Name_____ Period_____ Date _____

7-7
STUDENT PACKET

# *MATHLINKS*: GRADE 7
# STUDENT PACKET 7
# PROBABILITY

# WORD BANK

| Word or Phrase | Definition or Explanation | Example or Picture |
|---|---|---|
| event | | |
| experimental probability | | |
| fair game | | |
| outcome | | |
| probability | | |
| probability experiment | | |
| sample | | |
| sample space | | |
| theoretical probability | | |

# INTRODUCTION TO PROBABILITY

**Summary**

We will use vocabulary related to probability. We will write the probability of events using fractions, decimals and percents. We will perform a probability experiment.

**Goals**

- Understand vocabulary related to probability.
- Understand that the probability of a chance event is a number between 0 and 1.
- Use fractions, decimals, and percents to represent probabilities.
- Perform a probability experiment.

## Warmup

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

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

Use percents to describe what you think each of the following potential responses might mean.

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 will win."

# RACE TO THE TOP

1. Your teacher will explain an experiment using two number cubes. Rrecord your data in the chart below.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |

2. The sum that got to the top first for me was _____. It took _____ total trials (rolls) to do this.

3. What sum(s) do you think came up most for others in the class? _____

4. What sum(s) do you think came up least for others in the class? _____

5. Use data from the whole class to complete the chart below

| **For the class:** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Which sum came up the most?** | | | | | | | | | | | |

6. How does the class data confirm or change your answers to questions 3 and 4 above?

Imagine you will roll the two number cubes once more.

7. Is it likely that you will get a sum less than 10? Explain.

8. Is it unlikely that you will get a sum greater than 10? Explain.

9. Name two sums that are impossible to get.

10. What sums are you certain to get?

# WILL IT HAPPEN?

Choose a word from the word list below to describe each event.

1. You will have math homework today.

2. Everyone in the entire school will do their homework tonight.

3. You will exercise today.

4. A monkey will read the Declaration of Independence in your social studies class this year.

5. The sun will set in the east tonight.

6. You will breathe today.

7. You will get one try at making a full-court shot on the basketball court and make it.

8. You will flip a coin 20 times and it will land on heads every time.

9. From a full shuffled deck of cards you select a jack on your first pick.

10. From a full shuffled deck of cards you will pick four cards and they will be all aces.

11. You will roll a number cube and get a number greater than 1.

12. You will roll two number cubes and get a sum less than 10.

| | | | | |
|---|---|---|---|---|
| certain | probable | improbable | | |
| likely | unlikely | possible | impossible | |

# THE PROBABILITY OF AN EVENT

The probability of an event is a measure of the likelihood of that event occurring. For an event, denoted $E$, the probability of that event occurring is denoted $P(E)$.

- If an event is certain to occur, then $P(E) = 1$. Its chance of occurring is 100%.
- If an event is impossible, then $P(E) = 0$. Its chance of occurring is 0%.
- All likelihoods are between 0 and 1. That is, $0 \leq P(E) \leq 1$.

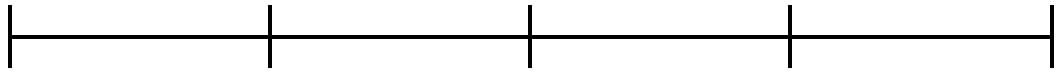
Example: When flipping a coin, the probability that it will land on heads is 50%.

We may write $P(\text{heads}) = 50\%$, $P(\text{heads}) = 0.5$, or $P(\text{Heads}) = \frac{1}{2}$.

1. Suppose slips of papers with the names of each student in your class are placed in a box. Your teacher shakes the box and then takes out a slip of paper.

   Predict the chances of each event by estimating its placement on the line below.

   - Event **A**: The name chosen from the box belongs to a student in this class.
   - Event **B**: A girl's name is chosen from the box.
   - Event **C**: The name chosen from the box belongs to a student wearing ice skates.
   - Event **D**: Your name is chosen from the box.




0% — Will never happen, Impossible

50% — Chance of happening is the same as chance of not happening

100% — Definitely will happen, Certain

Refer to the experiment above where the teacher pulls a slip of paper from a box. For each probability statement below, make up an event with that probability.

| | |
|---|---|
| 2. $P(E) = 0$ | 3. $P(E) = 1$ |
| 4. $0 \leq P(E) \leq \frac{1}{2}$ | 5. $\frac{1}{2} \leq P(\text{E}) \leq 1$ |

# CARDS AND COINS

1. In your own words, explain what you think it means for an event to be random. Write an example of a situation you think involves randomness.

Write the probability of each event when choosing one card at random from a typical deck of 52 cards (no jokers). Consider aces to be "low" (i.e. equal to 1).

| | |
|---|---|
| 2. *P*(draw the queen of hearts) | 3. *P*(draw a queen) |
| 4. *P*(draw a red queen) | 5. *P*(draw a black card) |
| 6. *P*(draw a club) | 7. *P*(draw a club ≤ 10) |
| 8. *P*(draw an even diamond ≤ 10) | 9. *P*(draw an odd diamond < 5) |

10. If you flip a coin 200 times, roughly how many times would you expect it to land on heads?

11. Flip a coin 50 times and record the results.

    a. At this rate, how many heads would you expect to get if you flipped it 200 times?

    b. Is this equal to the number of times you expected to get heads?

12. If you flip a coin 500 times, do you think it is very likely that you will get exactly 250 heads? Explain.

13. Suppose you flip a coin 20 times and it comes up heads each time. What is the probability of the 21$^{st}$ flip landing on heads? Explain.

# SPINNERS

**Summary**

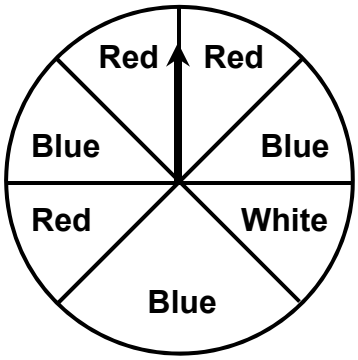
We will use spinners and puzzles to explore probability concepts. We will compare experimental probability to theoretical probability. We will use logical reasoning to determine the probability of different events.

**Goals**

- Use fractions, decimals, and percents to represent probabilities.
- Collect data using chance, and make predictions about long-run frequencies.
- Develop and use probability models to find theoretical probabilities of events.

## Warm-up

Use the spinner diagram to the right for problems 1-6. 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 colored areas below.




1. *P*(pointer stops on blue)

2. *P*(pointer stops on white)

3. *P*(pointer stops on red)

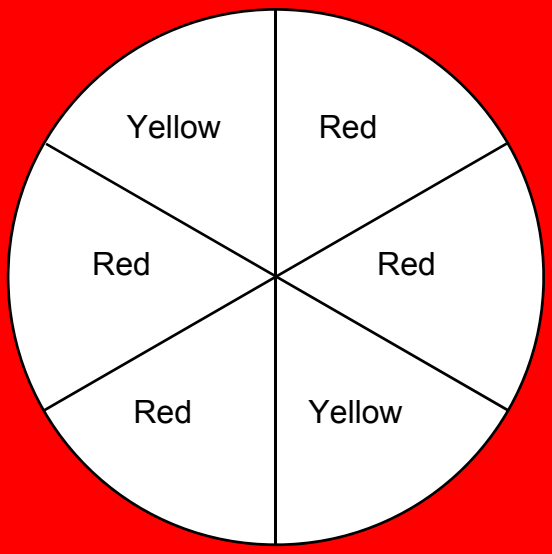
4. *P*(pointer stops on green)

5. Add the probabilities in problems 1, 2, and 3.

6. What is the probability of landing on a U.S. flag color?

# SPINNER EXPERIMENT

Use the spinner diagram below, a pencil, and a paper clip to collect data. Record your data in the table to the right.




| MY DATA Total Spins = _____ | |
|---|---|
| Red | Yellow |
| | |
| My total (Reds) | My total (Yellow) |

| TEAM DATA Total Spins = _____ | |
|---|---|
| Red | Yellow |
| | |

| CLASS DATA Total Spins = ____ | |
|---|---|
| Red | Yellow |
| | |

Answer the following questions for both your data and the class data below.

| | YOUR DATA | CLASS DATA |
|---|---|---|
| 1. In what fraction of the spins did the paper clip land on red? | | |
| 2. What fraction of the circle is red? | | |
| 3. In what fraction of the spins did it land on yellow? | | |
| 4. What fraction of the circle is yellow? | | |
| 5. In what fraction of the spins did it land on a primary color? | | |
| 6. In what fraction of the spins did it land on green? | | |

Compare the fraction for problem 2 to your data and the class data from problem 1. Compare the fraction for problem 4 to your data and the class data from problem 3.

7. How closely did your data match the actual areas?

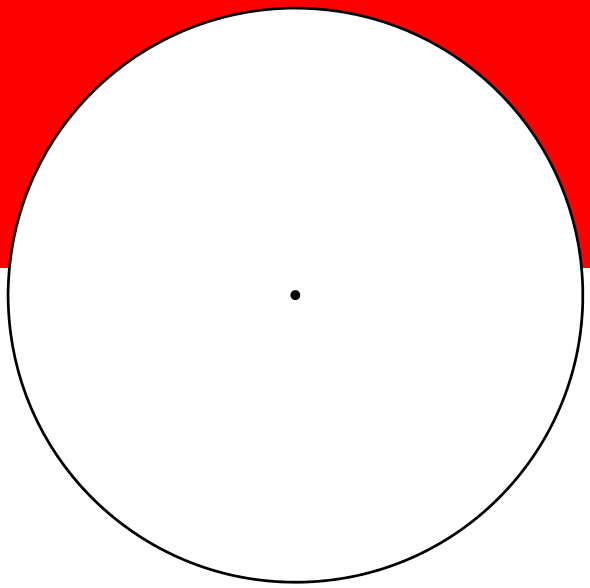
8. How closely did the class data match?

# SPINNER PUZZLE A

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

| **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. |

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



| | **Fraction** | **Decimal** | **Percent** |
|---|---|---|---|
| ***P*(hamster)** | | | |
| ***P*(turtles)** | | | |
| ***P*(goldfish)** | | | |
| **TOTAL** | | | |

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

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

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

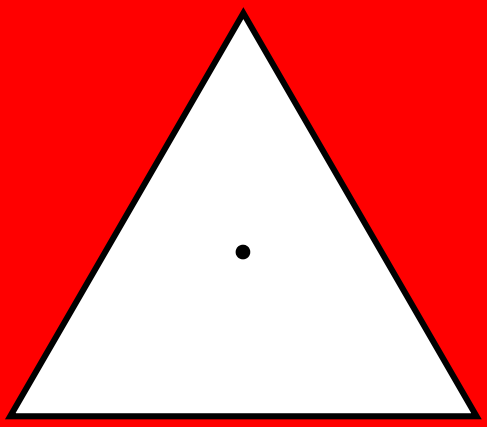
5. What is the greatest value the probability of an event can have? _____ The least? _____

6. Were there any clues you did not need? _____ Explain.

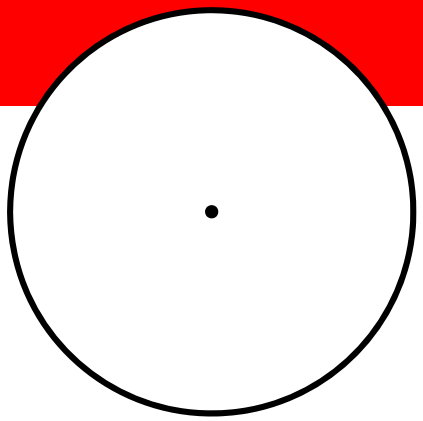
# SPINNER PUZZLES

Use the clues provided by your teacher to draw each spinner. Express each probability as a fraction, decimal, and percent.

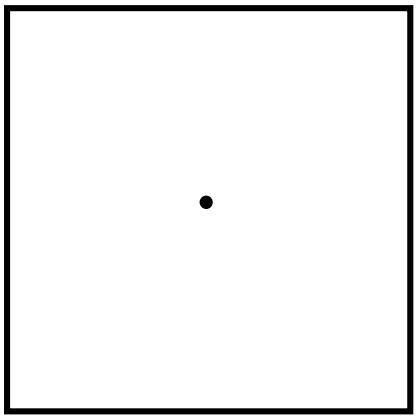
Triangle Puzzle B



Circle Puzzle C



Square Puzzle D

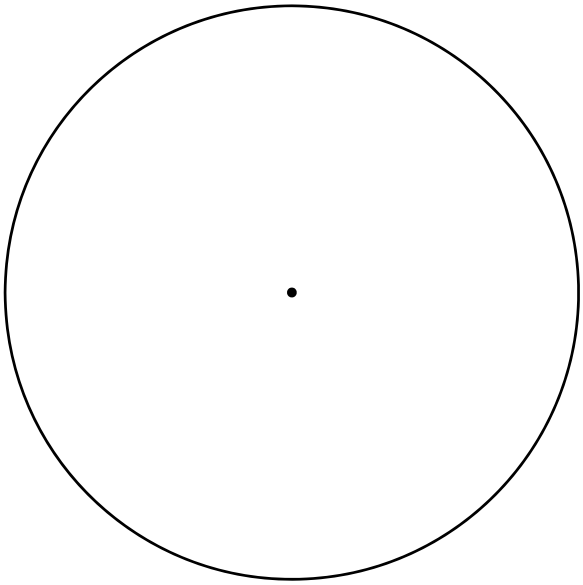


# SPINNER PUZZLE E

Can you draw a spinner diagram to match the clues below? _____

- If yes, draw the spinner below.
- If no, change one of the clues to make the spinner puzzle work, and then draw the spinner below.

| **Clue #1** | **Clue #2** |
|---|---|
| The spinner is divided into three colors: red, blue, and green | The chances of getting red are 6 out of 24. |
| **Clue #3** | **Clue #4** |
| You are twice as likely to get blue as red. | $P$ (Green) = $\frac{1}{2}$ |



# FLIPS, ROLLS, AND FAIR GAMES

**Summary**

We will explore probability concepts as we flip a coin and roll a number cube. We will learn techniques for organizing data. We will then analyze experiments by comparing experimental probabilities to the theoretical probability. We will use probability to determine if games are fair.

**Goals**

- Use lists, outcome grids, and tree diagrams to represent the sample space of a probability experiment.
- Use fractions, decimals, and percents to represent probabilities.
- Record and analyze outcomes from a probability experiment.
- Use probability to determine the fairness of games.

## Warm-up

A number cube is fair if the probabilities of getting each number 1-6 are equal.

We perform a probability experiment by rolling one fair number cube numbered 1-6. Let $P(1)$ be the probability that we roll a 1, and so on. Write the probability of the following events.

| | |
|---|---|
| 1. $P(1)$ | 2. $P(6)$ |
| 3. $P(12)$ | 4. $P(\text{an even number})$ |
| 5. $P(\text{an odd number})$ | 6. $P(\text{a result} < 4)$ |
| 7. $P(\text{a result} \leq 4)$ | 8. $P(\text{an even result} > 2)$ |

# FLIP AND ROLL

You play a game in which you flip a coin and roll a number cube ten times. There are two ways for you to win:

(1) the coin shows heads and the number on the cube is divisible by two,
OR
(2) the coin shows tails and the number on the cube is divisible by three.

Otherwise you lose.

1. Use the table below to record the results of your experiment for ten trials.

| Trial # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Heads or Tails?** | | | | | | | | | | |
| **Number Rolled?** | | | | | | | | | | |
| **Win or Lose?** | | | | | | | | | | |

2. Estimate for probability of winning $= \frac{\text{\# of wins}}{\text{\# of trials}} =$ fraction of wins

Estimate for probability of losing $= \frac{\text{\# of losses}}{\text{\# of trials}} =$ fraction of losses

| | MY DATA | | | | TEAM DATA | | | | CLASS DATA | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **My Results** | Fraction | Decimal | Percent | **Team Results** | Fraction | Decimal | Percent | **Class Results** | Fraction | Decimal | Percent |
| **Wins** | | | | | | | | | | | | |
| **Losses** | | | | | | | | | | | | |
| **Totals** | | | | | | | | | | | | |

3. Identify two events in this experiment: _____ and _____.

4. Which do you think is more accurate: (1) your individual estimates of the probabilities or (2) the class estimates of the probabilities? Explain.

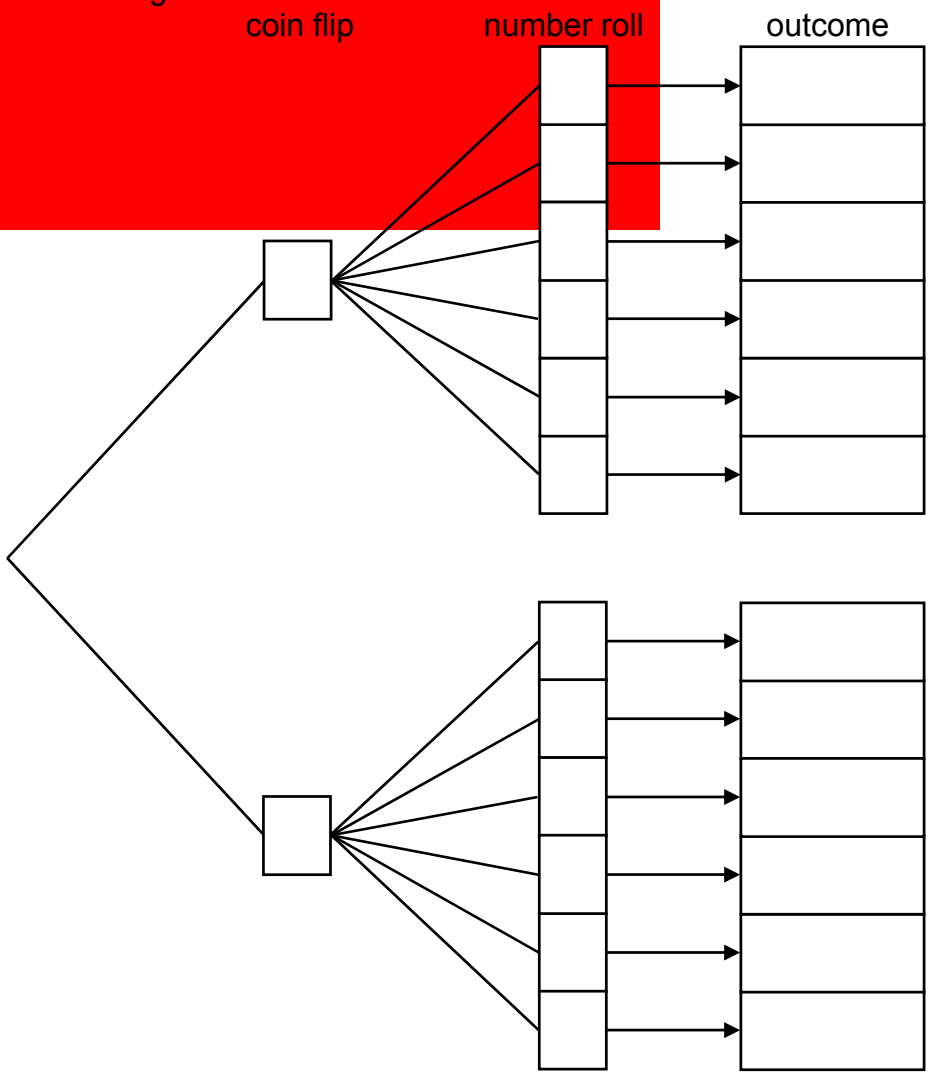
# SAMPLE SPACE DISPLAYS

Show all the outcomes (sample space) of the Flip-and-Roll experiment in an outcome grid, in a tree diagram, and as an organized list below. Circle all the outcomes in the sample space that result in a win.

1. Outcome grid:

| | | Number Roll | | | | | |
|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** |
| **Coin Flip** | **Heads** | H, 1 | | | | | |
| | **Tails** | | | | | | |

2. Tree diagram:




3. Organized list:

# THEORETICAL PROBABILITY

When all outcomes are equally likely to occur, the probability $P$ of an event $E$ is the value of the ratio of the number of outcomes in $E$ to the number of possible outcomes.

$$P(E) = \frac{\text{\# of outcomes in } E}{\text{\# of possible outcomes}}$$

1. Fill in the following table with the information from the Flip-and-Roll experiment using displays from page 13 and the class data on page 12.

| | **Theoretical** (from sample space) | **Experimental** (from class data) |
|---|---|---|
| ***P*(Win)** | | |
| ***P*(Lose)** | | |

2. How does the theoretical probability of winning compare to the estimate from the class experiment? Explain.

3. If you were to play this game 600 times, roughly how many games can you expect to win?

4. Do you think the probability of winning is the same as the probability of losing? _____

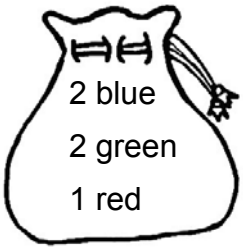
   If you think the game is fair, explain why you think so. If you do not think the game is fair, explain how you would change the rules to make it fair.

# COLORED MARBLES

Here are two bags of colored marbles.

First Bag

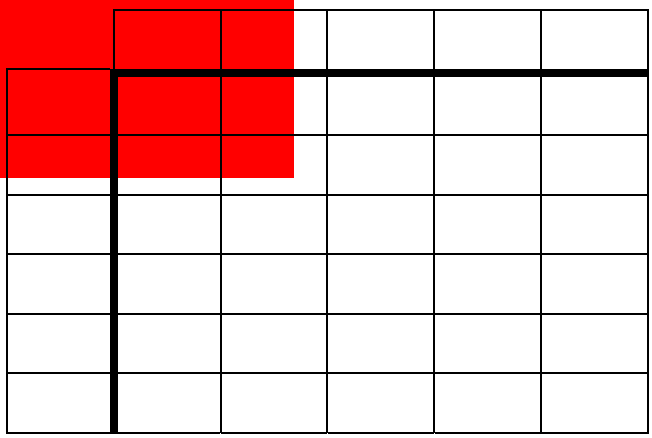

Second Bag




1. Make an outcome grid below that displays what might happen if you pick one marble at random from the first bag and then one marble at random from the second bag. For this outcome grid, you will need a way to distinguish the marbles of each color in each bag from each other.

Second Bag

First Bag



2. How many equally likely outcomes are in the outcome grid? _____ Circle the outcomes in the sample space where two blue marbles are chosen.

You pick one marble from the first bag and one marble from the second bag.

3. What is the probability of the <u>event</u> of choosing two blue marbles, which we can write as *P*(2 blue)?

4. Identify and calculate theoretical probabilities for two other events of your choice.

| | |
|---|---|
| | |

# RACE TO THE TOP REVISITED

1. In the Race to the Top experiment on page 2, you rolled two number cubes and recorded the sums. Create a sample space for rolling two number cubes.

Write the theoretical probabilities of sums when rolling two number cubes as fractions and as percents. Let *P*(1) refer to the probability of a sum of 1, and so on.

| | | |
|---|---|---|
| 2. *P*(1) = _____ = _____ | 3. *P*(2) = _____ = _____ | 4. *P*(3) = _____ = _____ |
| 5. *P*(4) = _____ = _____ | 6. *P*(5) = _____ = _____ | 7. *P*(6) = _____ = _____ |
| 8. *P*(7) = _____ = _____ | 9. *P*(8) = _____ = _____ | 10. *P*(9) = _____ = _____ |
| 11. *P*(10) = _____ = _____ | 12. *P*(11) = _____ = _____ | 13. *P*(12) = _____ = _____ |

2. Use your data from problem 1 in the Race to the Top experiment on page 2 to complete this table.

| | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **Total Trials** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Your results** | | | | | | | | | | | | |
| **Fraction** | | | | | | | | | | | | |
| **Percent** | | | | | | | | | | | | |

# ANALYZING RACE TO THE TOP

1. Compare the theoretical probabilities to the experimental data you collected in the Race to the Top experiment on page 16. Do they agree? Explain.

2. Which sum has the greatest probability? _____

3. Which is greater, $P(\text{sum} = 7)$ or $P(\text{sum} \neq 7)$? _____ Explain.

Angela made this sample space for the sum of two number cubes.

| | | | | | |
|---|---|---|---|---|---|
| 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 | | | | | |

Then she used the sample space to claim that $P(\text{sum} = 7) = \frac{3}{21} = \frac{1}{7}$.

4. What is wrong with Angela's work?

Find the probabilities.

| | | |
|---|---|---|
| 5. $P(\text{sum} = \text{prime number})$ | 6. $P(\text{sum} \leq 12)$ | 7. $P(\text{sum} = 14)$ |

# PRODUCTS WITH TWO NUMBER CUBES

1. Pretend that you are rolling two number cubes and finding the product of the digits. What is the result of rolling double sixes? _____

2. Create a display to show the sample space for this situation.

Find the probabilities of each event.

| | |
|---|---|
| 3. *P*(product = 9) | 4. *P*(product = even number) |
| 5. *P*(product = odd number) | 6. *P*(product = 1) |
| 7. *P*(product = multiple of 4) | 8. *P*(product = prime number) |

9. Which product has the greatest probability? Justify your answer.

10. Which is greater, *P*(product > 12) or *P*(product < 12)? Justify your answer.

# FAIR OR UNFAIR?

Determine whether each game is fair or unfair. If unfair, explain what can be done to make the game fair.

1. Two number cubes labeled 1 to 6 are rolled and the product is calculated. If the product is odd, Ryann gets a point. If the product is even, Dylan gets a point.

2. Two number cubes labeled 1 to 6 are rolled and the difference is calculated. If the difference is odd, Ryann gets a point. If the difference is even, Dylan gets a point.

# SKILL BUILDERS, VOCABULARY, AND REVIEW

## SKILL BUILDER 1

Write <, =, or > to make the statement true.

| | |
|---|---|
| 1. (-2) – 9 _____ (-2) + (-9) | 2. 3(-2) _____ -3(2) |
| 3. 5 – 13 _____ 8 – 16 | 4. -20 + (-9) _____ 7 – (-2) |
| 5. 20(-3) _____ 200 – 270 | 6. 29 – (-13) _____ -5(-8) |

Simplify this complex fraction using two different strategies.

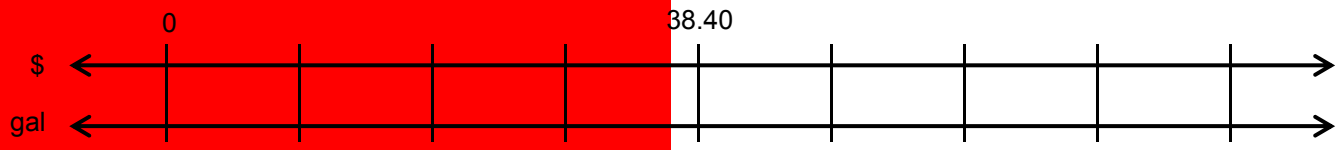
| | |
|---|---|
| 7. $\dfrac{\frac{5}{8}}{\frac{3}{4}}$ | 8. $\dfrac{\frac{5}{8}}{\frac{3}{4}}$ |

| | |
|---|---|
| 9. Emily sold 15 magazines in $\frac{3}{4}$ hour. What is her rate in magazines per hour? | 10. Joaquin drove 102 miles in $1\frac{1}{4}$ hours. What is his rate in miles per hour? |

# SKILL BUILDER 2

Ted is going on a road trip and needs to fill up his gas tank. He puts 12 gallons in his car and pays $38.40.

1. Complete the double number line diagram below to represent this information.

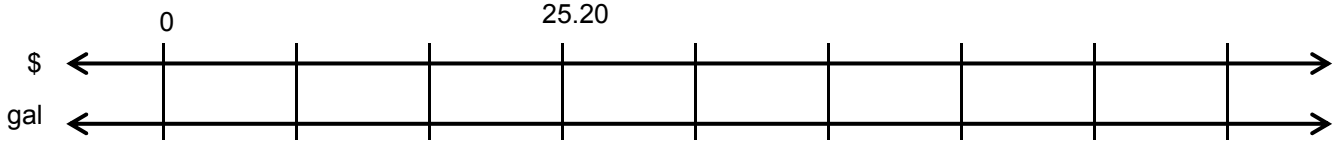



Find each cost or amount of gas at the given rate above.

| | |
|---|---|
| 2. What is the cost for 6 gallons? | 3. How much gas can Ted buy for $57.60? |
| 4. What is the cost per 1 gallon? | 5. How much gas can Ted buy for $0.80? |

On the way home Ted fills up his gas tank again. This time he puts 9 gallons in his car and pays $25.20.

6. Complete the double number line diagram below to represent this information.




Find each cost or amount of gas at the given rate above.

| | |
|---|---|
| 7. What is the cost for 21 gallons? | 8. What is the cost for 19.5 gallons? |
| 9. How much gas can Ted buy for $16.80? | 10. How much gas can Ted buy for $2.80? |

# SKILL BUILDER 3

Compute.

| | |
|---|---|
| 1. $\frac{-14.07}{0.07}$ | 2. $3\frac{1}{3} + \left(-1\frac{1}{2}\right)$ |
| 3. $2\frac{5}{6} - 8\frac{3}{4}$ | 4. $\left(-4\frac{2}{5}\right) \div \left(1\frac{1}{10}\right)$ |

5. Felix went to the grocery store. He started with \$24, and when he left he had \$8.
   a. Write an equation to show how much Felix spent ($x$) at the grocery store.

   b. Solve the equation mentally. How much did Felix spend at the store?

Solve using any method.

| | | |
|---|---|---|
| 6. $8 + x = 15$ | 7. $2.4 = 0.3x$ | 8. $\frac{x}{4} = 2\frac{1}{2}$ |

9. Circle all of the expressions that are equivalent to $4y + 6$.

$2(2y + 3)$ $5y - y + 6$ $2(2y + 6)$ $-3(-2) + 2(2y)$

# SKILL BUILDER 4

1. A waste company can process $\frac{3}{4}$ tons of garbage every $1\frac{1}{2}$ hours. Fill in the table below using this garbage to hours ratio.

| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| **Tons of garbage** | $\frac{1}{4}$ | $\frac{1}{2}$ | | 1 | 2 | $2\frac{1}{2}$ |
| **# of hours** | | | $1\frac{1}{2}$ | | | |

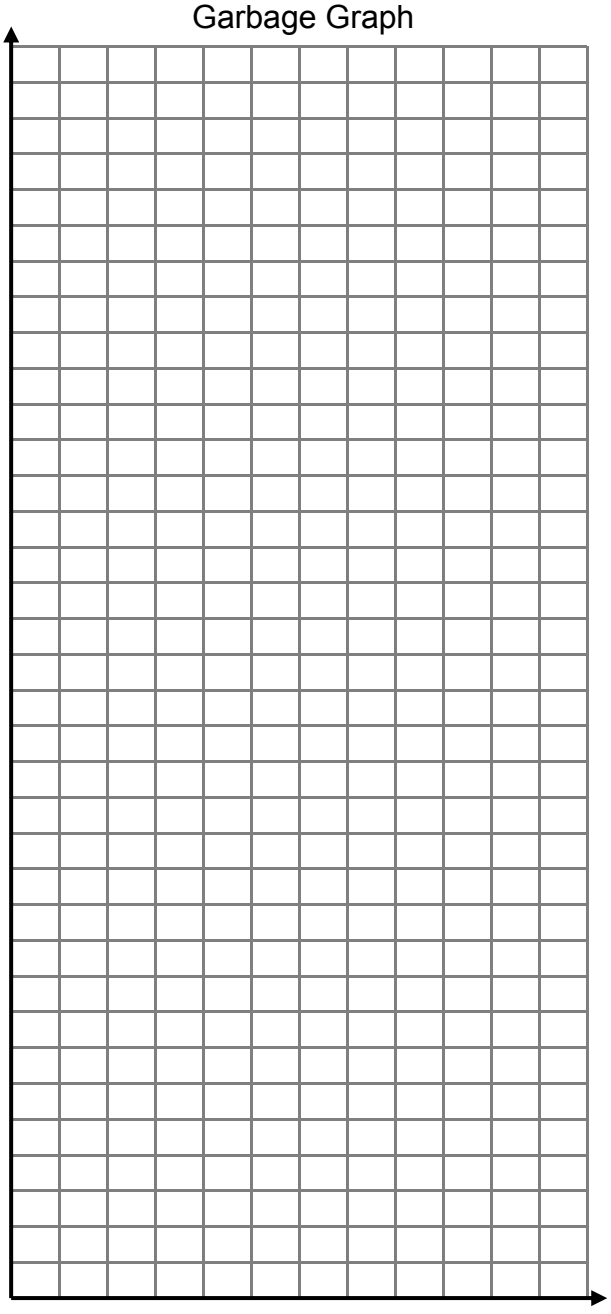
2. Graph the entries from the table above as ordered pairs at the right. Be sure to scale the axes appropriately. You may use a different scale on each axis.

3. Does the point (0, 0) "line up" with the other points you graphed?

4. What does (0, 0) represent in the context of the garbage?

5. The graph includes the coordinates (1, _____ ). What does this point represent in the context of the garbage?

Garbage Graph



# SKILL BUILDER 5

Choose a word from the word list below to describe each event.

| | |
|---|---|
| 1. A lion will serve you dinner tonight. | 2. From a full shuffled deck of cards you pick one card and get a 2 **or** a 3. |
| 3. All your best friends will be in your same math class. | 4. From a full shuffled deck of cards you pick one card and get a 2 **and** a 3. |
| 5. You flip a coin 50 times and it lands on tails every time. | 6. You roll a number cube and get a number greater than 2. |
| **Word List**<br>certain probable improbable<br>likely unlikely possible impossible | |

Write the probability of each event when choosing one card at random from a standard deck of 52 cards (no jokers). Let *P*(the ace of diamonds) refer to the probability of drawing that card, and so on.

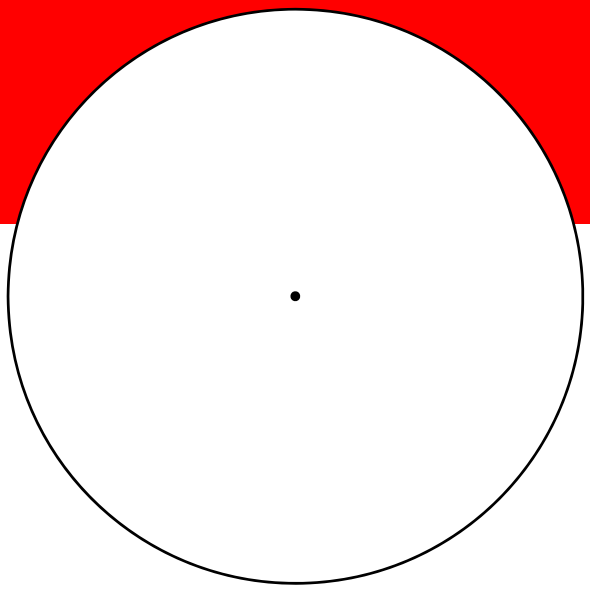
| | |
|---|---|
| 7. *P*(the ace of diamonds) | 8. *P*(a ten) |
| 9. *P*(a red queen) | 10. *P*(a jack or queen) |
| 11. *P*(a heart with a value less than 5) | 12. *P*(a spade with a value less than or equal to 9) |

13. A glass jar contains 6 red, 5 green, 8 blue and 3 yellow marbles. A single marble is chosen at random from the jar.
    a. What is the probability of choosing a red marble?
    b. What is the probability of choosing a green marble?
    c. What is the probability of choosing a blue marble?
    d. What is the probability of choosing a yellow marble?

# SKILL BUILDER 6

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

| **Clue #1** | **Clue #2** |
|---|---|
| The spinner is divided into eight equal sections, each colored red, blue, or yellow. | Each of the three colors has positive probability. |
| **Clue #3** | **Clue #4** |
| Spinning a blue is less likely than spinning a red. | It is more likely that the spinner will land in the yellow area than in the area with red and blue sections combined. |



| | **As a Fraction** | **As a Decimal** | **As a Percent** |
|---|---|---|---|
| ***P*(red)** | | | |
| ***P*(blue)** | | | |
| ***P*(yellow)** | | | |
| **TOTAL** | | | |

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

3. What is the probability of getting green? _____

4. If you spin 800 times, roughly how times would you expect to get yellow? _____

5. What is the probability of getting red, yellow, or blue on a spin? _____

# SKILL BUILDER 7

A popular word game requires players to guess letters that form a word or phrase.

1. Do you think some letters are more likely to appear than others? _____

2. How many total letters are there in the first sentence above? _____

3. Tally the number of times each letter is used in the first sentence above. Find the percentage that each letter is used.

| Letter | Tally | Total | Percent |
|---|---|---|---|
| A | | | |
| B | | | |
| C | | | |
| D | | | |
| E | | | |
| F | | | |
| G | | | |
| H | | | |
| I | | | |
| J | | | |
| K | | | |
| L | | | |
| M | | | |

| Letter | Tally | Total | Percent |
|---|---|---|---|
| N | | | |
| O | | | |
| P | | | |
| Q | | | |
| R | | | |
| S | | | |
| T | | | |
| U | | | |
| V | | | |
| W | | | |
| X | | | |
| Y | | | |
| Z | | | |

Pretend you wrote each letter in the first sentence on the page on a slip of paper and chose a letter at random. Find the following probabilities.

| | | |
|---|---|---|
| 4. *P*(an S) | 5. *P*(a vowel) | 6. *P*(an E or I) |

7. If you were to use a longer sentence, say two or three times longer, do you think your probability results would be the same? Explain.

8. Based on this experiment, which five letters seem to be most common in words? _____
(Curious? Research frequency of letters in English on the internet. Does data from this experiment agree with your findings?)

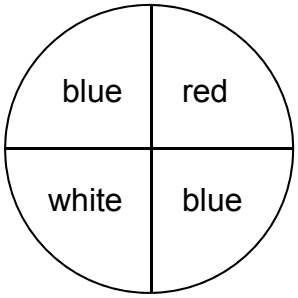
# SKILL BUILDER 8

1. What is the theoretical probability of getting a number less than 5 when you roll one number cube?

2. If you were to roll a number cube 300 times, roughly how many times would you expect to get a number less than 5?

3. EJ rolled a number cube 300 times and got a number less than 5 a total of 207 times. Is this reasonable? Explain.

4. You roll a number cube and spin the spinner pictured to the right. Create a display to show the sample space for this situation.



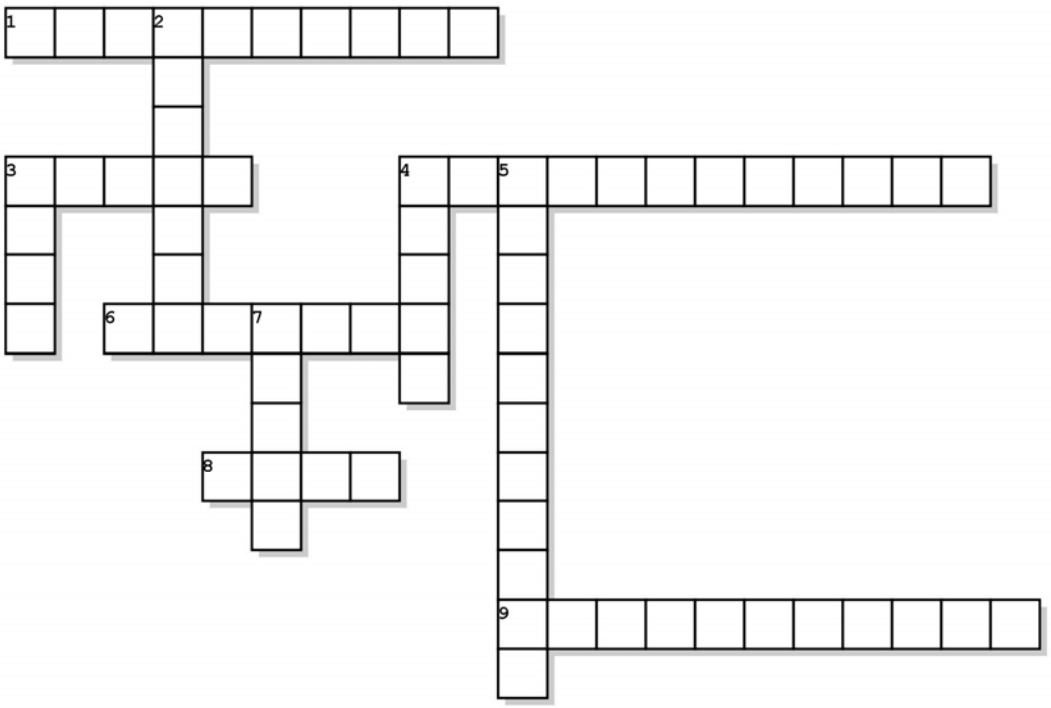

Use the sample space above to find the probabilities of the following combinations of spins and rolls.

| 5. *P*(red and a 6) | 6. *P*(white and an odd) | 7. *P*(blue and less than 5) |
|---|---|---|
| | | |

8. Yasiel is a very good baseball player. Last year he got a hit about one-third of the times he came to bat. He played 150 games and got up to bat about 3.7 times per game. Roughly how many hits would you expect he got in all?

9. In his first two games this year, Yasiel got 6 hits in 9 times at bats. Gabriel concluded, "Since Yasiel has gotten a hit two-thirds of the time so far this year, he will get twice as many hits this year as last year." Critique Gabriel's reasoning.

# FOCUS ON VOCABULARY



**Across**

1 0% probability

3 All the possible outcomes of an experiment: sample ___

4 A probability based on a random sample

6 100% probability

8 A two-person game where your chance of winning is equal to your chance of losing

9 A probability based on a sample space

**Down**

2 Result of a probability experiment

3 The number of trials in an experiment: sample ____

4 All or part of the sample space

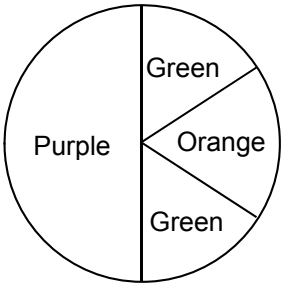
5 Measure of the likelihood of an event

7 Each performance of a probability experiment

# SELECTED RESPONSE

Show your work on a separate sheet of paper and choose the best answer(s).

1. Using the spinner to the right, what is the probability of spinning orange or purple, *P*(orange or purple)?




A. $\frac{2}{3}$ B. $\frac{1}{2}$ C. $\frac{1}{3}$ D. $\frac{1}{4}$

2. If you roll a number cube and flip a coin, what is the probability you will get an even number and tails?

A. $\frac{1}{6}$ B. $\frac{1}{4}$ C. $\frac{3}{4}$ D. $\frac{1}{2}$

3. Choose all words that are similar in meaning to probable.

A. certain B. impossible C. likely D. unlikely

4. You pull one card at random from a deck of 52 cards. Choose ALL of the numbers that represent the probability of getting a jack.

A. $\frac{1}{52}$ B. $\frac{2}{52}$ C. $\frac{4}{52}$ D. $\frac{1}{13}$

5. You roll a number cube 400 times. Choose ALL reasonable estimates for the number of times you might expect a 6 to come up.

A. 200 B. 70 C. 65 D. 20

6. You roll two number cubes and calculate the sum. Choose ALL true statements. Let *P*(sum = 3) refer to the probability that the sum is 3, and so on.

A. *P*(sum = 7) > *P*(sum = 3 or 4) B. *P*(sum = 7) > *P*(sum ≠ 7)

C. *P*(sum = 1) = *P*(sum = 12) D. *P*(sum = 6) = *P*(sum = 8)

# KNOWLEDGE CHECK

Show your work on a separate sheet of paper and write your answers on this page.

## 7.1 Introduction to Probability

From the word list below, use all the terms that apply to each situation.

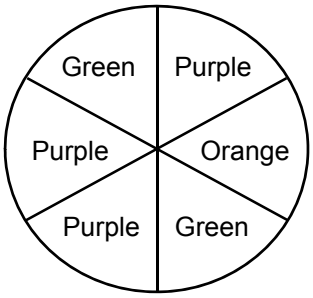
| | | | | |
|---|---|---|---|---|
| certain | probable | improbable | | |
| likely | unlikely | possible | impossible | |

1. When you get up in the morning, it is not raining or drizzling outside.

2. When you turn on the TV, the first thing you see is a commercial.

## 7.2 Spinners

Use the spinner to the right to find each probability expressed as a fraction, a decimal, and a percent.



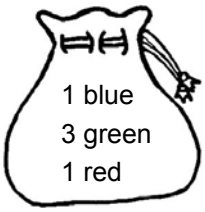

3. What is the probability of landing on orange?

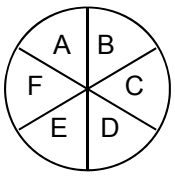
4. What is the probability of landing on purple or green?

## 7.3 Flip, Rolls, and Fair Games

There is a bag of marbles with 1 blue, 1 red, and 3 green marbles; and a spinner labeled with the letters A-F to the right. You pick one marble at random from the bag, and spin one time.

5. Make a grid to show all the possible outcomes.



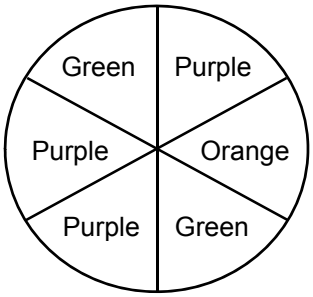

6. What is *P*(green and vowel)?

# HOME-SCHOOL CONNECTION

Here are some problems to review with your young mathematician.

1. You pick one playing card at random from a standard deck of 52 cards (no jokers). What is the probability that the card you select is NOT a face card?

2. For the spinner to the right, determine the theoretical probability of spinning green. Write this number as a fraction, as a decimal, and as a percent.




3. There are two bags containing marbles. The first bag contains 1 red and 2 orange marbles. The second bag contains 1 green and 2 red marbles. If you take out one marble at random from the first bag and one marble at random from the second bag, what is the theoretical probability of drawing two red marbles?

Parent (or Guardian) Signature_____

*This page is intentionally left blank.*

*This page is intentionally left blank.*

# COMMON CORE STATE STANDARDS – MATHEMATICS

## STANDARDS FOR MATHEMATICAL CONTENT

| | |
|---|---|
| 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.7a | 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: 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.* |
| 7.SP.7b | 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: 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.8a | Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation: 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. |
| 7.SP.8b | Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation: 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. |
| 7.SP.8c | Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation: 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*. |

## STANDARDS FOR MATHEMATICAL PRACTICE

| | |
|---|---|
| MP2 | Reason abstractly and quantitatively. |
| MP3 | Construct viable arguments and critique the reasoning of others. |
| MP4 | Model with mathematics. |
| MP6 | Attend to precision. |

9 7 8 1 6 1 4 4 5 0 3 0 6