

GUIDED NOTES – 3.3 RATES OF CHANGE AND BEHAVIOR OF GRAPHS

LEARNING OBJECTIVES

In this section, you will:

- Find the average rate of change of a function.
- Use a graph to determine where a function is increasing, decreasing, or constant.
- Use a graph to locate local maxima and local minima.
- Use a graph to locate the absolute maximum and absolute minimum.

FINDING THE AVERAGE RATE OF CHANGE OF A FUNCTION

Study the box in your textbook section titled “rate of change.”

- The rate of change describes how an _____ changes relative to the change in the _____.
- Give the formula for finding the average rate of change of a function $f(x)$, from $x = x_1$ to $x = x_2$.
- Write out the 3-step process for calculating the average rate of change of a function for the interval between two values x_1 and x_2 , given the value of a function at different points.
 - 1.
 - 2.
 - 3.

Try It: Read Examples 1 and 3 in the text, then answer the following.

Using the data in **Table 1**, find the average rate of change between 2005 and 2010.

y	2005	2006	2007	2008	2009	2010	2011	2012
$C(y)$	2.31	2.62	2.84	3.30	2.41	2.84	3.58	3.68

Table 1

Try It: Read Example 2 in the text, then answer the following.

Given the function $g(t)$ shown in **Figure 1**, find the average rate of change on the interval $[1,3]$.

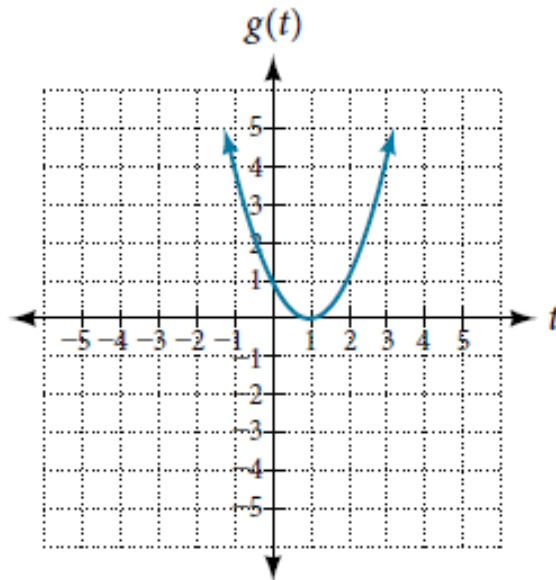


Figure 1

Try It: Read Example 4 in the text, then answer the following.

Find the average rate of change of $f(x) = x - 2\sqrt{x}$ on the interval $[1,9]$.

Try It: Read Examples 5 and 6 in the text, then answer the following.

Find the average rate of change of $f(x) = x^2 + 2x - 8$ on the interval $[5, a]$

in simplest form, in terms of a .

USING A GRAPH TO DETERMINE WHERE A FUNCTION IS INCREASING, DECREASING, OR CONSTANT

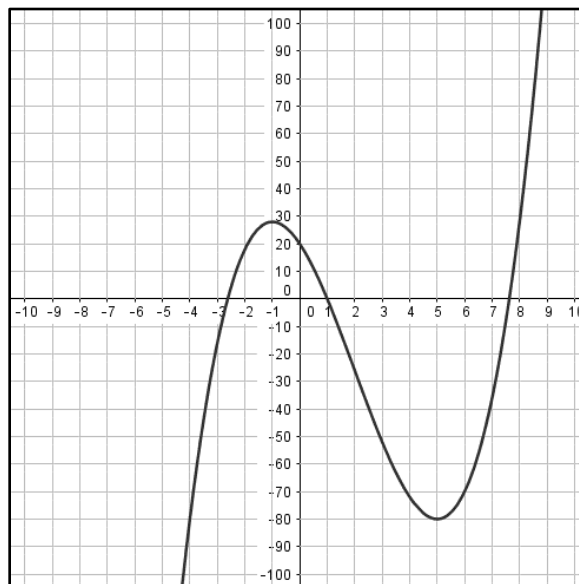
- While many functions are increasing (or decreasing) over their entire domain, many others are not. A value of the input where a function changes from increasing to decreasing (from left to right) as the input variable increases is called a _____. Similarly, a value of the input where a function changes from decreasing to increasing as the input variable increases is called a _____.
- If a function has more than one local maximum, we say it has a _____. Also, if a function has more than one local minimum, we say it has a _____. Together, the local maxima and minima are called _____.

Study the box in your textbook section titled “local minima and local maxima.”

- Given any two input values a and b in the given interval where $b > a$:
 - A function f is an **increasing function** on an open interval if _____.
 - A function f is a **decreasing function** on an open interval if _____.

Try It: Read Examples 7, 8, and 9 in the text, then answer the following.

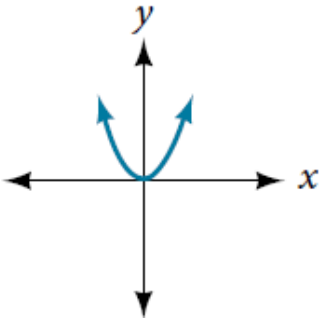
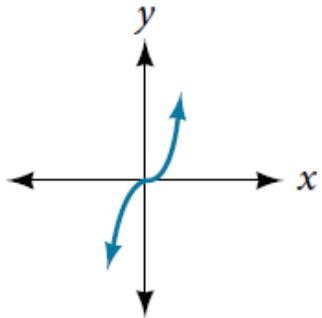
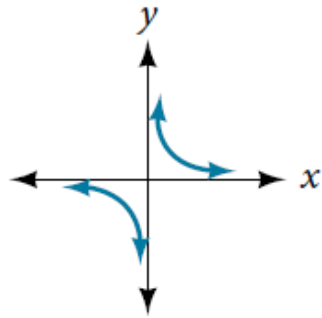
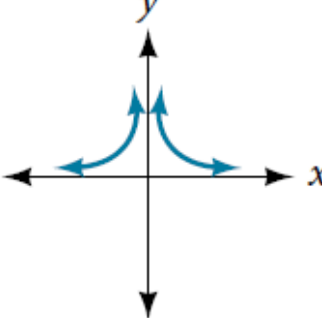
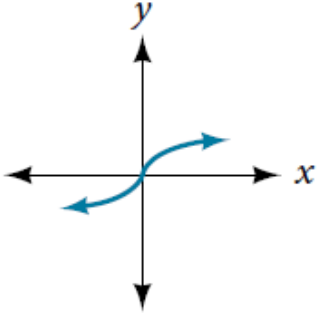
Use the graph of $f(x) = x^3 - 6x^2 - 15x + 20$, shown on the right, to estimate the local extrema of the function. Use these to determine the intervals on which the function is increasing or decreasing.



ANALYZING THE TOOLKIT FUNCTIONS FOR INCREASING OR DECREASING INTERVALS

Use **Figures 10, 11, and 12** in your textbook section to fill in the table.

Function	Increasing/Decreasing	Example
Constant Function <hr/>		
Identity Function <hr/>		

<p>Quadratic Function</p> <hr/>		
<p>Cubic Function</p> <hr/>		
<p>Reciprocal</p> <hr/>		
<p>Function</p>	<p>Increasing/Decreasing</p>	<p>Example</p>
<p>Reciprocal Squared</p> <hr/>		
<p>Cube Root</p> <hr/>		

<p style="text-align: center;">Square Root</p> <p style="text-align: center;">_____</p>		
<p style="text-align: center;">Absolute Value</p> <p style="text-align: center;">_____</p>		

USE A GRAPH TO LOCATE THE ABSOLUTE MAXIMUM AND ABSOLUTE MINIMUM

Study the box in your textbook section titled “absolute maxima and minima.”

- For all x in the domain of f :
 - The absolute maximum of f at $x = c$ is $f(c)$ where _____.
 - The absolute minimum of f at $x = d$ is $f(d)$ where _____.

Try It: Read Example 10 in the text, then answer the following.

For the function f shown below, find all absolute maxima and minima.

