Objective 1 - Limit Notation

Interpret the notation for limits.

Link to section in online textbook.

Intro video for limit notation

Our College Algebra textbook gives a light introduction to "arrow notation" when talking about limits. This is a great starting point to understand what exactly a limit is.

Symbol	**Meaning**
$x \to a^-$	x approaches a from the left
$x \to a^+$	x approaches a from the right
$x \to \infty$	x approaches infinity
$x \to -\infty$	x approaches negative infinity

This notation works for the output of a function as well! So if we say $f(x) \to \infty$, we mean that the output of the function approaches infinity. We've already seen this with end behavior of polynomials. For example, if we wanted to describe the end behavior of $f(x) = x^2$, we would say "$f(x) \to \infty$ as $x \to \infty$ and as $x \to -\infty$. The limit notation condenses this phrase.

Definition 1. $\lim_{x \to a}(f(x)) = L$ *means "as* $x \to a$*,* $f(x) \to L$*".*

Let's practice. Use this Desmos link to answer the following questions about $f(x) = \frac{1}{x}$.

Question 1 *As x approaches infinity, what happens to the y value of $\frac{1}{x}$?*

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

As x approaches negative infinity, what happens to the y value of $\frac{1}{x}$?

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

Looking at the graph, you are probably wondering what we would say about the limit as x approaches 0 of $f(x) = \frac{1}{x}$. We will deal with that in the next

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objective. For the rest of this objective, we'll practice interpreting the limit notation.

Question 2 *Translate the phrase "*$\dfrac{x+3}{x^2-9}$ *approaches* $-\dfrac{1}{6}$ *as* x *approaches* -3*" into limit notation.*

$$\lim_{\boxed{x}\to\boxed{-3}}\left(\boxed{\frac{x+3}{x^2-9}}\right)=\boxed{-\frac{1}{6}}$$

Question 3 *Translate the phrase "as* x *approaches infinity,* $-(x+2)^3(x-3)^2$ *approaches negative infinity" into limit notation.*

$$\lim_{\boxed{x}\to\boxed{+\infty}}\left(\boxed{-(x+2)^3(x-3)^2}\right)=\boxed{-\infty}$$

Question 4 *Translate the phrase "as* x *approaches 3,* $\dfrac{1}{(x-3)^2}$ *approaches infinity" into limit notation.*

$$\lim_{\boxed{x}\to\boxed{3}}\left(\boxed{\frac{1}{(x-3)^2}}\right)=\boxed{+\infty}$$