TOPIC: Revised Lesson Plan on Graphing Secant and Cosecant Function

STANDARD(S) & INDICATOR(S):
CCSS-Math: High School – Functions
F-IF 7e - Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.
F-TF 5 - Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.

OBJECTIVE(S): Students will be able to:
- Sketch graph the sine, cosine, secant, and cosecant functions.
- State the domain and range of each function.
- Analyze the maximum and minimum points of one graph of a function to the maximum and minimum points of the table of another function.

MATERIALS: Graphing Calculator, laptop computers, Graphing Trigonometric Function Lab.

LIST OF HANDOUTS (attach original copies of each handout) Graphing Trigonometric Lab

BACKGROUND INFORMATION: Students have finished graphing the sine and cosine function graphs.

EDUCATION TECHNOLOGY INTEGRATION: Students had a discussion on Haiku and typed up and submitted their labs in Dropbox. Within the lab, students had to insert graphs from the graphing calculator.

CLASSROOM ACTIVITY DESCRIPTION (LABORATORY/EXERCISES/PROBLEMS):
1.) The students’ warm-up was to sketch the graphs and provided the table of the sine and cosine functions.
2.) Notes were given to sketch the graph of the secant and cosecant graphs.
3.) Students hand sketch the functions \( f(x) = 2\sin x \) and \( g(x) = 2\csc x \) on the same graph.
4.) Students participated in an online discussion where they answered a question on Haiku.
5.) Students started the lab and finished it for homework.

**PARAMETERS TO EVALUATE STUDENT WORK PRODUCTS:**
As part of the discussion, students answer the following questions:
1) How do you graph the sine function?
2) How do you graph the cosine function?
3) How do you find the equation of a cosine graph?
4) Describe the differences and similarities between the sine and cosine function.
5) How are the secant and cosine functions related to each other? Describe how to graph the secant function.

**ENHANCEMENT OF LESSON:**
This lesson can be revised to allow the students to perform a more in-depth analysis on comparing trigonometric functions through the use of technology. In the original lesson the students were asked to graph the functions by hand, provide a table, and state the domain, and range. In the lesson plan, the students could check their results using their hand-held graphing calculator. In the revised lesson, the students are no only asked to graph the functions, provide a table, state the domain and range, but they are asked to analyze certain points on the graph of one function and on the table of another function. With the aid of the graphing calculator and applets, the students answer questions that are higher up on Bloom’s Taxonomy. In the original lesson plan, the student objectives reach only up to the application level on Bloom’s Taxonomy, whereas, the revised lesson plan’s objectives brought the students up to the analysis level on Bloom’s Taxonomy. Part of the discrepancy is the old lesson plan was written using the old state standards. Whereas, the new lesson plans were written for the Common Core Standards.

Cloud computing aids in the new lesson plan through a variety of ways. First, all students are required to answer the questions and participate in the online discussion; whereas, in the old lesson plan the students who raised their hand are the only ones who participate and are engaged in the learning process. Second, while there is merit to having students graph by hand, the students’ learning objectives could not go beyond the application level, because of the time constraints. Using web-based tools allow the students to see the graphs, tables, and equation at the same time, which allow the students to analyze the functions. The third way cloud computing aids in the student-centered lesson is that the students can create more accurate graphs. Even though the current version of the lesson does not include alternative assessment tools, in the future individualized problems can be generated. The students also had to submit their labs in Dropbox.

**REFERENCES:** Common Core Standards for Mathematics
Prentice Hall Precalculus Graphing and Data Analysis
Developing Essential Understanding of Functions for Teaching Mathematics in Grades 9-12 (e-book)
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