Math 2413- Calculus I

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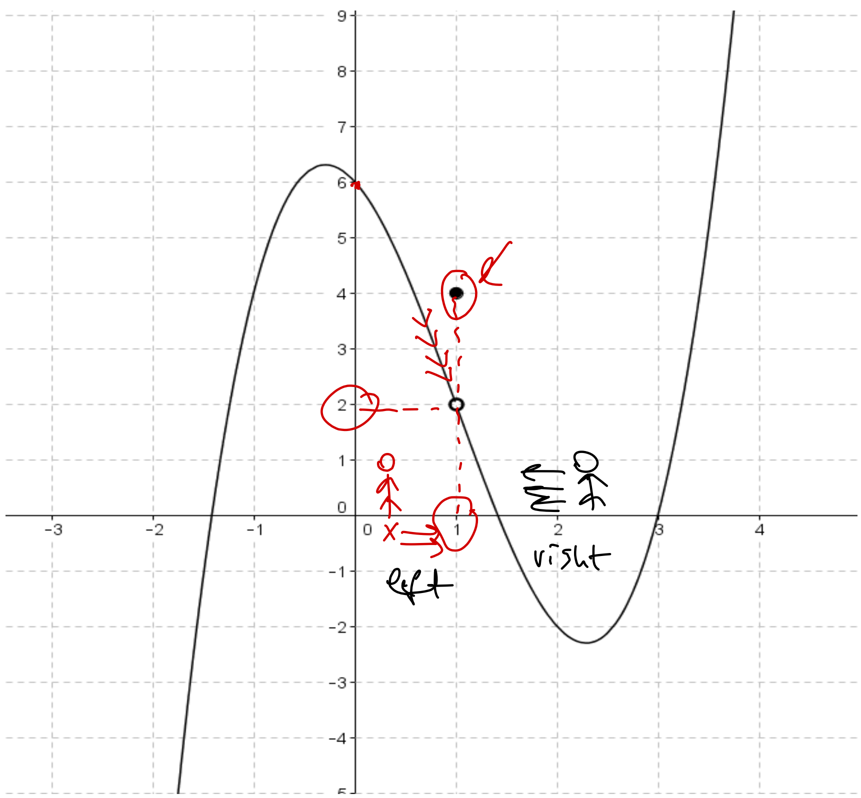
- Check CASA calendar for due dates.
- Bring “blank notes” to class. Completed notes will be posted after class.
- Do your best to attend every lecture and lab. This is a 4 credit course because of the lab component.
- Study after every lecture; work on the quiz covering the topic we cover on the lecture immediately afterwards. Retake your quizzes for more practice.
- Get help when you need help; bring your questions to the labs, or my office hours. We also have tutoring options on campus.
- Make sure you are a member of our team; check the discussion channel for announcements. You can post questions there. Make sure MS teams notifications are ON so that you are notifies when we make announcements there.
- When you email me, include course info in the subject line.

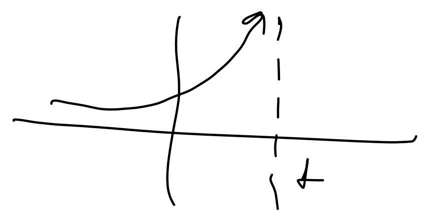
- Respect your friends in class; stay away from distractive behavior. Do your best to concentrate on the lecture.

Section 1.2 – An Intuitive Introduction to Limits

Suppose that a function f has the following graph.



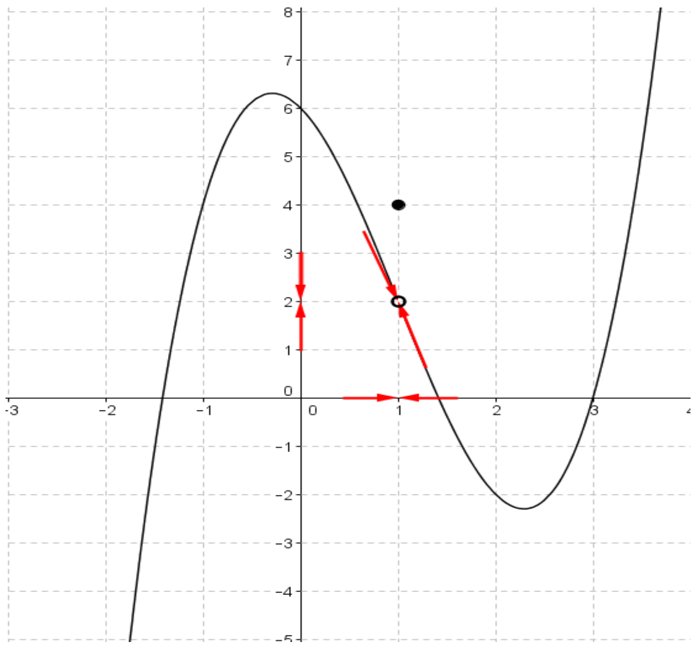
$f(1) = 4$



We want to describe the behavior of f when x is very close to 1.

- As x approaches 1 **from the left** (that is, x is very close to 1 but $x<1$), what function value do we expect to get?
- As x approaches 1 **from the right** (that is, x is very close to 1 but $x>1$), what function value do we expect to get?
- As x approaches 1, what function value do we expect to get?

The question is; as x approaches 1 (symbolized as: $x \to 1$), is there a **target number** that $f(x)$ is approaching?



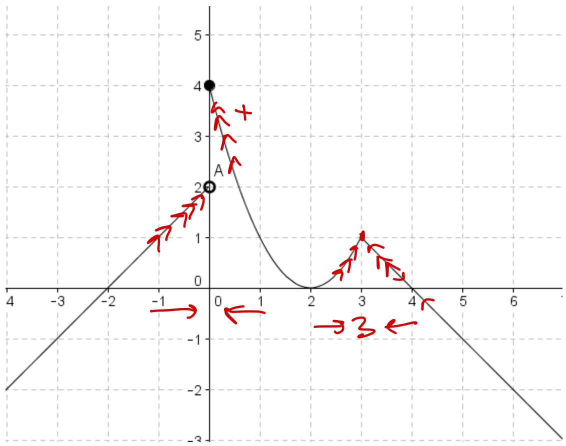
$$\lim_{x \to c} f(x)$$

We say that 2 is *the limit of* $f(x)$ *as* x *approaches* 1. This is written as:

Informal Definition: We say that the limit of $f(x)$ as x approaches c is the real number L, if the $y-$coordinates of the points $(x, f(x))$ are getting closer and closer to a certain target number L as x approaches c from each side of c. This is written as:

$$\lim_{x \to c} f(x) = L$$

Example:



$\lim_{x \to 3} f(x) = 1$

$\lim_{x \to 4} f(x) = 0$

$\lim_{x \to 0} f(x) =$ Does not exist

DNE

We can describe the behavior of $f(x)$ as x approaches 0 in terms of ***one-sided limits***.

Here, 2 is the limit of $f(x)$ as x *approaches 0 from the left* (or *from below*):

Notation: $\lim_{x \to 0^-} f(x) = 2$ $\quad x < 0$

And, 4 is the limit of $f(x)$ *as* x *approaches 0 from the right* (or *from above*):

Notation: $\lim_{x \to 0^+} f(x) = 4$ $\quad x > 0$

$x \to c^+$ means $x > c$

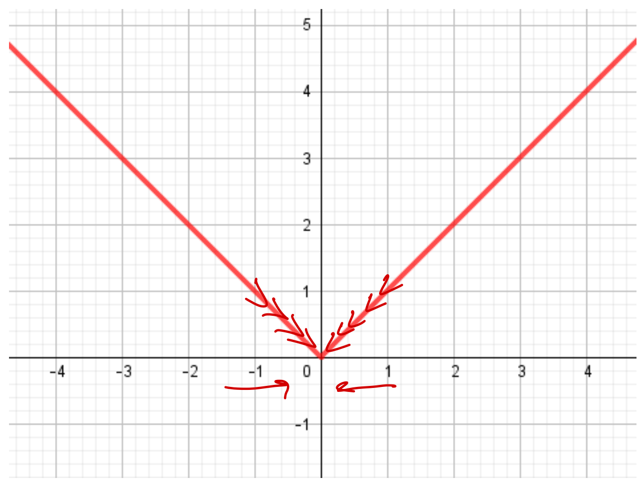
$x \to c^-$ means $x < c$

This example illustrates a very important fact about the existence of limit.

Fact: $\lim_{x \to c} f(x)$ exists if and only if $\lim_{x \to c^-} f(x)$ and $\lim_{x \to c^+} f(x)$ both exist and are equal.

Example: Here is the graph of $f(x) = |x|$. Note that this function is equivalent to:

$$|x| = \begin{cases} x, & \text{if } x \geq 0 \\ -x, & \text{if } x < 0 \end{cases}$$



$\lim_{x \to 0^+} f(x) =$ 0

$\lim_{x \to 0^-} f(x) =$ 0

Hence, $\lim_{x \to 0} f(x) =$ 0

Example: Another function you need to familiar with:

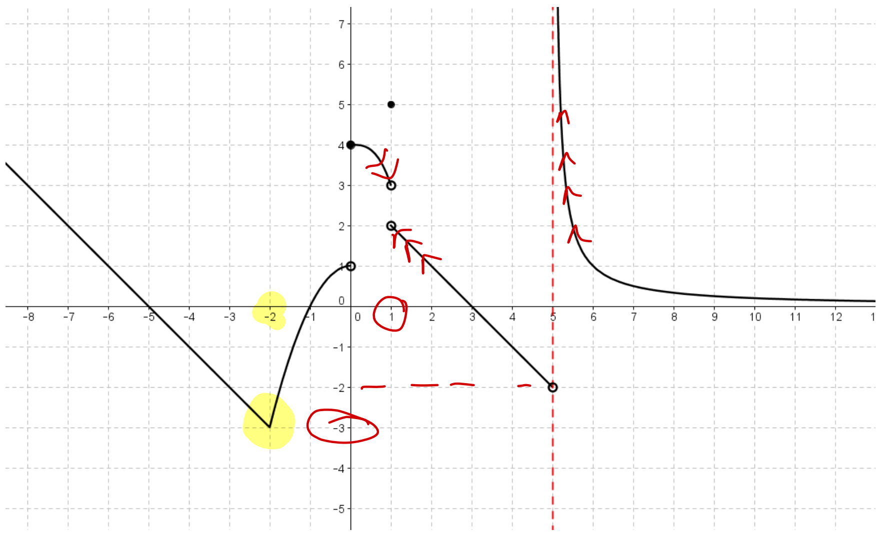
$f(x)=\frac{|x|}{x}$. This function can be written as: $\frac{|x|}{x}=\begin{cases}1, & \text{if } x>0\\ -1, & \text{if } x<0\end{cases}$

$\lim\limits_{x\to 0^+} f(x)=$ 1

$\lim\limits_{x\to 0^-} f(x)=$ -1

Hence, $\lim\limits_{x\to 0} f(x)$: DNE

Example: Given the graph of *f*, evaluate the following limits, if they do exist.



$\lim_{x\to -2} f(x) = -3$

$\lim_{x\to 0^+} f(x) = 4$

$\lim_{x\to 0^-} f(x) = 1$

$\lim_{x\to 0} f(x) =$ DNE

$\lim_{x\to 5^-} f(x) = -2$

$\lim_{x\to 5^+} f(x) =$ DNE

$\lim_{x\to 5} f(x) =$ DNE

$\lim_{x\to 1^+} f(x) = 2$

$f(1) = 5$

$\lim_{x\to 1^-} f(x) = 3$

$\lim_{x\to 1} f(x) =$ DNE

Homework: Read Sections 1.1 and 1.2 from your textbook.

Homework #1 is posted on CASA; due in LAB.

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