

EQ:

Businesses have discovered that the overall likelihood, or _____, of an event can be discovered by observing the results of a _____ of the situation in which the event may occur.

❖ New Terminology:

DEFINITION	EXAMPLE
<u>Trial</u> --- a _____ _____ for an event to occur	
<u>Experiment</u> --- one or more _____	
<u>Sample Space</u> --- the set of all _____ _____ of an event	
<u>Event</u> --- an _____ outcome or any specified _____ of outcomes	

Outcomes are _____ if all possible outcomes are equally likely.

Example 1 Finding a Sample Space

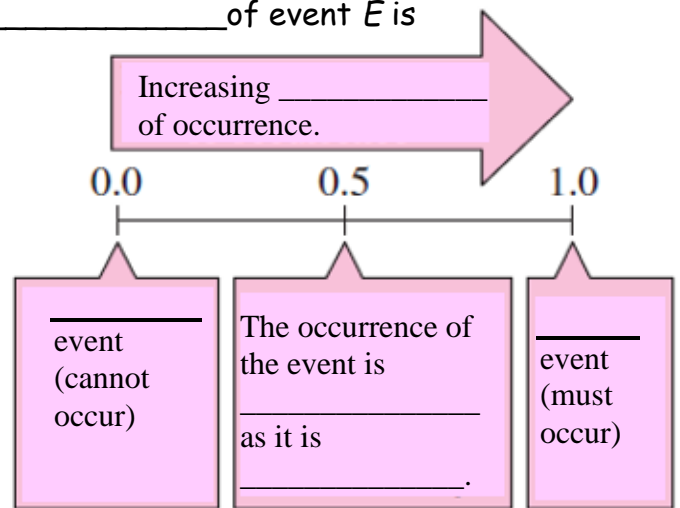
Find the sample space for each of the following.

- a. One coin is tossed. $S =$ _____
- b. Two coins are tossed. $S =$ _____
- c. Three coins are tossed. $S =$ _____

- Determine the sample space for tossing a coin and rolling a die simultaneously.
 $S =$ _____

The Probability of an Event --- if an event E has _____ equally likely outcomes and its sample space S has _____ equally likely outcomes, the _____ of event E is

$P(E) =$



❖ Expressing Probability:

1. _____ must be a number from _____ to _____, inclusive
2. _____ may be written as a _____, _____, or _____
3. _____ an _____ event has a probability of _____
4. _____ a _____ event has a probability of _____
5. _____ the _____ of the probabilities of all _____ in a sample space is _____

❖ Types of Probability:

- Theoretical --- what we _____ for a given event
- Experimental --- what _____ when we perform a simulation

$P(A) =$ _____

- Law of Large Numbers --- as the number of trials in an experiment _____, the approximation of the _____ probability _____ the _____ probability.

Example 2 Finding the Probability of an Event

- a. Two coins are tossed. What is the probability that both land heads up?
 - b. A card is drawn from a standard deck of playing cards. What is the probability that it is an ace?
- When tossing a coin three times, find the probability of getting exactly two heads.

Example 3 Finding the Probability of an Event

Two six-sided dice are tossed. What is the probability that the total of the two dice is 7?

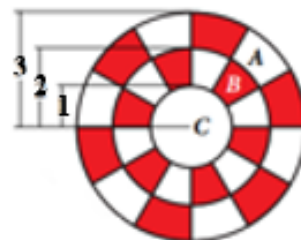
Because there are six possible outcomes on each die, you can use the _____
 _____ to conclude that there are _____ or _____ different
 outcomes when two dice are tossed. To find the probability of rolling a total of 7, you must
 first count the number of ways in which this can occur.

$$S = \underline{\hspace{10em}}$$

$$P(E) = \frac{n(E)}{n(S)} =$$

- When tossing a six-sided die twice, find the probability the sum is 5.

Ex. Assume that a dart will land on the dartboard at the right and that each point on the dartboard is equally likely to be hit. Find the probability of a dart landing in region **A**, the outer ring.



RECALL: Area of a Circle = _____ $P(A) = \frac{\text{area of region } A}{\text{total area}}$

Example 5 The Probability of Winning a Lottery

In Arizona's The Pick game, a player chooses six different numbers from 1 to 40. If these six numbers match the six numbers drawn (in any order) by the lottery commission, the player wins (or shares) the top prize. What is the probability of winning the top prize if the player buys one ticket?

To find the number of elements in the sample space, use the formula for the number of combinations of 40 elements taken six at a time.

$$n(S) = {}_{40}C_6 =$$

$$P(E) = \frac{n(E)}{n(S)} =$$

- A bag contains one green two yellow, and three red marbles. You draw two marbles (without replacement). Find the probability of obtaining two red marbles.

_____ or use combinations _____

- ❖ Mutually Exclusive Events --- given two events A and B from the same sample space having _____ outcomes in common; the intersection is the _____ $P(A \cap B) =$
- ❖ Probability of the Union of Two Events --- given A and B are events from the same sample space, the probability of _____ occurring

$$P(A \text{ or } B) = P(A \cup B) =$$

If A and B are _____, then $P(A \text{ or } B) = P(A \cup B) =$


Example 7 The Probability of a Union of Events

One card is selected from a standard deck of 52 playing cards. What is the probability that the card is either a heart or a face card?

$$P(A \cup B) = .$$

Example 8 Probability of Mutually Exclusive Events

The personnel department of a company has compiled data on the numbers of employees who have been with the company for various periods of time. The results are shown in the table.



Years of Service	Number of employees
0-4	157
5-9	89
10-14	74
15-19	63
20-24	42
25-29	38
30-34	37
35-39	21
40-44	8

If an employee is chosen at random, what is the probability the employee has the following?

- a. 4 or fewer years of service
- b. 9 or fewer years of service

- A shipment of 12 microwave ovens contains three defective ovens. A high school has ordered four of these ovens, and because each is identically packaged, the selection is random. What are the following probabilities?

- a) probability all four microwaves are good
- b) probability exactly 2 microwaves are good
- c) probability **at least 2** microwaves are good

Independent Events --- occurrence of one event has no _____ on the occurrence of the other.

Probability of Independent Events --- given A and B are independent events, the probability that _____ will occur is $P(A \text{ and } B) = P(A \cap B) =$

Example 9 Probability of Independent Events

A random number generator on a computer selects three integers from 1 to 20. What is the probability that all three numbers are less than or equal to 5?

Two integers from 1 through 40 are chosen at random by a random number generator. Find the following probabilities.

- a) probability that both numbers are even
- b) probability that one number is even or one number is odd
- c) probability that both numbers are less than 30
- d) probability that the same number is chosen twice

The Complement of an Event --- the collection of all outcomes in the sample space that are _____ in the event; denoted by _____. Because $P(A \text{ or } A') =$ _____ and because A and A' are _____, $P(A) + P(A') =$ _____.

Let A be an event and let A' be its complement. If the probability of A is _____, the probability of the complement is $P(A') =$ _____

Example 11 Finding the Probability of a Complement

A manufacturer has determined that a machine averages one faulty unit for every 1000 it produces. What is the probability that an order of 200 units will have one or more faulty units?

$$P(A) =$$

$$P(A') =$$

A fire company keeps two rescue vehicles to serve the community. Because the demand on the company's time and the chance of mechanical failure, the probability that a specific vehicle is available when needed is 90%. If the availability of one vehicle is *independent* of the other, find the following probabilities.

- a) both available
- b) neither available
- c) at least 1 available (means the same as the _____)

➤ Assignment: p. 682 - 685 #6, 10, 18, 23, 24, 41, 50, 51, 55