CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)	Project Number
Jacob Kantor	**J1407**

Project Title
Phi: The Golden Ratio

Abstract

Objectives/Goals

When creating a Fibonacci-like sequence of 100 numbers and then creating a ratio of the last number to the next-to-last number, which two starting numbers will produce a ratio that is closest to Phi, the Golden Ratio?

My Hypothesis: The sequence whose two starting numbers have the closest starting ratio to Phi will end up closest to Phi by the end of the sequence because all Fibonacci-like sequences will approach Phi, and this one has a head start. In this experiment testing 144 pairs of numbers, that will be the sequence starting with 5 and 8, the pair whose starting ratio is closest to Phi.

Methods/Materials

1. Create a spreadsheet using Microsoft Excel & the Arbitrary Precision Plug In (so that Excel does not cut off each number at 15 decimal places).
2. Select 144 pairs of numbers to test as follows: Every single combination of whole numbers between 1 and 12. (12X12=144 sequences).
3. Create a column in Excel that lists the Fibonacci-like sequence for each of the starting pairs until each sequence is 100 numbers long. (Formula = add the previous two numbers to get the next number in the sequence).
4. Find the ratio of the 100th number to the 99th number for each of the sequences.
5. Compare all of these final ratios to Phi to see which one is the closest.
6. Compare all of the starting ratios (2nd number divided by the 1st number) to see if the hypothesis is correct.

Results

I found that the sequence with starting numbers (1,12) had a final ratio (n100/n99) that was closest to Phi. My hypothesis (that the pair of numbers with the closest starting ratio to Phi would be closest at the final ratio) was wrong. In fact, the ratio that was closest to Phi at (n100/n99) had a starting ratio that was furthest from Phi.

Although in my experiment, I focused on comparing the differences between the ratios and Phi, one of the most surprising results is that no matter the what the starting numbers were, all 144 of my sequences ended up within one-quadrillionth of Phi!

Conclusions/Discussion

Upon further analysis, I found that the pair of numbers with the highest starting ratio had the final ratio that was closest to Phi. By trying a few other higher number pairs, I confirmed that the higher the starting

Summary Statement
In my project, I investigated Phi, the Golden Ratio and the Fibonacci Series and built a model to prove which two starting numbers of a series produce a ratio closest to Phi.

Help Received
My dad helped locate and install the Arbitrary Precision Plug-In for Excel and learn how to write the formulas using special syntax so that the numbers would not be truncated at 15 decimals points. My mom helped me format and print the data from Excel.