**Math 468 Problem Set 1**

1. Molly assigns every letter of the alphabet a different whole number value. She finds the value of a word by multiplying the values of its letters together. For example, if D has a value of 10, and I has a value of 8, then the word DID has a value of 10 × 8 × 10 = 800. The table shows the value of some words. What is the value of the word MATH?

| Word | Value |
|------|-------|
| TOTE | 18 |
| TEAM | 168 |
| MOM | 49 |
| HOME | 70 |
| MATH | ? |

*(Taken from the Gauss Contest for grade 7 from 2010)*

2. Counting Squares

Consider the 3 by 3 grid given here. Can you count all the squares?  Do you see that there are 14 squares in all? How many squares would you have in a 4 by 4 grid or a 5 by 5 grid?  Can you find a general rule to determine the number of squares for a given square grid? What size would the grid need to be to have at least 10 000 squares?
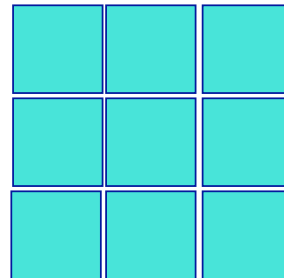
3. Choose a 3 by 3 grid anywhere on the hundreds chart below (examples are given for you). Find the sums of the numbers along the two diagonals of the 3 by 3 grid. How do the sums compare? Will this comparison always hold true no matter which 3 by 3 grid you choose? Why? Does this also hold true for a 4 by 4 grid? Why?

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|----|----|----|----|----|----|----|----|----|----|
| 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 |
| 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 |
| 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 |
| 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 |
| 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 |
| 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 |
| 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 |
| 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 |

4.  Four Fours

What numbers can you make using four fours and mathematical symbols? For example:

$$\frac{4}{4} \times \frac{4}{4} = 1 \qquad \frac{4}{4} + \frac{4}{4} = 2$$

Can you make all the numbers to 10?  Try using other start numbers such as four threes, four fives, four sevens. Which sets can be used to make the numbers from 1 to 10?

5. Diagonal through a Rectangle

Find out how many squares the diagonal of a rectangle passes through.
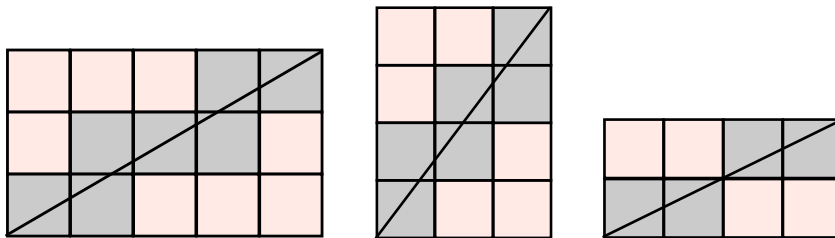


3 by 5 diagonal passes through 7 squares
4 by 3 diagonal passes through 6 squares
4 by 2 diagonal passes through 4 squares

Find a way to determine the number of squares that the diagonal passes through in any given rectangle. Explain your reasoning.

6. Consecutive Sums

Some numbers can be expressed as the sum of a string of consecutive positive numbers. Which numbers have this property? Explain how you know.

Examples:
5 = 2 + 3
9 = 2 + 3 + 4
12 = 3 + 4 + 5
18 = 3 + 4 + 5 + 6