Name _____ Date _____

LESSON 11.3

Study Guide

For use with the lesson "Find Probabilities Using Combinations"

GOAL **Use combinations to count possibilities.**

Vocabulary

A **combination** is a selection of objects in which order is *not* important.

EXAMPLE 1 Count combinations

Count the combinations of three letters from the list A, B, C, D.

Solution

List all of the permutations of three letters from the list A, B, C, D. Because order is not important in a combination, cross out any duplicate groupings.

ABC, ~~ACB~~, ABD, ~~ADB~~, ACD, ~~ADC~~

~~BAC~~, ~~BCA~~, BCD, ~~BDC~~, ~~BDA~~, ~~BAD~~

~~CAB~~, ~~CBA~~, ~~CBD~~, ~~CDB~~, ~~CAD~~, ~~CDA~~

~~DAB~~, ~~DBA~~, ~~DAC~~, ~~DCA~~, ~~DBC~~, ~~DCB~~

There are 4 possible combinations of 3 letters from the list A, B, C, D.

Exercise for Example 1

1. Count the combinations of 2 letters from the list A, B, C, D, E, F.

EXAMPLE 2 Use combination formula

Photo Background For your school picture, you can choose 4 backgrounds from a list of 10. How many combinations of backdrops are possible?

Solution

The order in which you choose the backgrounds is not important. So, to find the number of combinations of 10 backgrounds taken 4 at a time, find ${}_{10}C_4$.

$$
\begin{aligned}
{}_{10}C_4 &= \frac{10!}{(10-4)! \cdot 4!} && \text{Combination formula} \\
&= \frac{10!}{6! \cdot 4!} && \text{Subtract.} \\
&= \frac{10 \cdot 9 \cdot 8 \cdot 7 \cdot \cancel{6!}}{\cancel{6!} \cdot (4 \cdot 3 \cdot 2 \cdot 1)} && \text{Expand factorials. Divide out common factorial, } 6!. \\
&= 210 && \text{Multiply.}
\end{aligned}
$$

There are 210 different combinations of backgrounds you can choose.

LESSON 11.3

Study Guide *continued*

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EXAMPLE 3 Find a probability using combinations

Student Council A school's student council has 16 members, including 4 seniors. There are 4 members randomly chosen to represent the student council at a school open house. What is the probability that all 4 council members chosen are the seniors?

Solution

STEP 1 **Write** the number of possible outcomes as the number of combinations of 16 people chosen 4 at a time, or ${}_{16}C_4$, because the order in which the people are chosen is not important.

$$
\begin{aligned}
{}_{16}C_4 &= \frac{16!}{(16-4)! \cdot 4!} \\
&= \frac{16!}{12! \cdot 4!} \\
&= \frac{16 \cdot 15 \cdot 14 \cdot 13 \cdot \cancel{12!}}{\cancel{12!} \cdot 4 \cdot 3 \cdot 2 \cdot 1} \\
&= 1820
\end{aligned}
$$

STEP 2 **Find** the number of favorable outcomes. Only one of the possible outcomes includes all four seniors.

STEP 3 **Calculate** the probability.

$$P(\text{all seniors are chosen}) = \frac{1}{1820}$$

Exercises for Examples 2 and 3

2. **What if?** In Example 2, suppose you can choose 3 backgrounds out of the list of 10. How many combinations are possible?

3. **What if?** In Example 3, suppose there are 12 members on student council, 4 of them seniors. Find the probability the seniors are the 4 members chosen for the open house.