Sunrise Over New York

Kevin Westrich and 11th grade Mathematical Methods Students

Abstract:

Students were presented with a table of data that shows the times of sunrise over New York City at weekly intervals during 2003, starting on January 1. Students were required to use Geometer's Sketchpad to draw a scatter plot of the data and develop polynomial and trigonometric models that describe the observed data. These models were created using both TI graphing calculators and Geometer's Sketchpad. Students were making use of mathematical techniques that are taught as part of their IB Mathematics SL curriculum.

Once students created their models, they were asked to compare their usefulness in different circumstances. Which model would be best to use by a person taking an early morning run? Which model would be most useful to a computer programmer who wanted to write a program that would switch the streetlights off at dawn? Students were next asked to integrate their knowledge of math and Earth Science by seeing how the sunrise times would change if a person moved 1000km North, South, or West. Students could then comment on how the models would need to be appropriately modified under these new conditions. Students used websites such as http://aa.usno.navy.mil to aid in this research.

Finally, students were given a scatter plot of data with the corresponding sunset times for 2003. They were asked to determine the approximate length of the longest and shortest days, and the dates between which there are more than 12 hours of sunlight. Students could use some creativity in their solution to these last questions and would hopefully verify the dates of the solstices and equinoxes.