EXPLORE the Math

The school athletic council has five members: Jill, Ted, Rhaj, Yvette, and Martin. This Wednesday, they plan to hold a bake sale.

How can you count the number of committees of at ~~least~~ two people that can be chosen to sell baked goods during lunch?

Reflecting

A. Share your results and your strategy with several other pairs of students. Discuss any differences. $\frac{5\cdot 4}{2!}$ group of 2

B. When you considered all the possible committees, was each committee a permutation or a **combination** of people? Explain. order does NOT matter

C. The expression $\frac{5!}{a!b!}$ can be used to determine the number of committees that can be formed from 5 people. What do a and b represent in this expression? Verify that this expression works for all the 2-, 3-, 4- and 5-person committees you considered. $\frac{5!}{2!3!}$ # in group # not in group

D. Suppose only 1 person is needed for the bake sale. How many ways are there to choose that person? Does the expression in part C work in this situation?

E. What is the relationship between the number of people to choose from, in this case 5 people, and the variables a and b in the expression $\frac{5!}{a!b!}$?

$\frac{5!}{4!1!} = 5$

committee of 1

E. $a + b = 5$

committee of 2 $\Rightarrow \frac{5!}{2!3!} = 10$

3 $\Rightarrow \frac{5!}{3!2!} = 10$

4 $\Rightarrow \frac{5!}{4!1!} = 5$

5 $\Rightarrow \frac{5!}{5!0!} = 1$

ex// How many committees of 5 can be formed from 9 people?

$\frac{9!}{5!4!} = \frac{9\cdot \cancel{8}^{2}\cdot 7\cdot \cancel{6}^{3}\cdot \cancel{5}}{\cancel{5}\cdot \cancel{4}\cdot \cancel{3}\cdot \cancel{2}\cdot 1} = 126$ or ${}_9C_5$

4.5 Exploring Combinations

combination: a group of elements where order does not matter

ex. The elements A, B and C have _six_ permutations but if the order of these elements is irrelevant, they have only _one_ combination since ABC is the same as ACB, BCA, BAC, etc...

Explore Pg. 271

In Summary

Key Ideas

- When order does not matter in a counting problem, you are determining combinations. For example, *abc*, *acb*, *bac*, *bca*, *cab*, and *cba* are the six different permutations of the letters *a*, *b*, and *c*, but they all represent the same single combination of letters.
- When all n objects are being used in each combination, there is only one possible combination.

Need to Know

- From a set of n different objects, there are always fewer combinations than permutations when selecting r of these objects where $r \leq n$. For example, the number of permutations, P, possible using two of the three letters *a*, *b*, and *c* is

$$P = \frac{3!}{(3-2)!}$$
$$P = 6$$

The six permutations are *ab*, *ba*, *ac*, *ca*, *bc*, and *cb*. However, of these six permutations, only *ab*, *ac*, and *bc* are different two-letter combinations.

Homework: pg. 272 #1-4