Exclusive and Inclusive Probabilities—Adding Probabilities

A simple event is one event.

A compound event is an event that consists of two or more simple events.

Two events that cannot occur at the same time are called mutually exclusive.

Probability of Mutually Exclusive Events
If two events, A and B, are mutually exclusive, then the probability that A or B occurs is the sum of their probabilities.

\[ P(A \text{ or } B) = P(A) + P(B) \]

Two events whose outcomes may be the same are called inclusive events.

Probability of Inclusive Events
If two events, A and B, are inclusive, then the probability of A or B occurs is the sum of their probabilities decreased by the probability of both occurring.

\[ P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B) \]

Ex: A die is rolled. Find each probability.
1. P(1 or 6)  
2. P(at least 5)  
3. P(less than 3)
4. P(prime)  
5. P(even or prime)  
6. P(multiple of 2 or 3)
Ex: Ten slips of paper are placed in a container. Each is labeled with a number from 1 through 10. Determine whether the events are mutually exclusive or inclusive. Then find the probability.
1. \( P(1 \text{ or } 10) \)  
2. \( P(3 \text{ or odd}) \)  
3. \( P(6 \text{ or less than 7}) \)

Ex: Find each probability.
1. Two letters are chosen at random from the word GEESE and two are chosen at random from the word PLEASE. What is the probability that all four letters are Es or none of the letters are E?

2. Three dice are thrown. What is the probability that all three dice show the same number?

3. Two marbles are simultaneously drawn at random from a bag containing 3 red, 5 blue, and 6 green marbles.
   a. \( P(\text{at least one red marble}) \)  
   b. \( P(\text{at least one green marble}) \)
   c. \( P(\text{two marbles of the same color}) \)  
   d. \( P(\text{two marbles of different colors}) \)
4. There are 8 girls and 8 boys on ASB. Three of the students are juniors. What is the probability that a person selected from ASB is not a junior?

5. There are 2400 subscribers to an Internet service provider. Of these, 1200 own Brand A computers, 500 own Brand B, and 100 own both A and B. What is the probability that a subscriber selected at random owns either Brand A or Brand B?

6. Christina has a stack of playing cards consisting of 10 hearts, 8 spades, and 7 clubs. If she selects a card at random from this stack, what is the probability that it is a heart or a club?

**Binomial Probabilities**

Binomial Probabilities
A binomial probability exists if and only if all of these conditions occur:
1. There are exactly two possible outcomes for each trial.
2. There are a fixed number of trials.
3. The trials are independent.

Ex: Find each probability if a coin is tossed 3 times.
1. P(exactly 2 heads) 2. P(0 heads) 3. P(at least 1 head)
Ex: Find each probability.
1. Ten percent of a batch of toothpaste is defective. Five tubes of toothpaste are selected.
   a. P(0 defective)   b. P(exactly one defective)
   
   c. P(at least 3 defective)   d. P(less than 3 defective)

2. On a 20-question true-false test, you guess at every question.
   a. P(all answers correct)   b. P(exactly 10 correct)

3. Jessica Mendoza of Stanford University was the 2000 NCAA women’s softball batting leader with an average of .475. This means that the probability of her getting a hit in a given at-bat was 0.475.
   a. Find the probability of her getting 4 hits in 4 at-bats.
   b. Find the probability of her getting exactly 2 hits in 4 at-bats.
4. A report said that approximately 1 out of 6 cars sold in a certain year was green. Suppose a salesperson sells 7 cars per week.
   a. What is the probability that this salesperson will sell exactly 3 green cars in a week?

   b. What is the probability that this salesperson will sell at least 3 green cars in a week?

5. If a family has 4 children, what is the probability that they have 2 girls and 2 boys?

**Homework**
Exclusive-Inclusive Probabilities and Binomial Probabilities Worksheet