

Theoretical Probability of Simple Event

Q. How can you find the theoretical probability of a simple event?

A: Write a _____ of the number of ways the _____ can _____ to the total number of _____ outcomes.

Theoretical Probability

$$P(\text{event}) = \frac{\text{number of ways the event can occur}}{\text{total number of equally likely outcomes}}$$

Vocab

1. _____ the probability that an event occurs when all of the outcomes of the experiment are equally likely.

A bag contains 6 red marbles and 12 blue ones. You select one marble at random from the bag. What is the probability that you select a red marble?

Write your answer in simplest form.

STEP 1 Find the number of ways the event can occur, that is, the number of red marbles: 6

STEP 2 Add to find the total number of equally likely outcomes.

number of red marbles	+	number of blue marbles	=	total number of marbles
6	+	12	=	18

There are 18 possible outcomes in the sample space.

STEP 3 Find the probability of selecting a red marble.

$$P(\text{red marble}) = \frac{\text{number of red marbles}}{\text{total number of marbles}} = \frac{6}{18}$$

The probability that you select a red marble is $\frac{6}{18}$, or $\frac{1}{3}$.

2. You roll a number cube one time. What is the probability that you roll a 3 or 4? Write your answer in simplest form.

$$P(\text{rolling a 3 or 4}) = \frac{\boxed{}}{\boxed{}} = \frac{\boxed{}}{\boxed{}} = \frac{\boxed{}}{\boxed{}}$$

Theoretical Probability of Simple Event

Q. How can you find the theoretical probability of a simple event?

A: Write a ratio of the number of ways the event can occur to the total number of possible outcomes.

Theoretical Probability

$$P(\text{event}) = \frac{\text{number of ways the event can occur}}{\text{total number of equally likely outcomes}}$$

Vocab

1. theoretical probability the probability that an event occurs when all of the outcomes of the experiment are equally likely.

A bag contains 6 red marbles and 12 blue ones. You select one marble at random from the bag. What is the probability that you select a red marble? Write your answer in simplest form.

STEP 1 Find the number of ways the event can occur, that is, the number of red marbles: 6

STEP 2 Add to find the total number of equally likely outcomes.

number of red marbles	+	number of blue marbles	=	total number of marbles
6	+	12	=	18

There are 18 possible outcomes in the sample space.

STEP 3 Find the probability of selecting a red marble.

$$P(\text{red marble}) = \frac{\text{number of red marbles}}{\text{total number of marbles}} = \frac{6}{18}$$

The probability that you select a red marble is $\frac{6}{18}$, or $\frac{1}{3}$.

2. You roll a number cube one time. What is the probability that you roll a 3 or 4? Write your answer in simplest form.

$$P(\text{rolling a 3 or 4}) = \frac{\boxed{3 \text{ or } 4}}{\boxed{1 \ 2 \ 3 \ 4 \ 5 \ 6}} = \frac{\boxed{2}}{\boxed{6}} = \frac{\boxed{1}}{\boxed{3}}$$

LESSON
6-1

Theoretical Probability of Single Events

Reading Strategies: Building Vocabulary

The study of probability introduces new words and words used in ways with which you may not be familiar.

- probability ← the likelihood of an event occurring
- event ← an outcome of a calculation or an experiment
- outcome ← the result of an action or a calculation
- experimental probability ← based on experimental data; outcomes may not be equally likely to occur
- theoretical probability ← based on equally-likely outcomes

Several of these terms are combined in the definition of probability, P , of Event A occurring.

$$P(\text{event A}) = \frac{\text{number of event A outcomes}}{\text{number of all outcomes}}$$

Event A is an outcome of a calculation or an experiment.

In each situation, identify the outcomes and event. Find the probability.

1. A coin is tossed. What is the probability that a head will occur?
 - a. Outcomes: heads or tails
 - b. Event: head
 - c. Probability of the event: $\frac{1}{2}$ or .5
2. A softball team has a catcher, a pitcher, 4 infielders, and 3 outfielders. One player is chosen at random. What is the probability that the player is an outfielder?
 - a. Outcomes: pitcher, catcher, 4 infielders or 3 outfielders
 - b. Event: outfielder
 - c. Probability of the event: $\frac{3}{9}$ or $\frac{1}{3}$

Label the items.

3. A cube numbered 1 to 6 is rolled. What is the probability of a 4 being rolled?
 - 1, 2, 3, 4, 5, 6 ← a. outcomes
 - 4 ← b. event
 - $\frac{1}{6}$ ← c. theoretically probability

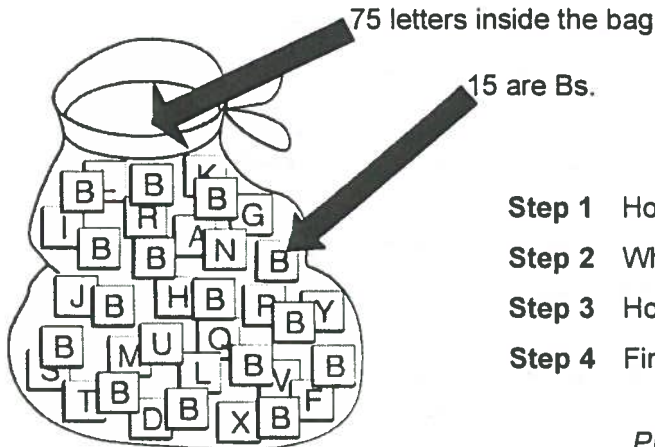
LESSON
6-1

Theoretical Probability of Single Events

Success for English Learners

Problem 1

What is the probability of picking a B from the bag?



- Step 1 How many possible outcomes? 75
- Step 2 What event do you want? B
- Step 3 How many of that event? 15
- Step 4 Find the probability.

$$P(B) = \frac{\text{number of Bs}}{\text{number of tiles}} = \frac{15}{75} = \frac{1}{5}$$

Problem 2

Math class has 25 students. 14 are boys.

How many are girls?

$$25 \text{ students} - 14 \text{ boys} = 11 \text{ girls}$$

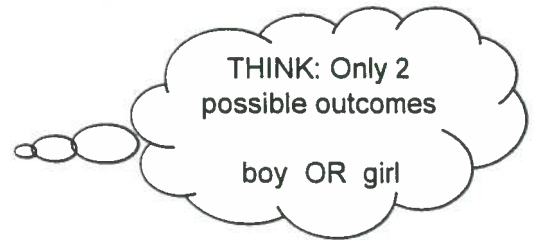
What is the probability of choosing a girl at random?

$$P(\text{girl}) = \frac{\text{event (girl)}}{\text{outcomes (boys + girls)}} = \frac{11}{25}$$

What is the probability of choosing a boy at random?

$$\text{So, } P(\text{boy}) = 1 - P(\text{girl})$$

$$P(\text{boy}) = 1 - \frac{11}{25} = \frac{14}{25}$$



Find the probability.

1. 12 dogs and 6 cats being given away

$$P(\text{cat}) = \frac{6}{18} = \frac{1}{3}$$

2. 8 pencils and 5 pens in a bag

$$P(\text{pen}) = \frac{5}{13}$$

LESSON
6-1

Theoretical Probability of Single Events

Practice and Problem Solving: D

Solve each problem. The first one is done for you.

1. The kitchen-tile installer has 20 green, 14 beige, and 16 white tiles in a box. What is the probability of picking a beige tile from the box without looking?

$$\frac{14}{20 + 14 + 16} = \frac{14}{50} = \frac{7}{25}$$

2. There are 25 spools each of blue, green, red, white, and yellow thread in the sewing basket. Without looking, what is the probability of picking a spool of blue thread from the basket?

$$\frac{25}{125} = \frac{1}{5}$$

Find the probability. The first one is done for you.

3. A gardener has a bag of flower seeds. Half of the seeds are roses, one fourth are gardenias, and one fourth are irises.

$P(\text{gardenias})$

$$\frac{1}{4}$$

$P(\text{not gardenias})$

$$1 - \frac{1}{4} = \frac{3}{4}$$

4. The traffic-control monitor on the freeway shows 200 vehicles per minute passing the camera in 5 minutes. Of those vehicles, on average, 125 have one passenger, 60 have four or fewer passengers, and 15 have more than four passengers.

$P(\text{vehicle with more than four people})$

$$\frac{3}{40}$$

$P(\text{vehicle with four or fewer people})$

$$1 - \frac{3}{40} = \frac{37}{40}$$

Use the information below to complete the table. The first row is done for you.

Tina has 3 quarters, 1 dime, and 6 nickels in her pocket. Find the probability of randomly drawing each of the following coins.

	Probability		
	Fraction	Decimal	Percent
5. quarter	$\frac{3}{10}$	0.3	30%
6. dime	$\frac{1}{10}$.1	10%
7. nickel	$\frac{6}{10} = \frac{3}{5}$.6	60%

LESSON
6-1

Theoretical Probability of Single Events

Practice and Problem Solving: A/B

Find the probability for each event.

1. tossing a number cube numbered from 1 to 6 and getting an even number that is greater than or equal to 2

2. tossing a number cube numbered from 1 to 6 and getting an odd number that is less than or equal to 3

3. randomly selecting a seventh grader from a school that has 250 sixth graders, 225 seventh graders, and 275 eighth graders

4. without looking, not picking a red hat from a box that holds 20 red hats, 30 blue hats, 15 green hats, and 25 white hats

Match each event to its likelihood.

- | | | |
|-----------------------------------------------------------------------------------------|-------|---------------------|
| 5. rolling a number greater than 6 on a number cube labeled 1 through 6 | _____ | A. likely |
| 6. flipping a coin and getting heads | _____ | B. unlikely |
| 7. drawing a red or blue marble from a bag of red marbles and blue marbles | _____ | C. as likely as not |
| 8. spinning a number less than 3 on a spinner with 8 equal sections labeled 1 through 8 | _____ | D. impossible |
| 9. rolling a number less than 6 on a number cube labeled 1 through 6 | _____ | E. certain |

Use the information to find probabilities in 10–13.

At a school health fair, individual pieces of fruit are placed in paper bags and distributed to students randomly. There are 20 apples, 15 apricots, 25 bananas, 25 pears, and 30 peaches.

10. the probability of getting an apple _____
11. the probability of not getting a pear _____
12. the probability of not getting an apple _____
13. the probability of getting an orange _____