Name: ______________________________ Period: ______

LESSON 1.1: *Limits & Continuity*

WARM UP

1. Given $f(x) = \frac{x^2-2}{x+3}$:

   a. $f(-1) =$ b. $f(2) =$ c. $f(-3) =$

WHAT *is a* LIMIT?

We take the limit of a ____________________ to determine the behavior of that function as x approaches some value.

Formally, $\lim_{x \to c} f(x) = L$ means:

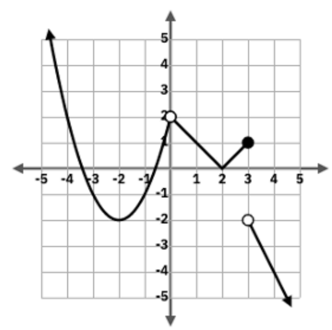
Example: Using $f(x) = \frac{x^2-2}{x+3}$ from the warm-up find:

a. $\lim_{x \to -1} f(x) =$ b. $\lim_{x \to 2} f(x) =$ c. $\lim_{x \to -3} f(x) =$

ONE-SIDED *limits*

Sometimes, a function has two different y-values as x approaches a specific value depending on which direction you are coming from.

For example, the graph of the function at right shows a piecewise function $f(x)$ such that when:



- As x approaches 3 from the left, $f(x)$ approaches:
- As x approaches 3 from the right, $f(x)$ approaches:

In limit notation we would write this as:

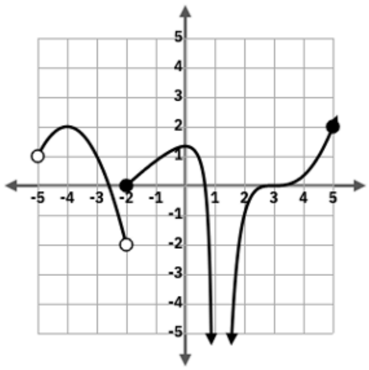
Therefore:

- $\lim_{x \to c^-} f(x)$ means:
- $\lim_{x \to c^+} f(x)$ means:

Note, if $\lim_{x \to c^-} f(x) \neq \lim_{x \to c^+} f(x)$, then $\lim_{x \to c} f(x)$ ______________________________ .

EVALUATING *limits* USING A GRAPH

Given the graph of the function $f(x)$ below, fill in the table.



Limits	Function Values	One-Sided Limits
1. $\lim_{x \to -5} f(x) =$	1. $f(-5) =$	1. $\lim_{x \to -2^-} f(x) =$
2. $\lim_{x \to -3} f(x) =$	2. $f(-3) =$	2. $\lim_{x \to -2^+} f(x) =$
3. $\lim_{x \to -2} f(x) =$	3. $f(-2) =$	3. $\lim_{x \to 1^+} f(x) =$
4. $\lim_{x \to 1} f(x) =$	4. $f(1) =$	4. $\lim_{x \to 1^-} f(x) =$
5. $\lim_{x \to 5} f(x) =$	5. $f(5) =$	

CONTINUITY *of* FUNCTIONS

Roughly, continuous means ___________________________ .

Informally, a function is _________________ where it can be drawn without lifting your pencil off of the paper.

Formally, a function is continuous where its ______________ and ________________________ are equivalent.

This means, if you are evaluating a limit at an x-value where the function is continuous you can use _________________________________ .

Examples: Evaluate the following limits.

1. $\lim_{x \to 3}(x - 5)$
2. $\lim_{x \to -1}(x^2 + 2x - 3)$
3. $\lim_{x \to 0} \frac{x-1}{x+2}$
4. $\lim_{x \to 2}(x^3 - 1)$

DISCONTINUITIES

There are three types of discontinuities we will be studying in this course.

______________________	______________________	______________________

REMOVABLE

vs

NONREMOVABLE

Discontinuities can be classified as either removable or nonremovable.

A discontinuity is removable if the _____________ exists at that x-value.

-

A discontinuity is non-removable if the _____________ of the function at that x value does not exist.

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Example: Using the graph below, identify all of the discontinuities. State the type of discontinuity and whether it is removable or nonremovable.