

Lecture Outline (Introduction to Limits)

Monday, January 14

Theory: Limits

Definition: In general, we say that the **limit of the function** $f(x)$, as x goes to a , equals L if we can make the values of $f(x)$ arbitrarily close to L by taking x to be sufficiently close to a but not equal to a . In this case, we write:

$$\lim_{x \rightarrow a} f(x) = L.$$

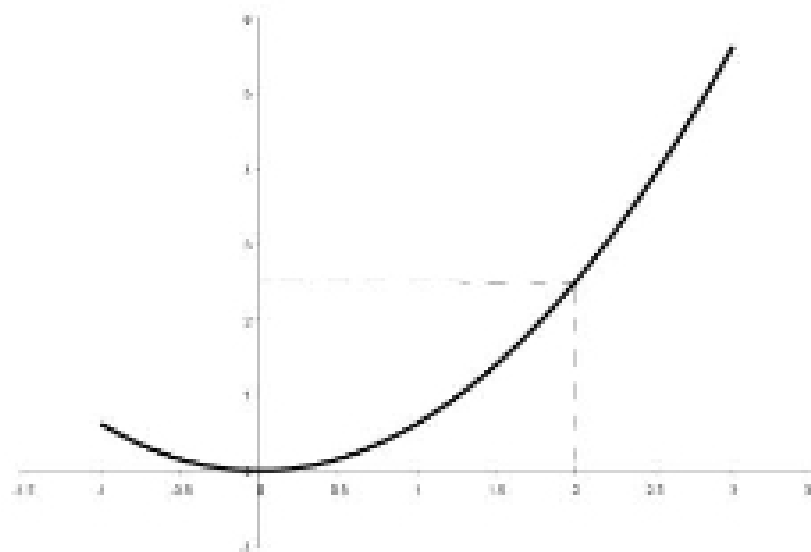
If no such L exists then $\lim_{x \rightarrow a} f(x)$ does not exist.

Intuitively, you can think of $\lim_{x \rightarrow a} f(x)$ as the quantity that outputs of $f(x)$ are approaching as inputs approach a .

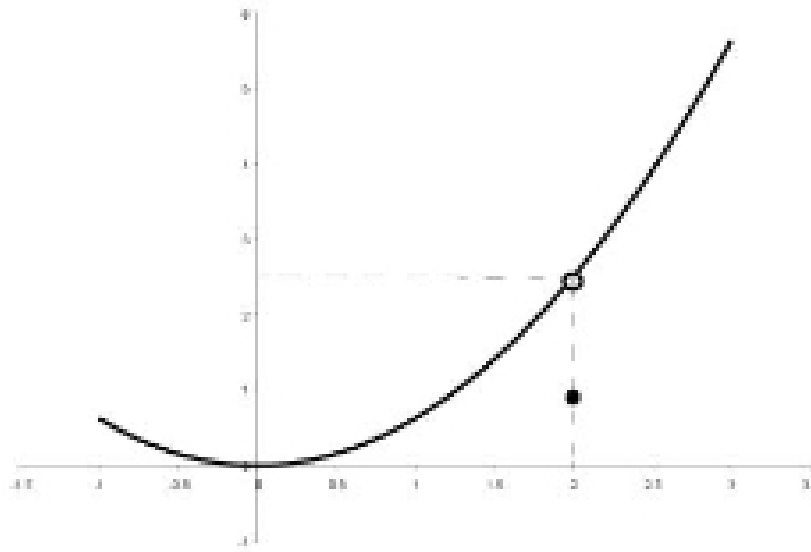
In other words, $\lim_{x \rightarrow a} f(x)$ is where it looks like the graph of $f(x)$ is heading as x approaches a .

Examples: Limits from Graphs

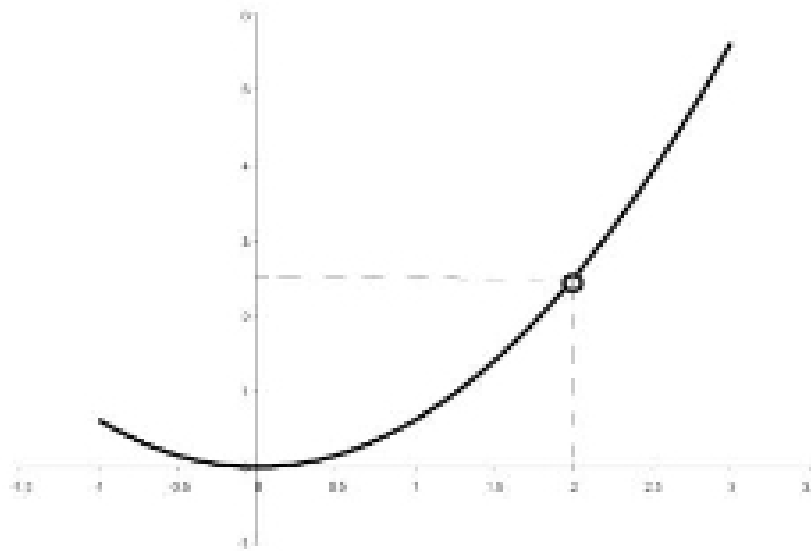
1. Consider the graph of $f(x)$ below. What is $\lim_{x \rightarrow 2} f(x)$?



2. Consider the following graph of $g(x)$. What is $\lim_{x \rightarrow 2} g(x)$?



3. Consider the following graph of $h(x)$. What is $\lim_{x \rightarrow 2} h(x)$?



Important lesson: the value of the limit $\lim_{x \rightarrow a} f(x)$ has nothing to do with the value $f(a)$.

What to Know/Memorize

The definition of the limit of a function $f(x)$ as $x \rightarrow a$.