

Title: Potato Possibilities

Brief Overview:

The students will conduct investigations to determine the probability of outcomes of a given event; collect and organize the data from the investigations, and analyze the data to draw conclusions. In lessons one and two, students will make predictions, perform experiments, record the outcomes, and analyze the data to draw conclusions. In lesson three, students will apply knowledge gained from previous lessons to design a probability experiment or game.

NCTM Content Standard/National Science Education Standard:

Data Analysis & Probability Standard

- Predict the probability of outcomes of simple experiments and test the predictions;
- Collect data using observations, surveys, and experiments;
- Describe events as likely or unlikely and discuss the degree of likelihood using such words as *certain*, *equally likely*, and *impossible*;
- Represent data using tables and graphs such as line plots, bar graphs, and line graphs.

Grade/Level:

Grades 5 – 6

Duration/Length:

3 Days (60-minutes daily)

Student Outcomes:

Students will:

- Predict outcomes of a tested experiment using spinners, two-sided counters, and coins;
- Organize data collected using a line plot or bar graph;
- Analyze and interpret data collected from experiments;
- Formulate conclusions based upon data collected or from experimental outcomes.

Materials and Resources

Day 1

- *Probability Pistachio*, Written by: Stuart J. Murphy (ISBN 0-06-446734-1)

- Brown lunch bags with connecting cubes in them (class set; 4 red, 3 green, 2 blue, 1 yellow per lunch bag)
- Two-color counters (class set)
- Transparency coin
- Plain Paper (per pair of students; class set)
- Pennies (1 per pair of students; class set)
- Teacher Resource 1 - Answer Key; Probability Pre-Assessment
- Teacher Resource 2 - Candy Exit Card Answer Key
- Teacher Resource 3 – BCR Homework Answer Key
- Student Resource 1 - Probability Pre-Assessment
- Student Resource 2 - Vocabulary Cards; 1-set per student (used for Lesson One and Lesson Three)
- Student Resource 3 - Flip A Chip Record Sheet
- Student Resource 4 - Candy Exit Card
- Student Resource 5 – BCR Homework
- Student Resource 20 – Two Counter Color Extension.

Day 2

- Paperclips and Pencil (1 per student)
- Index Cards (1 per student)
- 3 brown bags (labeled “likely,” “unlikely,” and “certain”)
- Teacher Resource 4 – Exit Card Answer Key
- Teacher Resource 5 – BCR Homework Answer Key
- Student Resource 6 – Probability Warm-Up
- Student Resource 7 – Potato Sack Race Directions
- Student Resource 8 - Potato Sack Race Game Board
- Student Resource 9 – Potato Sack Race Game Pieces
- Student Resource 10, 11, 12 – Potato Sack Race Game Spinners
- Student Resource 13A-B – Potato Sack Data Analysis
- Student Resource 14 – Exit Card
- Student Resource 15 – BCR Homework
- Student Resource 21A-B – Potato Sack Extension for Spinner

Day 3

- Beans
- Snap Cubes
- Colored Tiles
- Number Cubes
- Coins
- Brown Lunch Bags
- Colored Bears
- Probability Vocabulary cards (designed in Lesson One/Day One)
- Teacher Resource 6 (Probability Warm-Up Answer Key)
- Teacher Resource 7 (Summative Assessment Answer Key)

- Teacher Resource 8 – M.S.A. BCR Mathematics Rubric
- Student Resource 16 – Probability Warm-Up
- Student Resource 17 – Probability Performance-Task
- Student Resource 18 - Summative Assessment
- Student Resource 19 – Probability Homework

Development/Procedures

Day 1

- Pre-Assessment:
 - Distribute brown lunch bags with connecting cubes in them (one bag per student; 4 red, 3 green, 2 blue, 1 yellow per lunch bag).
 - Distribute Student Resource 1 (Probability Pre-Assessment).
 - Explain to students that they will use Student Resource 1 and the manipulatives to complete the Pre-Assessment.
 - Allow 15-minutes for the completion of the Pre-Assessment.
 - Use the results of the Pre-Assessment to drive instruction.
- Engagement
 - Read *Probability Pistachio* by: Stuart J. Murphy (ISBN 0-06-446734-1).
 - Identify key probability vocabulary words, such as, likely, certain, etc., from the book.
 - Distribute vocabulary cards (Student Resource 2) to each student.
 - Ask volunteers to define each vocabulary word and have students write the definition on the back of the card.
- Exploration
 - Distribute a penny and a blank sheet of paper to each pair of students.
 - Ask one partner to create a “T” chart with “Heads” and “Tails” as the headings. Ask partner 1 to flip the penny 10 times.
 - Ask partner 2 to record the outcomes using tally marks under the appropriate headings.
 - Ask: “How many times did your coin land on heads? How many times did your coin land on tails? What is the probability of landing on heads? ...on tails?”
- Application
 - Distribute two-colored counters to students; one per student.
 - Explain to students that they will be conducting an experiment using the two-colored counters.
 - Distribute Student Resource 3 - Flip A Chip Record Sheet
 - Distribute Student Resource 5 – BCR Homework. Use Teacher Resource 3 for answers to the BCR Homework.

- Differentiation
 - Enrich
 - Enrich: Distribute Student Resource 20 and 20 – Two Counter Color Extension. Explain to the students that they will create a graph using data from the Flip A Chip experiment.
- Assessment
 - Distribute Student Resource 4 - Candy Exit Card.
 - Use Teacher Resource 2 for the answers to the Candy Exit Card.

Day 2

- Engagement
 - Distribute Student Resource 6 (Warm-Up).
 - Allow students time to respond to the question and place them in the bag.
- Exploration
 - Draw a t-chart with the headings *Likely, Unlikely, and Certain* on the overhead projector or other visual aid and tally the data.
 - Explain to the students that they will discuss the outcomes from the Warm-Up.
 - Ask the students to discuss the following questions: What did most students say the outcome would be? Why do you think most chose that outcome? Do you feel differently? If so, why?
- Application
 - Distribute Student Resource 7-13 (Potato Sack Game Board/Pieces/Spinners).
 - Explain the directions of the game to the students.
 - Play the Potato Sack Game for 20-minutes using at least two of the spinners.
 - Upon completion of the game, students will respond to the questions about their outcomes from playing the game.
 - Distribute Student Resource 15 – BCR Homework.
 - Answers to the BCR Homework can be found on Teacher Resource 5 – BCR Homework Answer Key.
- Differentiation
 - Reteach: Play the Potato Sack Game for 20-minutes using one spinner in a small group facilitated by you.
 - Enrich: Play the Potato Sack Game for 20-minutes using at least two spinners and graph the outcomes from the game. Distribute Student Resource 21– Potato Sack Extension for Spinner. Explain that students will create a graph using data from the Potato Sack Race game.

- Assessment
 - Distribute Student Resource 14 (Exit Card) to assess student understanding.
 - Answers to the Exit Card can be found on Teacher Resource 4.

Day 3

- Engagement
 - Answers to the Exit Card can be found on Teacher Resource 4.
 - Distribute Student Resource 16 (Probability Warm-Up).
 - Allow 3-minutes to complete the Warm-Up.
 - Ask volunteers to share their responses to the questions.
- Exploration
 - Review probability concepts and vocabulary using the vocabulary cards distributed on Day 1.
- Application
 - Distribute Student Resource 17, Probability Performance Task.
 - Ask a volunteer to read the scenario and Criteria Checklist.
 - Group students in small groups (3 or less).
 - Allow students 20-minutes to complete the Performance Task.
 - Randomly ask volunteers to share the game/experiment they created.
 - Distribute Student Resource 19 – Probability Homework.

** Note: Students can play the games or conduct the experiments the next day.**

- Differentiation
 - Reteach: Select one manipulative and guide students through the activity.
 - Enrich: Select two or more manipulatives to independently create a game/experiment (i.e. a numbered cube and spinner).

Summative Assessment:

- Explain to the students they will complete an assessment to determine how well they mastered the probability concepts taught over the past three days.
- Distribute Student Resource 18A-C - (Summative Assessment).
Answers to the Summative Assessment can be found on Teacher Resource 7.

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Lesson One: Pre-Assessment

Name: _____ Date: _____

Pre-Assessment - Probability

1. A bag has 10 connecting cubes in it: 4 red, 3 green, 2 blue, and 1 yellow. What is the probability of choosing a cube of a certain color from the bag? Write each answer as a fraction, a decimal, and a percent.

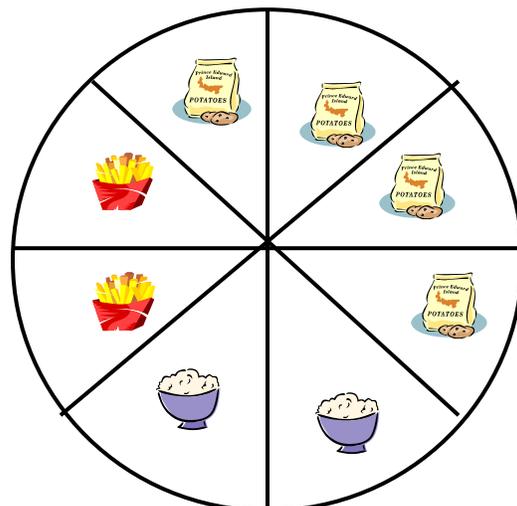
		Probability of Red	Probability of Green	Probability of Blue	Probability of Yellow	Probability of Not Getting Red
A.	Fraction					
B.	Decimal					
C.	Percent					

2. Look at the spinner below. Complete the table below to show the probability of landing on each object. Express the probability as a fraction.

Probability Table

Object	Probability
	
	
	

Spinner





Probability Vocabulary Cards

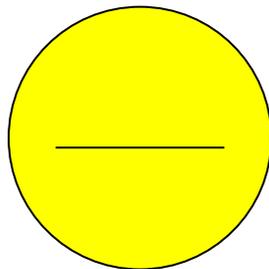
impossible	unlikely
likely	possible
certain	outcome
equally likely	probability

Name: _____

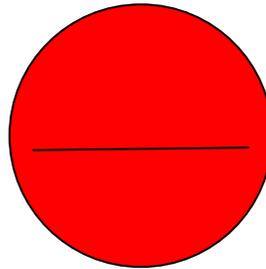


Flip a Chip

1. **PREDICT** how many yellow or red chips you will get when you flip a double-sided chip thirty times.



Yellow



Red

2. **FLIP** the chip thirty times and record your results below by shading one box per flip.

YELLOW

RED

3. **ANALYZE** the data by answering the question below.

- Does your prediction match your experimental results? Explain why you think they are the same or different.

Name _____



Candy Exit Card

Directions: There are 400 candies in a bowl. The table shows the different flavors. Meghan chooses one candy without looking. Using the given table, read the following statements and determine if they are least likely, equally likely, or impossible. Write your answer on the line provided.

Number of Candies in a Bag					
Cherry	Watermelon	Grape	Lime	Blueberry	Chocolate
100	86	86	78	50	0

1. Which flavor is least likely to be chosen? _____
2. Which flavors are equally likely to be chosen?

3. Which flavor is impossible to be chosen? _____
4. Which flavor is more likely to be chosen? _____

Name: _____ Date: _____



BCR: Homework

Hannah had three quarters, two nickels, four pennies, and three dimes in her purse. She reached into her purse for one coin.

Step A: What is the probability that Hannah will choose a penny?

Step B: Use what you know about probability to explain why your answer is correct. Use words and/or numbers in your explanation.

Warm-up

It's your lucky day today! You can vote for 1) likely, 2) unlikely, and 3) certain for the question below.

Place your answer on the provided paper, fold it in half, and place it in the marked bag.

Everyone in class will complete their math homework tonight.

Potato Sack Races

Directions

Materials Needed:

- Potato Sack game board
- Game pieces
- Spinner 1 through 5
- Paperclip and Pencil (to use for spinner)

Directions:

1. Tell students that they will learn a new game called "Potato Sack Races," and they will use spinners to play.
2. Tell students that they are participating in a sack race, using Potato racers. Inform the students that in this game, three "jumpers," represented with the game pieces (show students), will spin a spinner and try to cross the finish line first. Runners move forward according to the spinner they choose when their corresponding game piece is selected. After the spinner is spun, the "jumper" moves forward. The first "jumper" to cross the finish line wins.
3. Demonstrate the game with a student volunteer or two. Pause during the demonstration to check for student understanding.
4. After the experiment, students will complete the Potato Sack Data Analysis sheet to examine experimental data (Student Reference 1

Game Pieces for Potato Sack Rack

Player 1: Bag O' Chip



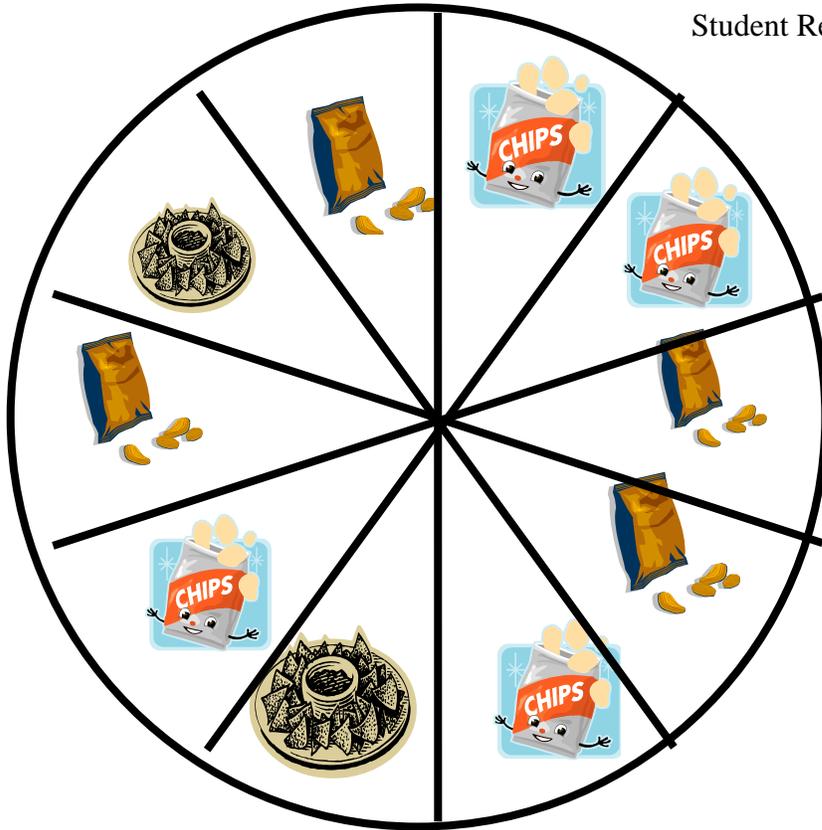
Player 2: Smile O' Chip



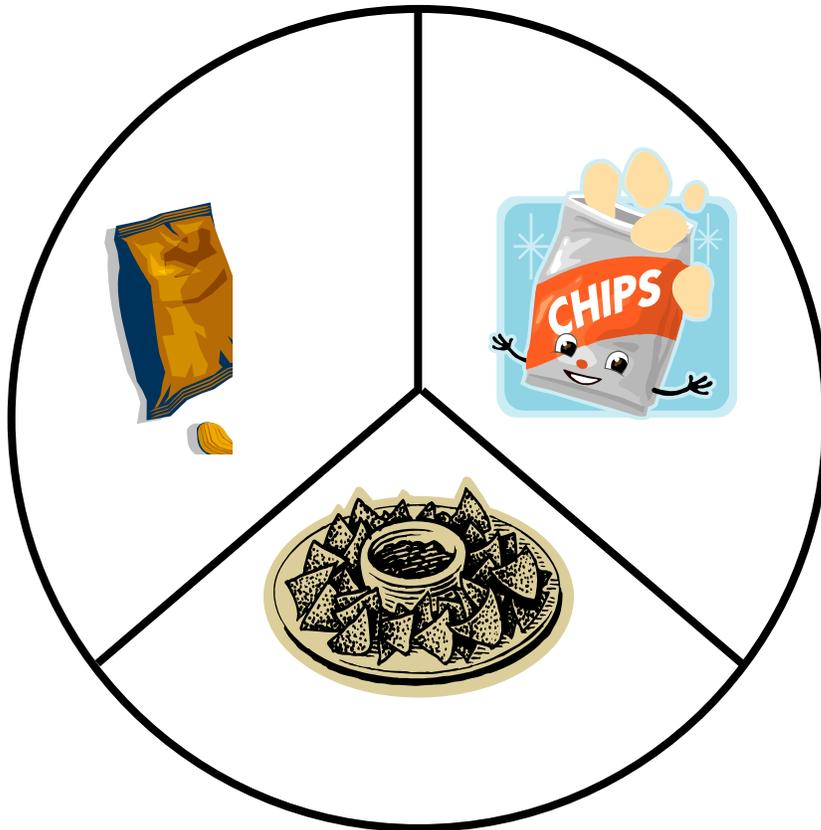
Player 3: Bowl O' Chip



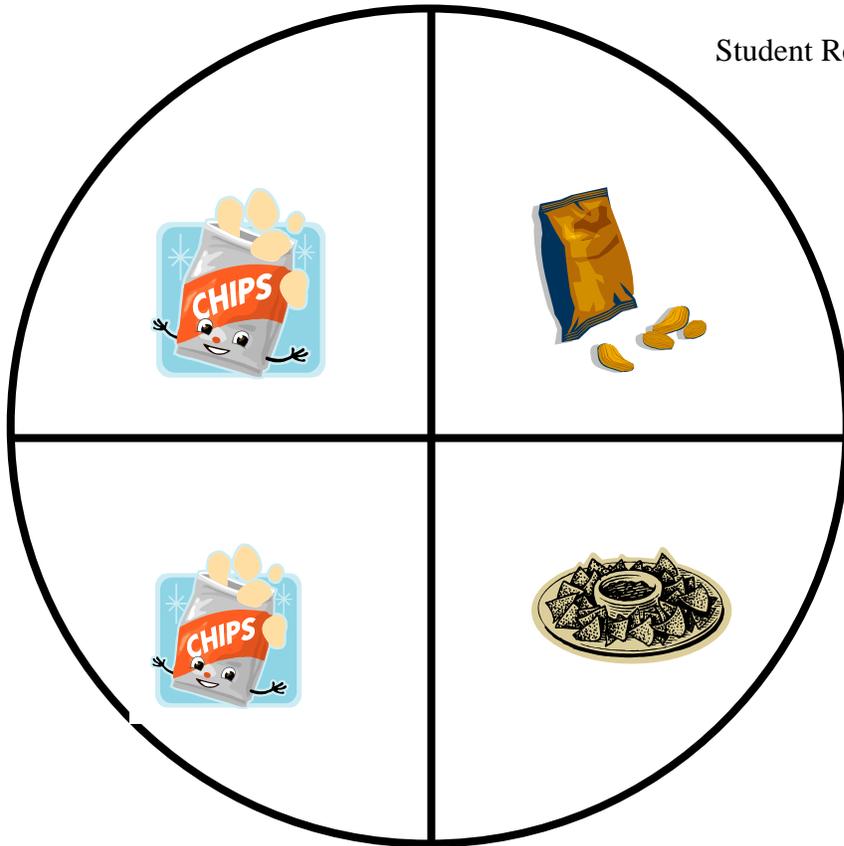
Spinner 1



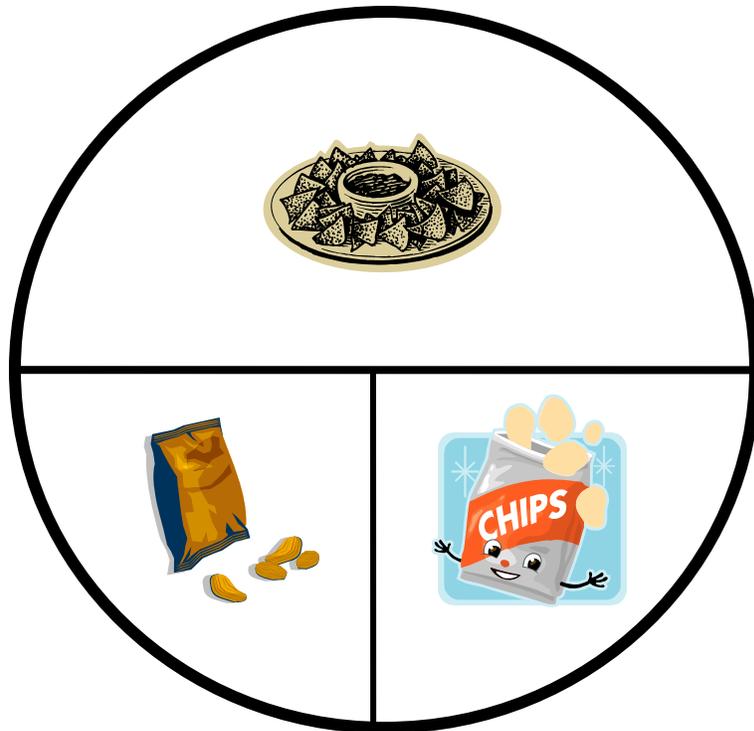
Spinner 2



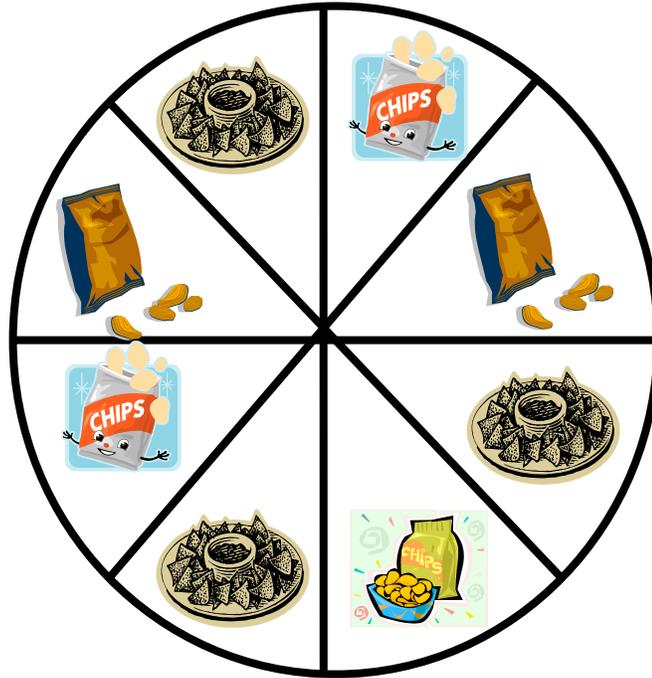
Spinner 3



Spinner 4



Spinner 5



Name: _____

Potato Sack Race Data Analysis

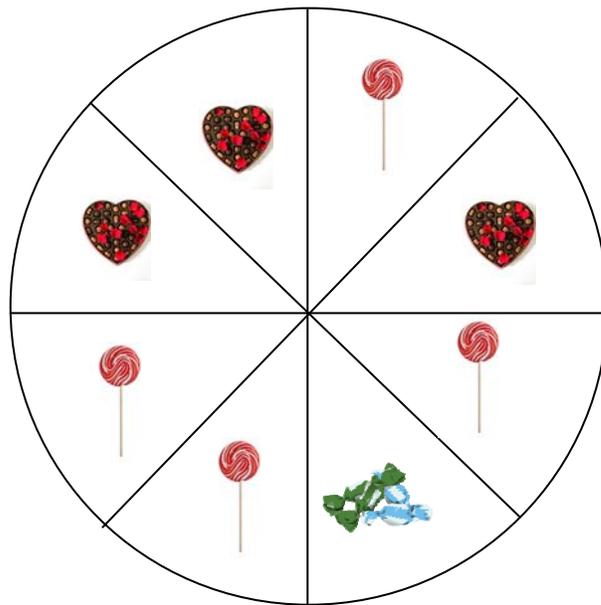
Potato Sack Race		 of Probability	 of Probability	 of Probability
A.	Fraction			
B.	Decimal			
C.	Percent			

1. Which spinner did you like using the most for the Potato Sack Race? Explain why you liked this spinner. Use numbers, pictures, and/or words in your explanation.

Name: _____ Date: _____

Exit Card

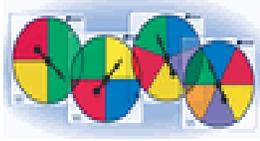
The spinner shown below is spun once. Use the spinner below to answer questions 1 and 2.



1. It is most likely that the spinner lands on

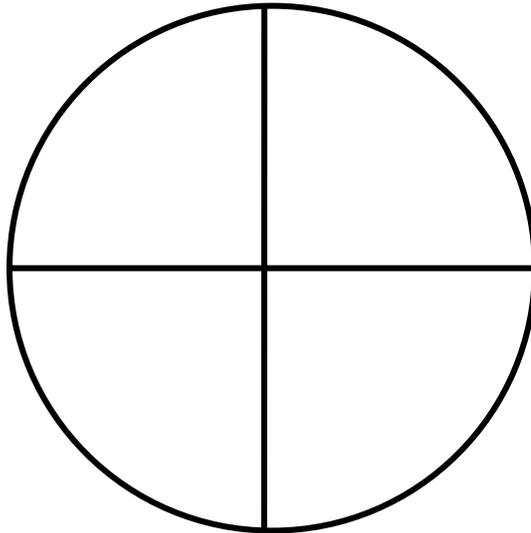
2. It is least likely that it lands on

Name: _____ Date: _____



Probability Warm-Up

Directions: Color the spinner below: $\frac{1}{4}$ orange $\frac{1}{4}$ green $\frac{1}{4}$ red
 $\frac{1}{4}$ purple



Write a percent to show the probability of landing on each color.

_____ orange _____ green _____ red _____ purple

Use your ruler to divide the circle into eight equal sections.

Does the probability of landing on each color change or stay the same? Explain your thinking?

Probability Performance-Task

Mrs. Johnson has left you in charge of the class. She has asked you to use the materials provided to design your own probability game or experiment. She is planning to use your game for her second math class. Be creative!!

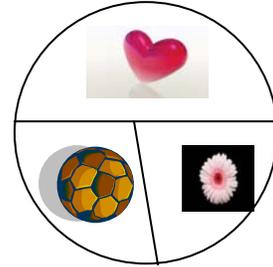
Criteria Checklist:

- Use any of the materials Mrs. Johnson has provided for your game/experiment.
- Use at least one type of manipulative to use in the game/experiment (for example; a coin).
- Create steps or directions for conducting the experiment or game.
- Create four questions to ask about your game/experiment (for example; What is the probability of rolling 2 number cubes whose sum is 6?)

Name: _____ Date: _____

Summative Assessments

1. Luke and Kristoffer are playing the board game *Life* with their family. The spinner is shown below.



What can be said about the spinner?

- A. All of the items are equally likely.
- B. The heart is more likely than flower.
- C. The soccer ball is less likely than the flower.
- D. The football is more likely than heart.

2. Kimberly rolled a die with the numbers 1-6 on it. It landed on six. Which statement is correct about her next dice roll?

- A. The dice is more likely to land on an even number.
- B. The dice is equally likely to land on a 1,2,3,4,5,6.
- C. The dice is more likely to land on a six.
- D. The dice will land on the seven.

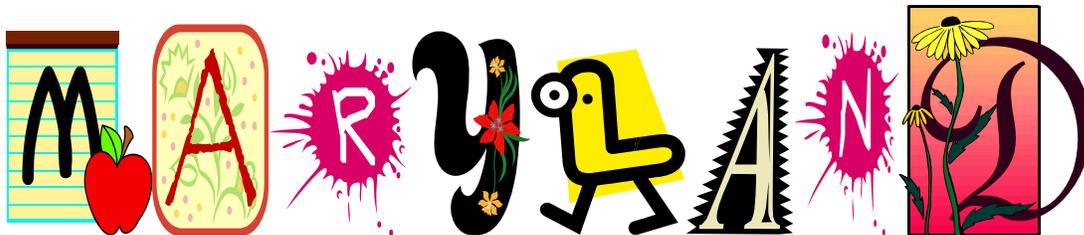


3. Draw and label a spinner that has one section that is more likely to occur than another. Explain why your spinner is correct.

4. Complete the chart below using fractions, decimals and percents:

	Probably of Green	Probably of Purple	Probably of Blue
Fraction	8/10		
Decimal		.50	
Percent			20%

5. Kaitlin spelled the state name shown below using letter tiles.



Step A: If Kaitlin chooses one letter without looking, what is the probability that she will get an A?

Step B: Use what you know about probability to explain why your answer is correct. Use numbers, pictures, and/or words to explain your answer.

6. The table below shows the coins in Frank's jar of change.

Coin	Penny	Nickel	Dime	Quarter
Number	33	20	15	32

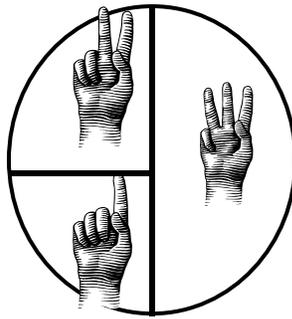
If Frank chooses one coin without looking, what is the probability that it will be a quarter? _____

Name: _____ Date: _____

Probability Homework

Answer those questions in the space provided. Make sure you restate and give support to answer the question.

Based on what we have learned in class, if a spinner looked like this:



Would you consider this a fair game? Why or why not?

What predictions could you make about the results of the spin?

On the back, draw a spinner that is a fair game. Why is your spinner fair?

Two-Colored Counters Extension

Using the graph paper (Student Resource 20B), graph the data collected from the experiment using the two-colored counters. Remember to include all parts of the graph chosen.

What type of graph did you make? _____

Explain why you chose this type of graph. Is this the best type of graph to show this data? Why or why not?

Potato Sack Extension for Spinner _____

(insert spinner chosen for the experiment)

1. Using the graph paper (Student Resource 21B), graph the data collected from the potato game. Remember to include all parts of the graph chosen.

2. What type of graph did you make? _____

Explain why you chose this type of graph. Is this the best type of graph to show this data? Why or why not?

Lesson One: Pre-Assessment (Answer Key)

Name: _____ Date: _____

Pre-Assessment - Probability

3. A bag has 10 connecting cubes in it: 4 red, 3 green, 2 blue, 1 yellow. What is the probability of choosing a cube of a certain color cube from the bag? Write each answer as a fraction, a decimal, and a percent.

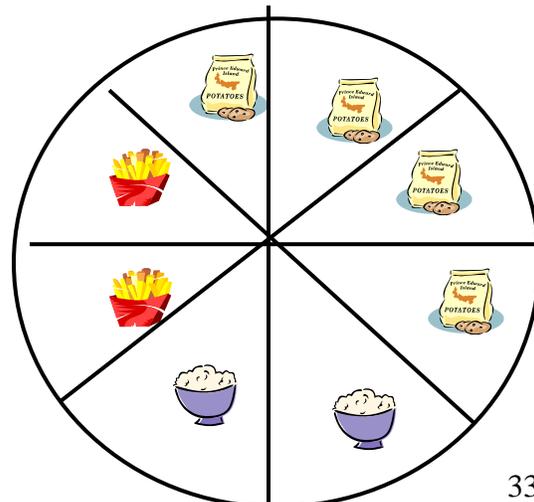
		Probability of Red	Probability of Green	Probability of Blue	Probability of Yellow	Probability of Not Getting Red
A.	Fraction	4/10	3/10	2/10	1/10	0/10
B.	Decimal	0.40	0.30	0.20	0.10	0.00
C.	Percent	40%	30%	20%	10%	0%

4. Look at the spinner below. Complete the table below to show the probability of landing on each object. Express the probability as a fraction.

Probability Table

Object	Probability
	2/8 OR 1/4
	4/8 OR 1/2
	2/8 OR 1/4

Spinner





Teacher Resource 2

Candy Exit Card Answer Key- Day 1

1. Blueberry/Chocolate
2. Watermelon and Grape
3. Chocolate
4. Cherry

Name: _____ Date: _____



BCR: Homework - Answer Key

Hannah had three quarters, two nickels, four pennies, and three dimes in her purse. She reached into her purse for one coin.

Step A: What is the probability that Hannah will choose a penny?

4/12 which equals 1/3

Step B: Use what you know about probability to explain why your answer is correct. Use words and/or numbers in your explanation.

Probability means to find the number of possible outcomes of an event out of the total number of possible outcomes. I know that there are four pennies (possible outcomes) that could be chosen out 12 coins (total possible outcomes). Therefore the probability is 4/12 which simplifies to 1/3. So Hannah has 1/3 of a chance of pulling a penny from her purse.

(ANSWERS MAY VARY, USE MSA RUBRIC)

Candy Exit Card- Answer Key

1. Lollipops
2. Blue/green candy

Name: _____ Date: _____



BCR: Homework

There are 20 tickets in the "chance" basket. Julio has his name on four tickets in the basket.

Step A: What is the probability that Julio's name will be chosen on the first random pick?

4/20 which equals 1/5

Step B: Use what you know about probability to explain why your answer is correct. Use words and/or numbers in your explanation.

Probability means to find the number of possible outcomes out of the total possible chances. So I know that there are 4 tickets with Julio's name on them out of 20 possible tickets. Therefore, the probability is 4/20 which simplifies to 1/5. So Julio has 1/5 of a chance of being selected from the chance basket.

(ANSWERS MAY VARY, USE MSA RUBRIC)

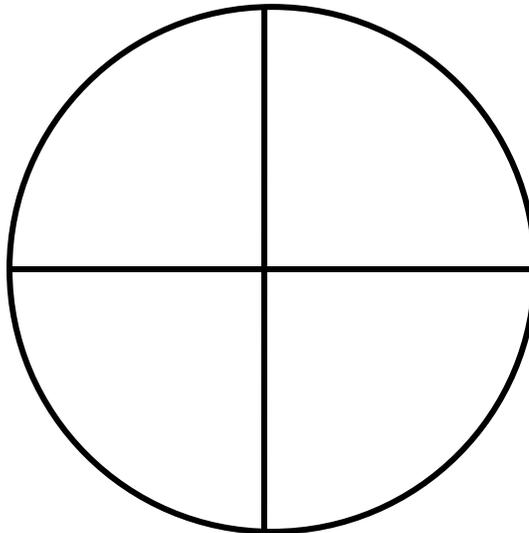
Name: _____ Date: _____



Probability Warm-Up (Answer Key)

Directions: Color the spinner below: $\frac{1}{4}$ orange $\frac{1}{4}$ green $\frac{1}{4}$ red
 $\frac{1}{4}$ purple

1-part orange 1-part green 1-part red 1-part purple
--



Write a percent to show the probability of landing on each color.

25% orange

25% green

25% red

25% purple

Use your ruler to divide the circle into eight equal sections.

Does the probability of landing on each color change or stay the same? Explain your thinking? *The probability stays the same, because dividing the spinner into eight sections does not change the percent (for example, $\frac{1}{4}$ is equal to $\frac{2}{8}$, which is 25%).*

Summative Assessment

ANSWER KEY

1. B
2. B
3. Answers will vary
- 4.

	Probably of Green	Probably of Purple	Probably of Blue
Fraction	8/10	5/10 or 1/2	2/10 or 1/5
Decimal	.80	.50	.20
Percent	80%	50%	20%

5. Step A: 2/8 Step B: Answers will vary, use MSA rubric
6. 32/100 or 16/50 or 8/25

**MSA Brief Constructed Response "Kid Speak"
Mathematics Rubric
Grades 1 through 8**

Score	
<p align="center">2</p>	<p>My answer shows I completely understood the problem and how to solve it:</p> <ul style="list-style-type: none"> • I used a very good, complete strategy to correctly solve the problem. • I used my best math vocabulary to clearly explain what I did to solve the problem. My explanation was complete, well organized and logical. • I applied what I know about math to correctly solve the problem. • I used numbers, words, symbols or pictures (or a combination of them) to show how I solved the problem.
<p align="center">1</p>	<p>My answer shows I understood most of the problem and how to solve it:</p> <ul style="list-style-type: none"> • I used a strategy to find a solution that was partly correct. • I used some math vocabulary and most of my reasons were correct to explain how I solved the problem. My explanation needed to be more complete, well organized or logical. • I partly applied what I know about math to solve the problem. • I tried to use numbers, words, symbols or pictures (or a combination of them) to show how I got my answer, but these may not have been completely correct.
<p align="center">0</p>	<p>My answer shows I didn't understand the problem and how to solve it:</p> <ul style="list-style-type: none"> • I wasn't able to use a good strategy to solve the problem. • My strategy wasn't related to what was asked. • I didn't apply what I know about math to solve the problem. • I left the answer blank.

