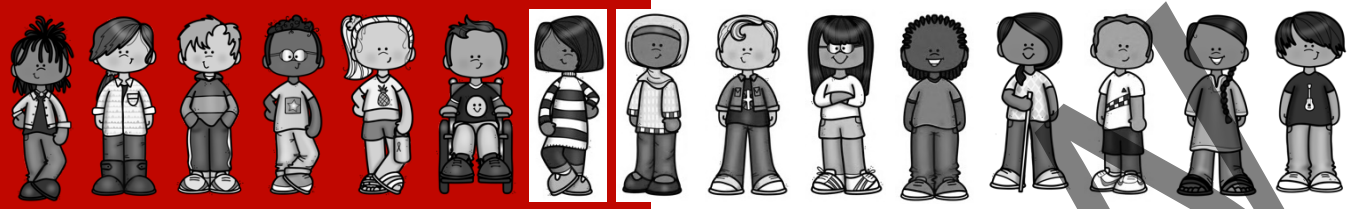
Name _____ Period _____ Date _____

UNIT 1
STUDENT PACKET

Math Links
GRADE 7



PROBABILITY

Parent (or Guardian) signature _____

MY WORD BANK

Explain the mathematical meaning of each word or phrase, using pictures and examples when possible. See **Student Resources** for mathematical vocabulary.

event	experimental probability
outcome	repeating decimal
sample space	terminating decimal
theoretical probability (probability)	trial

RACE TO THE TOP

Follow your teacher's directions.

(1) I predict I will roll a sum of _____ most often because…

(2)

2	3	4	5	6	7	8	9	10	11	12

(3)

sum	2	3	4	5	6	7	8	9	10	11	12
number of occurrences											

(4)

(5)

(6)

(7)

(8)

INTRODUCTION TO PROBABILITY

We will perform probability experiments and use the data to compute experimental probabilities. We will compare experimental probabilities to theoretical probabilities. We will use vocabulary related to probability, and write the probabilities of events using fractions, decimals, and percents.
[7.SP.5, 7.SP.6, 7.SP.7ab; SMP2, 3, 4]

GETTING STARTED

Kyla plays trombone in the school band. Her aunt buys a raffle ticket to support the band's fundraiser. She asks Kyla, "What do you think my chances are of winning the raffle?"

1. Explain what Donne's aunt means by this question.

We sometimes use percent values to describe the likelihood of an event occurring. You may have seen this on a weather app that is reporting the chance of rain. For each phrase below, write a percent value that corresponds to the **bold** word.

2. "It is **certain** that you will win."
3. "It is **unlikely** that you will win."
4. "It is **impossible** for you to win."
5. "It is **probable** that you will win."
6. "It is **possible** that you may win."
7. "It is **improbable** that you will win."
8. "It is **likely** that you may win."
9. "It is **equally likely** that you will win or lose."

Change each fraction to a decimal and percent.

10. $\frac{3}{5}$	11. $\frac{18}{25}$	12. $\frac{1}{20}$

WILL IT HAPPEN?

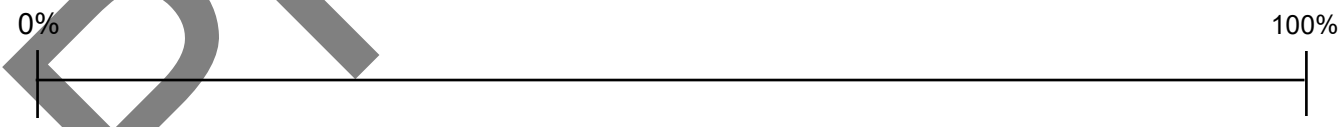
1. Place the following words/phrases in a reasonable position on the number line.
   likely unlikely equally likely as not impossible certain

2. Label each column below with the words/phrases from problem 1 in the order you placed them from left to right on the number line. Your teacher will give you a set of **Will It Happen?** Cards. Place the corresponding letter for each card in the appropriate column.

3. Choose an activity that you participate in and know well. Write three events below that might happen during the activity. Determine a potential likelihood of each event and explain why. Represent each event on the probability line below.

   My activity is:

Event	Chance of Event Happening (and Why)
a.	
b.	
c.	



Fill in each blank with a reasonable number.

4. Chris says to Everett, “I think it’s **impossible** for you to beat LeBron James in a one-on-one basketball game. You have a ____% chance.” Everett replies, “Maybe, but I’m ____% **certain** that I can beat you.

A COIN FLIP EXPERIMENT

Follow your teacher's directions for (1) – (8).

	(1) PREDICTION			(2)	MY DATA		(7) CLASS DATA		
	Number	**Fraction**	**Percent**	**Tally**	**Fraction**	**Percent**	**Total**	**Fraction**	**Percent**
Heads									
Tails									
Total	20	$\frac{\quad}{20}$		20	$\frac{\quad}{20}$				

(3)
(4)
(5)
(6)

(8) Record the meanings of experimental probability, theoretical probability, event, outcome, sample space, and trial in **My Word Bank**.

9. If you flip a coin 500 times, about how many times would you expect it to land on heads?

10. Suppose you flipped a coin 20 times and it landed on tails each time. What is the probability of the next flip landing on tails?

PRACTICE 1

A bag of marbles contains 10 blue, 5 yellow, 4 green, and 1 red. You pick a marble without looking into the bag. Determine the probability of each event occurring on your first pick. Write each probability as a fraction, decimal, and percent.

1. *P* (a blue marble)
2. *P*(a green marble)
3. *P*(a red marble)
4. *P*(a yellow marble)
5. *P*(a marble that is not blue)
6. *P*(blue or yellow)

7. Ryder conducted an experiment with the same bag of marbles. She drew a marble out of the bag 10 times (without looking, and replacing it after each turn). Check the box that contains the best description of likelihood of each event.

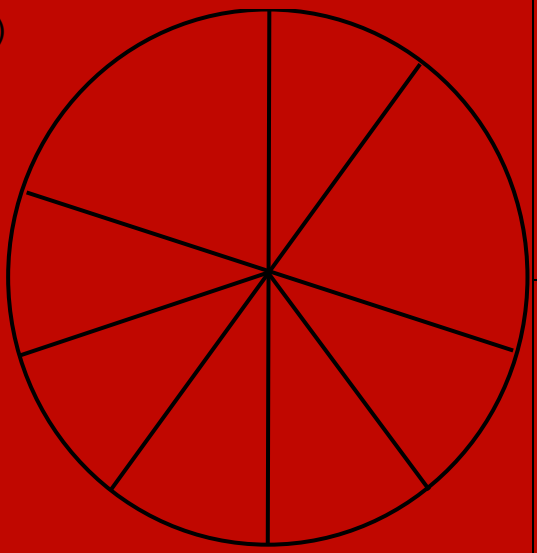
Event	Impossible	Unlikely	Equally Likely as Not	Likely	Certain
***P*(red)**					
***P*(not red)**					
***P*(pink)**					
***P*(blue)**					
***P*(a marble)**					

8. Ryder wants to play a game with the marbles above. She will choose a marble out of the bag 20 times (and replace it after each turn). If Ryder chooses a blue or yellow marble, she gets a point. If she chooses a red or green marble, you get a point. Is this game fair? Explain using words, diagrams, and/or numbers.

A SPINNER EXPERIMENT

Follow your teacher's directions for (1) – (4).

(1)



(2)

(3) If I perform _____ trials of the spinner experiment, I predict:
I will land on yellow _____ times (_____%).
I will land on red _____ times (_____%).

(4)

	MY DATA				CLASS DATA			
	Tally	**Fraction**	**Decimal**	**Percent**	**Total**	**Fraction**	**Decimal**	**Percent**
yellow								
red								
Total	25	$\frac{}{25}$						

Find the theoretical probabilities for each event as a fraction, decimal, and percent.

5. P(yellow) =

6. P(red) =

7. P(yellow or red) =

8. P(yellow and red) =

9. Which problems above focused on experimental probability?

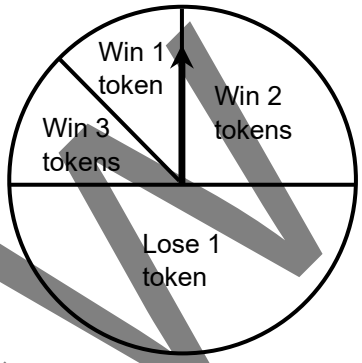
10. Which problems above focused on theoretical probability?

11. How did the experimental probability results compare to theoretical probabilities?

PRACTICE 2

Use the spinner to the right. All problems are based on the idea that the location where the pointer stops is random. Find the probability that the spinner will stop on each of the areas below—for any single spin—as a fraction, decimal, and percent.

1. *P*(lose 1 token)	2. *P*(win 1 token)
3. *P*(win 2 tokens)	4. *P*(win 3 tokens)
5. *P*(win at least 2 tokens)	6. *P*(lose 2 tokens)



7. For 100 trials, about how many times will you expect to win exactly 2 tokens?

8. For 100 trials, about how many times will you expect to win?

9. For 100 trials, explain if you expect to win or lose more tokens, and by how much.

10. If you spin 20 times and get 1 token each time, what is probability of getting one token on the next spin? Explain.

PRACTICE 3

Suppose you roll a six-sided cube numbered 1 – 6.

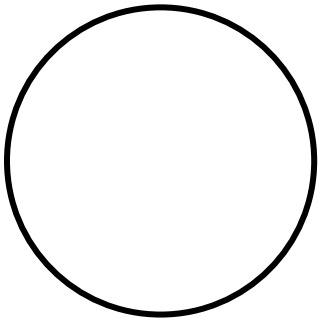
Find the probability of each event.

1. $P(3)$	2. $P(2 \text{ or } 5)$	3. $P(\text{odd number})$
4. $P(\text{number less than } 7)$	5. $P(10)$	6. $P(\text{prime number})$

Write a number cube rolling event different than above that would have each of the following probabilities. Explain your reasoning in words or numbers.

7. $P(E) = 0$	8. $P(E) = 1$
9. $P(E) = \frac{1}{6}$	10. $P(E) = \frac{1}{2}$

11. Draw a spinner with a blue, a green, and a pink space such that $P(\text{blue})$ is twice $P(\text{green})$, $P(\text{pink})$ is half $P(\text{green})$, and the rest is yellow. Clearly write the fractional amount with the color in the circle.



12. In your own words, explain what you think it means for a trial of an experiment to be random, using an appropriate situation as an example.

FLIPS, ROLLS, AND SAMPLE SPACE DISPLAYS

We will convert fractions into terminating and repeating decimals. We will continue to explore probability concepts and learn techniques for organizing data. We will more analyze experiments by comparing experimental probabilities to the theoretical probabilities.

[7.NS.2d, 7.SP.6, 7.SP.7ab, 7.SP.8ab; SMP1, 2, 3, 4, 5, 6, 7, 8]

GETTING STARTED

1. Write the product as a mixed number: $\frac{1}{3}(10)$.

Fill in the blanks using the distributive property.

2. $3\frac{1}{3}(10) = (\_\_\_\_\_)10 + (\_\_\_\_\_)10$ $= \_\_\_\_\_ + \_\_\_\_\_$ $= \_\_\_\_\_$	3. $33\frac{1}{3}(10) = (\_\_\_\_\_)10 + (\_\_\_\_\_)10$ $= \_\_\_\_\_ + \_\_\_\_\_$ $= \_\_\_\_\_$

Change each of the following fractions to a decimal and a percent using any method.

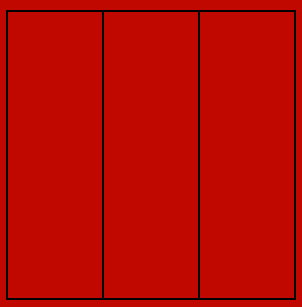
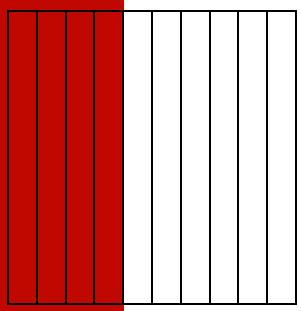
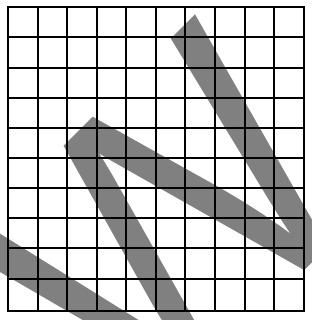
4. $\frac{3}{10}$	5. $\frac{3}{20}$	6. $\frac{3}{50}$
7. $\frac{3}{4}$	8. $\frac{3}{8}$	9. $\frac{3}{9}$

10. How is the number in problem 9 the same as those in problems 4 – 8?

How is it different?

INVESTIGATING ONE-THIRD

Follow your teacher's directions for (1) – (7).

(1) One-third is equal to…  ____ of a whole =	(2) One-third is equal to…  ____ tenths + ____ of a tenth =	(3) One-third is equal to…  ____ tenths + ____ hundredths + ____ of a hundredth =
(4)	(5)	(6)
(7)	8. Round the decimals in problems 6 and 7 to the nearest hundredths. Then write these as percents.	9. Round the decimals in problems 6 and 7 to the nearest thousandths. Then write these as percents.

10. Record the meanings of repeating decimal and terminating decimal in **My Word Bank**.

PRACTICE 4

Change each fraction to a decimal and a percent, using a repeat bar when necessary.

1. $\frac{1}{6}$	2. $\frac{2}{6}$	3. $\frac{3}{6}$	4. $\frac{4}{6}$
5. $\frac{5}{6}$	6. $\frac{6}{6}$	7. $\frac{1}{12}$	8. $\frac{3}{12}$
9. $\frac{5}{12}$	10. $\frac{7}{12}$	11. $\frac{9}{12}$	12. $\frac{11}{12}$

13. For each fraction above, circle those that are equivalent to repeating decimals, and box those that are equivalent to terminating decimals.

14. Cade thinks that the decimal equivalent for $\frac{1}{6}$ is $0.\overline{16}$. Bryce thinks it's $0.\overline{16}$. Explain who is correct.

FLIP AND ROLL

Follow your teacher's directions.

(1)

You win:

You lose:

(2)

(3)

Trial #	1	2	3	4	5	6	7	8	9	10
Flip Result										
Roll Result										
Win or Lose?										

(4)

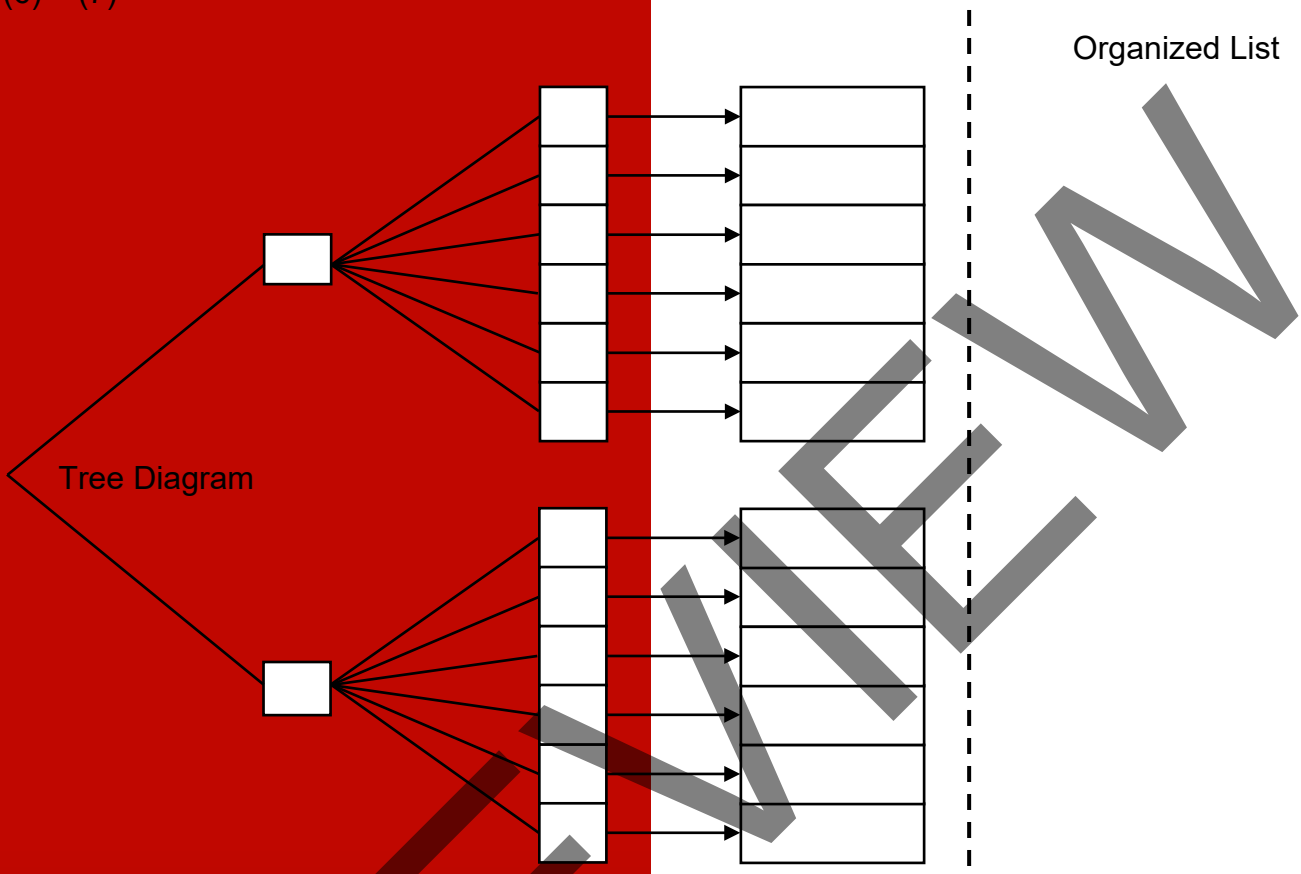
	EXPERIMENTAL PROBABILITY							
	My Data				Class Data			
	My Results	Fraction	Decimal	Percent	Class Results	Fraction	Decimal	Percent
Wins								
Losses								
Totals								

(5)

		Outcome Grid					

FLIP AND ROLL
Continued

(6) – (7)



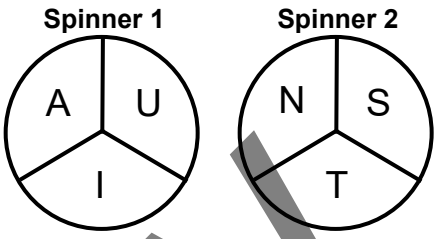
(8)

	THEORETICAL PROBABILITY		
	Fraction	**Decimal**	**Percent**
***P*(Win)**			
***P*(Lose)**			
Total			

(9)

PRACTICE 5

For these two spinners, one trial is spinning each spinner once, at the same time.



1. Make an outcome grid to display the sample space and a tree diagram to display the sample space.

Outcome Grid

Spinner 1 \ Spinner 2			

Tree Diagram

Spinner 1

2. How many equally likely outcomes are there? ____

You spin each spinner once. Determine the theoretical probability of each event as a fraction, a decimal, and a percent. Use a repeat bar when necessary.

3. *P*(spinning an A)

4. *P*(spinning the word "IT")

5. *P*(spinning any real word)

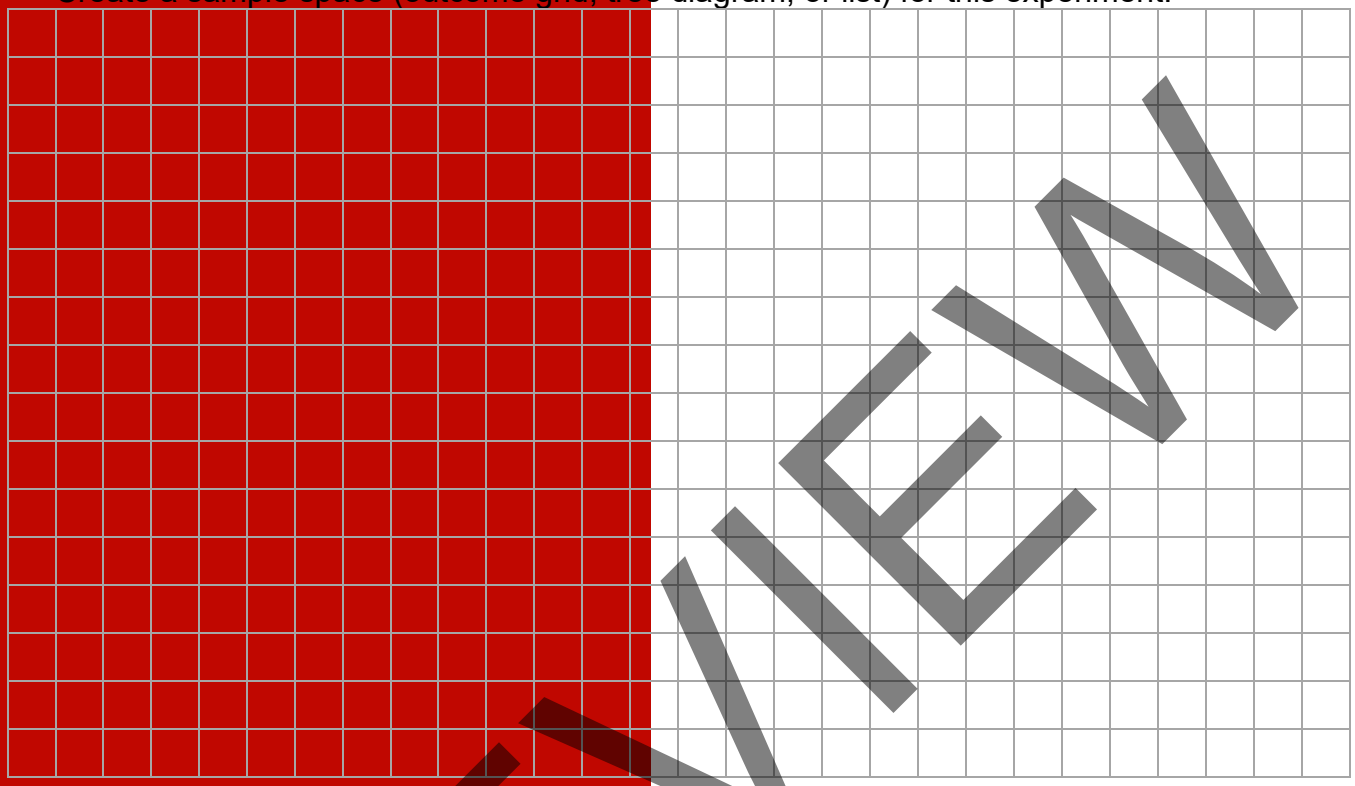
6. *P*(spinning a nonsense word)

7. Predict the number of times you are likely to spin the word "AT" in 300 spins.

8. Change one letter in one of the spinners so that *P*(spinning a real English word) = 100%.

RACE TO THE TOP REVISITED

1. In the **Race to the Top** experiment, you rolled two number cubes and recorded the sums. Create a sample space (outcome grid, tree diagram, or list) for this experiment.



2. Write the sum that has the greatest probability of occurring, and write the probability as a fraction.

3. Write the sum that has the least probability of occurring, and write the probability as a fraction.

RACE TO THE TOP REVISITED

Continued

4. Use your data from problems 2 – 3 in the **Race to the Top** experiment to complete this table.

	2	3	4	5	6	7	8	9	10	11	12	Total Trials
Your results												
Fraction												
Class results												
Fraction												

5. Compare the theoretical probabilities to the experimental probabilities.

6. Angela made this sample space for the sum of two number cubes. Then she used the sample space to claim that $P(\text{sum} = 7) = \frac{3}{21} = \frac{1}{7}$. What is wrong with her work?

1-1	1-2	1-3	1-4	1-5	(1-6)
2-2	2-3	2-4	(2-5)	2-6	
3-3	(3-4)	3-5	3-6		
4-4	4-5	4-6			
5-5	5-6				
6-6					

PROBABILITY EXPERIMENTS: GAMES AND PUZZLES

We will play a probability game that involves converting fractions into decimals that terminate or repeat, and determine the fairness of the game. We will create spinners from clues and analyze these probability puzzles.

[7.NS.2d, 7.SP.6, 7.SP.7ab, 7.SP.8abc; SMP1, 2, 4, 5, 8]

GETTING STARTED

Find the decimal equivalent for each fraction below. Use a repeat bar when necessary.

1. $\frac{1}{1}$	2. $\frac{1}{2}$	3. $\frac{1}{3}$	4. $\frac{1}{4}$
5. $\frac{1}{5}$	6. $\frac{1}{6}$	7. $\frac{1}{7}$	8. $\frac{1}{8}$
9. $\frac{1}{9}$	10. $\frac{1}{10}$	11. $\frac{1}{11}$	12. $\frac{1}{12}$

13. Box all the fractions that are equivalent to repeating decimals. Circle all the fractions that are equivalent to terminating decimals.

THE TERMINATOR: EXPERIMENTAL PROBABILITY

The Game: Roll two number cubes labeled 1 – 6 and create a fraction less than or equal to 1, using the values you rolled. For example, if you roll a 4 and 3, the fraction will be $\frac{3}{4}$.

- You win if the fraction results in a repeating decimal.
- You lose if the fraction results in terminating decimal.

1. Roll the cubes 20 times and record the results in the table. Circle each trial # you win.

Trial #	Numbers Rolled	Fraction	Decimal
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Trial #	Numbers Rolled	Fraction	Decimal
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			

	My Game Data			Class Game Data		
	Fraction	Decimal	Percent	Fraction	Decimal	Percent
***P*(losing)**						
***P*(winning)**						

2. Based on "My Game Data" results, which represent your experimental probability, do you think this is a fair game? Explain.

THE TERMINATOR: THEORETICAL PROBABILITY

1. Make an outcome grid to determine the theoretical probabilities of winning and losing the Terminator game. Using two different colored cubes helps to keep track of outcomes.

Number Cube (_____)

Number Cube (_____)	1	2	3	4	5	6
1	$\frac{1}{1} \rightarrow$ T		$\frac{1}{3} \rightarrow$ R			
2						
3						
4						
5						
6						

2. Determine the theoretical probabilities of winning and losing as a fraction, decimal and percent.

P(losing) = *P*(winning) =

3. Based on the theoretical probabilities, out of 3,000 rolls, about how many times is winning expected?

4. Go back to "My Game Data" and "Class Game Data" on the previous page.
   a. Explain how **your** experimental probability compares to the theoretical probability.

   b. Explain how **the class's** experimental probability compares to the theoretical probability.

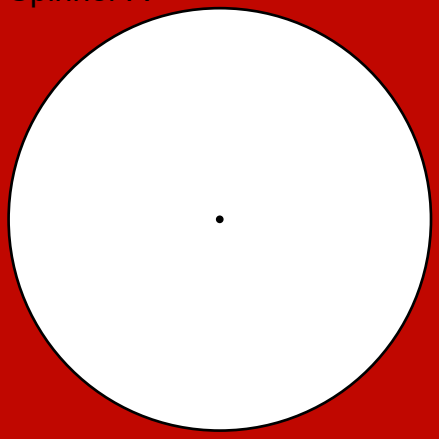
5. Based on the theoretical probabilities, explain why this is not a fair game.

6. Explain one way to make this a fair game.

SPINNER PUZZLES

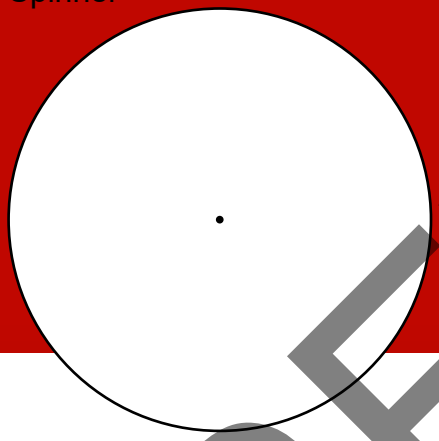
Follow your teacher's directions.

(1) Spinner A



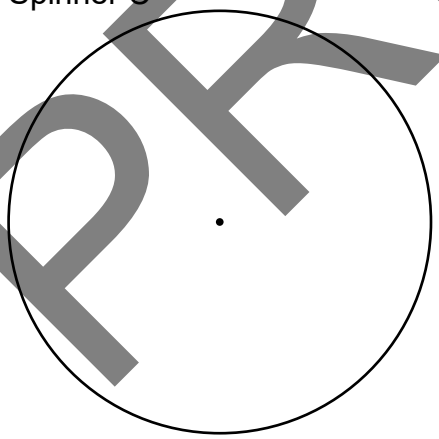
	Fraction	Decimal	Percent
P( )			
P( )			
P( )			
TOTAL			

(2) Spinner



	Fraction	Decimal	Percent
P( )			
P( )			
P( )			
P( )			
TOTAL			

(3) Spinner C



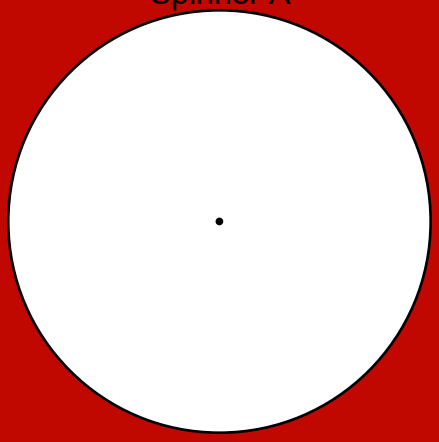
	Fraction	Decimal	Percent
P( )			
P( )			
P( )			
TOTAL			

(4)

PRACTICE 6

1. Draw Sinner A to match the clues below. Express each probability as a fraction, decimal, and percent in the table.

Spinner A



Clue #1	Clue #2
The Pet Palace is giving away turtles, hamsters, and goldfish as prizes. You are certain to get exactly one prize.	The probability you will get a hamster is $\frac{1}{4}$.
Clue #3	**Clue #4**
The probability you will get a goldfish is twice the probability you will get a turtle.	It is more likely you will get a goldfish than a turtle.

2. In the table below, let *P*(hamster) refer to the probability of getting a hamster by spinning, and so on.

	Fraction	Decimal	Percent
***P*( )**			
***P*( )**			
***P*( )**			
TOTAL			

3. What do you notice about the total in each column?

4. What is the probability of getting a dog? _____ An animal? _____

5. If you spin the spinner 400 times, about how many hamsters will you expect to get?

6. What is the greatest value the probability of an event can have? _____
   The least? _____

7. Were there any clues you did not need? Explain.

THE CEREAL BOX SIMULATION

There are six different animal prizes in Krispi Krunchy Cereal, and you want to collect all six. You have an equally likely chance of getting any of the prizes when buying a box. How many boxes do you think you need to buy to get all six? Create a simulation and carry it out.

1. First make a prediction. What is your "gut feeling?"

2. What tools or materials will you use to generate a simulation for collecting 6 objects? How many times will you perform the experiment?

3. Perform your experiment to collect and then organize your data.

4. Write a few sentences to analyze the data using statistics.

5. Write a few concluding sentences about the process. Did your prediction agree with your actual results?

REVIEW

BIG SQUARE PUZZLE: PROBABILITY

Your teacher will give you a **Big Square Puzzle** to complete with partners. After finishing, do the following.

1. In the puzzle, $\frac{1}{6}$ = _____ . Circle all numbers below that are also equal to $\frac{1}{6}$.

$\frac{2}{12}$ $\frac{0.5}{3}$ 0.16 0.1666… $0.1\overline{66}$ $0.1\overline{6}$

2. Write $\frac{1}{6}$ as:

   a. an exact percent value _____

   b. a percent rounded to the nearest whole percent _____

   c. a percent rounded to the nearest tenth of a percent _____

WHY DOESN'T IT BELONG?: PROBABILITY

Four different weather apps' reports about the probability it will rain are listed below.

1. Choose one of these news stations' predictions and explain why it doesn't belong with the others. Then choose at least one more and explain why it doesn't belong.

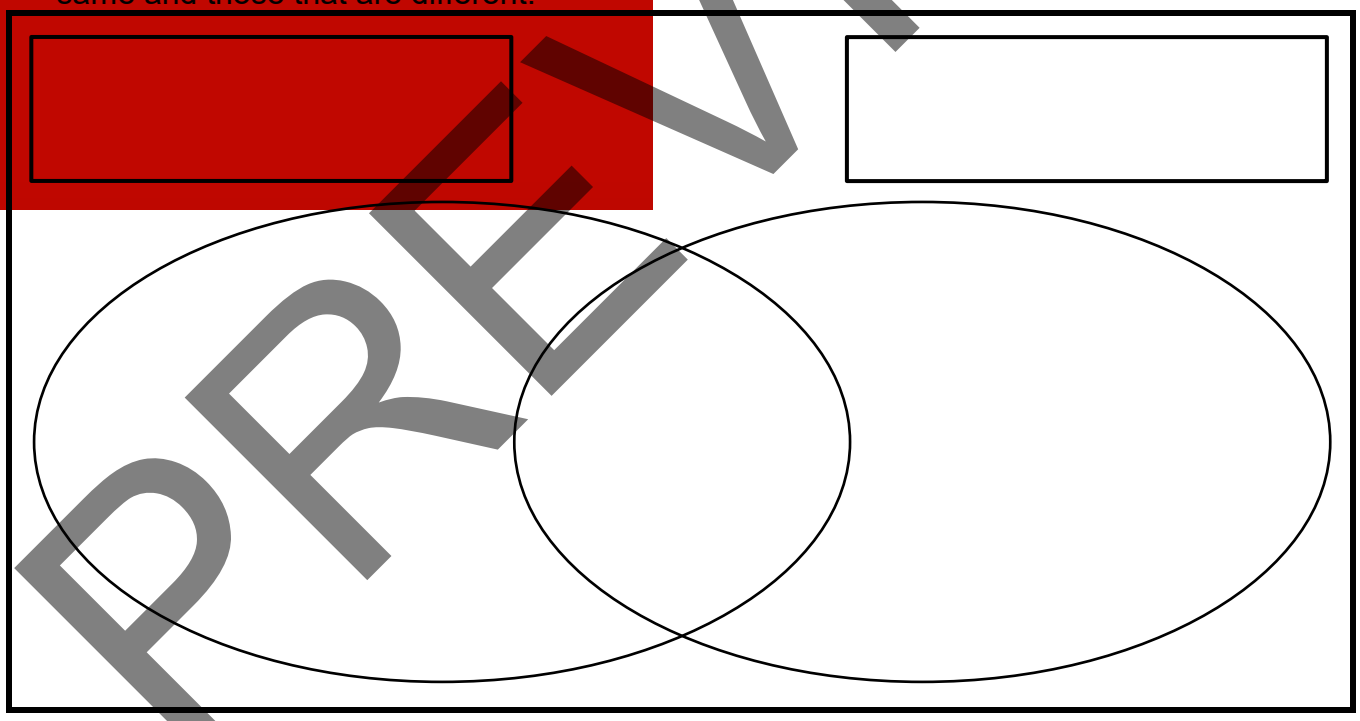
A There is a $83.3\overline{3}\%$ chance of rain.	**B** There is a $\frac{5}{6}$ chance of rain.
C There is a $0.8\overline{3}$ chance of rain.	**D** There is a 0.83 chance of rain.

MATCH AND COMPARE SORT: PROBABILITY

1. Individually, match your word cards to your description cards, discuss with your partner(s), and record all of your results in the table.

Card set △			Card set ◯		
Card number	**word**	**Card letter**	**Card number**	**word**	**Card letter**
I			**I**		
II			**II**		
III			**III**		
IV			**IV**		

2. Partners, choose a pair of numbered matched cards and record the attributes that are the same and those that are different.



3. Partners, choose another pair of numbered matched cards and discuss the attributes that are the same and those that are different.

POSTER PROBLEMS: PROBABILITY

Part 1: Your teacher will divide you into groups.

- Identify members of your group as A, B, C, or D.
- Each group will start at a numbered poster. Our group start poster is _____.
- Each group will have a different colored marker. Our group marker is _____.

Part 2: Do the problems on the posters by following your teacher's directions. Use a calculator as needed.

Poster 1 (or 5)	Poster 2 (or 6)	Poster 3 (or 7)	Poster 4 (or 8)
You roll two number cubes and find the product. You win if the product is odd.	You flip a coin and spin a fair spinner with the colors red, yellow, and blue. You win if you flip heads and land on red or blue.	You roll a fair 6-sided number cube (numbered 1 – 6) and pull a marble out of a bag with 3 red and 2 blue marbles. You win if you roll a number less than 3 and choose a red marble.	You flip a coin and roll a fair 8-sided number cube (numbered 1 – 8). You win if you flip tails and roll a prime number.

A. On your poster:
   - Summarize the probability experiment. Abbreviate as needed.
   - Summarize the event that describes how you win. Abbreviate as needed.

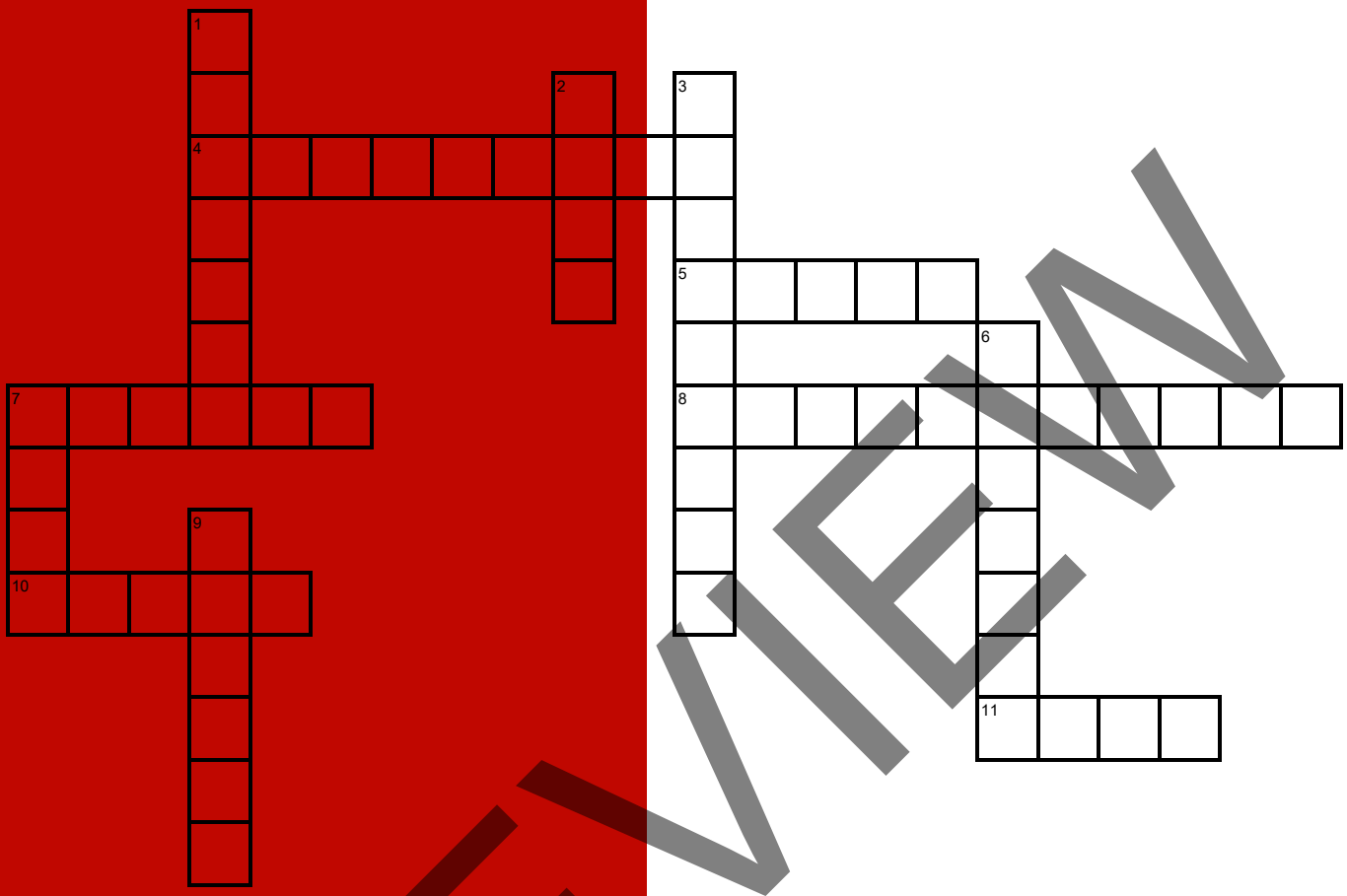
B. Create a sample space display for the two events. Make sure to label the display.

C. Find the probability for winning the game as a fraction, decimal and percent.

D. Edit the event that describes winning the game to make it fair. Write the new winning event on the poster.

Part 3: Go to your start poster and copy the abbreviated descriptions of the probability experiment and the **new** event describing how you win. At your seat, use words and numbers to justify whether it is now a fair game.

VOCABULARY REVIEW



Across

4 When converted, $\frac{3}{5}$ is an example of a decimal that will ____.

5 Subset of the sample space

7 If P(event) > 70%, it is ____ it will happen

8 When flipping a fair coin, the ___ probability of getting heads is 50%.

10 One repetition of a probability experiment

11 One way to display probability outcomes: _____ diagram

Down

1 The result of a probability experiment

2 A game where each player has the same chance of winning

3 A number that ends in a repetition of a block of digits, like 0.23232323… is an example of a ___ decimal

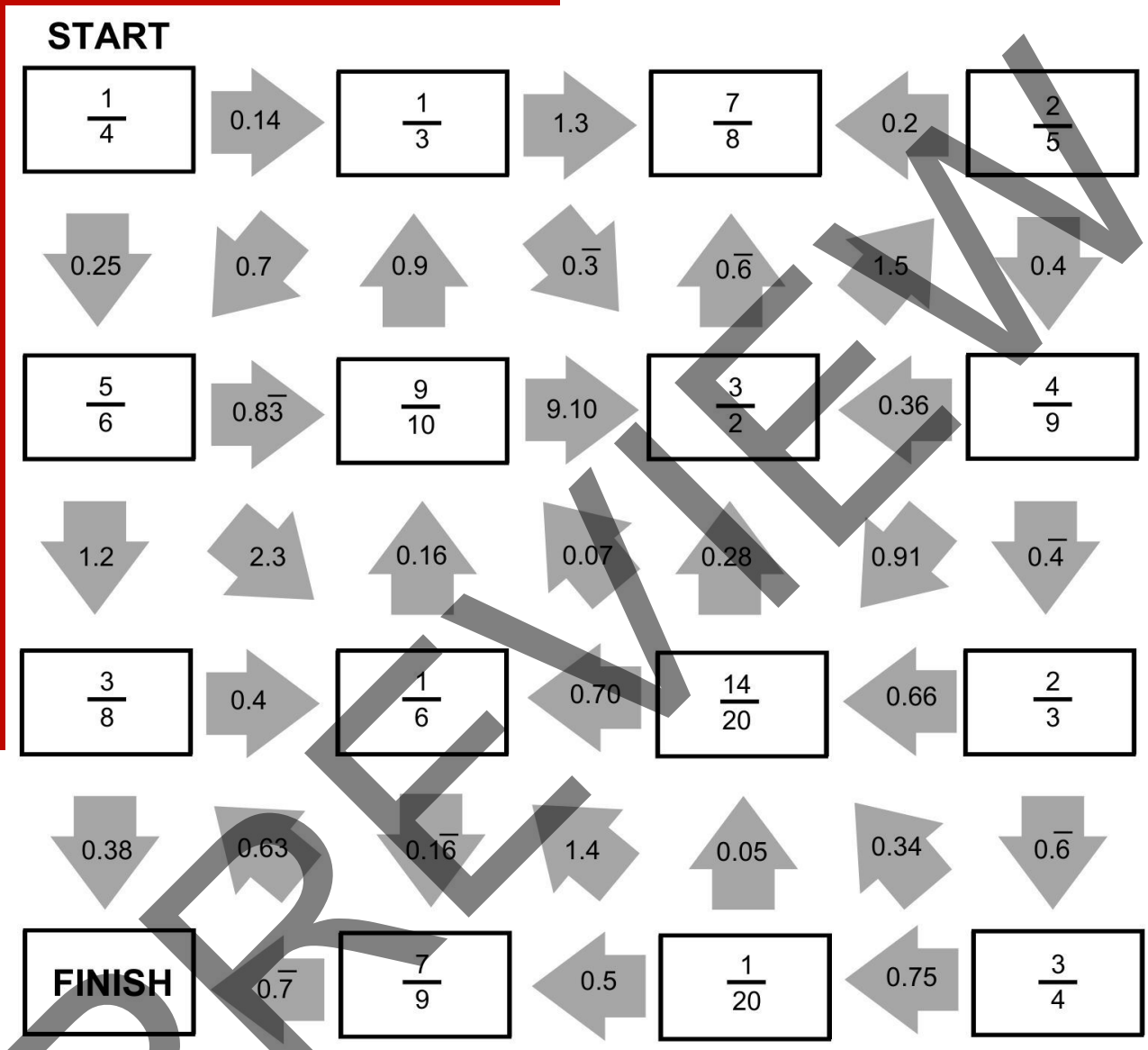
6 Per hundred

7 An organized way to display probability outcomes

9 All possible outcomes in a probability experiment are called the _____ space.

SPIRAL REVIEW

1. **Math Path Fluency Challenge**: Use what you know about fraction-decimal equivalencies to find the correct path from Start to Finish.



2. Complete the table:

	10%	20%	5%	15%	1%
	$10				
$36					
					$0.55

SPIRAL REVIEW
Continued

3. Rocco likes to make his own chocolate milk. He mixes 7 ounces of milk with 2 ounces of chocolate syrup each day.

   a. Make a tape diagram to represent this relationship.

   b. Rocco is going to the grocery store to buy chocolate milk supplies for 5 days. How many ounces of milk and chocolate syrup should he buy?

   c. Rocco is having friends over, and he makes a giant batch of chocolate milk. When he finishes mixing, he has 54 ounces of chocolate milk. How many ounces of milk did he use?

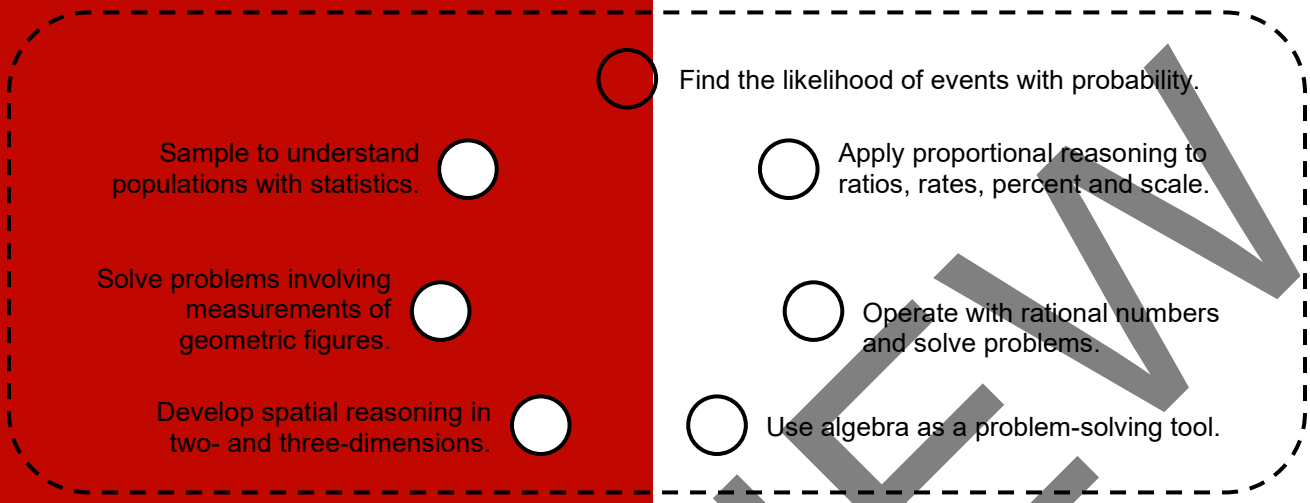
4. An overnight oats recipe calls for $\frac{1}{2}$ Tbsp chia seeds and 8 Tbsp oats for each person.

   a. Make a table that displays different equivalent ratios for the statement.

   b. Make a double number line or graph to display different equivalent ratios. Include some of the data from your table.

REFLECTION

1. **Big Ideas**. Shade all circles that describe big ideas in this unit. Draw lines to show connections that you noticed.



   Give an example from this unit of one of the connections above.

2. **Unit Progress.** Go back to **Monitor Your Progress** on the cover and complete or update your responses. Explain something you understand better now than before, OR something you would still like to work on.

3. **Mathematical Practice.** Explain a situation where you used theoretical probabilities (i.e., a probability model) to determine if a game was fair [SMP 2, 3, 4]. Then circle one more SMP on the back of this packet that you think was addressed in this unit and be prepared to share an example.

4. **Making Connections.** How might use probability in your life?

STUDENT RESOURCES

Word or Phrase	Definition
dependent events	Two events are dependent if the occurrence (or nonoccurrence) of one event affects the likelihood of the other. See independent events
event	An event is a subset of the sample space. See sample space. In the probability experiment of rolling a number cube, "rolling an even number" is an event, because getting a 2, 4, or 6 is a subset (part) of the sample space of {1, 2, 3, 4, 5, 6}.
experimental probability	In a repeated probability experiment, the experimental probability of an event is the number of times the event occurs divided by the number of trials. This is also called empirical probability. If, in 25 rolls of a number cube, we obtain an even number 11 times, we say that the experimental probability of rolling an even number is $\frac{11}{25} = 0.44 = 44\%$.
fair game	A game of chance is a fair game if all players have equal probabilities of winning. A two-person game of chance is a fair game if each player has probability $\frac{1}{2}$ of winning, that is, if each player has the same probability of winning as of losing.
independent events	Two events are independent if the occurrence (or nonoccurrence) of one event does not affect the likelihood of the other. See dependent. In the probability experiment of rolling a number cube and flipping a coin, the event of rolling a 1 is independent of the event of getting heads on the coin flip. The probability of rolling the 1 is $\frac{1}{6}$, no matter what the outcome of the coin flip is. In other words, the cube roll does not depend at all on the coin flip.
outcome	An outcome is a result of a probability experiment. If we roll a number cube, there are six possible outcomes: 1, 2, 3, 4, 5, 6.
percent	A percent is a number expressed in terms of the unit $1\% = \frac{1}{100}$. Fifteen percent = $15\% = \frac{15}{100} = 0.15$. $\frac{5}{6} = 0.8\overline{3} = 83.\overline{3}\%$

Word or Phrase	Definition
probability	The probability of an event is a measure of the likelihood of that event occurring. The probability $P(E)$ of the event E occurring satisfies $0 \le P(E) \le 1$. If the event, E, is certain to occur, then $P(E) = 1$. If the event E is impossible, then $P(E) = 0$. When flipping a fair coin, the probability that it will land on heads is $\frac{1}{2} = 0.5 = 50\%$.
probability experiment	A probability experiment is an experiment in which the results are subject to chance. Rolling a number cube can be considered a probability experiment.
repeating decimal	A repeating decimal is a decimal that ends in repetitions of the same block of digits. The repeating decimal 52.19343434… ends in repetitions of the block "34." An abbreviated notation for the decimal is $52.19\overline{34}$, where the bar over 34 indicates that the block is repeated. The terminating decimal 4.62 is regarded as a repeating decimal. Its value is 4.620000…
sample space	The sample space for a probability experiment is the set of all possible outcomes of the experiment. In the probability experiment of rolling a number cube, the sample space can be represented as the set {1, 2, 3, 4, 5, 6}.
simulation	Simulation is the imitation of one process by means of another process. We may simulate rolling a number cube by drawing a card blind from a group of six identical cards labeled one through six. We may simulate the weather by means of computer models.
terminating decimal	A terminating decimal is a decimal whose digits are 0 from some point on. Terminating decimals are regarded as repeating decimals, though the final 0's in the expression for a terminating decimal are usually omitted. See repeating decimal. 4.62 = 4.62000000… is a terminating decimal with value $4 + \frac{6}{10} + \frac{2}{100}$.
theoretical probability	The theoretical probability of an event is a measure of the likelihood of the event occurring. In the probability experiment of rolling a (fair) number cube, there are six equally likely outcomes, each with probability $\frac{1}{6}$. Since the event of rolling an even number corresponds to 3 of the outcomes, the theoretical probability of rolling an even number is 3 out of 6, or $3 \bullet \frac{1}{6} = \frac{3}{6} = \frac{1}{2}$.
trial	Each performance or repetition of a probability experiment is called a trial. Flipping a coin 25 times can be viewed as 25 trials of the probability experiment of flipping a coin once.

Phrases That Describe Probabilities

In their assessment reports on climate change, climate scientists attach the following probabilities to common expressions of likelihood:

Virtually certain:	> 99% probability
Extremely likely:	> 95% probability
Very likely:	> 90% probability
Likely:	> 66% probability
More likely than not:	> 50% probability
About as likely as not:	33 to 66% probability
Unlikely:	< 33% probability
Very unlikely:	< 10% probability
Extremely unlikely:	< 5% probability
Exceptionally unlikely:	< 1% probability

Estimating Probabilities from an Experiment With Equally Likely Outcomes

To estimate the probability of an event *E*, repeat the experiment a number of times and observe how many times the event occurs. The estimate for the probability of the event *E* occurring is then given by the fraction:

$$\text{estimate} = \frac{\text{number of times an event } E \text{ occurs}}{\text{number of trials}} = \frac{\text{numerator}}{\text{denominator}}$$

In a probability experiment of rolling a number cube with six equally likely outcomes, each has probability $\frac{1}{6}$.

The event of rolling an odd number corresponds to three outcomes: 1, 3, or 5. Below is data from an experiment where a cube is rolled 10 times.

Trial #	1	2	3	4	5	6	7	8	9	10
Outcome	4	5	6	3	5	2	1	6	4	2

In this experiment, an odd number occurred 4 times.

$\text{estimate(odd)} = \frac{4}{10} = \frac{2}{5} = 40\%$

Since the estimate is based on an experiment, different experiments may lead to different estimates.

Finding Theoretical Probabilities

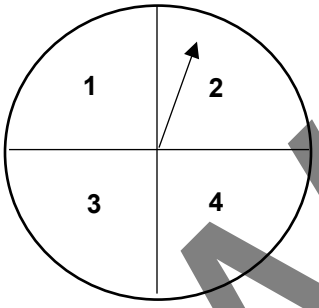
In a probability experiment of rolling a number cube with six equally likely outcomes, each has probability $\frac{1}{6}$.

The event of rolling an odd number corresponds to three outcomes: 1, 3, or 5. Thus the theoretical probability of rolling an odd number is given by the fraction:

$$P(E) = \frac{\text{number of outcomes in an event } E}{\text{total number of outcomes}} = \frac{3}{6} = \frac{1}{2} = 50\%$$

Sample Space Displays

Suppose our experiment is to flip a coin and then spin the spinner.

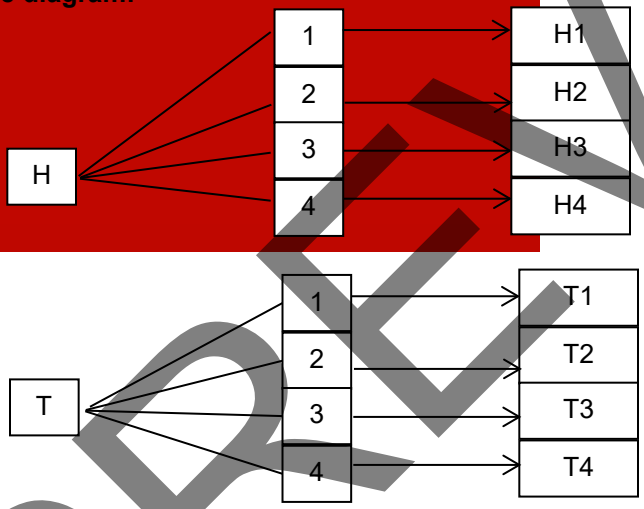


Below are three ways to show all the outcomes (or the sample space) of the experiment.

1. Outcome grid:

		Spinner			
		1	**2**	**3**	**4**
Coin Flip	**Heads (H)**	H1	H2	H3	H4
	Tails (T)	T1	T2	T3	T4

2. Tree diagram:



3. List

H1 H2 H3 H4
T1 T2 T3 T4

COMMON CORE STATE STANDARDS

STANDARDS FOR MATHEMATICAL CONTENT	
7.SP.C	**Investigate chance processes and develop, use, and evaluate probability models.**
7.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.
7.SP.6	Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability. For example, when rolling a number cube 600 times, predict that a 3 or 6 would be rolled roughly 200 times, but probably not exactly 200 times.
7.SP.7	Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy:
a	Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events. For example, if a student is selected at random from a class, find the probability that Jane will be selected and the probability that a girl will be selected.
b	Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process. For example, find the approximate probability that a spinning penny will land heads up or that a tossed paper cup will land open-end down. Do the outcomes for the spinning penny appear to be equally likely based on the observed frequencies?
7.SP.8	Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation:
a	Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs.
b	Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. For an event described in everyday language (e.g., “rolling double sixes”), identify the outcomes in the sample space which compose the event.
c	Design and use a simulation to generate frequencies for compound events. *For example, use random digits as a simulation tool to approximate the answer to the question: If 40% of donors have type A blood, what is the probability that it will take at least 4 donors to find one with type A blood*
7.NS.A	**Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.**
7.NS.2	Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers:
d	Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats.

STANDARDS FOR MATHEMATICAL PRACTICE	
SMP1	Make sense of problems and persevere in solving them.
SMP2	Reason abstractly and quantitatively.
SMP3	Construct viable arguments and critique the reasoning of others.
SMP4	Model with mathematics.
SMP5	Use appropriate tools strategically.
SMP6	Attend to precision.
SMP7	Look for and make use of structure.
SMP8	Look for and express regularity in repeated reasoning.

9 781614 450429