High School Functions Playlist: Circles in the Coordinate Plane and the Domains of Trigonometric Functions

Aligns with *CCSS.MATH.CONTENT.HSF.TF.A.2*: Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.

Related Standards

- *CCSS.MATH.CONTENT.HSF.TF.A.3*: Use special triangles to determine geometrically the values of sine, cosine, and tangent for π/3, π/4, and π/6, and use the unit circle to express the value of sine, cosine, and tangent for π − x, π + x, and 2π − x in terms of their value for x, where x is any real number.

- *CCSS.MATH.CONTENT.HSF.TF.A.4*: Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.

Objectives

In this module, you will learn and practice the following skills:

- Using the unit circle to extend the domain of trigonometric functions beyond that possible using right-triangle geometry

- Understand sign conventions for angles defined in the unit-circle

Let's get started!

Key Terms

- A **positive angle** is one formed by moving about the unit circle in a counterclockwise direction from the positive *x*-axis

- A **negative** angle is one formed by moving about the unit circle in a clockwise direction from the positive *x*-axis

- The **sine** of an angle is the *y*-coordinate of the point where the line defined by the angle intersects the unit circle

- The **cosine** of an angle is the *x*-coordinate of the point where the line defined by the angle intersects the unit circle

- The **tangent** of an angle is the slope of the line defined by the angle

Connections

- https://openstaxcollege.org/textbooks/algebra-and-trigonometry; sections 7.2–7.4

- www.ck12.org/book/CK-12-Trigonometry-Second-Edition; sections 2.3

Circles in the Coordinate Plane and the Domains of Trigonometric Functions

(HSF.TF.A.2)

A **positive angle** is one formed by moving about the unit circle in a counterclockwise direction from the positive *x*-axis, while a **negative** angle is one formed by moving in a clockwise direction. When working with angles using a unit circle in the coordinate plane, the **sine** of an angle is the *y*-coordinate of the point where the line defined by the angle intersects the unit circle. The **cosine** of the angle is the *x*-coordinate of the point where the line defined by the angle intersects the unit circle. The **tangent** of the angle is the slope of the line defined by the angle.

If your students…

Have difficulty identifying specific angles and their trigonometric ratios using a unit circle

WATCH: Defining positive and negative angles using the unit circle

https://www.opened.com/video/algebra-2-11-04a-the-unit-circle/59094

Lack understanding of how trigonometric function domains defined using right triangles differ from those defined using unit circles

WATCH: Unit Circle Definition of Trigonometric Functions

https://www.khanacademy.org/math/trigonometry/unit-circle-trig-func/Trig-unit-circle/v/unit-circle-definition-of-trig-functions-1

Fail to determine the correct domain or range of trigonometric functions

WATCH: Graph of Sine Function

https://www.khanacademy.org/math/trigonometry/trig-function-graphs/trig_graphs_tutorial/v/we-graph-domain-and-range-of-sine-function

WATCH: Graph of Cosine Function

https://www.khanacademy.org/math/trigonometry/trig-function-graphs/trig_graphs_tutorial/v/we-graph-of-cosine-function