Week 14
MTH-1320 – PreCalculus

Hello and Welcome to the weekly resources for MTH-1320 – PreCalculus!

This week is Week 14 of class, and typically in this week of the semester. your professors are covering these topics below. If you do not see the topics your particular section of class is learning this week, please take a look at other weekly resources listed on our website for additional topics throughout of the semester.

We also invite you to **look at the group tutoring chart on our website to see if this course has a group tutoring session offered this semester**.

If you have any questions about these study guides, group tutoring sessions, private 30 minute tutoring appointments, the Baylor Tutoring YouTube channel or any tutoring services we offer, please visit our website www.baylor.edu/tutoring or call our drop in center during open business hours. M-Th 9am-8pm on class days 254-710-4135.

Key Words: Trigonometric Functions, Right Triangle Trigonometry

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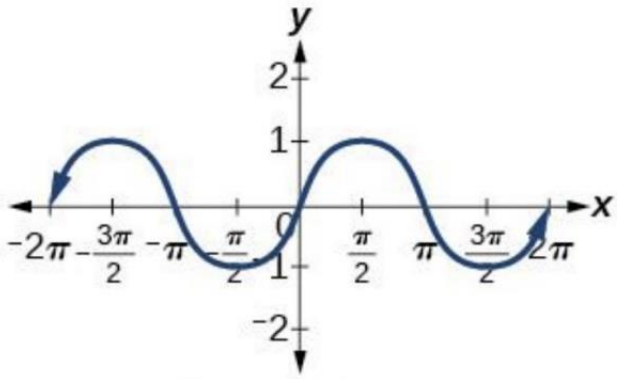
Topic of the Week: Graphs of Trig Functions

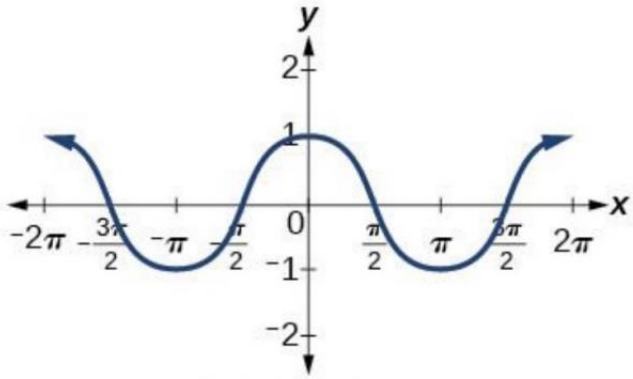
Before we look at how to graph trig functions, let's review some important lingo.
The horizontal shift P is called a period, and it is the "shortest interval in which a function completes one full cycle".
A periodic function (such as the trigonometric functions) are functions "for which a specific horizontal shift P, results in a function equal to the original function", meaning periodic functions repeat over and over. In other words

$$f(x + P) = f(x)$$

Highlight #1: First Look



f(x) = sin(x)



f(x) = cos(x)

Both sin and cos have a period of 2π

CHARACTERISTICS OF SINE AND COSINE FUNCTIONS

The sine and cosine functions have several distinct characteristics:

- They are periodic functions with a period of 2π.
- The domain of each function is $(-\infty, \infty)$ and the range is $[-1, 1]$.
- The graph of $y = \sin\ x$ is symmetric about the origin, because it is an odd function.
- The graph of $y = \cos\ x$ is symmetric about the y-axis, because it is an even function.

Highlight #2: Sinusoidal Functions

A function that can be described as a combination of transformations of the sine or cosine function is called a sinusoidal function or simply a sinusoid.

Sinusoids have the general form

y = A sin(Bx-C) + D or y = A cos(Bx -C) + D

Because cosine and sine are shifted versions of each other, the equation for a sinusoid can be written with cosine or sine.

You can check if two equations for a sinusoid are equivalent using the cofunction identities from section 5.4.

In addition to the period, which is 2 π /|B|, sinusoids have a few other notable characteristics:

- midline – the horizontal line through the middle of the graph, y = D
- amplitude – "the vertical height from the midline", |A| [1]
- phase shift – "the horizontal displacement of the basic sine or cosine function", C/B

To graph a sinusoid, follow these steps:

1. If necessary, write the function in the form y = A sin(Bx-C) + D or y = A cos(Bx -C) + D
2. Determine its amplitude, |A|
3. Determine its period, P = 2 π / |B|.
4. Graph the function y = A sin(Bx) or y = A cos(Bx)
5. Shift the graph of y = A sin(Bx) or y = A cos(Bx) left or right according to the phase shift, C/B.
6. Shift the graph from step 5 up or down according to the vertical shift, D.
7. If A is negative, reflect the graph across the ?-axis. (B is not usually negative, but a negative B value would cause a reflection across the ?-axis.)

To graph $y = A \sin(Bx)$ for step 4 above, follow these steps:

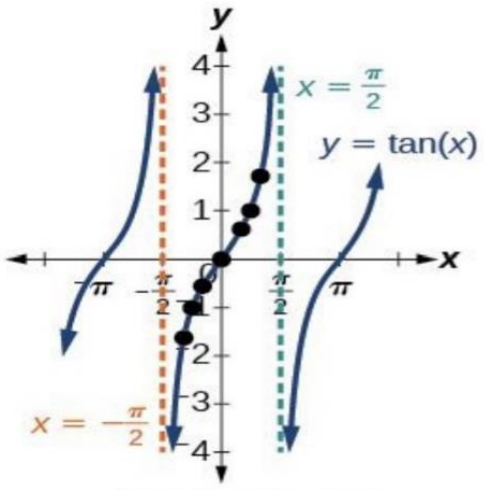
1. Plot a point at the origin.
2. Plot points on the x-axis at $x = \pm P/2, \pm P, \pm 3P/2, \pm 2P, \ldots$
3. Plot points with the y-value $\pm A$ at $x = \pm P/4, \pm 3P/4, \pm 5P/4, \pm 7P/4, \ldots$ Start with A and alternate back and forth with $-A$. (If A is positive, you will get a peak first, and if A is negative, you will get a trough first.)
4. Draw a sinusoidal curve through the points.

To graph $y = A \cos(Bx)$ for step 4 above, follow these steps:

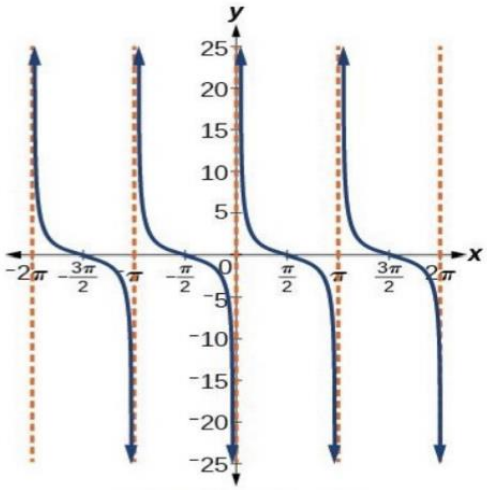
1. Plot a point $(0, A)$. (If A is positive, this will be a peak, and if A is negative, this will be a trough.)
2. Plot points with the y-value $\pm A$ at $x = \pm P/2, \pm P, \pm 3P/2, \pm 2P, \ldots$ Start with $-A$ and alternate back and forth with A.
3. Plot points on the x-axis at $x = \pm P/4, \pm 3P/4, \pm 5P/4, \pm 7P/4, \ldots$
4. Draw a sinusoidal curve through the points

Highlight #3: Graphs of other trig functions

Just like sine and cosine, the other trigonometric functions repeat. The graphs of tangent and cotangent are very similar because they are reciprocal functions.



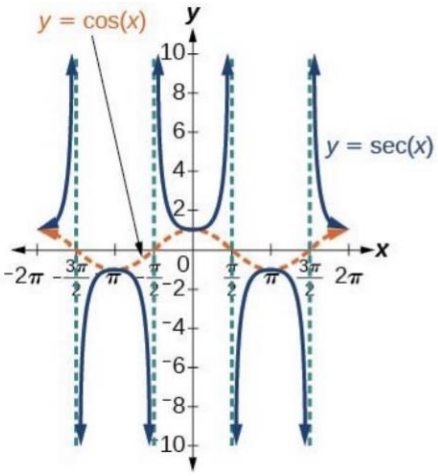
y = tan(x)

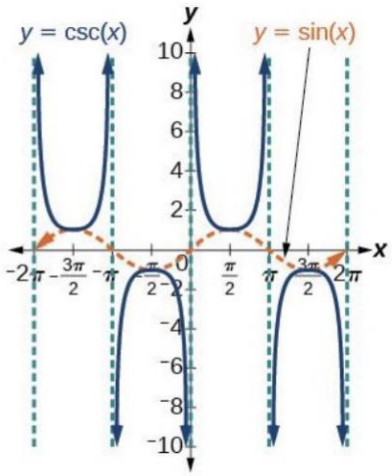


y = cot(x)

Note! The period of tangent and cotangent is π, and cotangent has asymptotes where tangent has zeros and vice versa. Also, the parent tangent function crosses through y = ±1 at x = ± π /4.

The graphs of secant and cosecant are also very similar because they are reciprocal functions of cosine and sine.





Secant's asymptotes occur where cosine is zero and cosecant's asymptotes occur where sine is zero.

Transformations of tangent, cotangent, secant, and cosecant can be graphed in a similar manner to transformations of sine and cosine.

Things you might struggle with:

1) Sin and Cos look very similar and it might be tricky to know which is which
    a. Remember! At 0, cos(x) = 1, while at 0 sin(x) = 0

Check Your Learning

1. What is the horizontal shift of a trig function defined as?

2. Where do the secant function's asymptotes occur?

3. Where do the cosecant function's asymptotes occur?

Answers to Check Your Learning

1. It is the Period (P), which is defined as the interval in which a function completes one full cycle. Make sure you practice identifying this interval on a graph!
2. Where cosine = zero
3. Where sine = zero

Thanks for checking out these weekly resources!
Don't forget to check out our website for group tutoring times, video tutorials and lots of other resources: www.baylor.edu/tutoring ! Answers to check your learning questions are below!