

Algebra 2

[Implement Start Year (2012-2013)]

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Unit #7, Trigonometric Functions

Stage 1 – Desired Results

Established Goals

2009 NJCCC Standard(s), Strand(s)/CPI #
(<http://www.nj.gov/education/cccs/2009/final.htm>)

Common Core Curriculum Standards for Math and English
(<http://www.corestandards.org/>)

Trigonometric Functions - F.TF.1, 2, 5, 8

- Understand Radian measure of an angle as the length of the arc on the unit circle subtended by the angle.
- Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers.
- Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline
- Prove the Pythagorean Identity $\sin^2\theta + \cos^2\theta = 1$ to find $\sin\theta$, $\cos\theta$, or $\tan\theta$, given $\sin\theta$, $\cos\theta$, or $\tan\theta$ and the quadrant of the angle.

21st Century Themes

(www.21stcenturyskills.org)

- Global Awareness
- Financial, Economic, Business and Entrepreneurial Literacy
- Civic Literacy
- Health Literacy
- Environmental Literacy

21st Century Skills

Learning and Innovation Skills:

- Creativity and Innovation
- Critical Thinking and Problem Solving
- Communication and Collaboration

Information, Media and Technology Skills:

- Information Literacy
- Media Literacy
- ICT (Information, Communications and Technology) Literacy

Life and Career Skills:

- Flexibility and Adaptability
- Initiative and Self-Direction
- Social and Cross-Cultural Skills
- Productivity and Accountability
- Leadership and Responsibility

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| <p>Enduring Understandings: <i>Students will understand that . . .</i></p> <p>EU1</p> <ul style="list-style-type: none"> • different units can be used to represent the same measurement. <p>EU2</p> <ul style="list-style-type: none"> • mathematical ideas can be represented numerically, symbolically or graphically. <p>EU3</p> <ul style="list-style-type: none"> • periodic phenomena can be modeled using trigonometric functions. <p>EU4</p> <ul style="list-style-type: none"> • expressions can be analyzed using different representations. <p>EU 5</p> <ul style="list-style-type: none"> • critical vocabulary is necessary to communicate and understand mathematics in the real world. | <p>Essential Questions:</p> <p>EU1</p> <ul style="list-style-type: none"> • What is the purpose to using different units of measurement? <p>EU2</p> <ul style="list-style-type: none"> • What are the different ways to represent trigonometric functions? <p>EU3</p> <ul style="list-style-type: none"> • How can periodic phenomena be represented using trigonometric functions? <p>EU4</p> <ul style="list-style-type: none"> • How can rewriting an expression in a different form help solve a problem? <p>EU 5</p> <ul style="list-style-type: none"> • What role does critical vocabulary play in understanding trigonometric functions? |
| <p>Knowledge: <i>Students will know . . .</i></p> <p>EU1</p> <ul style="list-style-type: none"> • standard position of an angle includes the initial side on the positive x-axis • angles can be sketched in degree or radian measure <p>EU2</p> <ul style="list-style-type: none"> • the Unit Circle is a circle of radius 1, with 16 special angles in both degree and radian measurement, with a coinciding coordinate pair at each angle. • SOH-CAH-TOA can be extended to apply to the Unit Circle <p>EU3</p> <ul style="list-style-type: none"> • The Unit Circle can be extended to the x-y coordinate plane to graph trigonometric functions • the basic rules of transformation studied earlier for basic functions also apply to trigonometric functions • the domain and range of each of the three basic trig functions. <p>EU4</p> <ul style="list-style-type: none"> • the relationship between the three basic trig functions and how one can be used to find the others. <p>EU 5</p> <ul style="list-style-type: none"> • critical vocabulary is necessary to communicate and understand mathematics in the real world. | <p>Skills: <i>Students will be able to . . .</i></p> <p>EU1</p> <ul style="list-style-type: none"> • sketch angles in standard position using both degree and radian measurement <p>EU2</p> <ul style="list-style-type: none"> • extend the domain of trigonometric functions using the unit circle • recall the Unit Circle from memory • use the Unit Circle to solve special angle problems <p>EU3</p> <ul style="list-style-type: none"> • sketch the basic shape of the sine, cosine and tangent graphs (tangent is optional) • transform the basic shapes of sine, cosine and tangent including period, amplitude, and midline changes. • state the domain and range of the three basic trig functions using interval notation <p>EU4</p> <ul style="list-style-type: none"> • prove the Pythagorean Identity $\sin^2\theta + \cos^2\theta = 1$ • determine sine, cosine, and tangent of an angle using the Pythagorean Identities – given one trig function and the quadrant <p>EU5</p> <ul style="list-style-type: none"> • demonstrate the correct usage and application of critical vocabulary |

Stage 2 – Assessment Evidence

Recommended Performance Tasks: EU2, EU3, EU5

Sunrise, Sunset

The September issue of National Geographic is highlighting photographs of beautiful sunrise and sunset pictures from different cities around the world. The head editor of the magazine is interested in submissions from amateur photographers. Using the Internet or an almanac; find the sunrise times for each day of the year for a particular city. On a coordinate plane, plot the sunrise times for every tenth day as a function of the day of the year.

- (a) Write the equation of a periodic function that approximately models this data.
- (b) Test how well your model fits the data by using the model to predict the sunrise for some of the days that are not included in the original data.
- (c) Write a report that details how the model was determined and discusses how well the model fits the data.

Other Recommended Evidence:

- Sketching Angles Assessment
- Around the World Special Angle Game
- Special Angles Assessment
- Graphing Trig Functions Assessment
- Cumulative test at the end of Trig unit

Stage 3 – Learning Plan

Suggested Learning Activities to Include Differentiated Instruction and Interdisciplinary Connections: Consider the *WHERE TO* elements. Each learning activity listed must be accompanied by a learning goal of A= Acquiring basic knowledge and skills, M= Making meaning and/or a T= Transfer.

- Activity # 1 – Discovering Radians (M)
- Activity #2 – Discovering The Unit Circle (M)
- Activity #3 – Around the World Special Angle Game (A)
 - Students stand at their seats, teacher holds up flash cards with a special angle question (example: $\cos 45^\circ$, $\sin \pi/4$), students must give the value. Correct = stay standing, incorrect = sit down
- Activity #4 – TRIGO (A)
 - Students fill in a Bingo board with angles in degree or radian measurement, teacher calls a special angle question (example: $\sin\theta = \frac{1}{2}$, $\cos \theta^\circ = -1$), students cross off angles that match.
- Activity #5 – TI-nspire – Application of the Unit Circle (T)
<http://education.ti.com/calculators/downloads/US/Activities/Detail?id=13451>
- Activity #6 – Spaghetti Sine Waves (T)
 - Students transfer the Unit Circle measurements to a coordinate plane to discover the graphs of sine & cosine

The following is the suggested sequence of learning activities and number of days for the Algebra 2 L2 class. Adjustments should be made accordingly for other levels.

Approximately 18 days for completion of unit

YWBAT sketch angles in degree measurement. (A)

Discovering Radians Activity (M)

YWBAT sketch angles in radian measurement. (A)

Discovering the Unit Circle Activity (M)

YWBAT solve special angle problems using sine and cosine in radians and degrees, finding both angles and values (example: $\sin\theta = \frac{1}{2}$, $\cos \theta^\circ = -1$, $\cos 45^\circ$, $\sin \pi/4$) (M)

TI-Nspire activity – Applications of the Unit Circle (T)

Spaghetti Sine Waves activity to discover graphs of sine & cosine (T)

YWBAT graph sine and cosine with period, amplitude, and midline transformations (A)

YWBAT graph the tangent function (optional) (A)

YWBAT use the Pythagorean Identity $\sin^2\theta + \cos^2\theta = 1$ to find $\sin\theta$, $\cos\theta$, or $\tan\theta$ given 1 piece and the quadrant of the angle. (A)

Critical Vocabulary

Amplitude

Midline

Special Angle

Angle

Period

Tangent

Cosine

Pythagorean Identity

Terminal Side

Degree

Quadrant

Trigonometry

Graph

Radian

Unit Circle

Initial Side

Sine