CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)

Alex Krolewski

Project Number

J1221

Project Title

Packing Ellipses into a Hexagon: Does Varying the Ratio of the Two Axes of an Ellipse Affect Packing?

Abstract

Objectives/Goals

The goal of these experiments was to determine if there is a correlation between the ratio of the two axes of an ellipse and the number of times the ellipse can be packed into a given hexagon. The experiment#s hypothesis is that the least elliptical ellipses will pack into the hexagon a greater number of times.

Methods/Materials

Twelve ellipses with different dimensions were constructed. Each ellipse was duplicated, and the duplicates were packed into a hexagon, with three trials per distinct ellipse. Then the trial producing the best packing was found, and it was used to represent the ellipse in all plotted data.

Results

The experiments seemed to prove the hypothesis wrong, although I did not observe a significant difference between ellipses of different ratios. However, it was more difficult to pack the least elliptical ellipses. These results should not be interpreted to mean that all packings of ellipses into hexagons follow the same curve, regardless of the size of the ellipses relative to the hexagon. Rather, it was hypothesized that, based on the previous observation, the smaller the ellipses became, relative to the hexagon, the more pronounced the slight negative correlation would become.

Conclusions/Discussion

The results showed no clear correlation. Whereas it had been postulated that the less elliptical ellipses would fit into the hexagon a greater number of times, there was actually a weak negative correlation: the less elliptical ellipses fit into the hexagon a lesser number of times. I theorized that the weak negative correlation I observed will gradually become more pronounced as the ellipses become smaller relative to the hexagon. This is because the ellipses are more difficult to manipulate when less elliptical.

Summary Statement

This project investigates optimal packing of two-dimensional elipses in a hexagon.

Help Received

My father filled out this application because I was in Japan for a 2.5 week period that overlapped the filing period. I received no other assistance.