4.2 – Trigonometric Functions: The Unit Circle

Accelerated Pre-Calculus

Mr. Niedert

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$45^\circ - 45^\circ - 90^\circ$ Triangles

Practice

The hypotenuse of a $45^\circ - 45^\circ - 90^\circ$ triangle is 1 unit. Find the missing two sides.

$30^\circ - 60^\circ - 90^\circ$ Triangles

Practice

The hypotenuse of a $30^\circ - 60^\circ - 90^\circ$ triangle is 1 unit. Find the missing two sides.

The Unit Circle

- Using what we found with the $45^\circ - 45^\circ - 90^\circ$ triangles and the $30^\circ - 60^\circ - 90^\circ$ triangles, we can complete what is referred to as the unit circle.

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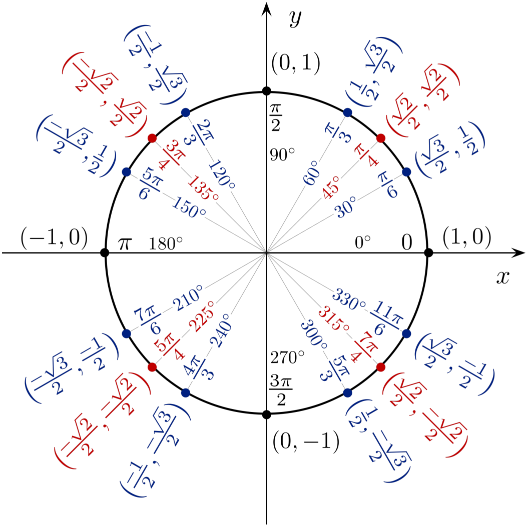
- You will need to know the unit circle like the back of your hand through the remainder of this year and into Calculus that's why I want to show you where it comes from instead of expecting you to just memorize it.

The Unit Circle



4.2 – Trigonometric Functions: The Unit Circle Quiz Tomorrow

- You will be given a blank unit circle and be expected to complete the unit circle tomorrow.

The Six Trigonometric Functions

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The six trigonometric functions can be defined in terms of their (x, y) coordinates. Let t be real number and let (x, y) be the point on the unit circle corresponding to t.

$$\sin t = y \qquad \cos t = x \qquad \tan t = \frac{y}{x}, x \neq 0$$

$$\csc t = \frac{1}{y}, y \neq 0 \qquad \sec t = \frac{1}{x}, x \neq 0 \qquad \cot t = \frac{x}{y}, y \neq 0$$

Evaluating Trigonometric Functions

Example

Evaluate the six trigonometric functions at each real number.

a $t = \frac{2\pi}{3}$

b $t = \frac{4\pi}{3}$

Evaluating Trigonometric Functions

Practice

Evaluate the six trigonometric functions at each real number.

a $t = 2\pi$

b $t = \frac{\pi}{2}$

c $t = -\frac{2\pi}{3}$

4.2 – Trigonometric Functions: The Unit Circle (Part 1 of 2) Assignment

Part 1: pg. 299 #6-28 even

Today's Learning Target(s)

1. I can evaluate trigonometric functions with and without a calculator.

Domain and Range of Sine and Cosine

Demonstration #1

What is the domain of $y = \sin x$?

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Demonstration #1

What is the domain of $y = \sin x$? What is the range?

Domain and Range of Sine and Cosine

Demonstration #1

What is the domain of $y = \sin x$? What is the range?

Demonstration #2

What is the domain of $y = \cos x$?

Domain and Range of Sine and Cosine

Demonstration #1

What is the domain of $y = \sin x$? What is the range?

Demonstration #2

What is the domain of $y = \cos x$? What is the range?

Periodic Functions

- As we saw on the previous slide, we have a domain of all real numbers, but the y-values repeat over and over again.

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- Functions that behave in such a repetitive (or cyclic) manner are called periodic.
- The period of the function refers to how “long” it takes for the y-values to complete a full cycle.

Even and Odd Trigonometric Functions

- Back at the beginning of the year, we discuss that a function is even if $f(-x) = f(x)$.

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Even and Odd Trigonometric Functions

The cosine and secant functions are even.

$$\cos(-t) = \cos t \qquad \sec(-t) = \sec t$$

The sine, cosecant, tangent, and cotangent functions are odd.

$$\begin{aligned} \sin(-t) &= -\sin t \qquad & \csc(-t) &= -\csc t \\ \tan(-t) &= -\tan t \qquad & \cot(-t) &= -\cot t \end{aligned}$$

Using the Period to Evaluate the Sine and Cosine

Practice

Find the following.

a $\sin \frac{13\pi}{6}$

b $\cos\left(\frac{-11\pi}{6}\right)$

c If $\tan(t) = \frac{2}{3}$, find $\tan(-t)$.

Using a Calculator to Evaluate Trigonometric Functions

Walk-Through

Evaluate each of the following using a calculator.

- a $\cos \frac{2\pi}{3}$
- b $\sin \frac{5\pi}{7}$
- c $\csc 2$

4.2 – Trigonometric Functions: The Unit Circle (Part 2 of 2) Assignment

Part 1: pg. 299 #6-28 even
Part 2: pg. 299-300 #30-52 even

4.2 – Trigonometric Functions: The Unit Circle Assignment
pg. 299-300 #6-52 even