Section 2.4

Library of Functions

Math 1051 - Precalculus I
Find the average rate of change of 

\[ f(x) = x^2 + x + 1 \]

from \(-2\) to \(3\).
Find the average rate of change of

$$f(x) = x^2 + x + 1$$

from $-2$ to $3$.

Ans: 2
Today we will look at many different important functions and their properties.
Today we will look at many different important functions and their properties.

You should either memorize these graphs, or be able to reproduce them very quickly without too much thought on a test.
The Square Root Function

\[ f(x) = \sqrt{x} \]
The Square Root Function

$f(x) = \sqrt{x}$
Cube Root Function

\[ f(x) = \sqrt[3]{x} \]
Cube Root Function

\[ f(x) = \sqrt[3]{x} \]
Absolute Value Function

\[ f(x) = |x| \]
Absolute Value Function

\[ f(x) = |x| \]

Graph of the absolute value function showing the V-shape with a vertex at the origin.
Constant Function

\[ f(x) = b \]
Constant Function

\[ f(x) = b \]
Identity Function

\[ f(x) = x \]
Identity Function

\[ f(x) = x \]
Square Function

\[ f(x) = x^2 \]
Square Function

\[ f(x) = x^2 \]
Cube Function

\[ f(x) = x^3 \]
Cube Function

\[ f(x) = x^3 \]
The Reciprocal Function

\[ f(x) = \frac{1}{x} \]
The Reciprocal Function

\[ f(x) = \frac{1}{x} \]
Greatest Integer Function

\[ f(x) = \text{int}(x)^* = [x] \]

This is the greatest integer less than or equal to \( x \)
Greatest Integer Function

\[ f(x) = \text{int}(x)^* = \lfloor x \rfloor \]

This is the greatest integer \textit{less than or equal to} \( x \)
Greatest Integer Function

\[ f(x) = \lfloor x \rfloor \]

Sometimes this is called a step function because it looks like a set of steps.
Greatest Integer Function

\[ f(x) = \lfloor x \rfloor \]

Sometimes this is called a \textit{step function} because it looks like a set of steps.
Federal regulations say that on a cruise ship there must be at least one fire extinguisher for every 10,000 cubic feet of passenger space. Construct a mathematical model for this situation.
This is a function where its definition is different for different values of $x$:
This is a function where its definition is different for different values of \( x \):

\[
f(x) = \begin{cases} 
2x + 5 & \text{if } -3 \leq x < 0 \\
-x + 3 & \text{if } 1 < x < 3 \\
2 & \text{if } x > 4 
\end{cases}
\]
\[ f(x) = \begin{cases} 
2x + 5 & \text{if } -3 \leq x < 0 \\
-x + 3 & \text{if } 1 < x < 3 \\
2 & \text{if } x > 4 
\end{cases} \]
\[ f(x) = \begin{cases} 
  x^2 + 1 & \text{if } -3 \leq x \leq 10 \\
  -3 & \text{if } 0 < x < 4 \\
  x & \text{if } x > 4 
\end{cases} \]
The function $f(x)$ is defined as:

$$f(x) = \begin{cases} 
  x^2 + 1 & \text{if } -3 \leq x \leq 10 \\
  -3 & \text{if } 0 < x < 4 \\
  x & \text{if } x > 4
\end{cases}$$
Suppose we are given the following graph. How can we construct its function?
Piecewise functions in the real world!

A company charges, for each pound of freight:
- $0.50 per mile for the first 100 miles
- $0.40 per mile for the next 300 miles
- $0.25 per mile for the next 400 miles
- $0.10 per mile for every remaining mile
A company charges, for each pound of freight:

- $0.50 per mile for the first 100 miles
- $0.40 per mile for the next 300 miles
- $0.25 per mile for the next 400 miles
- $0.10 per mile for every remaining mile
\[ C(x) = \begin{cases} 
0.50x & \text{for } 0 \leq x \leq 100 \\
0.40x + 10 & \text{for } 100 < x \leq 400 \\
0.25x + 70 & \text{for } 400 < x \leq 800 \\
0.10x + 190 & \text{for } x > 800 
\end{cases} \]
How much does it cost to move a 100 pound replica of Michelangelo’s Pieta 105 miles?
Read section 2.5 for Monday