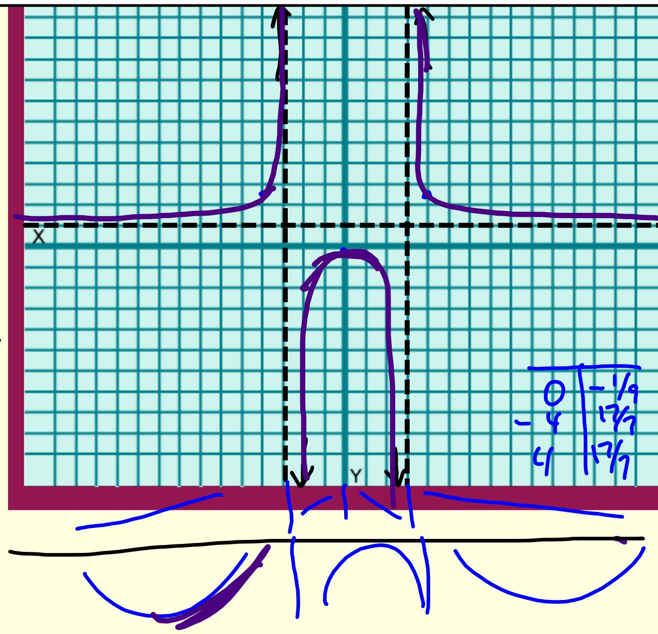
$\lim_{x \to 3^+} \dfrac{x^2+1}{x^2-9} = \dfrac{10}{0} = \dfrac{+}{+} = +\infty$

3.1

$\lim_{x \to 3^-} \dfrac{x^2+1}{x^2-9} = \dfrac{+}{-} = -\infty$

$\lim_{x \to -3^+} \dfrac{x^2+1}{x^2-9} = \dfrac{+}{-} = -\infty$

$\lim_{x \to -3^-} \dfrac{x^2+1}{x^2-9} = \dfrac{+}{+} = +\infty$



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

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

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

⟹ $= \dfrac{-20x}{(x^2-9)^2} = 0$

$-20x = 0$

$x = 0$

$\frac{+}{+}$ + $\frac{+}{+}$ + $\frac{-}{+}$ − $\frac{-}{+}$ −

−4   −3   −1   0   1   3

$f''(x) = \dfrac{(x^2-9)^2 \cdot -20 - -20x \cdot 2(x^2-9)^1 \cdot 2x}{(x^2-9)^4}$

$\dfrac{-20\cancel{(x^2-9)}[x^2-9-4x^2]}{(x^2-9)^{\cancel{4}\,3}}$

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

$= \dfrac{60[x^2+3]}{(x^2-9)^3}$ ⟸

$x^2+3 = 0$

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

$\frac{+}{+} = +$ $\frac{+}{-} = -$ $\frac{+}{+} = +$

−4   −3   0   3   4

November 15, 2021