

## Lesson 9-5

### Example 1 Find the Number of Combinations

**ICE CREAM** Susie's Ice Cream Shop offers a selection of four flavors of ice cream. How many different two-scoop cones are possible where the scoops are different flavors?

**Method 1** Make a list.

The four flavors are labeled chocolate (c), vanilla (v), mint chocolate chip (m), and strawberry (s). List all of the permutations of the flavors taken two at a time.

cv	cm	cs	vc	vm	vs	mc
mv	ms	sc	sv	sm		

Then cross out the cones that are the same as one another. This leaves:

cv cm cs vm vs ms

So, there are 6 different two-scoop cones.

**Method 2** Use a permutation.

**Step 1** Find the number of permutations of the entire set.

$$4 \cdot 3 = 12 \quad \text{A permutation of 4 flavors taken 2 at a time.}$$

**Step 2** Find the number of ways of arranging the two scoops.

$$2 \cdot 1 = 2$$

**Step 3** Find the number of combinations.

$$\frac{12}{2} \text{ or } 6 \quad \text{Divide the number of permutations of the entire set by the number of permutations of each smaller set.}$$

So, there are 6 different two-scoop cones.

**Example 2 Find the Number of Combinations****BASKETBALL** In how many ways can 5 players be chosen for a pick-up basketball game from a group of 14 students?

This is a combination because the order in which the players are selected is not important.

There are  $14 \cdot 13 \cdot 12 \cdot 11 \cdot 10 = 240,240$  ways to choose the five players.

There are  $5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 120$  ways to arrange the five players.

$$\frac{240,240}{120} = 2,002$$

So, there are 2,002 ways to choose the five players.

**Example 3 Find Probability****ICE CREAM** If the two scoops are chosen randomly in the situation presented in Example 1, what is the probability that the cone will have a scoop of vanilla?

Since there are 6 possible two-scoop cones and 3 of them have a scoop of vanilla, the probability that a randomly chosen cone will have a scoop of vanilla is  $\frac{3}{6}$  or  $\frac{1}{2}$ .