MATH 1 LECTURE 3 FRIDAY 09-16-16

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Contents

I. Reminders/Announcements

start 10:10am Bartlett 105

Remarks

- Quiz Monday
- Written HW#1 due Wednesday
- WebWork HW03 due Monday

II. Review Sequences

10:15am

Definition

define bounded sequence

Examples

- $a_n = 1/2^n$
- $b_n = (-1)^n/2^n$
- $c_n = -2^n$
- $d_n = \cos(2\pi/n)$

III. Average Rate of Change of a Function

10:20am

Examples

Dartmouth Coach

Location	Elapsed Time	Miles Traveled
Hanover	0 hours	0 miles
Lebanon	1/3 hours	5 miles
New London	5/6 hours	30 miles
South Station	17/6 hours	130 miles
Logan Airport	3 hours	134 miles

What is the average velocity that the bus was moving between New London and South Station?

What is the average velocity that the bus was moving between Hanover and Logan Airport?

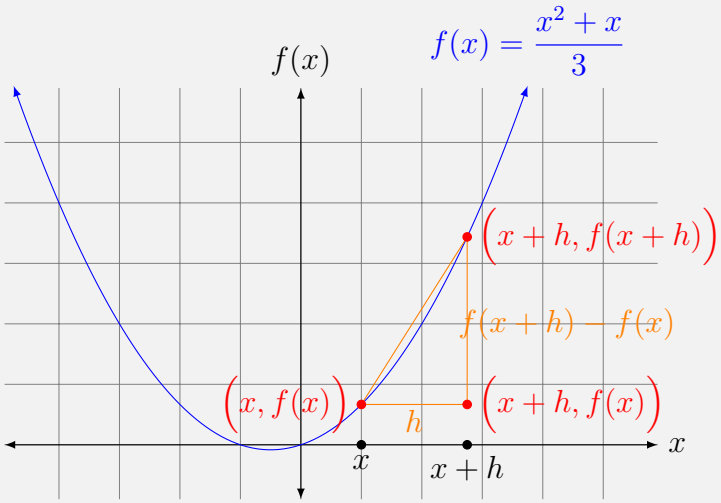
$$\text{average velocity} = \frac{\text{change in position}}{\text{change in time}}$$

Definition

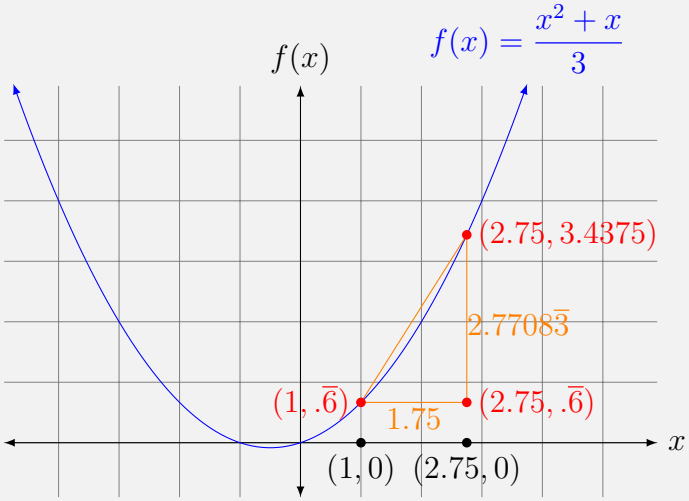
The average rate of change of a function f on the interval $[a, b]$ is

$$\frac{f(b) - f(a)}{b - a}.$$

Examples



$\dfrac{f(x+h) - f(x)}{h}$ is the slope of the orange line!



$\dfrac{2.7708\overline{3}}{1.75}$ is the slope of the orange line!

Exercises

Suppose that we have the function $f : \mathbb{R} \to \mathbb{R}$ defined by

$$f(x) = \frac{x^2 + x}{3}$$

Suppose h is a fixed real number. Please evaluate the following expressions.

(1)
$$f(x+h)$$
(2)
$$f(x+h)-f(x)$$
(3)
$$\frac{f(x+h)-f(x)}{h}$$

IV. Zoo of Functions

10:50am

IV.1. **Constant Functions.**

IV.2. **Linear Functions.**

IV.3. **Power Functions.**

IV.4. **Polynomial Functions.**

IV.5. **Rational Functions.**

IV.6. **Algebraic Functions.**

Definition

A function is algebraic if it can be obtained from polynomials by function operations or composing with a root function $x^{1/n}$ for some positive integer n.

Examples

$f(x) = \sqrt[5]{x-4} \cdot (x^2+5x+3)$.

IV.7. **Floor and Ceiling Functions.**

Examples

Compute floor and ceiling of $1.9, -1.9, 2.1, -2.1$

IV.8. **Trigonometric Functions.**

IV.9. **Exponential Functions.**

IV.10. **Logarithmic Functions.**

Examples

Give a few examples as time permits.

11:05am

V. Review Domains and Ranges of Functions

Examples

Function f	Domain of f
$f(x) = x$	$\mathbb{R}$
$f(x) = x^2$	$\mathbb{R}$
$f(x) = \dfrac{1}{x}$	$(-\infty, 0) \cup (0, \infty)$
$f(x) = \sqrt{x}$	$[0, \infty)$
$f(x) = x^2 - 8x + 7$	$\mathbb{R}$
$f(x) = \dfrac{1}{x^2 - 8x + 7}$	$(-\infty, 1) \cup (1, 7) \cup (7, \infty)$
$f(x) = \sqrt{x^2 - 8x + 7}$	$(-\infty, 1] \cup [7, \infty)$
$f(x) = \dfrac{1}{\sqrt{x^2 - 8x + 7}}$	$(-\infty, 1) \cup (7, \infty)$

Function f	Range of f
$f(x) = x$	$\mathbb{R}$
$f(x) = x^2$	$[0, \infty)$
$f(x) = \dfrac{1}{x}$	$(-\infty, 0) \cup (0, \infty)$
$f(x) = \sqrt{x}$	$[0, \infty)$
$f(x) = x^2 - 8x + 7$	$[-9, \infty)$

Exercises

- Find the domain of the funciton defined by $f(x) = \sqrt{3x + 1}$.
- Find the domain of the function defined by $f(x) = \sqrt{\dfrac{x^2}{x^2 - 2x}}$.

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end
11:15am