

Calculus 12

1.2 - Finding Limits Graphically & Numerically



Sir Isaac Newton (left) and Gottfried Wilhelm von Leibniz (right)

Isaac Newton & Gottfried Leibniz

The founding fathers of Calculus....and awesome hair!!

What is a Limit?

We know that the *Instantaneous ROC* of $f(x)$ is given by the expression: $\lim_{\Delta x \rightarrow 0} \frac{f(x + \Delta x) - f(x)}{\Delta x}$

Let's look at a simpler example:

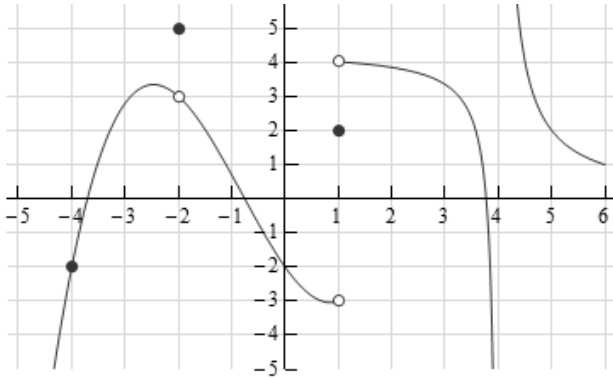
$$\text{Find } \lim_{x \rightarrow c} f(x)$$

$x \rightarrow c$ is made up of 2 parts: 1. $x \rightarrow c^-$

2. $x \rightarrow c^+$

To find the value of $\lim_{x \rightarrow c} f(x)$ we need to perform 3 steps:

Finding Limits Graphically



Given the graph of $f(x)$ on the left, determine:

a. $f(-4) =$

b. $f(-2) =$

c. $f(1) =$

d. $f(4) =$

e. $\lim_{x \rightarrow -4^-} f(x) =$

f. $\lim_{x \rightarrow -4^+} f(x) =$

g. $\lim_{x \rightarrow -4} f(x) =$

h. $\lim_{x \rightarrow -2^-} f(x) =$

i. $\lim_{x \rightarrow -2^+} f(x) =$

j. $\lim_{x \rightarrow -2} f(x) =$

k. $\lim_{x \rightarrow 1^-} f(x) =$

l. $\lim_{x \rightarrow 1^+} f(x) =$

m. $\lim_{x \rightarrow 1} f(x) =$

n. Find $\lim_{x \rightarrow 4} f(x)$

Finding Limits Numerically

I. Select arbitrary values for x that approach $x = 2$ from the left.

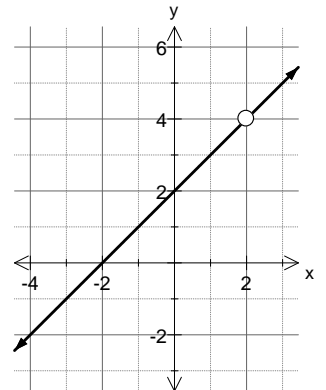
II. Select arbitrary values of x that approach $x = 2$ from the right.

III. Calculate $f(x)$ for each of the selected values for x .

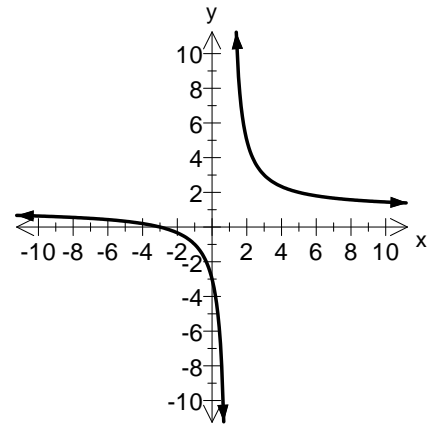
IV. Determine if the values of $f(x)$ from both sides are approaching the same value.

a. Find $\lim_{x \rightarrow 2} \frac{x^2 - 4}{x - 2}$

Note: $f(x) = \frac{x^2 - 4}{x - 2}$



b. Find $\lim_{x \rightarrow 1} \frac{x+3}{x-1}$



c. Find $\lim_{x \rightarrow 0} \sin\left(\frac{\pi}{x}\right)$

