F Math 12

4.1 Counting Principles p. 228

Name ________________

Date ________________

Goal: Determine the Fundamental Counting Principle and use it to solve problems.

1. **Fundamental Counting Principle (FCP)**: If there are ***a*** ways to perform one task and ***b*** ways to perform another, then there are ______________ ways of performing both.

Example 1: Selecting a strategy to solve a counting problem (p. 230)

Hannah plays on her school soccer team. The soccer uniform has:

- three different sweaters: red, white, and black,
- three different shorts: red, white, and black.

How many different variations of the soccer uniform can the coach choose from for each game?

Method 1: Use a tree diagram

Method 2: Use the Fundamental Counting Principle

Number of uniform variations = _______ x _______ = ________

There are __________ different variations of the soccer uniform to choose from.

Example 2: A bike lock opens with the correct four-digit code. Each wheel rotates through the digits 0 to 9.

a. How many different three-digit codes are possible?

Number of different codes = ______ x ______ x ______ x ______ = ________

There are _______ different four-digit codes.

b. Suppose each digit can be used only once in a code. How many different codes are possible when repetition is not allowed?

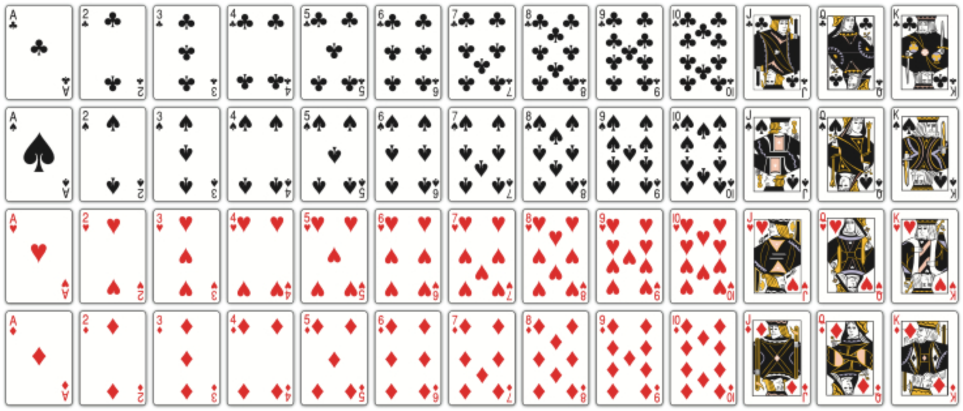
Number of different codes = ______ x ______ x ______ x ______ = _______

There are _______ different four-digit codes when the digits cannot repeat.

The Fundamental Counting Principle applies when tasks are related by the word **AND**
If tasks are related by the work **OR**: • If the tasks **are** mutually exclusive, they involve two disjoint sets A and B: • If the tasks **are not** mutually exclusive, they involve two sets that are not disjoint, C and D: The Principle of Inclusion and Exclusion must be used to avoid counting elements in the intersection of the two sets more than once.

Example 3: Solving a counting problem when the Fundamental Counting Principle does not apply (p. 232)

A standard deck of cards contains 52 cards as shown.



Count the number of possibilities of drawing a single card and getting:

a. either a black face card or an ace

There are _________ ways to draw a single card and get either a black face card or an ace.

b. either a red card or a 10

There are _________ ways to draw a single card and get either a red card or a 10.

In Summary

Key Ideas

- The Fundamental Counting Principle applies when tasks are related by the word AND.
- The Fundamental Counting Principle states that if one task can be performed in a ways and another task can be performed in b ways, then both tasks can be performed in $a \cdot b$ ways.

Need to Know

- The Fundamental Counting Principle can be extended to more than two tasks: if one task can be performed in a ways, another task can be performed in b ways, another task in c ways, and so on, then all these tasks can be performed in $a \cdot b \cdot c \ldots$ ways.

- The Fundamental Counting Principle does not apply when tasks are related by the word OR. In the case of an OR situation,
  - if the tasks are mutually exclusive, they involve two **disjoint** sets, A and B:

    $n(A \cup B) = n(A) + n(B)$
  - if the tasks are not mutually exclusive, they involve two sets that are not disjoint, C and D:

    $n(C \cup D) = n(C) + n(D) - n(C \cap D)$

  The Principle of Inclusion and Exclusion must be used to avoid counting elements in the intersection of the two sets more than once.

- Outcome tables, organized lists, and tree diagrams can also be used to solve counting problems. They have the added benefit of displaying all the possible outcomes, which can be useful in some problem situations. However, these strategies become difficult to use when there are many tasks involved and/or a large number of possibilities for each task.

HW: 4.1 p. 235-237 #4-12, 14 & 16