

Lesson Plans
Larry Lightner

Unit: Trigonometric Functions

- Lesson 1 Discuss the origin of the word “trigonometry”.
In the computer lab, research the history of trigonometry and its applications.
Research the history of the Ferris wheel and its creator (George W. G. Ferris).
- Lesson 2 Activity: Students are introduced to the tangent function by investigating triangular ratios found in the casing blocks of the Great Pyramid (“A New Angle on an Old Pyramid” SIMMS Level 2 Volume 1 Page 46).
Introduce and demonstrate Geometer’s Sketchpad demo version for this activity.
Go through discussion questions a – f.
Assignment: Page 51, 3.1 – 3.10 (SIMMS)
- Lesson 3 Activity: Students explore the sine and cosine ratios using Geometer’s Sketchpad and spreadsheets (“A New Angle on an Old Pyramid” SIMMS Level 2 Volume 1 Page 54).
Use Geometer’s Sketchpad demo version for this activity.
Go through discussion questions a – e.
Discuss and show the trigonometric functions of a right triangle.
Assignment: Page 57, 4.2 – 4.11 (SIMMS)
- Lesson 4 Discuss and show how trigonometry can be used to find the measure of an unknown angle or an unknown side length of a right triangle (solve right triangles).
Discuss the reciprocals of the six trigonometric functions.
Work on Unit Project Task 1
- Lesson 5 Vocabulary:
Angle of Rotation Terminal Side Positive Measure Degree
Initial Side Standard Position Negative Measure Coterminal
Discuss vocabulary. When done and go through example:
Find the coterminal angle for 123° , 180° , -27° , -185° such that $-360^\circ \leq \theta \leq 360^\circ$.
Discuss and derive the trigonometric functions of an angle θ in standard positions
- Lesson 6 Find exact values for trigonometric functions of special angles and their multiples
Find approximate values of trigonometric functions of any angle
Use the exact values of sine, cosine and tangent found above to evaluate any angle whose reference angle is 30° , 45° or 60° .
Discuss coordinates of points on a circle.
Construct the Unit Circle with angles of degree: 0, 30, 45, 60, 120, 135, 150, 180, 210, 225, 240, 270, 300, 315, 330, and 360
Work on Unit Project Task 2

- Lesson 7 Investigation 2: Radian Measure, students construct cardboard disks with moveable strips attached to model angular velocity. The following concepts will be discovered and discussed:
Radian measure
Conversion ratios
Arc length.
Linear speed and Angular speed
(Core Plus, Course 3 Part B, pages 419 – 423, 1 – 7)
Assignment: On Your Own Exercises, page 423, a – c.
Work on Unit Project Task 3
- Lesson 8 Activity: The “Plain” Sine Graph (IMP Year 4, page 23)
Graph the sine, cosine, and tangent functions and their transformations
Use the sine function to solve problems
- Lesson 9 Define and discuss amplitude.
Graph and explore translations.
Discuss and define a phase shift.
Work on Unit Project Task 4
- Lesson 10 End of Unit
Unit Review
Unit Quiz
- Lesson 11 Unit Project Presentations

PERFORMANCE PACKAGE TASK 1
TRIGONOMETRY & GEOMETRY
(Trigonometry)

Specific Statement(s) from the Standard:

- Understand the properties of the standard trigonometric functions and apply them to real-world and mathematical problems, especially geometrical problems.

Product(s):

- A word-processed document of students research on trigonometry and the history of the Ferris Wheel and its creator.
- Presentation of students' research and the project task results.

Task Descriptions:

Task 1:

- Graph the height of a point on the Ferris wheel, (relative to the center of the wheel) as a function of the angle of rotation on a coordinate plane.
- Create a table of values for the distance from a point on the Ferris wheel to the x-axis, with the following angles of counterclockwise rotation: 0° , 90° , 180° , 270° , . . . , 810° .
- Graph the resulting ordered pairs, and sketch a *smooth curve* through the points.

Task 2:

- Graph the altitude of a rider on the Ferris wheel, as a function of the angle of rotation.
- Create a table of values for the altitude (height above the ground) of a rider on the Ferris wheel. Let the independent variable include all common angle measures for θ such that $0 \leq \theta \leq 810^\circ$.
- Graph the points, and sketch a *smooth curve* through the points.

Task 3:

- Graph the altitude of a rider on the Ferris wheel as a function of time, and find the speed of a rider on the Ferris wheel.
- Using the table of values created in task 2 and the fact that one complete revolution takes 440 seconds, convert the units of the independent variable from degrees to time in seconds.
- Graph the points and sketch a *smooth curve* through the points.
- Find the linear speed, in miles per hour, of a rider on the Ferris wheel.
- Find the amplitude and period of the graph.

Task 4:

- Create and interpret a model for the altitude of a rider on the Ferris wheel.
- Find the amplitude and period of the graph.
- Write an equation of the form $y = a \sin bt$ to model the altitude of a rider on the Ferris wheel as a function of time.
- Describe what each variable in your model represents.
- Create a scatter plot of the data, and then graph the model on the same set of axis. Explain the fit.

Special Notes:

Enough computer lab time should be scheduled for research, activities, and write-ups.

Materials needed: protractors, drinking straws, string (one per student), paper clips (one per student), cardboard, compasses and graphing calculators.

FEEDBACK CHECKLIST

The purpose of the checklist is to provide feedback to the student about his/her work relative to the content standard. Have the standard available for reference.

Task Checklist

Y = Yes

N = No Evidence Shown

Student	Trigonometry Research	Teacher
	The research on trigonometry is thorough and accurate.	
	The research on the history of the Ferris Wheel and George W.G. Ferris is thorough and accurate.	
	The paper is clear, accurate and free of grammatical errors.	
Task 1		
	Identification of coordinates is accurate.	
	Table of values is complete and accurate and clearly organized.	
	Graph accurately represents the data.	
Task 2		
	Altitude is accurate for each angle of rotation.	
	Table of values for the altitudes is accurate and clearly organized.	
	Graph accurately represents the data.	
Task 3		
	The corresponding time for each value from the table in task 2 is accurate.	
	Graph of altitude vs. time is accurate.	
	The period of the graph and its representation is accurate and meaningful.	
	The linear speed of a rider on the Ferris wheel is accurate.	
Task 4		
	The amplitude of the graph is accurate.	
	The explanation of the representation of the amplitude is meaningful and accurate.	
	Equation to model the data is accurate.	
	Description of variables is accurate	
	Scatter plot and graph of equation is accurate.	
	Explanation of the model for the data is meaningful.	

Overall Comments: Check progress after each task is complete to keep students on track. Accommodations to the project can be made for special needs students as per their IEP.