Warm Up

Record your homework for the week in your agenda

Mon: Unit 4 review

Tues: Unit 1 review

Wed: Unit 2 Review

Thurs: Unit 3 review

Fri: Study for CRCT

14-1 Probability Basics

Probability

MCC7.SP.5 Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.

Introduction

Probability

Learn to use informal measures of probability.

Vocabulary

experiment
trial
outcome
event
probability
simple event
compound event
complement

Probability

An activity involving chance, such as rolling a cube, is called an **experiment**. Each repetition or observation of an experiment is a **trial**, and each result is an **outcome**. A set of one or more outcomes is an **event**. For example, rolling a 5 (one outcome) can be an event, or rolling an even number (more than one outcome) can be an event.

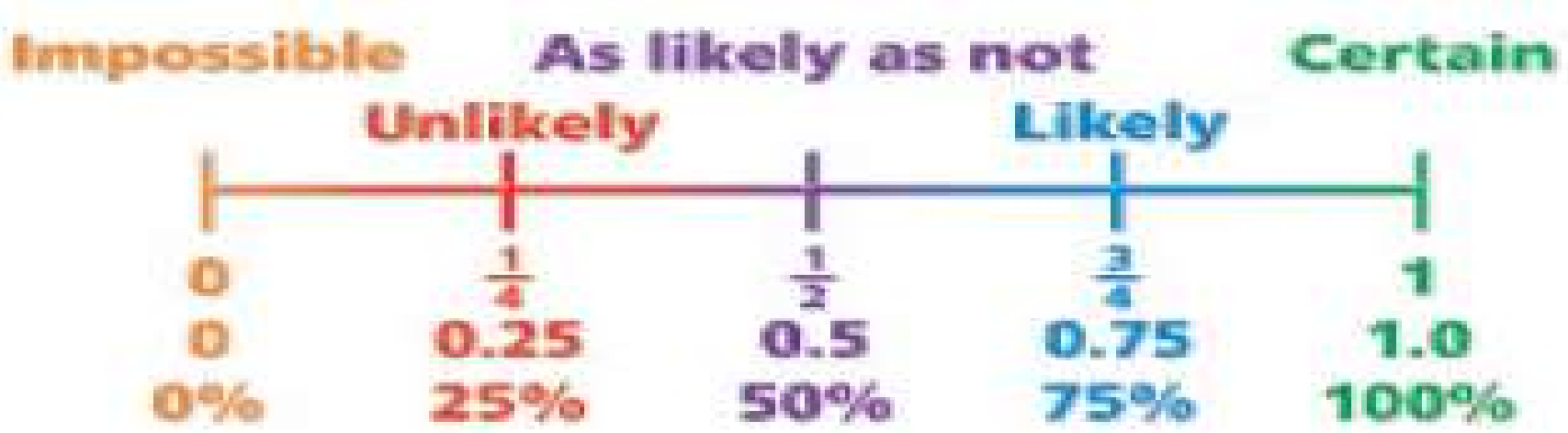
Probability

The **probability** of an event, written *P*(event), is the measure of how likely an event is to occur. A **simple event** has a single outcome. A **compound event** is two or more simple events. Probability is a measure between 0 and 1, as shown on the number line. You can write probability as a fraction, a decimal, or a percent.

Back of Foldable

Probability is a measure between 0 and 1

Can write probability as a fraction, a decimal, or a percent.



Practice

p. 324

Additional Example 1A: Determining the Likelihood of an Event

Determine whether each event is impossible, unlikely, as likely as not, likely, or certain.

rolling an odd number on a number cube

There are 6 possible outcomes:

Odd	*Not* Odd
1, 3, 5	2, 4, 6

Half of the outcomes are odd.

Rolling an odd number is as likely as not.

Additional Example 1B: Determining the Likelihood of an Event

Determine whether each event is impossible, unlikely, as likely as not, likely, or certain.

rolling a number less than 2 on a number cube

There are 6 possible outcomes:

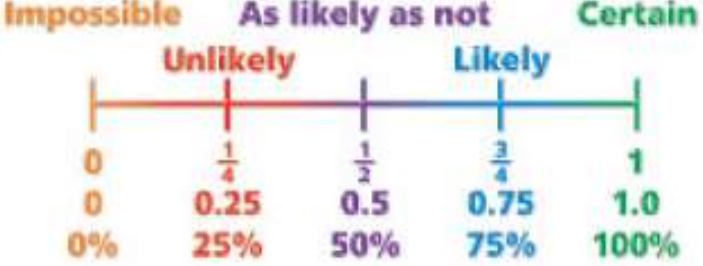
Less than 2	*2 or more*
1	2, 3, 4, 5, 6

Only one outcome is less than 2.

Rolling a number less than 2 is unlikely.

Oral Review.. Toss the cube

Probability



2 EXAMPLE Describing Events

Determine whether each event is impossible, unlikely, as likely as not, likely, or certain. Then, tell whether the probability is 0, close to 0, $\frac{1}{2}$, close to 1, or 1.

A You flip a coin. The coin lands heads up.

This event is as likely as not. The probability is $\frac{1}{2}$.

B You roll two number cubes and the sum of the numbers is 10.

C A bowl contains 14 red marbles and 3 green marbles. You pick a red marble.

D A spinner has 10 equal sections marked 1 through 10. You spin and land on a nun greater than 0.

Name _____ Date _____ Class _____

LESSON 14-1

Experimental and Theoretical Probability

Practice A: Probability

Match each event to its likelihood.

1. rolling a number greater than 6 on a number cube labeled 1 through 6 _____
2. flipping a coin and getting heads _____
3. drawing a red or blue marble from a bag of red marbles and blue marbles _____
4. spinning a number less than 3 on a spinner with 8 equal sections marked 1 through 8 _____
5. rolling a number less than 6 on a number cube labeled 1 through 6 _____

A likely
B unlikely
C as likely as not
D impossible
E certain

Complement

- Subtract to see what you didn't use

Probability

When a number cube is rolled, either a 5 will be rolled or it will not. Rolling a 5 and not rolling a 5 are examples of *complementary events*. The **complement** of an event is the set of all outcomes that are *not* the event.

Because it is certain that either an event or its complement will occur when an activity is performed, the sum of the probabilities is 1.

$$P(\text{event}) + P(\text{complement}) = 1$$

Oral

A bag contains circular chips that are the same size and weight. There are 8 purple, 4 pink, 8 white, and 2 blue chips in the bag. The probability of drawing a pink chip is $\frac{2}{11}$. What is the probability of not drawing a pink chip?

$P(\text{event}) + P(\text{complement}) = 1$

The probability of not drawing a pink chip is $\frac{9}{11}$.

Probability

A bag contains circular buttons that are the same size and weight. There are 7 maroon buttons, 3 sky buttons, 5 white buttons, and 5 lavender buttons in the bag. The probability of drawing a sky button is $\frac{3}{20}$. What is the probability of not drawing a sky button?

$P(\text{event}) + P(\text{complement}) = 1$

The probability of not drawing a sky button is $\frac{17}{20}$.

Probability

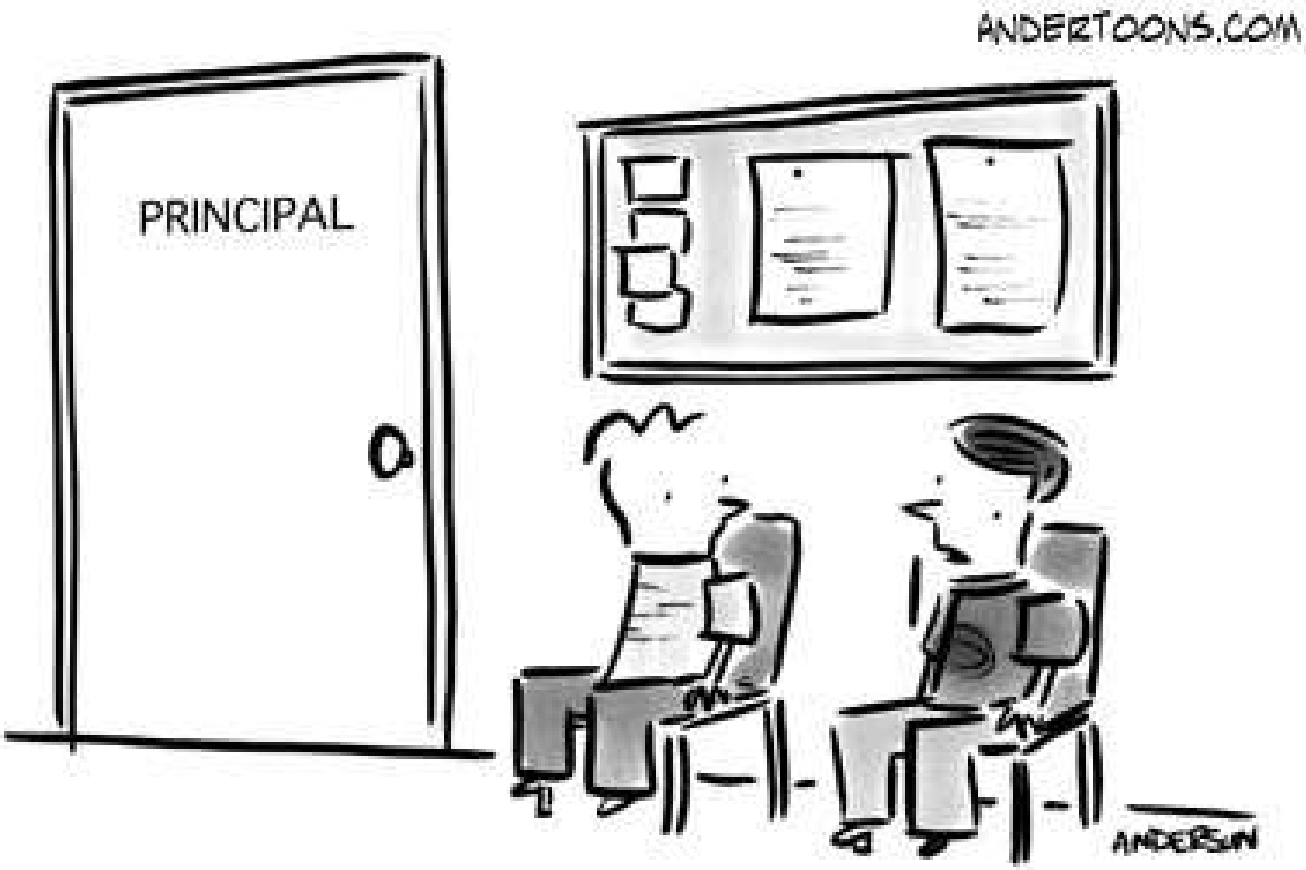
Toss the cube

TRY THIS!

3a. A jar contains balls marked with the numbers 1 through 8. The probability that you pick a number at random and get a 5 is $\frac{1}{8}$. What is the probability of not picking a 5?

3b. You roll a number cube. The probability that you roll an even number is $\frac{1}{2}$. What is the probability you will roll an odd number?

Probability



"I wish we hadn't learned probability 'cause I don't think our odds are good."

Solve

3. A bag holds 4 red marbles, 3 green marbles, and 2 yellow marbles. You pull one without looking. What is the probability of not picking a yellow marble?

$\frac{7}{9}$

4. A number cube is labeled 1 through 6. What is the probability of not rolling a 4?

$\frac{5}{6}$

Probability

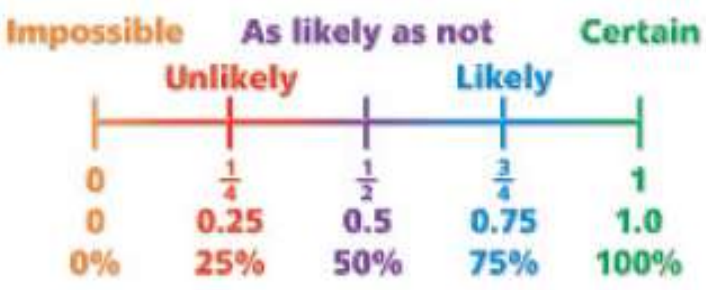
Tell whether the event is impossible, unlikely, as likely as not, likely, or certain.

8. Janelle almost never eats beef. On Monday, the school cafeteria offers three main choices. The choices are hamburger, tuna, or a turkey sandwich. Estimate the probability that Janelle will choose a hamburger._____

1/3. Unlikely.

9. Tyrone rides his bicycle to school if he gets up by 7:15 A.M. Tyrone gets up by 7:15 A.M. about half the time. Estimate the probability that Tyrone will ride his bicycle to school. _____

½ . As likely as not



14-2 Experimental Probability

Probability

Experimental probability is one way of estimating the probability of an event. The **experimental probability** of the event is found by comparing the number of times an event occurs to the total number of trials. The more trials you have, the more accurate the estimate is likely to be.

Probability

Just write the faction

EXPERIMENTAL PROBABILITY

$$\text{probability} \approx \frac{\text{number of times the event occurs}}{\text{total number of trials}}$$

Writing Math

"*P*(event)" represents the probability that an event will occur. For example, the probability of a flipped coin landing heads up could be written as "*P*(heads)."

Complete Example 2 in 7th grade workbook Pg. 330

Probability

Hmwk: 1. 2. 3. check

Additional Practice

Find the experimental probability. Write your answer as a fraction, as a decimal, and as percent.

1. Jaclyn is a soccer goalie. If she has 21 out of 25 saves in practice, what is the experimental probability that she will have a save on the next shot on goal? _____

2. If Harris hit the bull's-eye 3 out of 8 times at archery practice, what is the experimental probability that he will hit the bull's-eye on his next try? _____

3. Nathan inspects new pants at a factory. Of the first 56 pairs of pants he inspected 49 were acceptable. What is the experimental probability that the next pair of pants will be acceptable? _____

4. Sara has gone to work for 60 days. On 39 of those days she arrived at work before 8:30 A.M. On the rest of the days she arrived after 8:30 A.M. What is the experimental probability that she will arrive at work after 8:30 A.M. the next day she goes to work? _____

Find the experimental probability in the box. Each answer can be used only once.

$\frac{4}{11}$	$\frac{7}{9}$	$\frac{11}{15}$	$\frac{2}{9}$	$\frac{4}{15}$	$\frac{7}{11}$

1. Jolene is playing basketball. She scores on 11 out of the 15 baskets she shoots.

   a. What is the experimental probability that Jolene will get a basket on the next shot?

   b. What is the experimental probability that Jolene will not get a basket on the next shot?

2. Jamie is playing baseball. He gets a hit 7 out of 9 times at bat.

   a. What is the experimental probability that Jamie will get a hit his next time at bat?

   b. What is the experimental probability that Jamie will not get a hit his next time at bat?

Probability

3. Lou Ann is practicing for an archery tournament. She hits the target 7 out of 11 times.

a. What is the experimental probability that Lou Ann will hit the target on the next shot?_____

b. What is the experimental probability that Lou Ann will not hit the target on the next shot?_____

Find the experimental probability.

4. A batter gets 6 hits in 12 times at bat. What is the experimental probability that she will get a hit in her next time at bat?_____

5. A goalie blocks 16 out of 20 shots. What is the experimental probability that he will block the next shot? _____

14-3 Sample Spaces

MCC7.SP.8c Design and use a simulation to generate frequencies for compound events.

Vocabulary

sample space

Fundamental Counting Principle

Probability

Because you can roll the numbers 1, 2, 3, 4, 5, and 6 on a number cube, there are 6 possible outcomes. Together, all the possible outcomes of an experiment make up the **sample space**.

You can make an organized list to show all possible outcomes of an experiment.

Additional Example 1: Problem Solving Application

One bag has a red tile, a blue tile, and a green tile. A second bag has a red tile and a blue tile. Vincent draws one tile from each bag. What are all the possible outcomes? How many outcomes are in the sample space?

Additional Example 1 Continued

3 **Solve**

Bag 1	Bag 2
R	R
R	B
B	R
B	B
G	R
G	B

Let R = red tile,
B = blue tile, and
G = green tile.

Record each possible outcome.

The possible outcomes are RR, RB, BR, BB, GR, and GB. There are six possible outcomes in the sample space.

Check It Out: Example 1

Darren has two bags of marbles. One has a green marble and a red marble. The second bag has a blue and a red marble. Darren draws one marble from each bag. What are all the possible outcomes? How many outcomes are in the sample space?

Check It Out: Example 1 Continued

1 **Understand the Problem**

Rewrite the question as a statement.

- Find all the possible outcomes of drawing one marble from each bag, and determine the size of the sample space.

List the **important information.**

- There are two bags.
- One bag has a green marble and a red marble.
- The other bag has a blue and a red marble.

Check It Out: Example 1 Continued

Make a Plan

You can make an organized list to show all possible outcomes.

Check It Out: Example 1 Continued

3 Solve

Bag 1	Bag 2
G	B
G	R
R	B
R	R

Let R = red marble,
B = blue marble, and
G = green marble.

Record each possible outcome.

The four possible outcomes are GB, GR, RB, and RR. There are four possible outcomes in the sample space.

Check It Out: Example 1 Continued

Look Back

Each possible outcome that is recorded in the list is different.

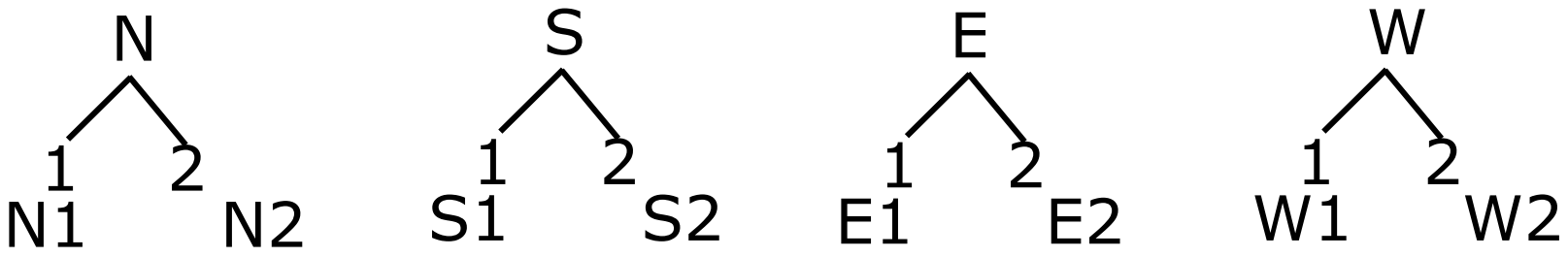
Additional Example 2: Using a Tree Diagram to Find a Sample Space

There are 4 cards and 2 tiles in a board game. The cards are labeled N, S, E, and W. The tiles are numbered 1 and 2. A player randomly selects one card and one tile. What are all the possible outcomes? How many outcomes are in the sample space?

Make a tree diagram to show the sample space.

Additional Example 2 Continued

List each letter of the cards. Then list each number of the tiles.



There are eight possible outcomes in the sample space.

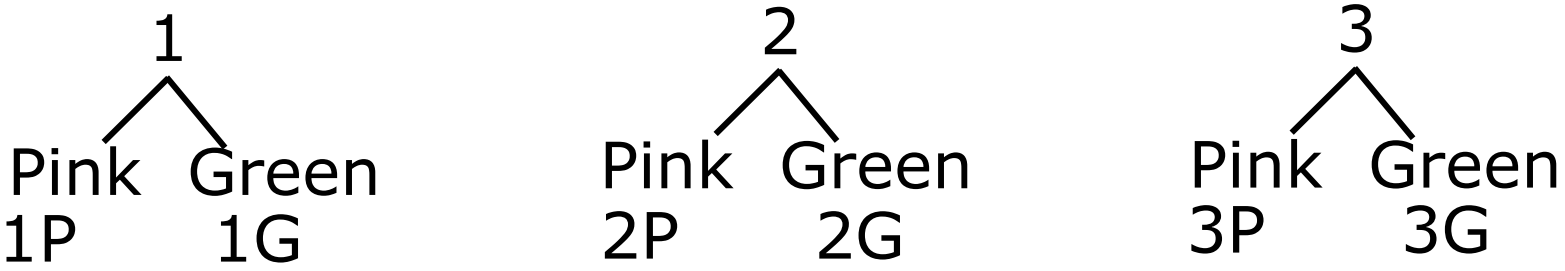
Check It Out: Example 2

There are 2 marbles and 3 cubes in a board game. The marbles are pink and green. The cubes are numbered 1, 2, and 3. A player randomly selects one marble and one cube. What are all the possible outcomes? How outcomes are in the sample space?

Make a tree diagram to show the sample space.

Check It Out: Example 2 Continued

List each number of the cubes. Then list each color of the marbles.



There are six possible outcomes in the sample space.

Probability

The **Fundamental Counting Principle** states that you can find the total number of outcomes for two or more experiments by multiplying the number of outcomes for each separate experiment.

Record beside the word on the front page

Additional Example 3: *Application*

Carrie rolls two 1–6 number cubes. How many outcomes are possible?

List the number of outcomes for each separate experiment.

The first number cube has 6 outcomes.

The second number cube has 6 outcomes

$6 \cdot 6 = 36$ *Use the Fundamental Counting Principle.*

There are 36 possible outcomes when Carrie rolls two 1–6 number cubes.

Check It Out: Example 3

Sammy picks three 1-5 number cubes from a bag. After she picks a number cube, she puts in back in the bag. How many outcomes are possible ?

List the number of outcomes for each separate experiment.

Number of ways the first cube can be picked: 5

Number of ways the second cube can be picked: 5

Number of ways the third cube can be picked: 5

$5 \cdot 5 \cdot 5 = 125$

Use the Fundamental Counting Principle.

There are 125 possible outcomes when Sammy rolls 3 1-5 number cubes.

Review

1. Lindsay flips a coin and rolls a 1–6 number cube at the same time. What are the possible outcomes?

2. Jordan has a choice of wheat bread or rye bread and a choice of turkey, ham, or tuna for lunch. What are all the possible choices of sandwiches he can have?

3. Marisol has to decide whether to study Italian, French, or Spanish, and whether to take golf, tennis, or archery in gym class. What are the possible choices that Marisol has?

Probability

Choose the letter for the best answer.

4. Chad and Victoria are playing a game with a quarter and a spinner divided into sixths, numbered 1–6. Each player spins the spinner and tosses the coin. How many outcomes are possible in the game?

   A 2 C 10

   B 8 D 12

5. For a snack, Sophie can choose milk, apple juice, orange juice, or punch.
   To go with her drink, she can choose a chocolate cupcake, oatmeal cookie, or crackers. How large is the sample space?

   F 12 H 4

   G 7 J 3

6. Marva has a spinner divided into fourths and a 1–6 number cube. She spins the spinner and rolls the
   number cube. How many outcomes are possible in the game?

   A 4 C 10

   B 6 D 24

7. Larry has a choice of vanilla, chocolate, or strawberry ice cream. The choices of toppings are nuts, sprinkles, or coconut. How many
   one-topping sundaes can he make?

   F 3 H 9

   G 6 J 12

Theoretical Probability

Probability

Theoretical probability is used to find the probability of an event when all the outcomes are equally likely.

Equally likely outcomes have the same probability.

THEORETICAL PROBABILITY

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

If each possible outcome of an experiment is equally likely, then the experiment is said to be **fair**. Experiments involving number cubes and coins are usually assumed to be fair.

Find the probability of each event. Write your answer as a fraction, as a decimal, and as a percent. Round to the nearest tenth of a percent.

1. randomly choosing a white counter from a bag of 12 red counters, 12 white counters, 12 green counters, and 12 blue counters

_____

2. tossing two fair coins and having one land on tails and one land on heads

There are 14 girls and 18 boys in Ms. Wiley's class. Ms. Wiley randomly selects one student to solve a problem. Find the probability of each event.

11. selecting a boy _____

12. selecting a girl _____

Probability

Find the probability of each event.

1. randomly choosing a red card in a game that has 10 red, 10 blue, 10 green, 10 yellow cards, and 10 orange cards

2. tossing two fair coins and having both land tails up

3. randomly choosing 1 of the 4 S's from a bag of 100 letter tiles

4. rolling a number greater than 4 on a fair number cube

A game has 12 blue disks, 10 red disks, and 8 black disks. Find the probability of each event when a disk is chosen at random.

5. red _____ 6. black _____

7. blue _____ 8. not red or blue _____

Making Predictions

Proportions

Probability

A **prediction** is something you can reasonably expect to happen in the future. Weather forecasters use several different methods of forecasting to make predictions about the weather.

One way to make a prediction is to use probability.

Additional Example 1: Using Experimental Probability to Make Predictions

Lawrence finds the experimental probability of his reaching first base is 40%. Out of 350 at-bats, how many times can he expect to reach first base?

Additional Example 1 Continued

Set up a proportion.

$\frac{4}{10} = \frac{x}{350}$ *Think: 4 out of 10 is how many out of 350.*

$4 \cdot 350 = 10 \cdot x$ *The cross products are equal.*

$\frac{1400}{10} = \frac{10x}{10}$ *Multiply.*

Divide each side by 10 to isolate the variable.

$140 = x$

Lawrence can predict that he will reach first base about 140 of 350 times.

Check It Out: Example 1

Malia finds the experimental probability of her scoring a goal is 20%. Out of 225 attempts, how many times can she expect to score a goal?

Check It Out: Example 1 Continued

Set up a proportion.

$\frac{20}{100} = \frac{x}{225}$ *Think: 2 out of 10 is how many out of 225.*

$2 \cdot 225 = 10 \cdot x$ *The cross products are equal.*

$\frac{450}{10} = \frac{10x}{10}$ *Multiply.*

Divide each side by 10 to isolate the variable.

$45 = x$

Malia can predict that she will score about 45 goals of 225 attempts.

Check It Out: Example 2

A spinner has eight sections of equal size. Three sections are labeled 1, two are labeled 2, and the others are labeled 3, 4, and 5. In 50 spins, how often can you expect to spin a 2?

$P(\text{spinning a 2}) = \frac{2}{8}$

$\frac{2}{8} = \frac{x}{50}$ *Think: 2 out of 8 is how many out of 50.*

$2 \cdot 50 = 8 \cdot x$ *The cross products are equal.*

$\frac{100}{8} = \frac{8x}{8}$ *Multiply. Divide each side by 8 to isolate the variable.*

$12.5 = x$ You can expect to spin a 2 about 13 times.

Name _____ Date _____ Class _____

LESSON 14-5

Experimental and Theoretical Probability

Practice A: Making Predictions

Make a prediction based on an experimental probability.

1. A bowler knocks down at least 6 pins 70% of the time. Out of 200 rolls, how many can the bowler predict will knock down at least 6 pins?

_____

2. A tennis player hits a serve that cannot be returned 45% of the time. Out of 300 serves, how many can the tennis player predict will not be returned?

_____

3. West Palm Beach, Florida, gets rain about 16% of the time. On how many days out of 400 can residents of West Palm Beach predict they will see rain?

_____

4. Rob notices that 55% of the people leaving the supermarket choose plastic bags instead of paper bags. Out of 600 people, how many can Rob predict will carry plastic bags?

_____

Probability

Make a prediction based on a theoretical probability.

5. Martin flips a fair coin 64 times. How many times can he expect the coin to come up tails?

_____

6. A spinner has five equal sections labeled 1–5. In 60 spins, how often can you expect to spin a 3?

_____

7. Harriet rolls a number cube 39 times. How many times can she expect to roll 3 or 4?

_____

8. A bag contains 6 red and 10 black marbles. You pick out a marble, record its color, and return it to the bag. If you do this 200 times, how many times can you expect to pick a black marble?

_____

Independent vs dependent events

Probability

Learn to find the probability of independent and dependent events.

Vocabulary

independent events

dependent events

Probability

Raji and Kara must each choose a topic from a list of topics to research for their class. If Raji's choice has no effect on Kara's choice and vice versa, the events are *independent*. For **independent events**, the occurrence of one event has no effect on the probability that a second event will occur.

If once Raji chooses a topic, Kara must choose from the remaining topics, then the events are *dependent.* For **dependent events**, the occurrence of one event *does* have an effect on the probability that a second event will occur.

Additional Example 1A: Determining Whether Events Are Independent or Dependent

Decide whether the set of events are dependent or independent. Explain your answer.

Kathi draws a 4 from a set of cards numbered 1–10 and rolls a 2 on a number cube.

Since the outcome of drawing the card does not affect the outcome of rolling the cube, the events are independent.

Additional Example 1B: Determining Whether Events Are Independent or Dependent

Decide whether the set of events are dependent or independent. Explain your answer.

Yuki chooses a book from the shelf to read, and then Janette chooses a book from the books that remain.

Since Janette cannot pick the same book that Yuki picked, and since there are fewer books for Janette to choose from after Yuki chooses, the events are dependent.

Check It Out: Example 1A

Decide whether the set of events are dependent or independent. Explain your answer.

Joann flips a coin and gets a head. Then she rolls a 6 on a number cube.

Since flipping the coin does not affect the outcome of rolling the number cube, the events are independent.

Additional Example 3: Finding the Probability of Dependent Events

A reading list contains 5 historical books and 3 science-fiction books. What is the probability that Juan will randomly choose a historical book for his first report and a science-fiction book for his second?

The first choice changes the number of books left, and may change the number of science-fiction books left, so the events are dependent.