

12-1 Fundamental Counting Principle
& Multiplying Probabilities

1. **Outcome** - the result of a single trial.
2. **Sample Space** - the set of all possible outcomes
3. **Independent Events** - when one event does NOT affect the choices for the other events
4. **Dependent Events** - The outcome of one event DOES affect the outcome of another event.
5. **Fundamental Counting Principle** - If event M can occur in m ways and is followed by event N that can occur in n ways, then event M followed by event N can occur in $m \bullet n$ ways

6. **Tree Diagram**- A way to show the possible outcomes

ex) Dane is renting a tuxedo for prom. Once he has chosen his jacket, he must choose from three types of pants and six colors of vests. How many ways can he select his attire for prom?

ex) Draw a tree diagram of this situation.

ex) A sandwich menu offers customers a choice of white, wheat or rye bread with one spread chosen from butter, mustard, or mayonnaise. How many different combinations of bread and spread are possible?

ex) Sara wants to take ten different classes next year. Assuming each class is offered each period, how many different schedules could she have?

7. **Probability** - the ratio that measures the chance of an event occurring.

8. **Success** - A desired outcome

9. **Failure** - any other outcome

10. $P(S) = \frac{s}{s+f}$

ex) A bag contains 3 red, 4 blue and 6 green marbles. One marble is chosen. Find each.

P(red) =

P(blue)=

P(not blue)=

8. Probability of Two Independent Events -

$$P(A \text{ and } B) = P(A) \cdot P(B)$$

9. Probability of Two Dependent Events -

$$P(A \text{ and } B) = P(A) \cdot P(B \text{ following } A)$$

ex) Jared has 9 dimes and 7 pennies in his pocket. He randomly selects one coin, looks at it, and replaces it. He then randomly selects another coin. What is the probability that both coins he selects are dimes?

ex) $P(\text{both are pennies})$

ex) When three dice are rolled, what is the probability that the first two show a 5 and the third shows an even number?

ex) $P(\text{they are all } 6) =$

ex) $P(\text{all are even}) =$

ex) The host of a game show is drawing chips from a bag to determine the prizes for which contestants will play. Of the 10 chips in the bag, 6 show *television*, 3 show *vacation*, and 1 shows *car*. If the host draws the chips at random and does NOT replace them. Find each.

$P(\text{vacation then car}) =$

$P(\text{two televisions}) =$

$P(\text{car then television}) =$

ex) Three cards are drawn from a standard deck of cards WITHOUT replacement. Find each.

$P(\text{heart, heart, spade in that order}) =$

$P(\text{diamond, club, diamond in that order}) =$

$P(\text{three cards of the same suit}) =$

ex) Three cards are drawn from a standard deck of cards WITH replacement. Find each.

$P(\text{club, heart, diamond in that order}) =$

$P(\text{three of the same number}) =$

12-2 Permutations and Combinations

1. Permutation - when a group of objects or people are arranged in a certain order. The order of the objects is very important.
2. Combination - an arrangement or selection of objects or people in which order is NOT important.
3. Determine if the following are combinations or permutations.

ex) seven shoppers in a line at a checkout counter

ex) the first, second and third place finishers in a race

ex) choosing 5 toppings on a pizza

ex) an arrangement of the letters in the word *algebra*

4. The number of permutations of n distinct objects taken r at a time is given by

$${}_n P_r \text{ or } P(n,r) = \frac{n!}{(n-r)!}$$

5. The number of combinations of n distinct objects taken r at a time is given by

$${}_n C_r \text{ or } C(n,r) = \frac{n!}{(n-r)!r!}$$

6. The number of permutations of n objects of which p are alike and q are alike is given

$$\text{by } \frac{n!}{p!q!}$$

7. ! = Factorial

ex) $3! = 3 \cdot 2 \cdot 1$

ex) $5! = 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$

ex) ${}_6 C_2$

ex) ${}_8 P_3$

ex) $P(4,1)$

ex) $C(5,2)$

ex) There are 10 finalists in a figure skating competition. How many ways can gold, silver, and bronze medals be awarded?

ex) Five cousins at a family reunion decide that three of them will go to pick up pizza. How many ways can they choose three people who will go?

ex) How many different ways can the letters of the word *DECIDED* be arranged?

ex) A newspaper has nine reporters available to cover four different stories. How many ways can the reporters be assigned to cover the stories?

ex) Find the number of possibilities for choosing two CDs to buy from ten that are on sale.

ex) Find the number of possibilities for seating 5 men and 5 women alternately in a row, beginning with a woman.

***ex) Six cards are drawn from a standard deck of cards. How many hands consist of two hearts and four spades?

***ex) Five cards are drawn from a standard deck of cards. How many hands consist of three clubs and two diamonds?

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Secondary Math II

12-1 In-Class

Fundamental Counting Principle and Multiplying Probability

1. A bag contains 3 white cards, 2 black cards, and 5 red cards. Find the probability of each event for one draw:

A white card

A red card

Calculate the probability of each event for one roll of a 6 sided die:

2. An even number, an odd number

3. A number less than 3, A number greater than 3

Find the total number of license plates possible :

4. 2 letters followed by 3 digits, 3 letters followed by 4 digits

Draw a tree diagram for the following situations, and find the total possible number of outcomes:

5. The Pie Pizzeria offers a special price on a 2-topping pizza. You can choose 1 topping from each of the following groups:

A) provolone cheese or extra mozzarella cheese

B) pepperoni, sausage, or Canadian bacon

6. Suppose that the probability of Kevin coming to a party is 80% and the probability of Judy coming to a party is 95%. Assuming that these events are independent, what is the probability that they both will come to a party?

Events A, B, C and D are independent, and $P(A) = 0.5$, $P(B)=0.25$, $P(C)=0.75$, and $P(D)=0.1$. Find each probability.

7. $P(C \text{ and } D)$

8. $P(A \text{ and } D)$

Refer to the spinner shown below in which each numbered section is exactly $\frac{1}{8}$ of the circle. Find the probability of each event in three spins of the spinner.

9. All three numbers are 7's.

10. All three numbers are even.



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Secondary Math II

**12-2 In-Class
Permutations and Combinations**

Evaluate each expression:

1. ${}_{10}P_7$

2. ${}_{10}C_7$

3. Find the number of permutations of the first 8 letters of the alphabet for each situation:

taking 6 letters at a time

taking 1 letters at a time

taking all 8 letters at a time

4. Determine if the situation involves a permutation or a combination:

Four recipes were selected for publication and 302 recipes were submitted.

Four out of 200 contestants were awarded prizes of \$100, \$75, \$50, and \$25.

5. Use a combination or a permutation to answer each question:

How many ways are there to choose a committee of 3 from a group of 12 people?

Find the number of ways to choose a chairperson, secretary, and treasurer from a group of 12 people.

6. Find the number of permutations of the letters in each word:

barley

pencil

trout

circus

7. Find the probabilities using combinations:

A bag contains 5 white marbles and 3 green marbles. Find the probability of selecting 1 green and 1 white marble.

Find the probability of drawing 4 kings and a queen from a standard deck of 52 playing cards.

8. Five different stuffed animals are to be placed on a circular display rack in a store. In how many ways can this be done?

9. Seven different types of sunglasses are to be displayed on a circular display rack. In how many ways can they be arranged?

10. A basketball team of 5 players is huddled in a circle along with their coach. In how many ways can they be arranged in the huddle?