

Project Overview for:

Introducing and Exploring Trigonometric Ratios Using Geometer's Sketchpad

This project is designed to allow students the opportunity to explore and understand trigonometric relationships through the use of the Geometer's Sketchpad software. This software was chosen due to its dynamic nature and the close connection between geometry and trigonometry. The overall goal of the project is to allow students to move from their prerequisite knowledge of similar triangles to a conceptual understanding of the graphs of trigonometric functions. Students will be required to incorporate concepts and representations from the geometrical, algebraic, and graphical points of view. In the first activity, students will examine similar triangles and end up with an understanding of sine and cosine as ratios of the sides of right triangles. In the second activity, students will be led to an understanding of sine and cosine on the unit circle and will prove coordinate relationships algebraically. In activity three, students will bridge the gap between trig ratios and trig functions as they manipulate and interpret a unit circle construction to produce conjectures about the nature of the trigonometric functions. In the final activity, students will geometrically construct the graphs of the six trigonometric functions by using the locus capability of Geometer's Sketchpad. A Summary, Lesson, Procedure, and Student GSP file are included for each exploration. Instructor versions of two of the sketches are provided as I thought they would be helpful for clarity and demonstration purposes.

In the development of this resource package, I have tried to incorporate activities that address the following Standards from NCTM:

In grades 9-12 all student should-

- interpret representations of functions of two variables
- use Cartesian coordinates and other coordinate systems, such as navigational, polar, or spherical systems, to analyze geometric situations;
- investigate conjectures and solve problems involving two- and three-dimensional objects represented with Cartesian coordinates.
- understand and represent translations, reflections, rotations, and dilations of objects in the plane by using sketches, coordinates, vectors, function notation, and matrices;
- explore relationships (including congruence and similarity) among classes of two- and three-dimensional geometric objects, make and test conjectures about them, and solve problems involving them;
- draw and construct representations of two- and three-dimensional geometric objects using a variety of tools;
- use geometric models to gain insights into, and answer questions in, other areas of mathematics;

## How to Incorporate These Activities into Your Classroom

The activities provided in the following documents are designed for use in conjunction with traditional problems and instruction from your favorite trigonometry text. Note that the explorations are labeled in terms of the number of the activity and not in terms of the number of days. These materials are best used to introduce or highlight the goals identified in the lesson outline for each activity and should not be implemented over a four or five day period.

### Assumed Knowledge

It is assumed in the activities that students are fairly familiar with GSP. If students have not used GSP before, the activities will take longer than outlined in the Timeline found in each lesson. It is also important that students are comfortable with both degree and radian measures before using the provided activities. For students with no experience of radian measure, I have provided a sketch that may serve as a starting point for an exploration involving radian angle measure that you may modify and develop as you see fit.

### Contact Me

This series of activities was created with the intention providing an opportunity for technology-based exploration in the classroom. The activities here are not set in stone. Comments, criticisms, changes, and questions are welcome through [email](#).