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Math 31A Lecture Notes: Limits

Introduction: Consider the function . When x is equivalent to 0, the f(x) is indeterminate because the function is equivalent to . However, as x approaches 0, f(x) reaches the value. To attain this value, we set a range of arbitrary numbers in which the limit exists. Hence, we achieve a value for f(x) even though the exact f(x) may or may not exist.

Definition; *Limit*: Assume that f(x) is defined in an open interval around some c (except for maybe c). We determine the limit of f(x) as x approaches c is equal to the number L. (the distance between f(x) and L) can be made arbitrarily small for all x sufficiently close to c. Hence, .

Example 1: f(x) = 5;

for all x => .

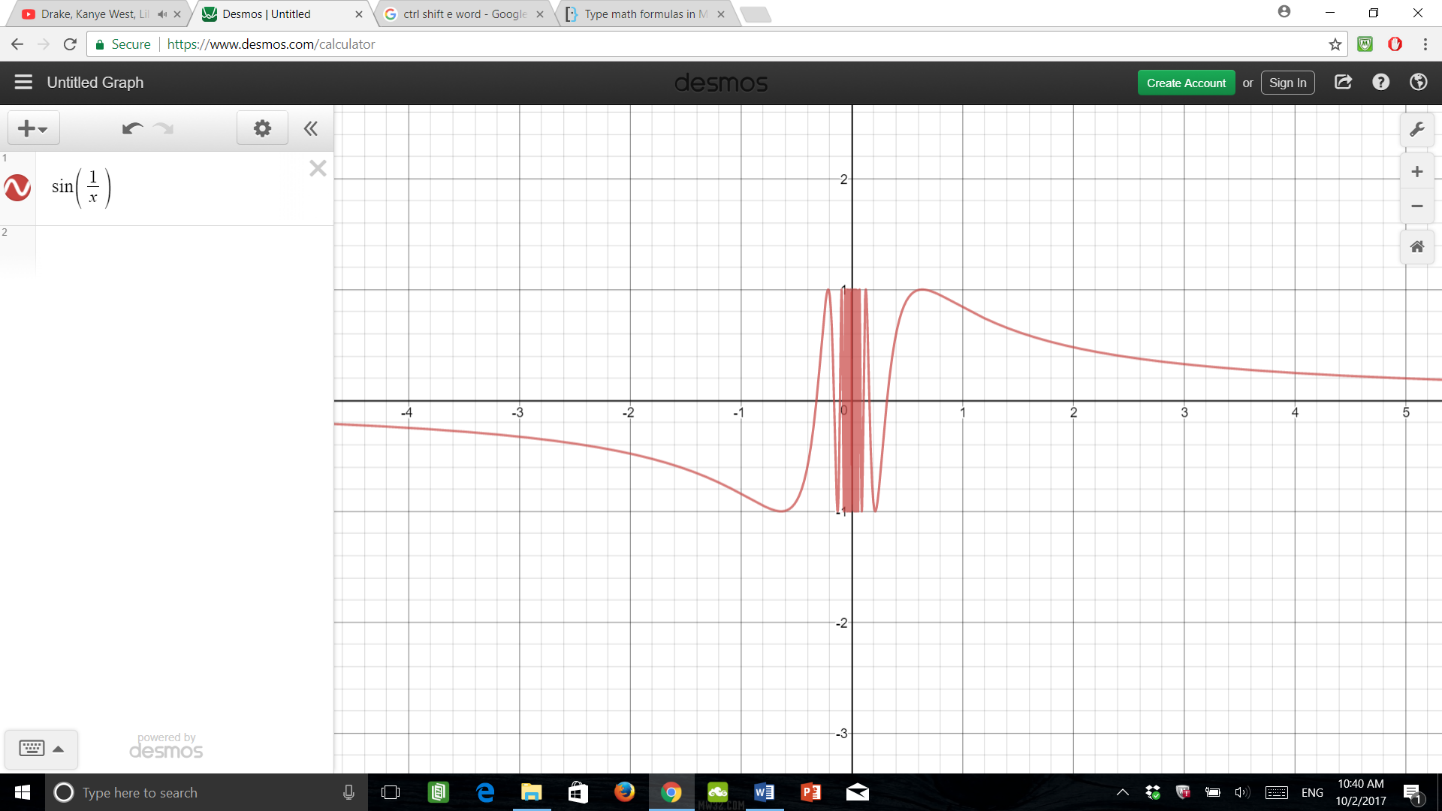
Example 2:

The distance can be made arbitrarily small for x sufficiently close to 4 so .

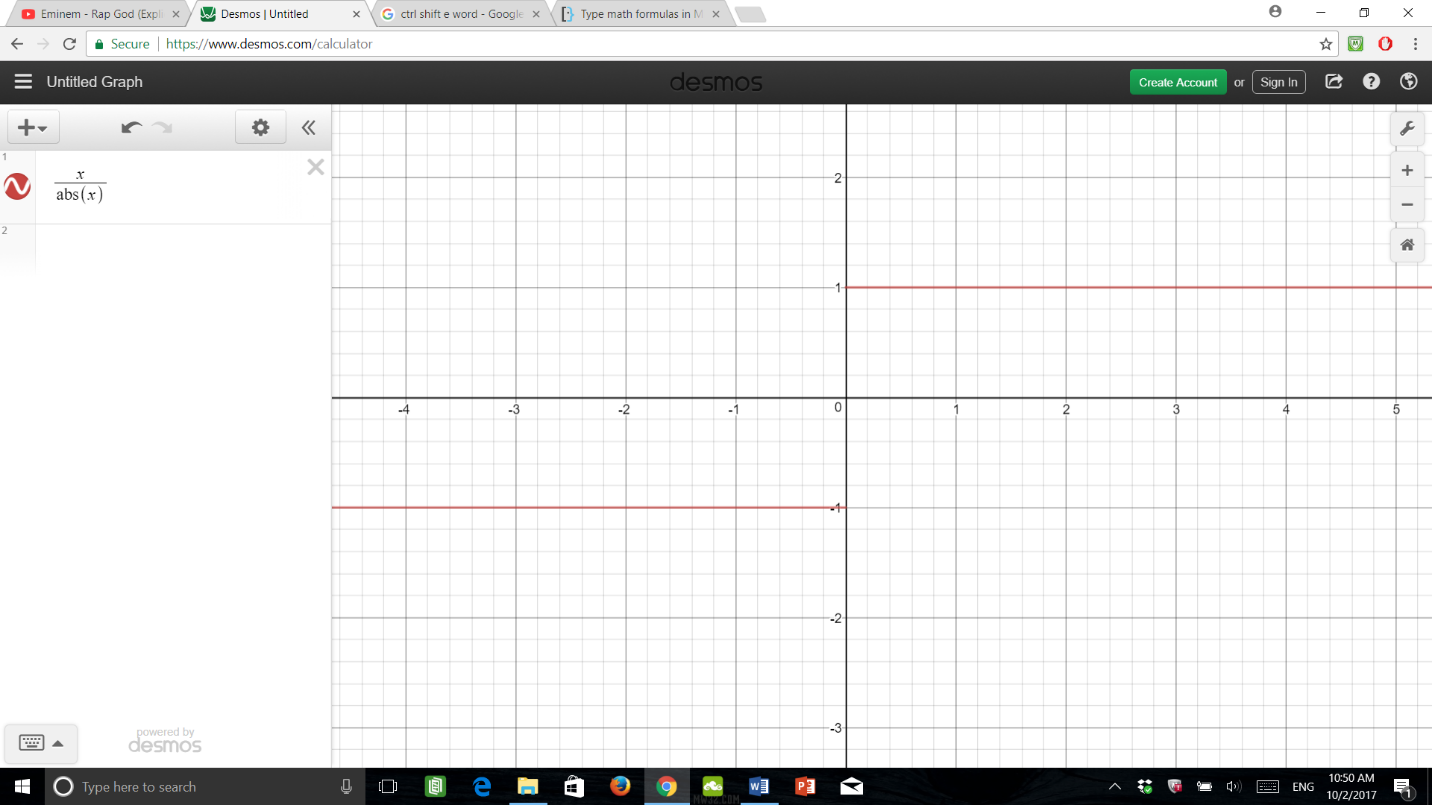
Theorem 1: Let c, k be some constant numbers.

AND

Example 3: Let

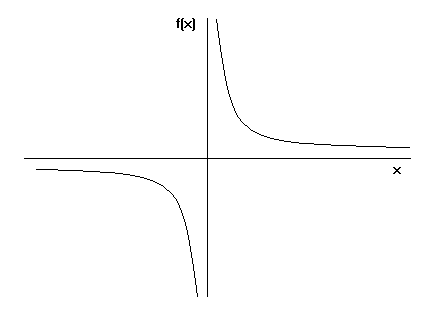
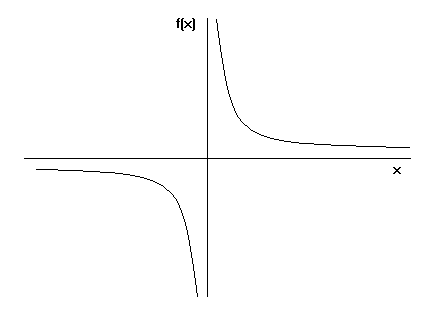
The limit of the f(x) does not exist because the value of the limit oscillates to the value of 1. For instance, lets determine the limit of f(x) as x approaches 0.. However, since the f(x) oscillates between -1 and 1 at x, the limit is more than 0.5. Hence, the limit does not exist.

Example 4: Let f(x) =

For this problem, two limits exist. However, the limit also doesn’t exist. As x approaches 0 from negative infinity, the limit is clearly -1. However, as x approaches 0 from positive infinity, the limit is clearly 1. Say we attempt to determine the limit of f(x) as x approaches 0 from both infinities, we arrive at the conclusion that a limit does not exist because there are different values for each side.

*One-Sided Limit*: Let () if f(x) approaches L for x smaller (bigger) than C.

Examples 6 and 7: Let f(x) = and g(x) =



Lim = ∞ Lim = -∞

Postulate:

Let if f(x) increases without bounds for x c.

Let if f(x) decreases without bounds for x c.

