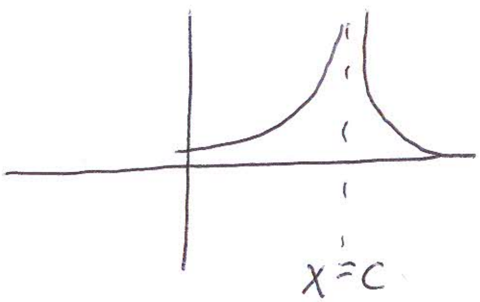
Friday, August 30, 2013 (Day 4)

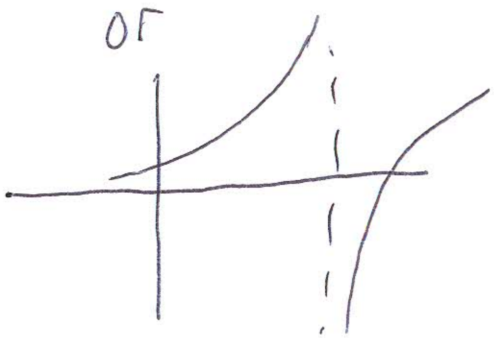
Summary of Limits Involving Infinity (Graphical Approach)

Graph That Has Vertical Asymptote at $x = c$ $\Longleftrightarrow$ (limit behavior at $x=c$) (infinite limits)



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

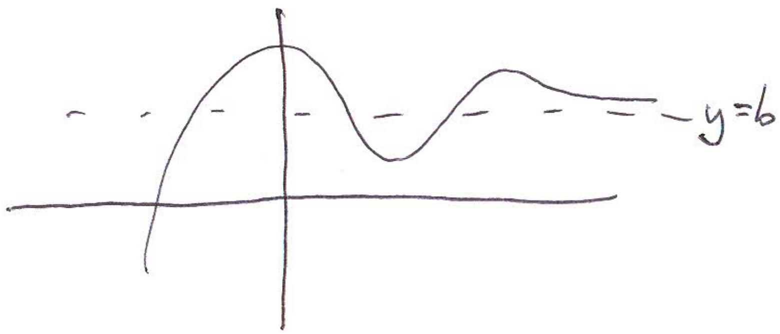
or



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

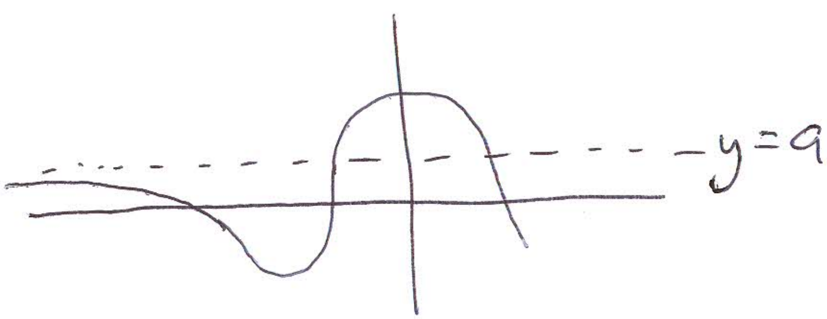
$$\lim_{x \to c} f(x) = \pm\infty \text{ or DNE}$$

Graph with Horiz asymptote on right at y=b $\Longleftrightarrow$ limit behavior (limit at infinity)



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

Horizontal Asymptote on left at y=a $\Longleftrightarrow$ $\lim\limits_{x\to-\infty} f(x) = a$

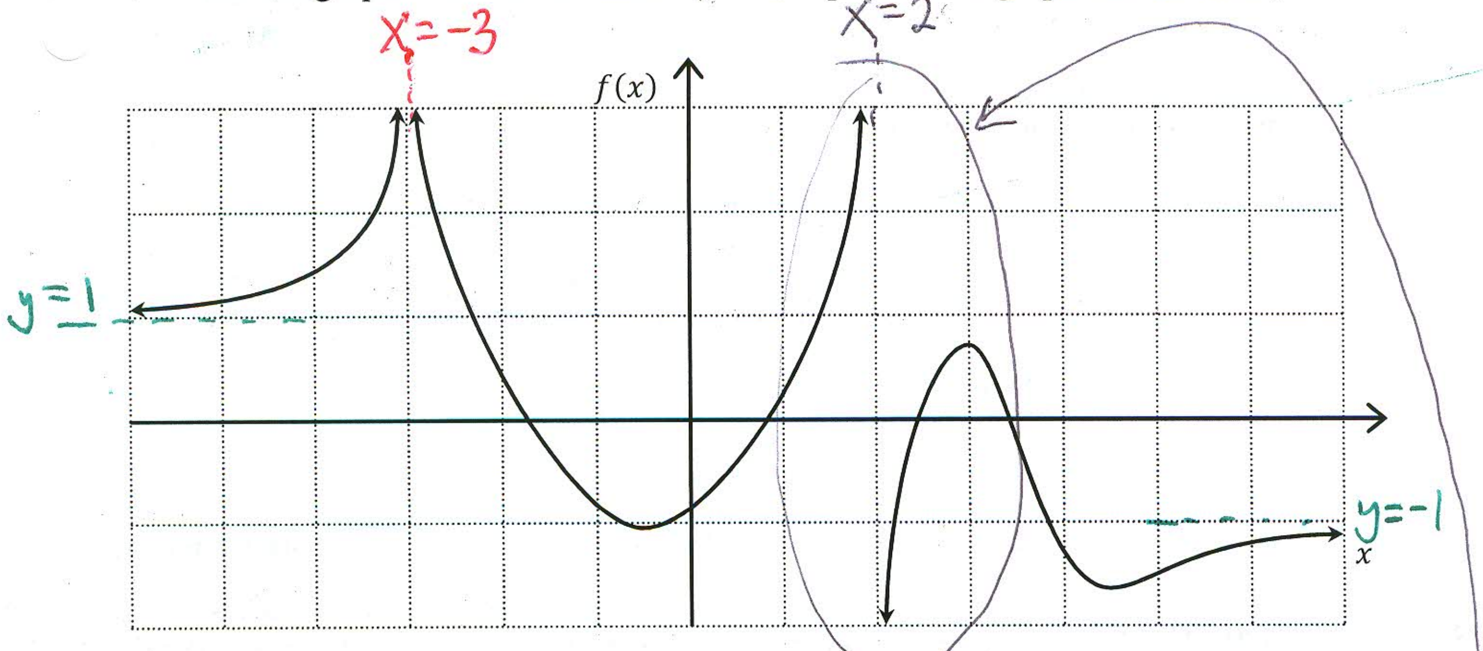


~~Do~~ Now Do Class Drill 2

Class Drill 2: Limits Involving Infinity

③

Use the graph to fill in the table. (Extra copies of the graph are on back.)



$(A)\ \lim_{x\to-\infty} f(x) =$ 1 because horiz asymptote ~~on~~ on left at $y=1$.

$(B)\ \lim_{x\to-3} f(x) = \infty$ because symmetric vertical asymptote going up at $x=-3$

$(C)\ \lim_{x\to2^-} f(x) = \infty$

$(D)\ \lim_{x\to2^+} f(x) = -\infty$

$(E)\ \lim_{x\to2} f(x) =$ DNE

asymmetric vertical asymptote at $x=2$ (up on left, down on right.)

$(F)\ \lim_{x\to\infty} f(x) = -1$ because horiz asymptote on right at $y=-1$

Now take an Analytic approach to limits involving infinity.

Start by considering limits at infinity

That is, $\lim\limits_{x \to \infty} f(x)$ or $\lim\limits_{x \to -\infty} f(x)$

where $f(x)$ is described by a formula.

We will be interested in these three functions

$$f(x) = \frac{9x^2 - 90x + 189}{2x^2 - 24x + 70}$$

$$g(x) = \frac{9x^2 - 90x + 189}{2x^3 - 24x^2 + 70x}$$

$$h(x) = \frac{9x^3 - 90x^2 + 189x}{2x^2 - 24x + 70}$$

Identify Leading Terms

find $\lim_{x\to\infty} f(x) = \lim_{x\to\infty} \frac{9x^2 - 90x + 189}{2x^2 - 24x + 70}$

$= \lim_{x\to\infty} \frac{9x^2}{2x^2}$

the limit is the same as the limit with just the leading terms

$= \lim_{x\to\infty} \frac{9}{2}$

$= \frac{9}{2}$

This tells us that the graph of f will have a horizontal asymptote on right at $y = \frac{9}{2}$