Monday, August 27, 2012 (Day 1)

MATH 1350 Survey of Calculus

Things you can call me:

Mark ← my favorite
Mr. Barsamian
Dr. Barsamian
~~Bub~~

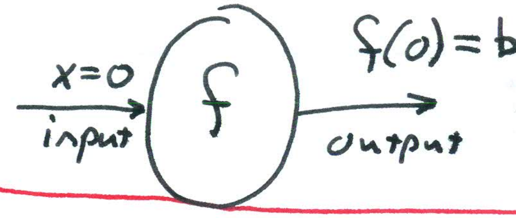
e-mail formalities

"Sender" should show your real name
Old fashioned greeting ("Hi Mark," etc)
Old fashioned closing ("–Bubba", etc)
Old fashioned writing (~~u~~ you)

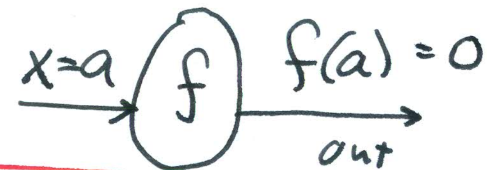
Chapter 3 Limits

See Reference 4 in Course Packet

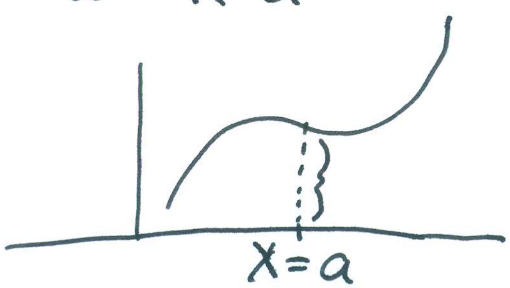
(1) graph has y intercept at (0, b) $\longleftrightarrow$ $f(0) = b$



(2) x-intercept at (a, 0) $\longleftrightarrow$ $f(a) = 0$



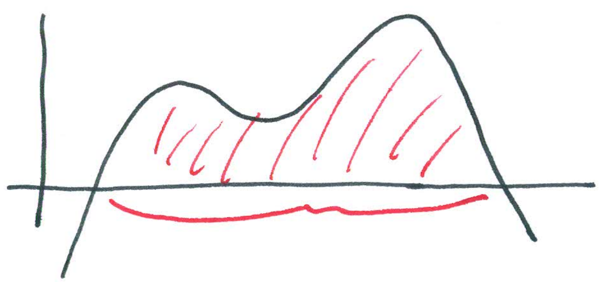
(3) height of graph at $x=a$ $\longleftrightarrow$ $f(a)$



(4) Does y-value on graph even exist at $x=a$? $\longleftrightarrow$ Does $f(a)$ exist?

(5) Region of graph that remains above the x-axis $\longleftrightarrow$ Interval of x-values such that

$$f(x) > 0$$



(6) yada yada yada $\longleftrightarrow$ $f(x) < 0$

(7) ⋮ (16) All of these have to do with <u>trends</u> in graph, not with behavior at individual x-values. We need calculus to describe these thing.

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 symbol: $f(x) \to L$ 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 actually equal L).

Work on Class Drill 1 Limits.

Consider row where $x = 1$.

As x gets closer & closer to 1 but not equal to 1, the y values get closer & close to 3.

abbreviation: "$\lim\limits_{x \to 1} f(x) = 3$"

We see that Reference 4 ~~R~~ row 7 should say

(7) ~~Rd~~ Hole in graph at $x = a$ $\longleftrightarrow$ $f(a)$ DNE but $\lim\limits_{x \to a} f(x)$ does exist.

Return to Class Drill I.

Now work on row where $x = 4$

Dot $(4,2)$ on graph $\longleftrightarrow$ $f(4) = 2$

As x approaches 4, but does not equal 4, $f(x)$ gets closer & closer to 1.

abbreviation: $\lim\limits_{x \to 4} f(x) = 1$.

Consider Row of table where $x = -1$

One sided limits.

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

x approaches -1 from left

causes y values closer & closer to 1.

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

X approaches -1 from the right

causes y values close + closer to 2

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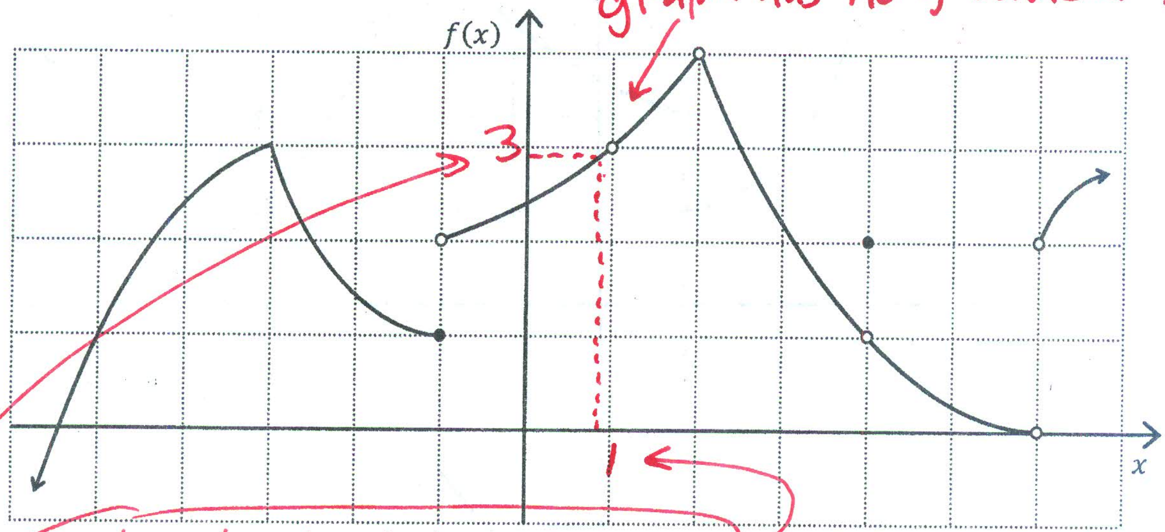
Class Drill 1: Limits

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

graph has no y-value at x=1



X values close to 1 but not equal to 1 cause y values close to 3

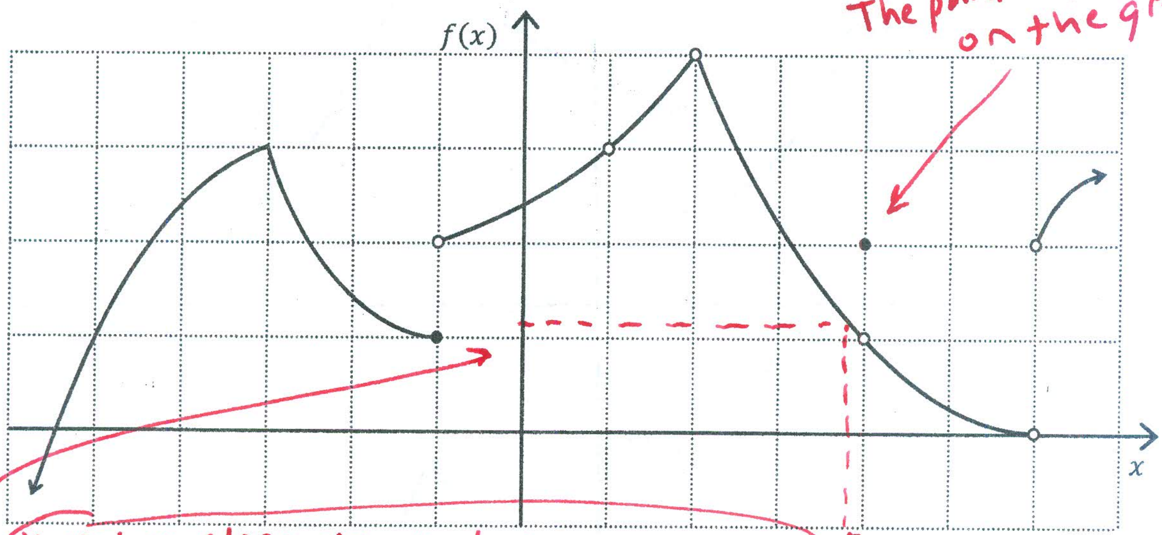
x-value	limit from left	limit from right	limit	y-value
-5	$\lim_{x\to-5^-} f(x) =$	$\lim_{x\to-5^+} f(x) =$	$\lim_{x\to-5} f(x) =$	$f(-5) =$
-3	$\lim_{x\to-3^-} f(x) =$	$\lim_{x\to-3^+} f(x) =$	$\lim_{x\to-3} f(x) =$	$f(-3) =$
-1	$\lim_{x\to-1^-} f(x) =$	$\lim_{x\to-1^+} f(x) =$	$\lim_{x\to-1} f(x) =$	$f(-1) =$
1	$\lim_{x\to1^-} f(x) =$	$\lim_{x\to1^+} f(x) =$	$\lim_{x\to1} f(x) = 3$	$f(1) =$ DNE
2	$\lim_{x\to2^-} f(x) =$	$\lim_{x\to2^+} f(x) =$	$\lim_{x\to2} f(x) =$	$f(2) =$
4	$\lim_{x\to4^-} f(x) =$	$\lim_{x\to4^+} f(x) =$	$\lim_{x\to4} f(x) =$	$f(4) =$
6	$\lim_{x\to6^-} f(x) =$	$\lim_{x\to6^+} f(x) =$	$\lim_{x\to6} f(x) =$	$f(6) =$

9 [redacted]

Class Drill 1: Limits

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

The point (4, 2) is on the graph



x values close to 4 but not equal to 4 cause y values close to 1

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	$\lim_{x\to 1^-} f(x) =$	$\lim_{x\to 1^+} f(x) =$	$\lim_{x\to 1} f(x) =$	$f(1) =$
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	$\lim_{x\to 6^-} f(x) =$	$\lim_{x\to 6^+} f(x) =$	$\lim_{x\to 6} f(x) =$	$f(6) =$

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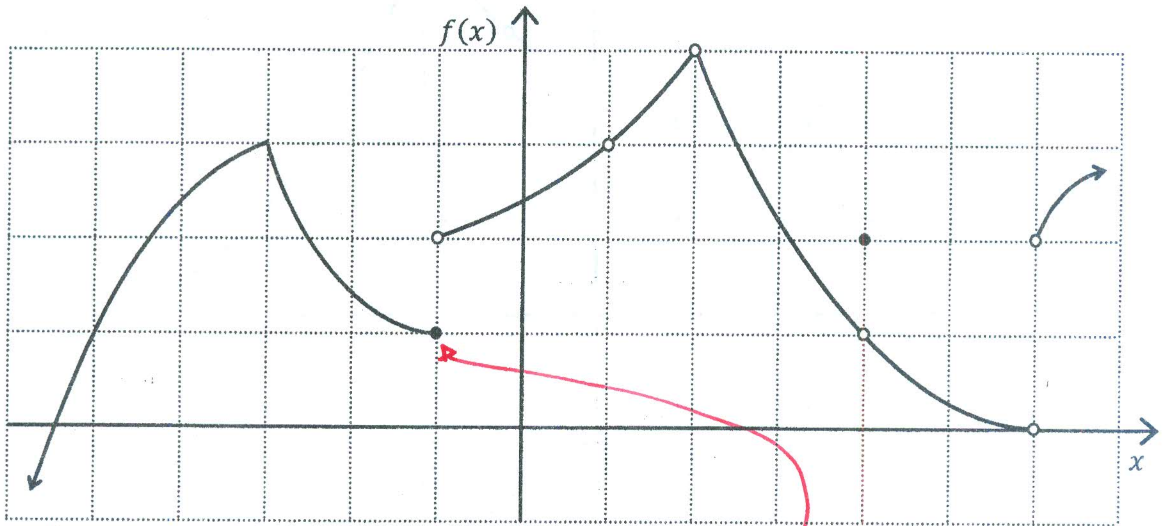
Class Drill 1: Limits

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



The point (−1,1) is on the graph

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	$\lim_{x\to1^-} f(x) =$	$\lim_{x\to1^+} f(x) =$	$\lim_{x\to1} f(x) =$	$f(1) =$
2	$\lim_{x\to2^-} f(x) =$	$\lim_{x\to2^+} f(x) =$	$\lim_{x\to2} f(x) =$	$f(2) =$
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6	$\lim_{x\to6^-} f(x) =$	$\lim_{x\to6^+} f(x) =$	$\lim_{x\to6} f(x) =$	$f(6) =$

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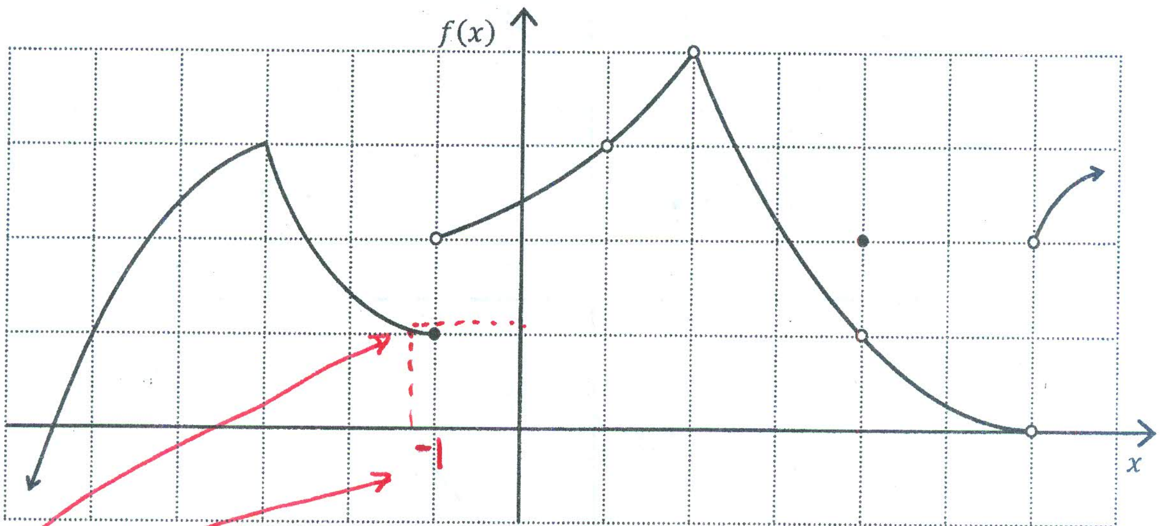
Class Drill 1: Limits

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	$\lim_{x\to-1^-} f(x) = 1$	$\lim_{x\to-1^+} f(x) =$	$\lim_{x\to-1} f(x) =$	$f(-1) =$
1	$\lim_{x\to1^-} f(x) =$	$\lim_{x\to1^+} f(x) =$	$\lim_{x\to1} f(x) =$	$f(1) =$
2	$\lim_{x\to2^-} f(x) =$	$\lim_{x\to2^+} f(x) =$	$\lim_{x\to2} f(x) =$	$f(2) =$
4	$\lim_{x\to4^-} f(x) =$	$\lim_{x\to4^+} f(x) =$	$\lim_{x\to4} f(x) =$	$f(4) =$
6	$\lim_{x\to6^-} f(x) =$	$\lim_{x\to6^+} f(x) =$	$\lim_{x\to6} f(x) =$	$f(6) =$

X values close to −1 but to the left of −1 cause y-values close to 1.

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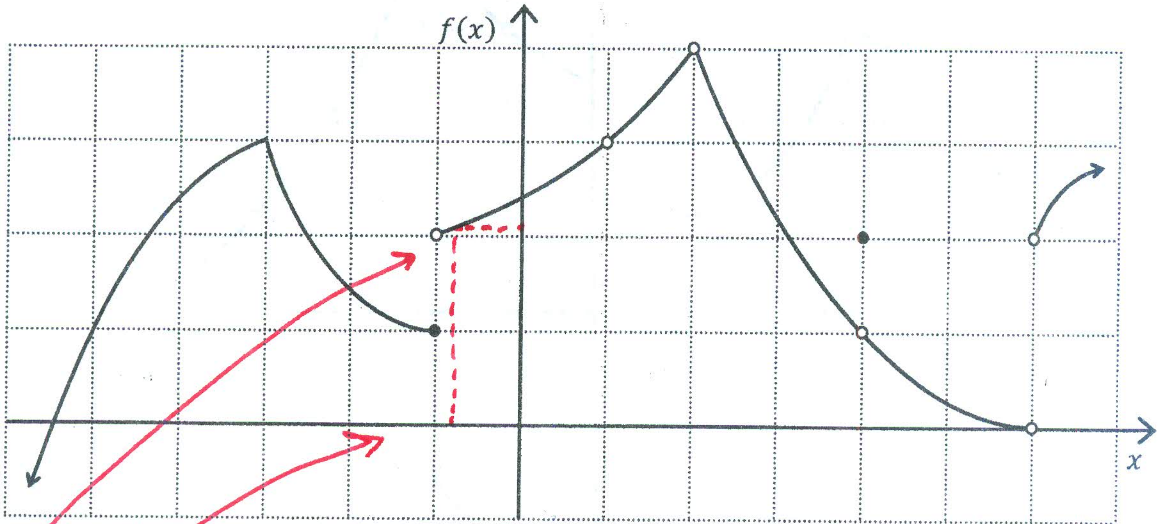
Class Drill 1: Limits

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	$\lim_{x\to-1^-} f(x) =$	$\lim_{x\to-1^+} f(x) = 2$	$\lim_{x\to-1} f(x) =$	$f(-1) =$
1	$\lim_{x\to1^-} f(x) =$	$\lim_{x\to1^+} f(x) =$	$\lim_{x\to1} f(x) =$	$f(1) =$
2	$\lim_{x\to2^-} f(x) =$	$\lim_{x\to2^+} f(x) =$	$\lim_{x\to2} f(x) =$	$f(2) =$
4	$\lim_{x\to4^-} f(x) =$	$\lim_{x\to4^+} f(x) =$	$\lim_{x\to4} f(x) =$	$f(4) =$
6	$\lim_{x\to6^-} f(x) =$	$\lim_{x\to6^+} f(x) =$	$\lim_{x\to6} f(x) =$	$f(6) =$

x-values close to -1 but to the right of -1 cause y-values close to 2.

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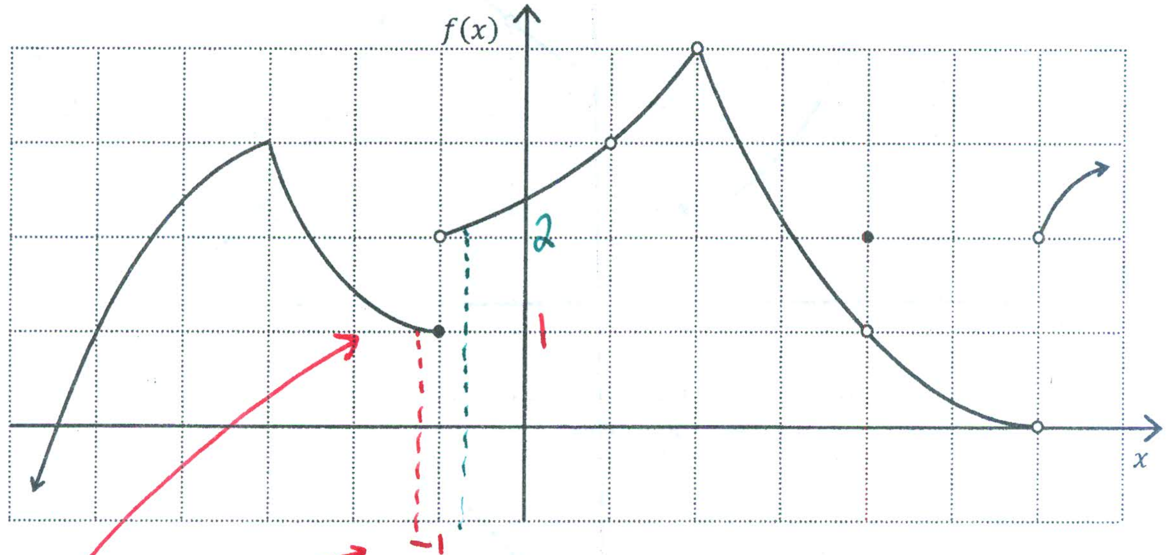
Class Drill 1: Limits

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	$\lim_{x\to -1^-} f(x) =$	$\lim_{x\to -1^+} f(x) =$	$\lim_{x\to -1} f(x) =$ DNE	$f(-1) =$
1	$\lim_{x\to 1^-} f(x) =$	$\lim_{x\to 1^+} f(x) =$	$\lim_{x\to 1} f(x) =$	$f(1) =$
2	$\lim_{x\to 2^-} f(x) =$	$\lim_{x\to 2^+} f(x) =$	$\lim_{x\to 2} f(x) =$	$f(2) =$
4	$\lim_{x\to 4^-} f(x) =$	$\lim_{x\to 4^+} f(x) =$	$\lim_{x\to 4} f(x) =$	$f(4) =$
6	$\lim_{x\to 6^-} f(x) =$	$\lim_{x\to 6^+} f(x) =$	$\lim_{x\to 6} f(x) =$	$f(6) =$

as x approaches -1 but is not equal to -1, there does not exist a single number that the y-values are getting closer + closer to.