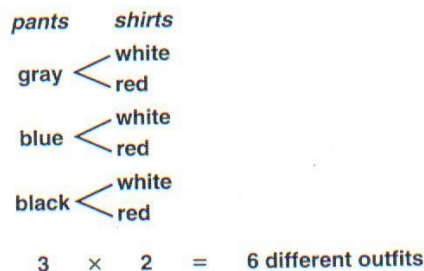


## Counting Outcomes

Andy has 3 pairs of pants: 1 gray, 1 blue, and 1 black. He has 2 shirts: 1 white and 1 red. If Andy picks 1 pair of pants and 1 shirt, how many different outfits does he have?

Andy can choose 1 of 3 pairs of pants and 1 of 2 shirts. A tree diagram can help you count his choices.



The total number of choices is the product of the number of choices for pants and the number of choices for shirts.

You can also use the *counting principle*.

$$\begin{array}{ccccccc}
 n & \times & m & \text{give} & n \times m \\
 \text{first choices} & & \text{second choices} & & \text{total choices}
 \end{array}$$

Andy has 6 different outfits.

### Find the total number of choices.

- |   |   |
|---|---|
| <p>1. Moesha has 6 pairs of socks and 2 pairs of sneakers. She chooses 1 pair of socks and 1 pair of sneakers. How many possible combinations are there?</p> <p>_____</p> | <p>2. Ralph wants to have soup and salad for lunch. There are 5 kinds of soup and 3 kinds of salad on the menu. He picks one of each. From how many possible combinations can he choose?</p> <p>_____</p> |
| <p>3. Carla has 4 hats and 4 scarves for winter weather. She picks one of each to wear. How many hat and scarf combinations are there?</p> <p>_____</p>                   | <p>4. Lorenzo is looking at 5 color markers and 4 types of paper. He picks one of each. How many choices of color and paper does he have?</p> <p>_____</p>  |
| <p>5. Eric has 3 baseballs and 4 bats. From how many possible ball and bat combinations can he choose?</p> <p>_____</p>   | <p>6. Kim has 5 swimsuits, 3 pairs of sandals, and 2 beach towels. In how many ways can she pick one of each?</p> <p>_____</p>  |

## Practice: Counting Outcomes

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Draw a tree diagram to show all possibilities.

1. Today, the school's cafeteria is offering a choice of pizza or spaghetti. You can get milk or juice to drink. For dessert you can get pudding or an apple. You must take one of each choice.
2. A clothing store sells shirts in three sizes: small, medium, and large. The shirts come with buttons or with snaps. The colors available are blue or beige.

Choose a calculator, paper and pencil, or mental math.

3. How many license plates are possible if four letters are to be followed by two digits?  
\_\_\_\_\_
4. How many license plates are possible if two letters are to be followed by four digits?  
\_\_\_\_\_
5. A dress pattern offers two styles of skirts, three styles of sleeves, and four different collars. How many different types of dresses are available from one pattern?  
\_\_\_\_\_
6. In a class of 250 eighth graders, 14 are running for president, 12 are running for vice president, 9 are running for secretary, and 13 are running for treasurer. How many different results are possible for the class election?  
\_\_\_\_\_
7. A home alarm system has a 3-digit code that can be used to deactivate the system. If the homeowner forgets the code, how many different codes might the homeowner have to try?  
\_\_\_\_\_
8. A 4-letter password is required to enter a computer file. How many passwords are possible if no letter is repeated and nonsense words are allowed?  
\_\_\_\_\_

## Analyzing Events Not Equally Likely

The student council president at Whelms Junior High is drawing a name out of a hat to select a council member to represent the student body at a reception for the mayor.

Council Members							
Member	Grade	Member	Grade	Member	Grade	Member	Grade
Dan Jones	8	Jim Monroe	9	Tom Mayer	9	Sue Wiley	9
Mary Mifume	8	Kate Wright	7	Max Doria	9	Judy Stein	8
Joan Carr	7	Jenny Pitt	9	Debbie Lee	7	Mandy Jacobs	7
Miranda Perez	9	Ben Hope	9	Anna Sanchez	8	Russell Young	8
Norm Gant	8	Stew Barns	8	Jack Toth	7	Steve Kasko	9

Complete the frequency chart as needed in order to answer the questions below. Use the probability formula to compute your answers.

- What is the probability of drawing the name of a council member
  - who is female? \_\_\_\_\_
  - who is male? \_\_\_\_\_
  - who is an eighth grader? \_\_\_\_\_
  - who is not a seventh grader? \_\_\_\_\_
  - who is a ninth grader? \_\_\_\_\_
  - who is a male ninth grader? \_\_\_\_\_
- What is the probability of drawing the name of either a male or a female? \_\_\_\_\_
- The probability of drawing the name of a student who is 14 years old is  $\frac{2}{5}$ . How many students are 14 years old? \_\_\_\_\_
- The probability of drawing the name of a student who has a class with Mr. Cartwright is  $\frac{3}{10}$ . How many of Mr. Cartwright's students are in the drawing? \_\_\_\_\_

Description	Frequency
female	
male	
eighth grader	

## Practice: Analyzing Events Not Equally Likely

**Example** A card is drawn from a well-shuffled deck. What is the probability that the card is a five?

**Solution**  $P(\text{five}) = \frac{4}{52}$  There are 4 fives and 52 possible outcomes.  
 $= \frac{1}{13}$

**A card is drawn from a well-shuffled deck.**

1. What is the probability that the card is a nine?
2. What is the probability that the card is a six?
3. What is the probability that the card is a two?
4. What is the probability that the card is a three?
5. What is the probability that the card is a four?

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_

**Suppose you draw 1 card from a standard deck of 52 cards. Find each probability.**

6.  $P(\text{jack})$
7.  $P(\text{red } 10)$
8.  $P(\text{club})$
9.  $P(\text{not a red card})$
10.  $P(\text{face card})$
11.  $P(7 \text{ of hearts})$
12.  $P(\text{not a diamond})$
13.  $P(\text{not the ace of spades})$
14. A student reaches into a bag that contains 14 blue pens, 8 black pens, and 6 red pens. What is the probability that the student will pick a black pen?
15. Your cousin reaches into a bag that contains 12 popcorn balls, 16 rice cakes, and 10 granola bars. What is the probability that your cousin will pick a rice cake?
16. A teacher reaches into a bag that contains 6 plums, 14 clementines, and 12 nectarines. What is the probability that the teacher will pick a clementine?

6. \_\_\_\_\_
7. \_\_\_\_\_
8. \_\_\_\_\_
9. \_\_\_\_\_
10. \_\_\_\_\_
11. \_\_\_\_\_
12. \_\_\_\_\_
13. \_\_\_\_\_
14. \_\_\_\_\_
15. \_\_\_\_\_
16. \_\_\_\_\_

## Activity: Analyzing Events Not Equally Likely

Two **complementary** events have probabilities whose sum is 1.

If we have two **mutually exclusive** events  $A$  and  $B$ , then

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

For any two events  $A$  and  $B$ ,  $P(A \text{ or } B) = P(A) + P(B) - P(A \cap B)$ ,

where  $A \cap B$  means the intersection of  $A$  and  $B$ , or  $A$  and  $B$  both happening.

### Examples

An event  $B$  has a probability of  $\frac{3}{17}$ . What is  $P(B')$ ?

Since  $B$  and  $B'$  are complementary events we know  $P(B) + P(B') = 1$ .

$$\frac{3}{17} + P(B') = 1 \text{ so } P(B') = 1 - \frac{3}{17} = \frac{14}{17}$$

A spinner numbered 1–8 is spun. What is the probability of spinning a 1 or a 5?

Spinning a 1 or a 5 are mutually exclusive events. That is, they cannot occur at the same time. Thus,  $P(1 \text{ or } 5) = P(1) + P(5) = \frac{1}{8} + \frac{1}{8} = \frac{2}{8} = \frac{1}{4}$

A card is drawn from a well shuffled deck of 52 cards. What is the probability of drawing a diamond or a jack?

Drawing a diamond or drawing a jack are not mutually exclusive events. That is, they can occur at the same time, namely by drawing the jack of diamonds.

Thus,  $P(\text{diamond or jack}) = P(\text{diamond}) + P(\text{jack}) - P(\text{diamond} \cap \text{jack})$

$$P(\text{diamond}) = \frac{13}{52}, P(\text{jack}) = \frac{4}{52}, P(\text{diamond} \cap \text{jack}) = \frac{1}{52}$$

$$P(\text{diamond or jack}) = \frac{13}{52} + \frac{4}{52} - \frac{1}{52} = \frac{16}{52} = \frac{4}{13}$$

1. Suppose an event  $A$  has a probability of  $\frac{3}{7}$ . What is  $P(A')$ ? \_\_\_\_\_
2. Suppose an event  $AC$  has a probability of 0.23. What is  $P(C')$ ? \_\_\_\_\_
3. Suppose that the probability that you will win a contest is 0.0001. What is the probability that you will not win the contest? \_\_\_\_\_

**A card is drawn from a well shuffled deck of 52 cards.**

4. What is the probability that the card will be a spade or a red face card? \_\_\_\_\_
5. What is the probability that the card will be a red 7 or a black face card? \_\_\_\_\_
6. What is the probability that the card will be even or a red card? \_\_\_\_\_