Section 6.5
Graphing Trigonometric Functions

Goals:

- Learn transformations of trigonometric graphs
- Graph trigonometric functions by hand using function properties
- Learn about simple harmonic motion

Your instructor may or may not have you work on this goal; follow directions given in class:
- Model real data with trigonometric functions

Vocabulary to learn:
As you read this section in your textbook, write in a definition for each of these terms. It may also help you to draw a picture to illustrate some of the terms.
Make sure you understand the meaning of each word well enough to explain it clearly to someone else and to understand how to use it in an example or homework problem.

- Amplitude
- Period
- Phase shift
- Vertical shift
- Key points
- Harmonic motion
- Sinusoidal graph
- Frequency

Summary:
In this section you will learn how to transform the graph of a trigonometric function by changing its amplitude, changing its period, shifting it horizontally, and/or shifting it vertically. You will learn how these changes show up in the graph and in the symbolic representation (equation) of the function. You will learn how to write an equation to match a given graph, and you will also learn to sketch a graph by hand to match a given equation. You will explore some applications in which the sine or cosine function can be used to model harmonic motion. You may also use the regression algorithm on your graphing calculator to obtain sine function models of real life data.
**Formulas/Procedures:**

Transformations of the six trigonometric functions:

<table>
<thead>
<tr>
<th>Function</th>
<th>Vertical Asymptote Locations, ( n ) is an integer</th>
<th>Range</th>
<th>Amplitude</th>
<th>Period</th>
<th>Phase Shift</th>
<th>Vertical Shift</th>
<th>x-intercepts</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y = a \sin[b(x-c)] + d )</td>
<td>None</td>
<td>([-</td>
<td>a</td>
<td>+d,</td>
<td>a</td>
<td>+d])</td>
<td>(</td>
</tr>
<tr>
<td>( y = a \cos[b(x-c)] + d )</td>
<td>None</td>
<td>([-</td>
<td>a</td>
<td>+d,</td>
<td>a</td>
<td>+d])</td>
<td>(</td>
</tr>
<tr>
<td>( y = a \tan[b(x-c)] + d )</td>
<td>(x = \frac{\pi}{2} + \pi n)</td>
<td>All real numbers</td>
<td>None</td>
<td>(\frac{\pi}{</td>
<td>b</td>
<td>})</td>
<td>Left or right by (c)</td>
</tr>
<tr>
<td>( y = a \cot[b(x-c)] + d )</td>
<td>(x = \frac{\pi n}{</td>
<td>b</td>
<td>} + c)</td>
<td>All real numbers</td>
<td>None</td>
<td>(\frac{\pi}{</td>
<td>b</td>
</tr>
<tr>
<td>( y = a \csc[b(x-c)] + d )</td>
<td>(x = \frac{\pi n}{</td>
<td>b</td>
<td>} + c)</td>
<td>((-\infty,-</td>
<td>a</td>
<td>] \cup [</td>
<td>a</td>
</tr>
<tr>
<td>( y = a \sec[b(x-c)] + d )</td>
<td>(x = \frac{\pi}{2} + \pi n)</td>
<td>((-\infty,-</td>
<td>a</td>
<td>] \cup [</td>
<td>a</td>
<td>,\infty))</td>
<td>None</td>
</tr>
</tbody>
</table>

Notes:
If \(a\) is negative, the graph is reflected about the x-axis in comparison to the original graph.
If \(b\) is negative, the graph is reflected about the y-axis in comparison to the original graph.