**MSLC Workshop Series
Math 1151 – Workshop 1
Limits and Continuity**

Warm-up 1: Let and let . Are *f* and *g* equivalent functions? Why or why not? Hint: Try factoring the numerator of .

Draw the graphs of  and .



**Limits:**

There is a technical definition, but for us, the intuitive definition will do just fine. Here it is:

The limit is the value the function “gets close to” if we make the *x* values “get close to” (but not equal to) *.* We write .

**Continuity:**

**Definition:** A function is continuous at if and only if .

This definition actually states three things:

 1.

 2.

 3.

**Limits Continuity:**



*Part 1: Limits and Continuity given by a Graph*

Let be given by the graph below. Use the graph to find the following.

1. a.  2. a. 

 b.  b. 

 c. Is  continuous at ? c. 

 d. d. Is  continuous at ?

3. a.  4. a. 

 b.  b. 

 c.  c. 

 d.  d. 

 e. Is  continuous at ? e. Is  continuous at ?

 f. f.

5. a. 

 b. 

 c. 

 d. 

 e. Is  continuous at ?

 f. 

 g. 

*Part 2: Limits and Continuity given by an Equation*

**Hints about finding Limits:**

* Plugging in nearby numbers will get you no credit unless the directions specifically say to do so.
* For any function which is CONTINUOUS, you can find the limit just by plugging in the number as long as the answer is defined.
	+ In particular we know the following functions and all their combinations are continuous wherever they are defined:

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* Ways you can combine continuous functions to get another continuous function:

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* What do you do if the function is undefined? Look at the form of the limit!

  

  

Limits Problems:

1. 
2. 
3. 
4. 
5. 
6. List the asymptotes of . Justify your answers by citing appropriate limits. Explain how you know there are no others.
7. 
8. 
9. 
10. 
11. 
12. 
13. 
14. 
15. 
16. 
17. List the asymptotes of . Justify your answers by citing appropriate limits. Explain how you know there are no others.
18. 
19. 
20. 
21. 
22. 

|  |  |  |
| --- | --- | --- |
|  | **Limits** | **Continuity** |
| **Conceptually** | Where is the function headed (y-value) as you get near a certain x-value? | Can you draw it without picking up your pencil?  |
| **Graphically** | No jumps or infinite squiggles,ignore the point itself | No holes, breaks, or infinite squiggles |
| **Algebraically** | 1. Limits from both sides have to agree
 | 1. Limits from both sides have to agree
2. The y-value of the point has to agree with the limit
 |
| **Math Notation**\* And fine print | 1.

\*f(x) is defined on an interval on both sides of a | 1.
2. is defined and
 |

**Comparison Chart of Limits vs. Continuity**

# Squeeze Theorem

Let . Evaluate the limit:

# Intermediate Value Theorem

If is a continuous function on the closed interval , and is any value between and , then there is a number in such that .

We will use the IVT to show that the equation

has a solution on the interval (1, 10).

1. IVT requires a single function, . What is your choice for ? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. **On which interval** do we need to show that is continuous? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Explain why is continuous on that interval.
4. Evaluate and .
5. IVT requires a number, . What is your choice for ?
6. Fill in the blanks appropriately (according to your answers above):
7. Based on your answers above, explain how to use IVT to determine that the equation has a solution in the interval (1, 10).