Name(s)	Project Number
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Project Title

Inverse Symmetry Pattern in the Multiplication Table

Abstract

Objectives/Goals

My objective is to find out why when a multiplication table is folded diagonally so that the fold runs from the upper left corner to the lower right corner, the numbers that touch each other (excluding the row and column headings) have identical ones place numbers.

Methods/Materials

Methods: I thought that this pattern was caused by another pattern in the factors of the numbers with identical ones place digits, so I examined these factors and looked for patterns.

Materials: A multiplication table

Results

I did find a pattern in the factors of the numbers with ones place digits related to this previously found pattern. However, while I was explaining my findings to a judge in the Santa Clara Valley Science Fair, I discovered that this pattern that I had found did not always work. As far as I know now, it only works for the even pairs of numbers. I also found that this pattern with the ones place numbers only occurs in square multiplication tables that go up to a multiple of five. In the process, I noticed some other patterns in the factors of these numbers, which will take a while to explain thoroughly, so I am not including that in the abstract.

Conclusions/Discussion

The quite significant pattern that I found (which I later discovered to not always work) that is relevant to the first pattern is explained here. Take two of the numbers with identical ones place digits explained previously.

10   40
2 x 5   8 x 5

Give them two other common factors.

2 x 5   2 x 20

Multiply the common factor, 2, by the ones place digit of the other number in each product.

$2 \times 5 = 10$
$2 \times 0 = 0$

I condensed all of this into one formula, that is shown here, in which n = the ones place value.

$$n \{ GCF(b, y) \ x \ n[\ (\ b / GCF(b, y)) \ x \ c \ ] \} \ = \ n \{ GCF(b, y) \ x \ n[\ (\ y / GCF(b, y)) \ x \ z \ ] \}$$

Summary Statement

Why, when a multiplication table is folded diagonally so that the fold runs from the upper left to the lower right corner, do the numbers that touch each other (excluding the row and column headings) have identical ones place numbers?

Help Received

My Mother and my teachers helped me to find ideas. My Mother did some of the formatting for the report. My teachers helped me to improve the report, the poster and my presentation.