

Combinatorics Problems

Sunday, October 18th, 2009, Math Circle Group A

Addition Principle: if there are a number of objects in the first set, a number of objects in the second set, and a number of objects in every set until the last set, and if none of these sets overlap, then the *total number of ways* to select an object from all of the sets is the total of all the objects.

Multiplication Principle: if a procedure can be broken into a number of steps, and all the steps are independent, then the *total number of outcomes* is the number of possibilities in step one times the possibilities in step two time each step until the last one.

1. Do the following problems. If you use one of the principles above, say so.
 - (a) How many whole numbers are between 0 and 40 (including 0 and 40)?
 - (b) How many of these numbers are divisible by 2?
 - (c) How many pairs of different numbers are there whose difference is 5? Do not repeat numbers- for example, 3 and 8 is the same as 8 and 3.
2. Two six-sided dice are rolled, one green and one red.
 - (a) How many different outcomes of this procedure are there? Which principle did you use?
 - (b) If I add one more red die, and then roll all three, how many different outcomes are there?
3. There are five different Spanish books, six different French books, and eight different Transylvanian books.
 - (a) How many different books can you pick? Which principle did you use?
 - (b) How many ways are there to pick a pair of two books not in the same language?
4. A store carries 7 styles of pants. For each style, there are 10 different possible waist sizes, 6 pants lengths, and 4 color choices. How many different types of pants could the store have?
5. How many 5-letter combinations can you make with the 26 letters of the alphabet? What principle does this use?