## MAT201 Differential Calculus

Limits

## **VOCABULARY & NOTATION**

$$\lim_{x\to a} f(x) = L$$

is read: "the limit of the function f(x) as x approaches a is L."

x: domain values a: value along the x-axis

f(x): function L: value of limit; range value

A limit is an observation of a function's behavior around a point or out towards infinity.

The goal of determining functions is to find what the y-values of a function are approaching for the x-value in question.

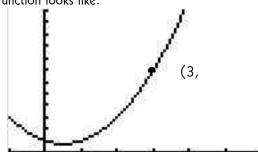
In other words, you are trying to find how the function is behaving.

Determine:

$$\lim_{x\to 3} x^2 - x + 1$$

(say this to yourself in English, substituting words for the symbols)

This function looks like:

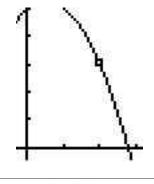


The question is asking us to determine what value the y-values are approaching as the x values substituted into the function approach 3.

A table may help us see this better.

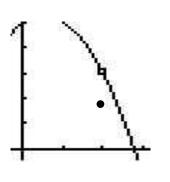
×	у	As x takes on values closer to 3, the
2.9	6.51	 y-values get closer to 7.
2.99	6.95	
2.99	6.99	Since in a limit, x never actually
3	7	 takes on the value it is
3.01	7.05	approaching (in this case 3), the
3.1	7.51	y-values are said to "approach 7."
3.2	8.04	

## Limits toward constants



 $\lim_{x\to 2} f(x) = 3$ Note that f(x) is undefined

when x is exactly 2 but there is a limit.

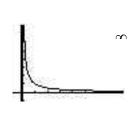


 $\lim_{x\to 2} f(x) = 3$ 

Note that f(x) is now defined. However, the limit is not the value of the

## Limits toward infinity

Limits can tell us how a function is behaving way out towards infinity.



X	У
1	1
10	.1
100	.01
100	.001
0	
$\downarrow$	$\rightarrow$
$\infty$	?

What is "?" in the table?