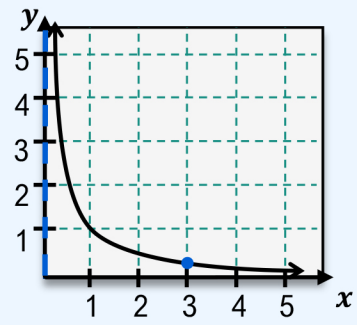
TOPIC: LIMITS AT INFINITY

Finding Limits at Infinity Numerically & Graphically

- Recall: A limit is the y-value a function goes to as x gets really close to a specific number.
  - You may be asked to take the limit of a function as x gets really *BIG* (approaches ____)

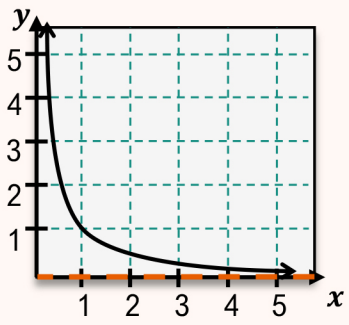
Recall — Limits at a Number



$$\lim_{x\to 3}\frac{1}{x}=\frac{1}{3}$$

$$\lim_{x\to 0}\frac{1}{x}=\text{DNE}\ (\infty)$$

New — Limits at Infinity



$$\lim_{x\to\infty}\frac{1}{x}=\_\_\_\_$$

EXAMPLE Find each limit using the specified method.

(A)

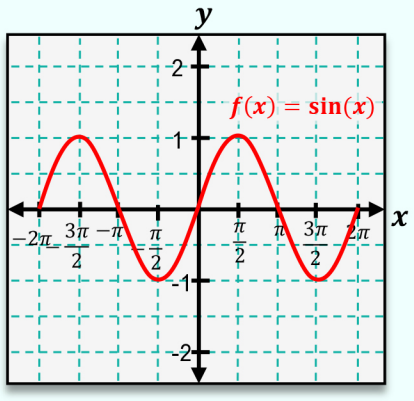
Find $\lim_{x\to\infty}\frac{5}{x}$ by creating a table of values.

x	1	10	100	1,000	10,000
$\frac{5}{x}$					

$$\lim_{x\to\infty}\frac{5}{x}=\_\_\_\_\_$$

(B)

Find $\lim_{x\to-\infty}\sin(x)$ using the graph below.



$$\lim_{x\to-\infty}\sin(x)=\_\_\_\_\_$$

TOPIC: LIMITS AT INFINITY

PRACTICE Evaluate the following limit: $\lim_{x\to\infty} -\frac{4}{x} + 2$.

PRACTICE Evaluate the following limit: $\lim_{x\to\infty} \tan(x) - 6$.

TOPIC: LIMITS AT INFINITY

Finding Limits at Infinity Algebraically

- To evaluate limits as $x \to \pm\infty$ of rational fcns, divide each term by the _____ power of x.
  - Shortcut: Compare the highest power of x (a.k.a degrees) in the _____ & _____.

Recall

$$\lim_{x\to\infty} \frac{1}{x} = 0$$

EXAMPLE Evaluate the limit.

Top Deg. < Bottom Deg.

(A)

$$\lim_{x\to\infty} \frac{3x^2 + 4x - 1}{x^3 + 27}$$

Top Degree: _____

Bottom Degree: _____

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

x	1	10	100	1,000
$f(x)$	0.214	0.330	0.030	0.003

Top Deg. > Bottom Deg.

(B)

$$\lim_{x\to\infty} \frac{7x^3 - x^4 + 11x}{6x^2 - 2}$$

Top Degree: _____

Bottom Degree: _____

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

x	1	10	100	1,000
$f(x)$	4.25	−4.83	−1,550	−165,500

Top Deg. = Bottom Deg.

(C)

$$\lim_{x\to-\infty} \frac{2x - 1}{5x + 1}$$

Top Degree: _____

Bottom Degree: _____

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

x	−1	−10	−100	−1,000
$f(x)$	0.750	0.429	0.403	$0.400 = \frac{2}{5}$

- This shortcut works the same whether you're dealing with $x \to \infty$ or $x \to -\infty$.

TOPIC: LIMITS AT INFINITY

PRACTICE Evaluate the following limit: $\lim_{x\to\infty} \frac{x+7}{8x-100}$.

TOPIC: LIMITS AT INFINITY

EXAMPLE Evaluate each limit.

$(\boldsymbol{A})$

$$\lim_{x\to-\infty}\frac{7x^2-100}{49x^2+27x+563}$$

$(\boldsymbol{B})$

$$\lim_{x\to-\infty}5x^2+3$$

$(\boldsymbol{C})$

$$\lim_{x\to\infty}\frac{10x^{10}-8x^6+30x^3}{23x^{10}-40x^2+9x-137}$$