Julia Robinson Mathematics Festival

Directed By Joshua Zucker

Times Tables and Beyond

Begin by filling in a 10 by 10 multiplication table.

1. Where are the odd numbers in the table? Where are the even numbers? Why?

2. What numbers occur in the fewest places in your table? Will they still be the rarest if you extended your table to 100 by 100 or 1000000 by 1000000?

3. What numbers occur in the most places in your table? Will they still be the most common if you extended your table?

4. What numbers occur an odd number of times in your table? Will they still be the ones occurring an odd number of times if you extended your table to 1000 by 1000?

5. What is the smallest number that will occur 10 or more times in your table?

6. What is the smallest number that will occur exactly 11 times in your table?

7. What is the sum of all the numbers in your table? You might enjoy visiting the "Counting Squares" activity to apply what you learn here.

8. Add up the cubes of the numbers from 1 through 10.

9. Make a multiplication table whose labels are not the consecutive integers 1 through 10. For instance, what if the sides are labeled 1, 3, 9 and you have a 3 by 3 multiplication table? How about if you label them 1, 2, 3, 5? Or 1, 2, 3, 6? Or 1, 2, 2, 4? Or 1, 2, 2, 3, 4, 6? Why do some of these fit the pattern from #7 and 8, and others not?

10. Can you explain what you discovered?

11. Now let's sum the (backward) diagonals of the standard multiplication table. 1, 2+2, 3+4+3, 4+6+6+4, … Do you see a pattern?

12. Write out Pascal's triangle, and look for a relationship between it and the sums of the diagonals of the multiplication table. Can you explain what you discovered?

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