Trigonometry and Statistics

2013-2014

Chris Foley cfoley@lrhsd.org ext. 8465

Chris Callinan ccallinan@lrhsd.org ext. 8364

Robert Kibler rkibler@lrhsd.org ext. 8583

Mike Spera mspera@lrhsd.org ext. 8340

Unit 3 Analytic Trigonometry **Level 3** **Approximately 27 days**

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/)

Reasoning with Equations A.REI: #10
- Represent and Solve Equations and Inequalities Graphically

Creating Equations A.CED: #2
- Create Equations that Describe Numbers and Relationships

Interpreting Functions F.IF: #1,2
- Understand the Concept of a Function and Function Notation

Interpreting Functions F.IF: #4,5,7
- Interpret Functions that Arise in Applications in Terms of the Context

Interpreting Categorical and Quantitative Data S.ID: #7
- Interpret Linear Models

Trigonometric Functions F.TF: #4
- Extend the Domain of the Trigonometric Functions Using the Unit Circle

21st Century Themes
(www.21stcenturyskills.org)

___ Global Awareness
_x__Financial, Economic, Business and Entrepreneurial Literacy
___Civic Literacy
___Health Literacy
___Environmental Literacy

21st Century Skills

Learning and Innovation Skills:
_x__Creativity and Innovation
_x__Critical Thinking and Problem Solving
_x__Communication and Collaboration

Information, Media and Technology Skills:
___Information Literacy
___Media Literacy
_x__ICT (Information, Communications and Technology) Literacy

Life and Career Skills:
_x__Flexibility and Adaptability

Trigonometric Functions F.TF: #5-7 • Model Periodic Phenomena with Trigonometric Functions **Building Functions: F.BF: #1** • Build a Function that Models a Relationship between Two Quantities **Building Functions: F.BF: #4** • Build New Functions from Existing Functions **Similarity, Right Triangles and Trigonometry G.SRT: #8** • Define Trigonometry Ratios and Solve Problems Involving Right Triangles **Similarity, Right Triangles and Trigonometry G.SRT: #11** • Apply Trigonometry to General Triangles	_x__Initiative and Self-Direction ___Social and Cross-Cultural Skills _x__Productivity and Accountability _x__Leadership and Responsibility
Enduring Understandings: *Students will understand that . . .* *EU 1* analytic trigonometry is used to simplify trigonometric expressions and to solve trigonometric equations. *EU 2* the characteristics of trigonometric functions and their representations are useful in solving real-world problems. *EU 3* the properties of functions and function operations are used to model and analyze real-world applications and quantitative relationships. *EU 4* algebraic and geometric properties are used in trigonometry to solve problems and justify reasoning.	**Essential Questions:** *EU 1* How can fundamental trigonometric identities allow you to evaluate trigonometric functions and simplify and rewrite trigonometric expressions? *EU 2* • What factors can be used to determine whether an analytic or graphical strategy is most advantageous in solving a problem? • How can the characteristics of trigonometric functions and their representations used to solve real-world problems? *EU 3* How do trigonometric functions model real-world problems and their solutions? *EU 4* How are the properties of algebra and geometry used to obtain the trigonometric functions values?

Knowledge: *Students will know . . .*	**Skills:** *Students will be able to . . .*
EU 1 • inverse trigonometric functions can be used to find one solution; using periodicity can be used to find all solutions. • the law of sines relates the sines of the angles of the triangles to the side lengths. • the law of cosines relates the length of a side of any triangle to the measure of the opposite angle and the other two side lengths.	*EU 1* verify trigonometric identities using the properties of the known trigonometric functions. solve for all unknown parts of a right triangle by implementing properties of the trigonometric functions and their inverses
EU 2 trigonometric identities are used to rewrite trigonometric equations that model real-life applications.	*EU 2* model real-life applications using trigonometric equations.
EU 3 • that the inverses of trigonometric functions can be used to solve for unknown information in right triangles • basic trigonometric identities are fundamental to simplifying expressions and solving trigonometric equations.	*EU 3* • implement the laws of sines and cosines to solve for right and non right triangles. • identify the cases in which to use the laws of sine and cosine.
EU 4 • known identities can be used to verify new identities. • trigonometry can be used to solve a triangle if two angles and a side of the triangle, two sides and the included angle or all three sides of the triangles are known.	*EU 4* • use the information (angle and sides) from one trigonometric function to convert to any of the other five trigonometric functions. • manipulate trigonometric identities to manipulate and solve trigonometric equations.

Stage 2 – Assessment Evidence

Recommended Performance Tasks (M, T) ***EU 1,2***

The owners of a ski resort would like to make it easier for their guests to get from the top of one mountain to the top of the other mountain without descending to the base of the mountains. They want to install cable cars (gondolas) that will connect the top of each of the mountains. The decision has to be made of how long of a cable car ride be in order to accomplish this task.

As an engineer, you have been tasked with informing the owners of the mountain of how long of a cable (discarding any natural sag of the cable) is needed in order to accomplish this task. Using the internet, find 2 mountains that are adjacent to each other (they may be 2 peaks of the same mountain). Please provide a graph and all equations necessary to make an effective presentation to the owners of the mountain.

Provide an oral/written/visual presentation of your finished product, including the calculations used in your project to your teacher.

All other specifications and requirements are to be determined by the classroom teacher.

Other Recommended Evidence: *Tests, Quizzes, Prompts, Self-assessment, Observations, Dialogues, etc.*

- Tests and quizzes to include: Using trigonometric identities; verifying trigonometric identities; solving trigonometric identities; applications and models of trigonometric expressions and equations; the law of sines; the law of cosines.

Stage 3 – Learning Plan

Suggested Learning Activities to Include Differentiated Instruction and Interdisciplinary Connections: *Consider the WHERETO 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*

- TI-Nspire Activity# 1: Law of Sines (M,T)
- Students will understand how the Law of Sines is derived.
- Students will understand when the Law of Sines can be used to find missing sides and angles in a triangle.
- Students will be able to solve for missing sides and angles in a triangle using the Law of Sines, when appropriate.

- Students will use appropriate tools strategically (CCSS Mathematical Practice)
- http://education.ti.com/calculators/downloads/US/Activities/Detail?id=17194
- TI-Nspire Activity# 2: Radio Station KTNS (Law of Cosines)(M,T)

- Students will solve a problem experimentally by fitting a function to a set of data.
- Students will solve the same problem theoretically by making and verifying conjectures using algebraic and trigonometric methods.
- Students will use appropriate tools strategically (CCSS Mathematical Practice).
- Students will reason abstractly and quantitatively (CCSS Mathematical Practice).
- Students will construct viable arguments and critique the reasoning of others (CCSS Mathematical Practice).
- http://education.ti.com/calculators/downloads/US/Activities/Detail?id=17198

TI-Nspire Activity # 3: Law of Cosines (M,T)

- Students will be able to state the Law of Cosines.
- Students will be able to apply the Law of Cosines to find missing sides and angles in a triangle.
- Students will understand why the Law of Cosines is true.
- Students will use appropriate tools strategically (CCSS Mathematical Practice).
- http://education.ti.com/calculators/downloads/US/Activities/Detail?id=17195

Critical Vocabulary: trigonometric identities angle of elevation, angle of depression, initial side, terminal side, coterminal angles, unit circle, law of sines, law of cosines

Below is the suggested sequence of learning activities and number of days for the Trigonometry and Statistics class.

Approximate time line 27 days

Students will

- **identify basic trigonometric identities (A)**
- **simplify trigonometric expressions (A)**
- **use Pythagorean trigonometric identities to verify equations (A,M)**
- **use inverse trigonometric identities to verify equations (A,M)**
- **Solving triangles using Trigonometric Identities (M)**
- **Solving Trigonometric Equations (M)**
- **Apply the Law of Sines to solve non right triangles (A,M)**
- **Ti-Nspire Activity #1 (T)**

• **Apply the Law of Cosines to solve non right triangles (A,M)** • **Ti-Nspire Activities #2 and #3 (T)** • **Modeling using right triangle trigonometry (M,T)** • **Modeling using the Law of Sines (M,T)** • **Modeling using the Law of Cosines (M,T)**