SECTION 4.6: LIMITS AT INFINITY AND ASYMPTOTES (DAY 1)

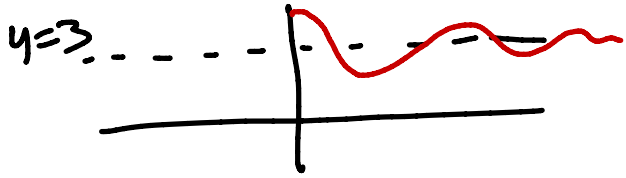
1. Limits at Infinity: In plain English, what should the symbols below mean?

$\lim_{x\to\infty} f(x) = L$ as x-values get bigger + bigger, y-values get closer to y-value L

$\lim_{x\to\infty} f(x) = L$ as x-values get smaller + smaller, y-values get closer to y-value L

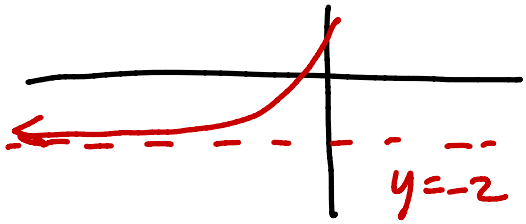
2. Using the calculating tool of your choice, determine the limits below or determine that the limit does not exist.

(a) $\lim_{x\to\infty} \dfrac{3x+\sin(x)}{x} = 3$



x	100	1000	1,000,000
$\frac{3x+\sin(x)}{x}$	2.9949	3.000827	2.9999997...

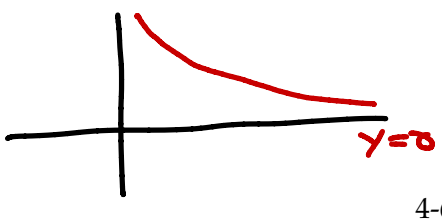
(b) $\lim_{x\to-\infty} \dfrac{2x+1}{\sqrt{x^2+1}} = -2$



x	-100	-1000	-1,000,000
$\frac{2x+1}{\sqrt{x^2+1}}$	-1.989900	-1.998999	-1.999999

(c) $\lim_{x\to\infty} \dfrac{1}{x} = 0$

x	10	100	1000	1,000,000
$\frac{1}{x}$	$\frac{1}{10}=0.1$	$\frac{1}{100}=0.01$	$\frac{1}{1000}=0.001$	$\frac{1}{1000000}=0.000001$



Goals:

① What is the relationship between limits at infinity and graphs?

$\lim_{x\to\infty} f(x)=L$ $\Longleftrightarrow$ the graph of $f(x)$ has $y=L$ as a horizontal asymptote

(Same for $\lim_{x\to-\infty} f(x)$!)

② What methods do we have to evaluate $\lim_{x\to\infty} f(x)$?

- Calculator/numerical (like page 1)
- Graphical (exploit ① above)
- Algebra + simple principles