CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)

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Project Number

J1208

Project Title

The Pleasure of Pi

Abstract

Objectives/Goals

The hypothesis of the experiment is that the ratio between the error in determining I using by inscribing polygons within and circumscribing polygons about a circle with (km) sides and that obtained using polygons with (kn) sides will approach (n/m)^2 as k increases.

Methods/Materials

To test my hypothesis, I needed to develop formulas to determine the perimeters of the regular polygons inscribed within and circumscribed about a circle. I discovered that the perimeter of the regular polygon with X sides inscribed in a circle with a diameter of 1 is X(sin(180/X)). The perimeter of the regular polygon of X sides circumscribed about a circle with a diameter of 1 is X(tan(180/X). I estimated I by using the expression:

(X(sin(180/X) + X(tan(180/X))) / 2, and I calculated the error in estimating pi using polygons with the formula:

error = ((X(sin(180/X) + X(tan(180/X))) / 2) - I.

I calculated the ratios of the errors of the estimates using polygons of m and n sides employing six different values for m and n [(m=8, n=10,) (m=6, n=8,) (m=4, n=6,) (m=4, n=8,) (m=4, n=10,) and (m=4, n=12)]. I then calculated the error ratios for polygons of km and kn sides using those given m and n values, and k = (1, 2, 3, 4, and 1000). Finally, I graphed the results.

Results

The graphs are consistent with the hypothesis. As k increases, the error ratio approaches (n/m)^2, the square of the inverse of the ratio of the number of sides.

Conclusions/Discussion

By completing this experiment, I discovered that the ratio between the error in determining I using by inscribing polygons within and circumscribing polygons about a circle with (km) and (kn) sides approaches (n/m)^2 as k increases.

Summary Statement

The summary is that I determined that the ratio between the error in estimating pi using by inscribing polygons within and circumscribing polygons about a circle with (km) and (kn) sides approaches (n/m)^2 as k increases.

Help Received

Dad helped edit my report.