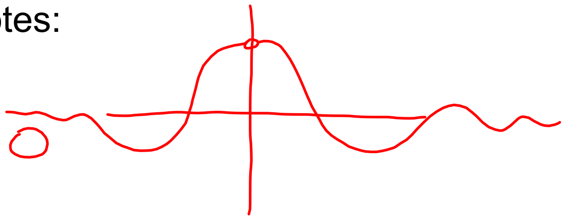
Definition of a Horizontal Asymptote:

If $\lim_{x \to \infty} f(x) = b$ *or* $\lim_{x \to -\infty} f(x) = b$ then there is a HA at y = b

Find the horizontal asymptotes:

$$f(x) = \frac{\sin x}{x}$$

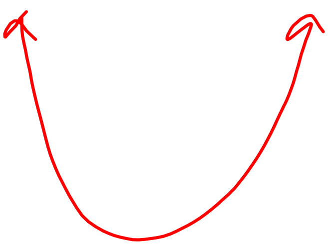
$y = 0$



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

$\lim_{x \to \infty} f(x) = 1$

$\lim_{x \to -\infty} f(x) = -1$



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

1. $f(x) = \cos\left(\frac{1}{x}\right)$

a. $\lim_{x \to \infty} f(x) = 1$

b. $\lim_{x \to -\infty} f(x) = 1$

c. $y = 1$

43.

$$f(x) = \frac{4x^3 - 2x + 1}{x - 2}$$

$$\text{e.b.m.} = \frac{4x^3}{x} = 4x^2$$

$x \to \infty$

$x \to -\infty$

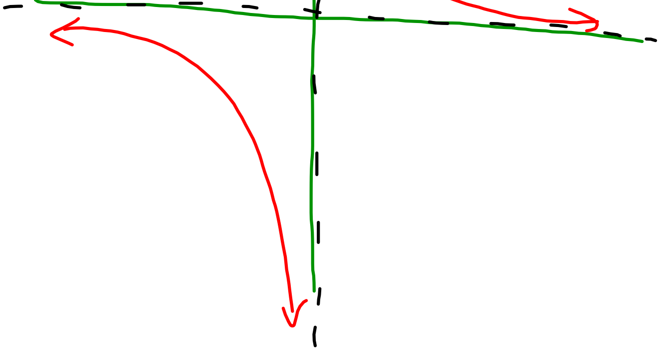
none

Estimate: (remember this includes both the left and right hand limits!)

$$\lim_{x\to 0}\frac{1}{x^{1}} = \text{DNE}$$

$\lim_{x\to\infty} f(x) = 0$

$\lim_{x\to -\infty} f(x) = 0$



$\lim_{x\to 0^+}\left(\frac{1}{x}\right) = \infty$

$\lim_{x\to 0^-}\left(\frac{1}{x}\right) = -\infty$

Definition of a Vertical Asymptote:

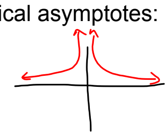
$\lim_{x\to a^+} f(x) = \pm\infty$

or then there is a VA at x = a

$\lim_{x\to a^-} f(x) = \pm\infty$

Find the vertical asymptotes:

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



$x = 0$

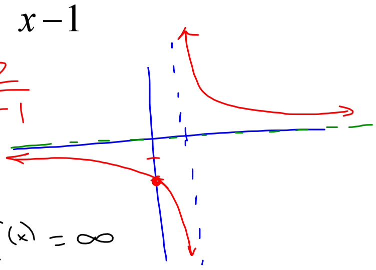
$\lim_{x\to 0^+} f(x) = \infty$

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

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

$x = 1$

$0 = \frac{2}{x-1}$



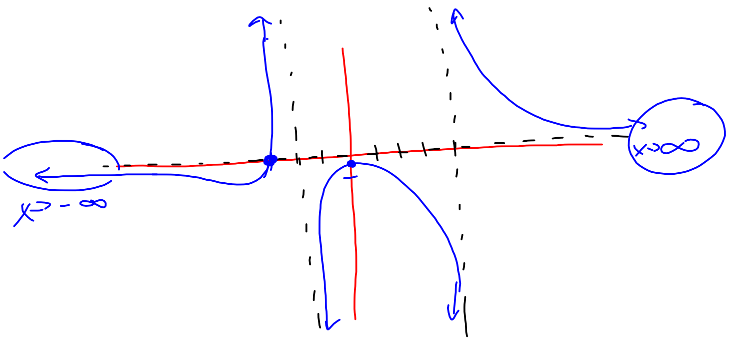
$\lim_{x\to 1^+} f(x) = \infty$

$\lim_{x\to 1^-} f(x) = -\infty$

Find the limits on the left & rt. of the VA:

$$f(x) = \frac{(x+3)}{x^2 - 2x - 8} = 0$$

$$(x-4)(x+2)$$



$\lim_{x \to -2^+} f(x) = -\infty$ $\lim_{x \to 4^+} f(x) = \infty$

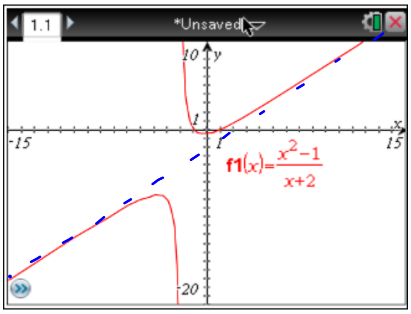
$\lim_{x \to -2^-} f(x) = \infty$ $\lim_{x \to 4^-} f(x) = -\infty$

End Behavior Models:

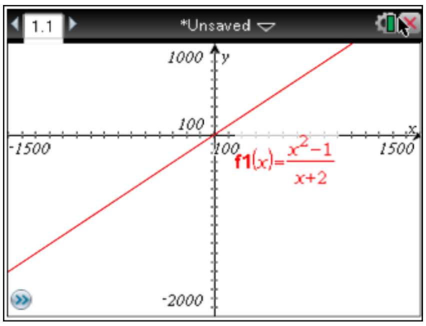
$$f(x) = \frac{x^2 + 1}{x + 2}$$ e.b.m $= \frac{x^2}{x} = x$

Graph f(x) using the following windows:

[-15,15] [-20,10]
x's y's



[-1500, 1500] [-2000,1000]



what is an end-behavior model for f(x):

Find the end behavior models:

$$y = \frac{2x^5 + x^4 - x^2 + 1}{3x^2 - 5x + 7}$$

$7 - 5x + 3x^2$

e.b.m. = $\frac{2}{3}x^3$

$\frac{2x^3}{3}$

$$y = \frac{x+1}{3x^2 - 4x + 5}$$

e.b.m. = $\frac{1}{3x}$