Week 12
MTH-1320 – PreCalculus

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

This week is Week 12 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

---

Topic of the Week: Intro to Trig

In section 5.2, we learned about the two most common trigonometric functions: sine and cosine. There are four other trigonometric functions: tangent, secant, cosecant, and cotangent. Like sine and cosine, these functions are defined with respect to a point (x, y) on the unit circle (circle with radius 1 centered on the origin). The following table gives a summary of what these function tell us and how all they relate to each other

Name	Notation	Definition in Terms of Coordinates on the Unit Circle	Relationship to Other Trigonometric Functions
Cosine	$\cos\theta$	x	
Sine	$\sin\theta$	y	
Tangent	$\tan\theta$	$\frac{y}{x}, x \neq 0$	$\frac{\sin\theta}{\cos\theta}$
Secant	$\sec\theta$	$\frac{1}{x}, x \neq 0$	$\frac{1}{\cos\theta}$
Cosecant	$\csc\theta$	$\frac{1}{y}, y \neq 0$	$\frac{1}{\sin\theta}$
Cotangent	$\cot\theta$	$\frac{x}{y}, y \neq 0$	$\frac{1}{\tan\theta} = \frac{\cos\theta}{\sin\theta}$

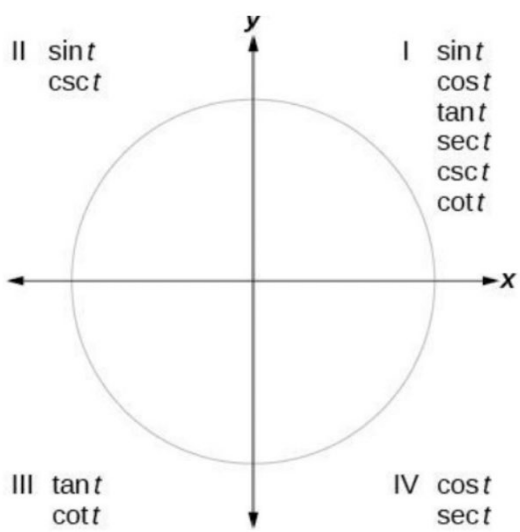
Using Reference Angles to Evaluate Trig Functions

Remembering the patterns of the unit circle can be a bit tricky, especially as we add more and more functions. Therefore, if you haven't already, I would recommend learning the values of the trig functions at the values of 30°, 45°, 60°, and 90°, so that you can use reference angles to find the values of trig functions at any common angle.

Given an angle not in the first quadrant, use reference angles to find all six trigonometric functions.

1. Measure the angle formed by the terminal side of the given angle and the horizontal axis. This is the reference angle.
2. Evaluate the function at the reference angle.
3. Observe the quadrant where the terminal side of the original angle is located. Based on the quadrant, determine whether the output is positive or negative.

Step 3 says to determine whether the output is positive or negative, which we can do by looking at the unit circle.



The functions mentioned are positive in that respective quadrant

---

Highlight 1#: Even and Odd Trigonometric Functions

We learned about even and odd functions during our first weeks of school. Remember that even functions are symmetric around the y-axis, and odd functions are symmetric around the origin.

If a function is even, then f(x) = f(-x), and if a function is odd, then f(-x) = -f(x).

How is this relevant to trigonometric functions?

- $\cos(-\theta) = \cos\theta$ (even)
- $\sin(-\theta) = -\sin\theta$ (odd)
- $\tan(-\theta) = -\tan\theta$ (odd)
- $\sec(-\theta) = \sec\theta$ (even)
- $\csc(-\theta) = -\csc\theta$ (odd)
- $\cot(-\theta) = -\cot\theta$ (odd)

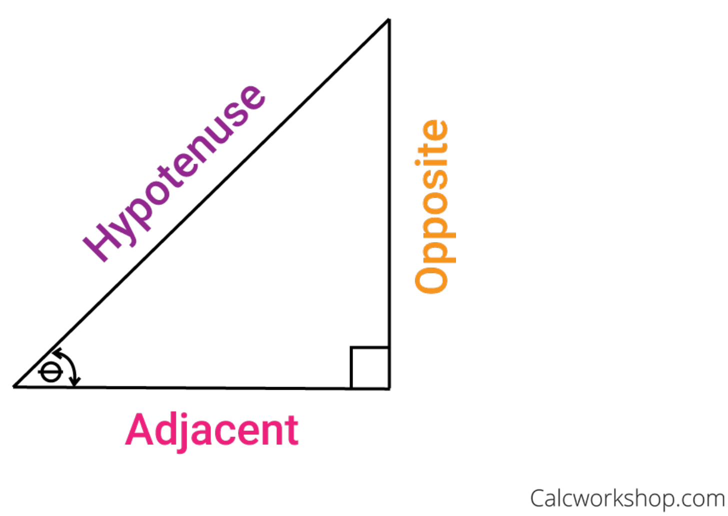
Note! Only cos and sec are even

Highlight #2: Alternate forms of the Pythagorean identity

We have already gone over the first Pythagorean identity, but now that we are more comfortable with tan, csc, sec, and cot we can introduce more Pythagorean identities

$$\sin^2\theta + \cos^2\theta = 1$$
$$\tan^2\theta + 1 = \sec^2\theta$$
$$1 + \cot^2\theta = \csc^2\theta$$

Some important applications of trigonometry involve right triangles. So far, we have defined the trigonometric functions in terms of a point on the unit circle, but we can also define them based on the sides of a right triangle. This makes the trigonometric functions much more versatile. The sides of a right triangle are called the hypotenuse, adjacent side, and opposite side. The hypotenuse is always the angle opposite to the right angle. The opposite and adjacent sides, however, vary based on which acute angle.



Knowing these terms for the sides of a right triangle, we can now learn how trigonometric functions of an acute angle θ are related to these sides.

- $\sin(\theta)$ = opposite/hypothenuse
- $\cos(\theta)$ = adjacent/hypotenuse
- $\tan(\theta)$ = opposite/adjacent

A way to remember these relationships is the mnemonic Soh Cah Toa:
- Soh: Sine is opposite over hypotenuse.
- Cah: Cosine is adjacent over hypotenuse.
- Toa: Tangent is opposite over adjacent. in the triangle we want to examine.

The opposite side is the side opposite of the acute angle in question. The adjacent side is the side adjacent to (next to) the acute angle in question

Note that the reciprocal relationship between secant, cosecant, and cotangent and cosine, sine, and tangent, respectively, still holds. Therefore, definitions for the other trigonometric functions in terms of the sides of a right triangle could be derived using the above definitions for sine, cosine, and tangent.

Highlight #3: Cofunction Identities

Some useful identities called the cofunction identities can be derived because the two acute angles in a right triangle are complementary.

- $\cos\theta = \sin(\pi / 2 - \theta)$
- $\sin\theta = \cos(\pi / 2 - \theta)$
- $\tan\theta = \cot(\pi / 2 - \theta$
- $\cot\theta = \tan(\pi / 2 - \theta$
- $\sec\theta = \csc(\pi / 2 - \theta)$
- $\csc\theta = \sec(\pi / 2 - \theta)$

Things you might struggle with

1. Often exercises will ask about certain functions, while only giving you sin and cos, so remember! All functions are in term of sin and cos so you can calculate all of them by knowing those two
2. Make sure you are identifying the adjacent and opposite side correctly, based on which angle you are calling θ

Since the content is conceptual, there is no Check Your Understanding this Week

---

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!

Images:
https://courses.lumenlearning.com/csn-precalculus/chapter/reference-angles/
https://calcworkshop.com/triangle-trig/sohcahtoa/