Trigonometry Project

In this project you will find some data that is approximately sinusoidal and then fit a curve to it. Once you have fit a curve to the data, you will use it to make some predictions. Your data, the fitted curve, and the predictions will be displayed in a poster format.

Outcomes

1. The student can identify data that is periodic.
2. The student can use the concepts of period, amplitude, and translations to fit a sinusoidal equation to periodic data.
3. The student can graph a sinusoidal function.
4. The student can solve a sinusoidal equation for both the dependent and independent variables.

Procedure

1. Find some interesting periodic data (see websites on the back). The most common periodic data sets include: average daily temperature, hours of daylight, and tide levels.

2. Plot the data. The graph should be large, neat, and easy-to-read. You may want to put several pieces of graph paper together or carefully make your own grid. Make sure the axes are clearly labeled with NUMBERS, not dates and/or times. You may need to come up with a system for converting your x-values to numbers; it often works well to choose a reference date and start counting days from there. INCLUDE A WRITTEN DESCRIPTION OF THE SYSTEM YOU USED TO LABEL THE X-AXIS. Use the graph to approximate the period and amplitude.

3. Using the approximations of period and amplitude, fit a sinusoidal equation to the data. This process will involve some trial and error – explain the process you used clearly. You should try AT LEAST 4 different equations -- in your write-up include the equations you did not use along with a short description on why you chose the one you did. Once you decide upon an equation, place the curve on the same graph as your data points. Be sure to record the equation used as well.

   Describe how well the curve fits. Are there places where it works better than others? If the curve does not fit well, the equation may need to be adjusted.

4. Pose and answer two types of questions using the equation you developed above (do 2 of each type for a total of **4 questions**). Make your questions as creative and interesting as possible:
   - Finding the dependent variable (y) when the independent variable (x) is given.
   - Finding possible values for the independent variable when the dependent variable is given.

   Note that for this type of question, you should have multiple possible answers.

   In other words, use the equation you fit to the data to make predictions for a variety of situations.

   These questions should be solved algebraically – with work shown, but reference to the graphical representation would also be appropriate.

   Discuss how well the equation answers the questions. Do the answers seem to fit the data well?

5. Your write-up will consist of a poster display. The display should include an annotated table of the data, a graph of the data points and the fitted equation, and the questions you asked and answered. In addition, include a concise written description of the process you used to fit the equation and how well it fits.

Evaluation Criteria

1. The student chose appropriate data.
2. The student fit an appropriate equation to the data and graphed it accurately.
3. The student answered the questions they posed accurately and supported their answers graphically.
4. The poster display contains all relevant information as well as clear and concise explanations. The display is neat and easy to follow.

Websites for Periodic Data:

http://www.mindspring.com/%7ecavu/sunset.html

This site will give you the length of the day at many locations around the world. Read the options carefully. Do NOT hit the first "compute" button – scroll down to step 4 and make sure you get one year's worth of data and that you switch the text color to black for printing. You should choose at least 10 points of data spread throughout the year as your data. Be sure you hit the max and min points (June 21 and Dec. 21)!

http://www.co-ops.nos.noaa.gov/cdata/StationList?type=Current Data&filter=survey

This site will give you the tide level at observation sites around the world. Choose the station for which you want data, then choose the depth by clicking "plot and view data." You will receive data in 6 minute intervals which is more detailed than you need. Choose 10 to 12 observations from the "00" column (this is hourly data). Make sure you hit the max and min points of each cycle – there should be about 2 each day.

http://lwf.ncdc.noaa.gov/oa/climate/online/ccd/meantemp.html

This site gives the average monthly temperatures for a variety of U.S. cities. You should use all twelve months of data. Because the climate varies so much from city to city, you should record the data for a few different cities and use the one that appears to be the most sinusoidal. (You can also do this on weather.com if you can't find the city you want at the above website.)

Trigonometry Project Grade Sheet

Student:

1. Poster is complete and accurate -- all required components are included and labeled.

   1 2 3 4 5 6 7 8 9 10

Table of data	_____
Graph of data points	_____
Graph of fitted equation	_____
List of other equations tried	_____
Description of how well curve fits	_____
4 questions posed and answered	_____
Regression equation/comparison	_____

2. The fitted equation approximates the data well and is accurately graphed. The process used to obtain the equation is clearly explained. At least 3 other equations were tried; these equations are included along with a description of why they were rejected.

   1 2 3 4 5 6 7 8 9 10

3. 4 questions were posed and answered -- 2 where the dependent variable was given and 2 where the independent was given. For those where the independent was given, ALL solutions were found. Equations were solved algebraically – with work shown, with mention of the graphical interpretation.

   1 2 3 4 5 6 7 8 9 10

4. The poster was well-organized and creative. It was neat and easy to read and understand.

   1 2 3 4 5 6 7 8 9 10

Total Grade: /40