CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Stephanie Salcedo

Project Number
S1217

Project Title
Morphing Circles

Abstract

Objectives/Goals
The purpose of my project is to see what would happen if a basic sine function is added to the graph of a circle or an ellipse. I believe that a pattern will be created according to how the circle "bumps" around the curve.

Methods/Materials
Using the computer software "Nucalc," I graphed a regular circle. I overlaid it with a circle with the same radius but with a sine function added to the equation of that circle. I noticed that adding a sine function to a circle creates bumps, so I defined a "bump" as a curve that is outside but still intersecting the original circle. I made t-charts to record the amount of bumps I saw as I increased the period of the sine function. I recorded the number of bumps up to the 25th period. I made t-charts using circles with radii of two through six. With ellipses, I followed the same procedures, and I used ellipses of different sizes for my t-charts.

Results
As I made my t-charts, I noticed that as the period increased, the number of bumps either stayed the same, increased by two, or increased by four. The number of bumps was always an odd number. When I overlaid the "morphed" circle with the sine curve graphed separately, I saw that the number of times the sine curve crossed the x-axis while inside the original circle was equal to the number of bumps the morphed circle has. In addition, when I increased the amplitude of the sine function that was added to the circle, the number of bumps stayed the same, but the morphed circle began to break apart.

Conclusions/Discussion
My data supports my hypothesis because numerical patterns did exist in my t-charts. I found out that the number of bumps on a circle uses the greatest integer function and 2rb/Pi, where r is the radius of the circle, and b is the period of the added sine function. With ellipses, the number of bumps uses the greatest integer function and 2cb/Pi, where c is the radius along the x-axis for the ellipse. Based on all the data and research I have gathered, I was able to see a relationship between the number of bumps a sine curve creates on a circle when added together and the period of the sine function.

Summary Statement
My project is about what would happen if a sine function is added to a circular graph.

Help Received
My mother helped cut out some of my work for my board, my project advisor, Diana Herrington, proofread my work and provided me with some necessary materials, and my father provided the transportation for me to go buy the needed materials for my project.