Name(s)	Project Number
Karen Chee	**S1403**

Project Title

The Table of Secrets

Abstract

Objectives/Goals

To study numbers of the form $X^2 + 5(Y^2)$ and see why they are so strange in comparison to the rest of the numbers of the form $X^2 + D(Y^2)$ where D is a whole number. I am following the path that Fermat took when studying Diophantus's old work, but I am branching off and making my own way.

My hypothesis: While all of the $X^2 + Y^2$ tables have numbers that are divisible by prime numbers (and upon dividing, resort into patterns of similar looking multiples), the $X^2 + 5Y^2$ has numbers that appear in the table for unknown reasons. I hypothesize that there is some of outside numbers that corresponds with the $X^2 + 5Y^2$ table.

Methods/Materials

A posterboard, Excel spreadsheets, paper, and glue. Also, lots of pencils and lots more thinking!

I created the tables via the Excel computer program. I looked for patterns and colored them in, and pieced together boxes to create a new table.

Results

The multiplicative patterns in the data sets suggest a product law (or really more than one such law) on pairs of integers which has all the usual arithmetic features (commutative, associative, distributive, etc.) But prime factorization of pairs of integers is NOT unique. This has far-reaching consequences, and calls for some modification of the theory of these number pairs that might restore the uniqueness of prime factorization in some sense.

Conclusions/Discussion

Fermat's mysterious remarks point to a need to ensure that the "generalized numbers" arising naturally in number theory should factor uniquely into primes and we exhibit on broadly applicable way to do this.

Summary Statement

I am studying numbers of the form $X62 + 5Y^2$ and creating a new, previously hidden table from the original's entries.

Help Received

Laurens Gunnarsen helped create the Excel spreadsheets for me because I do not have the Excel program on my computer).