2012-2013 Spring Semester Math 1350

Day 1, Monday, January 14, 2013

Chapter 3

Section 3-1 Limits

The Definition of Limit

- Symbol: $\lim_{x \to c} f(x) = L$
- spoken: "The limit, as x approaches c, of $f(x)$ is L."
- less-abbreviated symbols: $f(x) \to L$ as $x \to c$
- spoken: "$f(x)$ approaches L as x approaches c."
- usage: x is a variable, f is a function
  c is a real number constant, L is a real number constant
- meaning: As x gets closer + closer to c, but not equal to c,
  the value of $f(x)$ gets closer + closer to L. (And may equal L.)
- graphical interpretation: The graph of $f(x)$ appears to be
  heading for the location $(x, y) = (c, L)$.

Today: Graphical Approach to Limits

Class Drill 1 Limits on page 8 of the course packet.

Start with the row where $x=1$

$f(1)$ DNE (does not exist) because there is no point on the graph at $x=1$. (There is a hole)

What about $\lim_{x \to 1} f(x) =$??

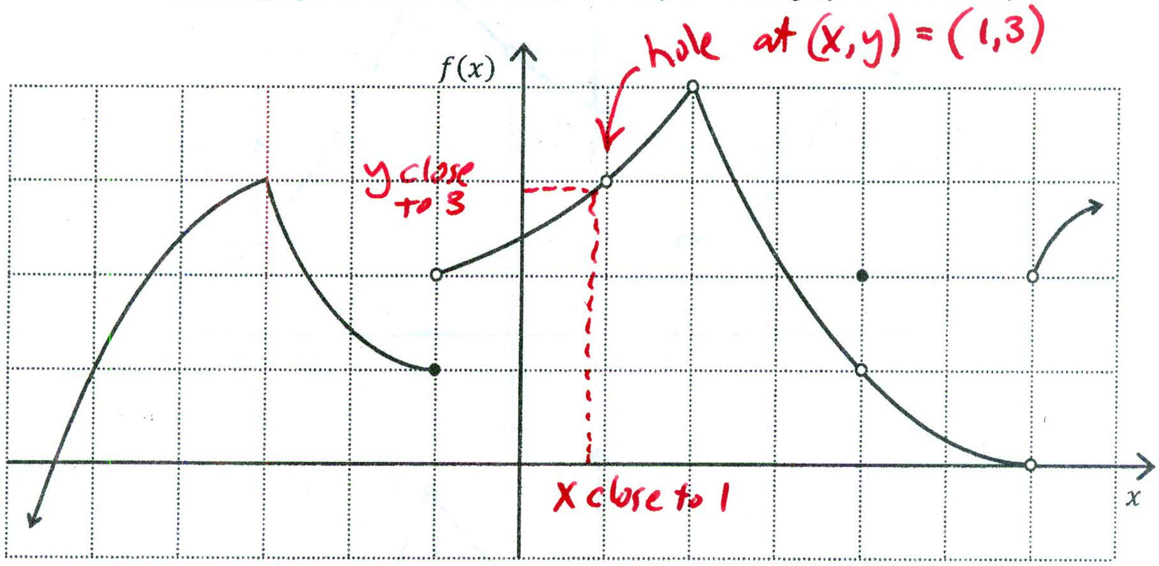
When x is close to 1 but not equal to 1, y gets close to 3.

In symbols, this gets abbreviated $\lim_{x \to 1} f(x) = 3$

In other words, the graph appears to be heading for the location $(x,y) = (1,3)$.

Class Drill 1: Limits

Use the graph to fill in the table. (Extra copies of the graph are on back.)



x-value	limit from left	limit from right	limit	y-value
-5	$\lim_{x\to -5^-} f(x) =$	$\lim_{x\to -5^+} f(x) =$	$\lim_{x\to -5} f(x) =$	$f(-5) =$
-3	$\lim_{x\to -3^-} f(x) =$	$\lim_{x\to -3^+} f(x) =$	$\lim_{x\to -3} f(x) =$	$f(-3) =$
-1	$\lim_{x\to -1^-} f(x) =$	$\lim_{x\to -1^+} f(x) =$	$\lim_{x\to -1} f(x) =$	$f(-1) = 1$
1	$\lim_{x\to 1^-} f(x) = 1$	$\lim_{x\to 1^+} f(x) =$	$\lim_{x\to 1} f(x) = 3$	$f(1) =$ DNE
2	$\lim_{x\to 2^-} f(x) =$	$\lim_{x\to 2^+} f(x) =$	$\lim_{x\to 2} f(x) =$	$f(2) =$
4	$\lim_{x\to 4^-} f(x) =$	$\lim_{x\to 4^+} f(x) =$	$\lim_{x\to 4} f(x) = 1$	$f(4) = 2$
6	$\lim_{x\to 6^-} f(x) =$	$\lim_{x\to 6^+} f(x) =$	$\lim_{x\to 6} f(x) =$	$f(6) =$

Now do the row of the table with $x = 4$

$f(4) = 2$ because there is a dot at $(x,y) = (4,2)$.

But when x is close to 4 <u>but</u> <u>not</u> equal to 4,
the y-values get closer + closer to 1.

That is the graph appears to be heading for the location $(x,y) = (4,1)$. (Hole at $(x,y) = (4,1)$)

In symbols, $\lim_{x \to 4} f(x) = 1$

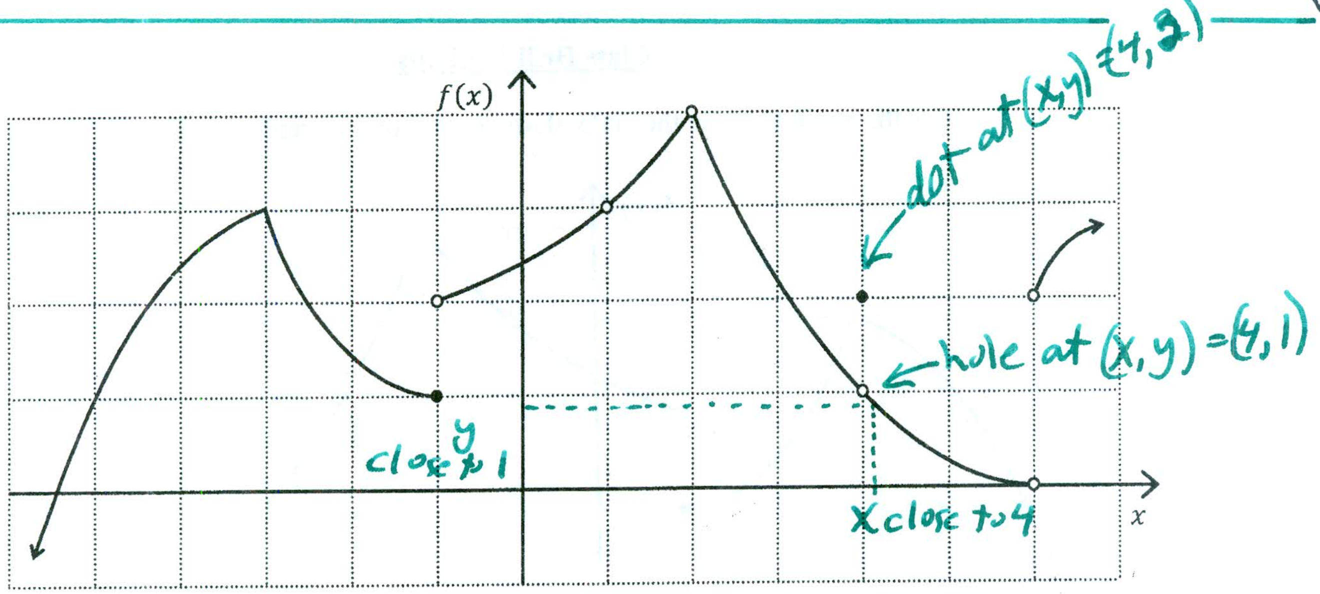
Now do the row with $x = -1$.

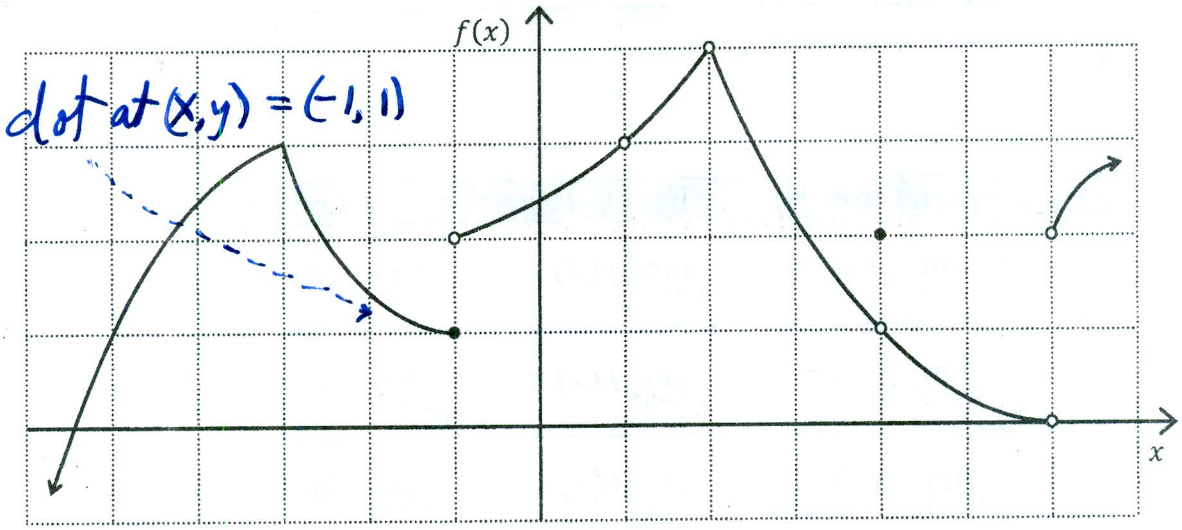
$f(-1) = 1$ because graph has dot at $(x,y) = (-1,1)$

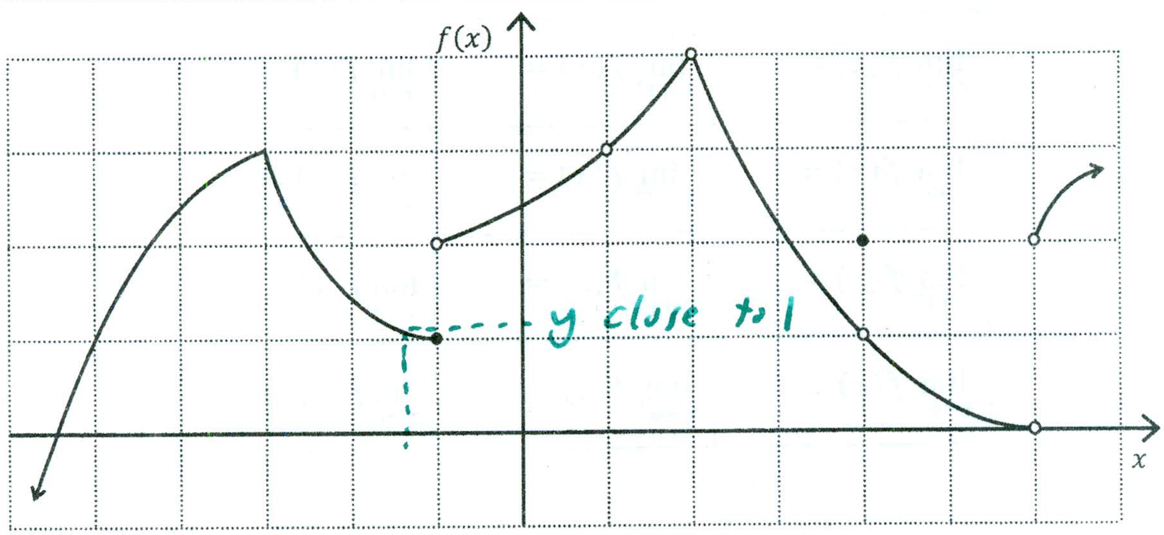
What about $\lim_{x \to -1}$?

When x is close to -1, but to left of -1, y values are close to $y = 1$.

This is ~~abbreviate~~ related to "one-sided limits"







X value close to −1
but to left of −1

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

That is, the "limit from the left" is the number 1.

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

minus sign denotes limit from the left.