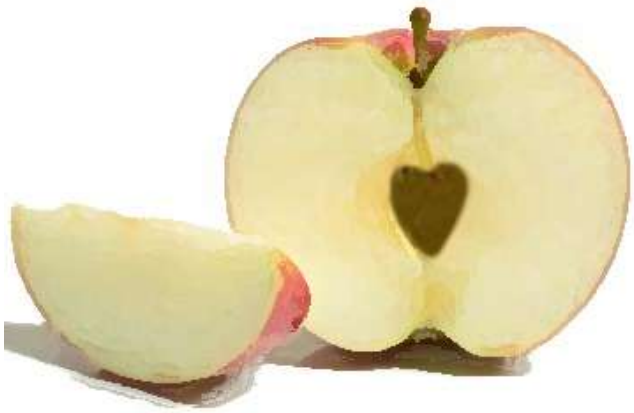


Getting to the Core

Math 7

Probability

Updated on April 10th , 2013

Student Name _____ Period _____

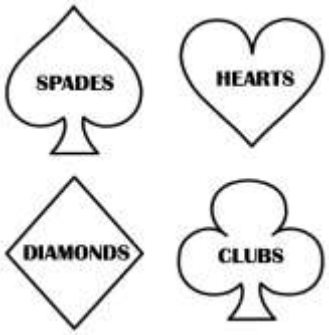
P1-1 Are You Psychic?

Experiment #1

Directions:
Player 1 holds card on his/her forehead
Player 2, without speaking, concentrates on the color of the card (no hints!)
Player 1 tries to read Player's 2 mind, and guesses the color on his/her forehead
Players tally correct and incorrect guesses below:

	Correct Guesses	**Incorrect Guesses**	**Total Guesses**	**Correct Guesses as a Fraction**
Player 1 Name:				
Player 2 Name:				

Record your data on class chart #1.
Do you or your partner appear to be psychic? Explain why or why not?



Experiment #2

Directions:
Player 1 holds card on his/her forehead
Player 2, without speaking, concentrates on the **suit** of the card (no hints!)
Player 1 tries to read Player's 2 mind, and guesses the suit on his/her forehead
Players tally correct and incorrect guesses below:

	Correct Guesses	**Incorrect Guesses**	**Total Guesses**	**Correct Guesses as a Fraction**
Player 1 Name:				
Player 2 Name:				

Record your data on class chart #2.
Do you or your partner now appear to be psychic? Explain why or why not?

Experiment #3

How to play:
Player 1 predicts what number will be rolled.
Player 2 rolls a die.
Players tally numbers as they are rolled.
Players also tally whether their predictions were correct or incorrect.

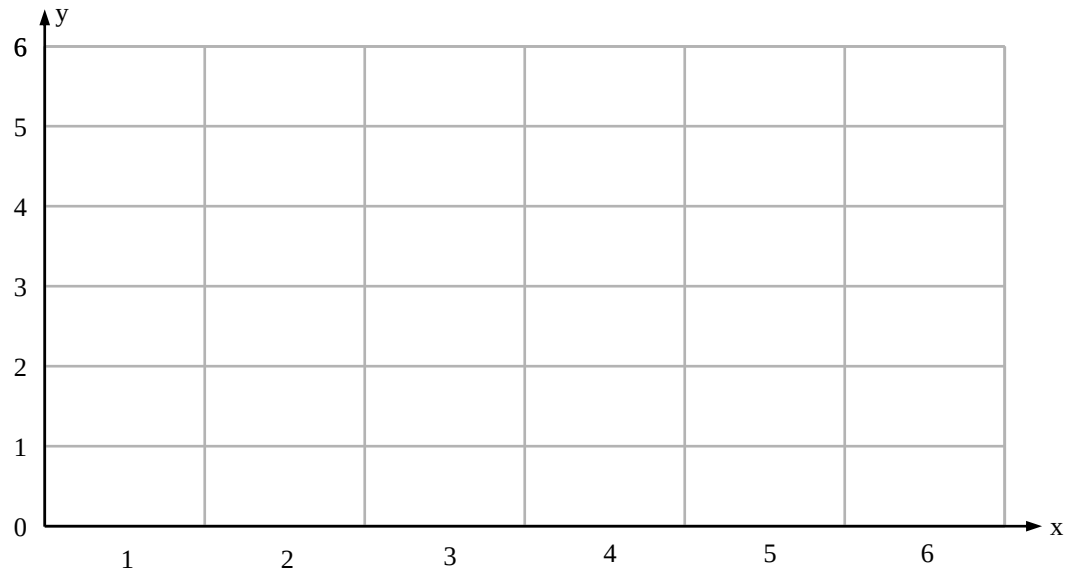
Outcome tallies: 1 _____ 2 _____ 3 _____ 4 _____ 5 _____ 6 _____

Your Correct Tallies Your Wrong Tallies Total correct as a fraction _____
(Simplify if possible.)

Partner Correct Tallies Partner Wrong Tallies Total correct as a fraction _____
(Simplify if possible.)

Do you or your partner appear to be psychic? Why or why not?

Make a bar graph of your outcome tallies.



P1-2 Probability Investigation: Guess & Draw

Examine the tallies from the Guess and Draw activity.

Partner Talk:

- Based on our classroom tally, why do you think some of the colors were drawn out more than others?
- If you want to correctly guess the color of the object, what color do you think is the BEST choice for your guess?

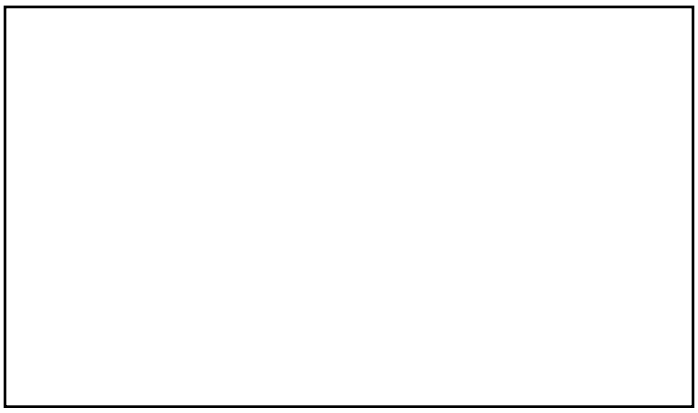
Record your ideas here:

_____

_____

_____

Sketch the contents of the container here:



There are _____ _____ _____.

There are _____ _____ _____.

There are _____ _____ _____.

There are _____ _____ _____.

_____

There are ____ _____ in total.

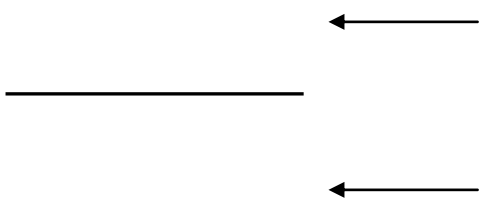
The probability of pulling out a _____ is ——— or P( ) = ———

The probability of pulling out a _____ is ——— or P( ) = ———

The probability of pulling out a _____ is ——— or P( ) = ———

The probability of pulling out a _____ is ——— or P( ) = ———

Probability written as a ratio:



PROBABILITY means

Partner Talk:

- Was the Guess and Draw game the same for everyone who played?
- If you could play Guess and Draw again, would you prefer to make your guess first, last, or in the middle of the game? Explain your thoughts?

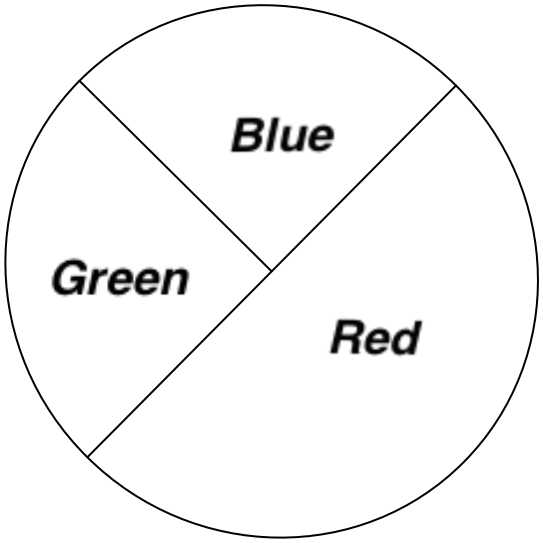
Record your ideas here: _____

_____

_____

P1-3 Probability Investigation: Predict & Spin

Color this spinner so that the two smaller parts are blue and green. Make the largest part red. Your team will spin this spinner 25 times. **Before** spinning, make predictions about how many blue, green and red you will get. Record your predictions on the chart, then spin and record the actual results.



Color	Prediction	Actual
Blue		
Green		
Red		
Total	**25**	**25**

Who in your team had the closest prediction?

_____

Look at the spinner. Record the probability for each color here:

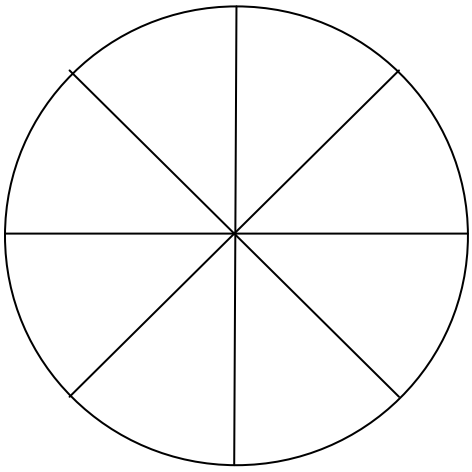
P(Blue) = _____ P(Green) = _____ P(Red) = _____

Partner Talk: How do you read this? *(write it out below)*

_____

For the spinner below, choose colors for the parts of the spinner, but every person at your team needs to color the spinner the same. You must use exactly 3 different colors.
Again, make predictions **before** you spin 25 times.

Color	Prediction	Actual
Total	**25**	**25**



Who had the closest prediction? _____

P( ) = _____ P( ) = _____ P( ) = _____

P1-4 A Two-Coin Game for Three People

Today you will play a game with two other students. In this game, you will flip two coins at the same time.

Each person will choose one of the outcomes below as their own:

Both Heads	Both Tails	One of Each
_____	_____	_____
Player 1	Player 2	Player 3

Directions: Player 1 flips the two coins 10 times
Each player records a tally for the outcome
Player 2 flips the two coins 10 times
Each player records a tally for the outcome
Player 3 flips the two coins 10 times
Each player records a tally for the outcome

	Player 1 wins (both heads)	Player 2 wins (both tails)	Player 3 wins (one of each)
Tallied Wins			

Who won the game? _____

Partner Talk:
If you could play the game again which player would you want to be? Why?

Record your thoughts below:_____

_____

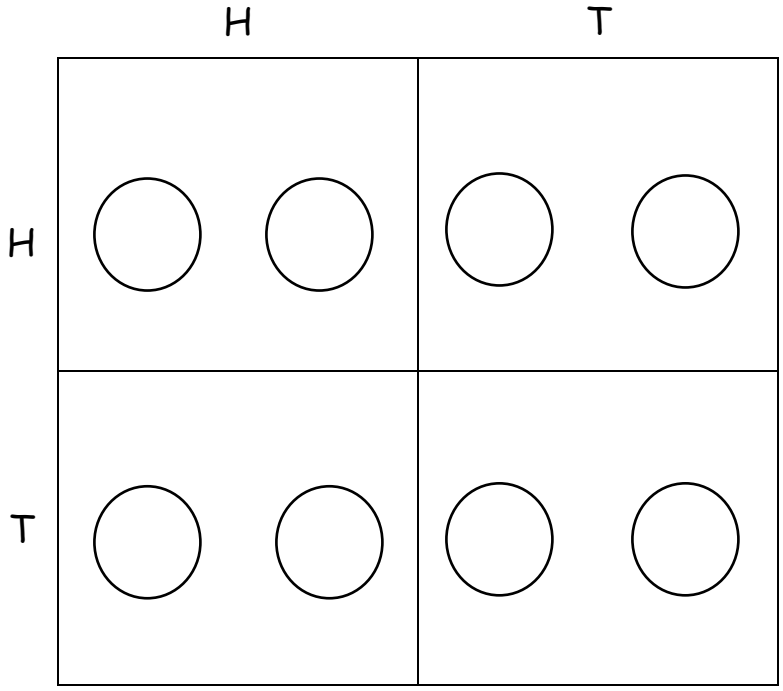
_____

How many events are taking place when the coins are flipped? _____

A "compound event" represents when _____ or more events are taking place at the same time.

Possibilities

First coin:



Based on your proportional reasoning, if you flipped two coins roughly 200 times, approximately how many times would you have flipped both tales? Explain your reasoning: _____

_____

_____

P2-1 Investigating Dice

A pair of dice will be rolled and the two numbers will be added.

What is the largest possible total you can get with two dice?

_____

What is the smallest possible total you can get with two dice?

_____

Directions:

1) List all of the possible sums from smallest to largest on the "sum" line.
2) Each person chooses a sum and circles it as his/her own.
3) Roll the dice 20 times and tally the sum for each roll.
4) The person with the most tallies is the winner!

Sum:												
Tallies:												

Who won the game? _____

Partner Talk:

If you were to play the game again, which sum would you choose? Explain your reasoning.

_____

_____

_____

A "compound event" represents when _____ or more events are taking place at the same time.

On the chart below, list the sums of the values from rolling two dice.

First Die

Second Die	1	2	3	4	5	6
1						
2						
3						
4						
5						
6						

How many *total* possibilities did you find from the table? _____

Based on this information what would everyone choose and why?

$P(2) =$ $P(12) =$

$P(3) =$ $P(11) =$

$P(4) =$ $P(10) =$

$P(5) =$ $P(9) =$

$P(6) =$ $P(8) =$

$P(7) =$

If two dice were rolled 550 times, how many times could you expect to get a sum of 2? Explain your reasoning: _____

_____

_____

If you and your partner tried this experiment and rolled the dice 550 times, do you think you would get a sum of 2 exactly this many times? Why or why not?

_____

_____

P2-2 Compound Probability – Chart Strategy

Shirley flipped two coins.
What is the probability of both coins landing on "tails"?

Jordan had a bag of marbles. In the bag were 3 blue marbles, 2 purple marbles, and 1green marble. What is the probability of pulling a blue marble, putting it back in, and pulling out a green marble?

Brian rolled two dice.
What is the probability of Brian getting a sum of 9?

Jesus has one striped shirt, two green shirts, and two yellow shirts. He also has two pairs of jeans and a pair of shorts. How many different outfits can Jesus make?

_____ probability means the probability of _____ events happening.

Whenever you do a _____ probability problem, one strategy is to use a _____.

P2-3 The Order Game

If you had the numbers A, B, C, and D in a bag, how many tries would it take for you to pull them out *in order*?

Make a prediction: _____

Directions:

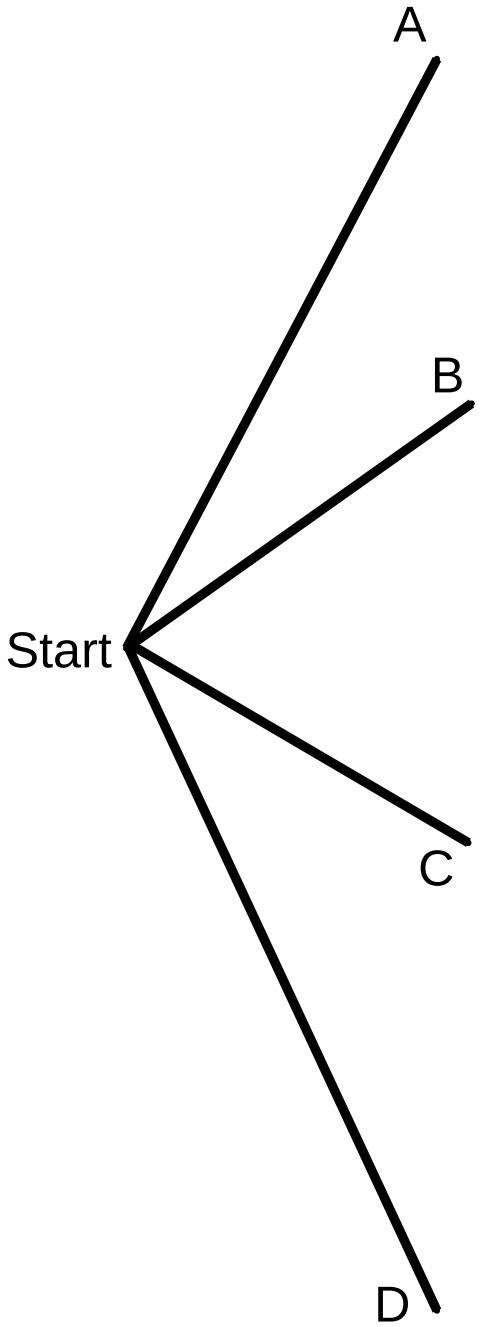
1) Pull cards from the bag one at a time.
2) Do not replace the card that is pulled.
3) Pull the other cards out of the bag *one at a time*.
4) Record your results.

Record your results each time:

_____	_____	_____	_____
Card 1	Card 2	Card 3	Card 4
_____	_____	_____	_____
Card 1	Card 2	Card 3	Card 4
_____	_____	_____	_____
Card 1	Card 2	Card 3	Card 4
_____	_____	_____	_____
Card 1	Card 2	Card 3	Card 4
_____	_____	_____	_____
Card 1	Card 2	Card 3	Card 4
_____	_____	_____	_____
Card 1	Card 2	Card 3	Card 4
_____	_____	_____	_____
Card 1	Card 2	Card 3	Card 4
_____	_____	_____	_____
Card 1	Card 2	Card 3	Card 4

P2-3 The Order Game – Tree Strategy

If you had the numbers A, B, C, and D in a bag, how many tries would it take for you to pull them out *in order*?



P2-4 What is the probability?

Directions: Some things are *certain* to happen. If today is Monday, tomorrow will be Tuesday. Some things are *impossible*. You can't roll a 7 using only one regular die. Some things may or may not happen. *Maybe* it will rain, maybe it won't.

Part A:
Mark each of the following statements with one of the following:
C for *certain*, ***I*** for *impossible*, or ***M*** for *maybe*.

_____1. There is a live dinosaur in the zoo.
_____2. You will get tails if you flip a coin.
_____3. It will rain on Sunday.
_____4. Superman will always beat the bad guys.
_____5. Someone will win a state lottery twice in one year.
_____6. When you grow up, you will be 10 feet tall.
_____7. Outside at night, you can see the stars.
_____8. Your little league team will win its next game.
_____9. The Earth revolves around the sun.
_____10. You will be in school tomorrow.
_____11. In a new box of crayons, at least one will be red.
_____12. The next time you throw an ordinary ball up into the air, it will keep going into space.

Part B:
Now write 2 more statements that fit into each category. Include your answers.

Certain

1. _____

2. _____

Possible

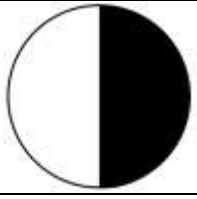
3. _____

4. _____

Impossible

5. _____

6. _____

No Way	Maybe	Good Chance	For Sure
Unlikely	Likely	Equally likely	Small Chance
Even Chance	Probable	Equally unlikely	0.25
25%	50%	75%	90%
100%	0%	1/4	1/2
3/4	.75	.50	10%
1/6	5/6	.30	.8
The Braves will win the World Series.	You will have two birthdays this year.	If today is Friday, tomorrow will be Saturday.	At least one student will be absent tomorrow.
It will rain this week.	There will be an earthquake in California this month	The sun will rise in the morning.	You will be in 8th grade next year.
Add your own word:	Add another word	Add another decimal	Make up your own sentence
			

P2-5 Number Line Activity

Directions:

1. Draw a line down the length of a separate piece of paper
2. Label the line as indicated below.
3. Cut out the Probability cards (previous page) and glue them onto the appropriate place on the probability scale.
4. Add additional words to the scale.
5. Answer the questions below.

Probability Scale

_____

0
Impossible

1
Certain

Based on your probability scale, the probability of a chance event occurring will be between _____ and _____.

If an event has a probability near 0, what does that indicate?

_____

What does it mean if an event has a probability near 50%?

_____

If an event is very likely to occur, what term(s) may serve to represent this likelihood? _____

P3-1 Let's Practice!

What is the probability of choosing a green marble from a jar containing 5 red, 6 green and 4 blue marbles?

Chart:

Tree diagram:

START

My answer:
Where would this probability occur on my scale?

P3-2 Let's Practice!

What is the probability of getting an odd number when rolling a single six-sided die?

Chart:

Tree diagram:

START

My answer:
Where would this probability occur on my scale?

P3-3 Let's Practice!

What is the probability of picking a red marble, a blue marble and a green marble **in order (red, blue, green)** from a bag containing only three

Chart:

Tree diagram:

START

My answer:
Where would this probability occur on my scale?

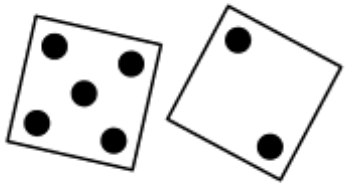
P3-4 Let's Practice!

What is the probability of choosing the letter *i* from the word probability?

Choose a strategy! Show your work:

My answer:

P3-5 Let's Practice!



What is the probability of getting a sum of 11 when two dice are rolled at the same time?

Choose a strategy! Show your work:

My answer:
How many times would I get a sum of 11 if I rolled the dice 110 times?

P3-6 Let's Practice!

Out of 72 apples at the store, 12 are rotten and half are bruised. What is the probability that Michael will choose a perfect apple?

Choose a strategy! Show your work:

My answer:
Where would this probability occur on my scale?

P3-7 Let's Practice!

What is the probability of selecting cards labeled C-A-N in order from a bag containing only the cards C, A, and N?

Choose a strategy! Show your work:

My answer:

₱3-8 Let's Practice!

What is the probability of flipping three coins at the same time and getting "heads" on all three?

Choose a strategy! Show your work:

My answer:

₱3-9 Let's Practice!

Janice has 2 dimes and 3 nickels in her pocket. What's the probability that she will have 15 cents by picking two coins at random?

Choose a strategy! Show you work:

My answer:

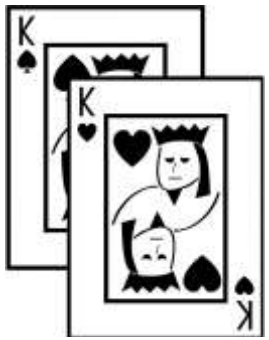
P3-10 Let's Practice!

Two playing cards are flipped at random. What's the probability that they both have the same suit (assume that the Joker cards have been removed)?

Choose a strategy! Show your work:

My answer:

P3-11 Let's Practice!

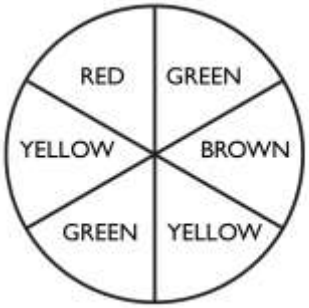


What is the probability of selecting two Kings by picking two cards at random?

Choose a strategy! Show your work:

My answer:

₱3-12 Let's Practice!

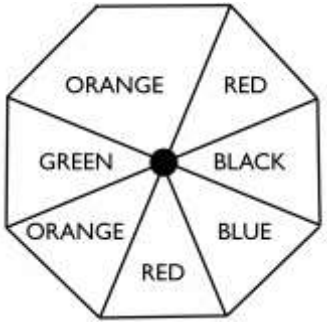


What is the probability of landing on "green"?

Choose a strategy! Show your work:

My answer:

₱3-13 Let's Practice!



What is the probability of landing on "Orange"?

Choose a strategy! Show your work:

My answer:
Where would this probability occur on my scale?

P3-14 Let's Practice!

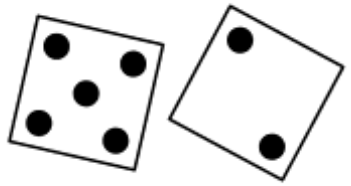
What is the probability of landing on an odd number after spinning a spinner with 7 equal sectors numbered 1 through 7?

Choose a strategy! Show your work:

My answer:

P3-15 Let's Practice!

Alex is rolling two dice and counting the number of times he gets "doubles". After 100 times, he's rolled "doubles" 19 times, is that close to



Choose a strategy! Show your work:

My answer:

P3-16 Let's Practice!

James has a bag containing the letters D, O, O, and R. What is the probability that he will pull the letters spelling D-O-O-R in order?

Choose a strategy! Show your work:

My answer:
Where would this probability occur on my scale?

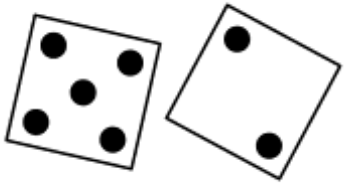
P3-17 Let's Practice!

There are 10 counters in a bag: 3 are red, 2 are blue and 5 are green. If all 10 counters are mixed in a bag, what is the probability that Maxine will NOT pick a red counter?

Choose a strategy! Show your work:

My answer:

₱3-18 Let's Practice!



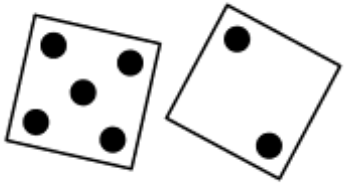
Two dice are thrown together. What is the probability that both numbers are **less** than five?

Choose a strategy! Show your work:

My answer:
What might the probability be if they are thrown approximately 200 times?

P3-19 Let's Practice!

Two dice are rolled at the same time. What is the probability that their product is a multiple of 4?



Choose a strategy! Show your work:

My answer:

P3-20 Let's Practice!

If $P(red) = \frac{1}{2}$, $P(green) = \frac{1}{5}$, $P(blue) = \frac{1}{2}$, find $P(purple)$ if there are 20 total marbles in a bag.

Choose a strategy! Show your work:

My answer:

Additional Practice

Part I: Chance Experiments

1. Decide if each of the following events is "Impossible," "Unlikely," "Equally likely to occur or not occur," "Likely," or "Certain to occur".

   Event:

   A. A vowel will be picked when a letter is randomly selected from the word "ICEE."

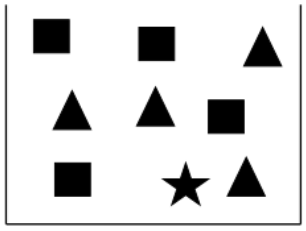
   B. A vowel will not be picked when a letter is randomly selected from the word "MATH."

   C. A blue cube will be drawn from a bag containing only five blue and five black cubes.

   D. A red cube will be drawn from a bag of 100 red cubes.

   E. A red cube will be drawn from a bag of 10 red and 90 blue cubes.

2. A shape will be randomly drawn from the box shown below. Decide where each event would be located on the probability scale. Then, place the letter for each event on the appropriate place on the probability scale.



   Event:

   A. A circle is drawn.
   B. A square is drawn.
   C. A star is drawn.
   D. A shape that is not a square is drawn.

Probability Scale

0		**½**	**1**
Impossible	**Unlikely**	**Equally Likely to Occur or Not Occur**	**Likely**
Certain			

3. An experiment consists of randomly drawing a cube from a bag containing three red and two blue cubes.
   a. What is the sample space of this experiment?

   b. List the probability of each outcome in the sample space.

Part II: Possible Outcomes & Sample Space

1. For each of the following chance experiments, list the sample space (all the possible outcomes).

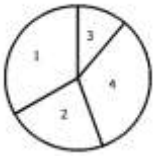
a. Rolling a 4-sided die with the numbers 1– 4 on the faces of the die.

b. Selecting a letter from the word: mathematics.

c. Selecting a marble from a bag containing 50 black marbles and 45 orange marbles.

d. Selecting a number from the even numbers from 2– 14, inclusive.

e. Spinning the spinner below:

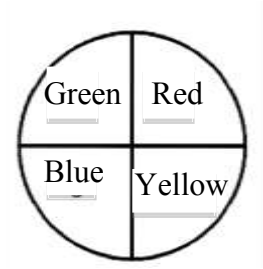


2. Color the cubes below so that it would be equally likely to choose a blue or yellow cube.

3. Color the cubes below so that it would be more likely to choose a blue than a yellow cube.

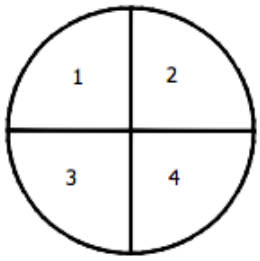
4. List the sample space for the chance experiment of flipping a coin twice.

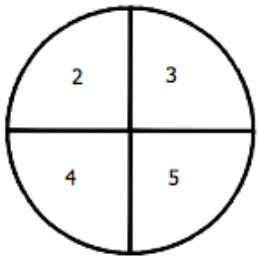
5. You are playing a game using the spinner below. The game requires that you spin the spinner twice. For example, one outcome could be Yellow on 1st spin and Red on 2nd spin. List the sample space (all the possible outcomes) for the two spins.



Part III: Estimating Probabilities by Collecting Data

1. Play a game using the two spinners below. Spin each spinner once, and then multiply the outcomes together. If the result is less than or equal to 8, you win the game. Play the game 15 times, and record your results in the table below.





Turn	1st Spin Results	2nd Spin Results	Product
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			

a. What is your estimate for the probability of getting a product of 8 or less?

b. What is your estimate for the probability of getting a product more than 8?

c. What is your estimate for the probability of getting a product of exactly 8?

d. What is the most likely product for this game?

e. If you played this game another 15 times, will you get the exact same results? Explain.

Part V: Calculating Probabilities for Chance Experiments with Equally Likely Outcomes

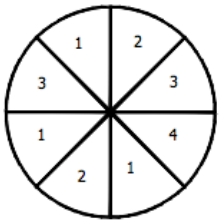
1. In a seventh grade class of 28 students, there are 16 girls and 12 boys. If one student is randomly chosen to win a prize, what is the probability that a girl is chosen?

2. An experiment consists of spinning the spinner once.

   a. Find the probability of landing on a 2.

   b. Find the probability of landing on a 1.

   c. Is landing in each section of the spinner equally likely to occur? Explain



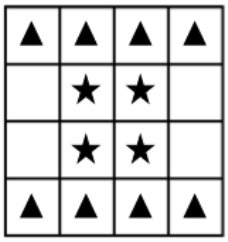
3. An experiment consists of randomly picking a square section from the board shown below.

   a. Find the probability of choosing a triangle.

   b. Find the probability of choosing a star.

   c. Find the probability of choosing an empty square.

   d. Find the probability of choosing a circle.



4. Seventh graders are playing a game where they randomly select two integers from 0– 9, inclusive, to form a two-digit number. The same integer might be selected twice.

   a. List the sample space for this chance experiment. List the probability of each outcome in the sample space.

   b. What is the probability that the number formed is between 90 and 99, inclusive?

   c. What is the probability that the number formed is evenly divisible by 5?

   d. What is the probability that the number formed is a factor of 64?

Part IV: Chance Experiments with Outcomes that are Not Equally Likely

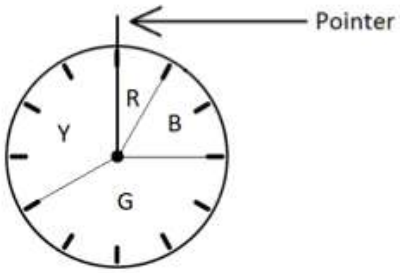
1. A chance experiment consists of flipping a coin and rolling a number cube with the numbers 1– 6 on the faces of the cube.

a. List the sample space of this chance experiment. List the probability of each outcome in the sample space.

b. What is the probability of getting a head on the coin and the number 3 on the number cube?

c. What is the probability of getting a tail on the coin and an even number on the number cube?

Exercises 2-5: The diagram below shows a spinner designed like the face of a clock. The sectors of the spinner are colored red (R), blue (B), green (G), and yellow (Y).



Spin the pointer, and award the player a prize according to the color on which the pointer stops.

1. Writing your answers as fractions in lowest terms, find the probability that the pointer stops on:

a. Red:

b. Blue:

c. Green:

d. Yellow:

2. Complete the table of probabilities below.

Color	Red	Blue	Green	Yellow
Probability				

3. Find the probability that the pointer stops in either the blue region or the green region.

4. Find the probability that the pointer does not stop in the green region.

5. The “Gator Girls” are a soccer team. The possible numbers of goals the Gator Girls will score in a game and their probabilities are shown in the table below.

Number of Goals	0	1	2	3	4
Probability	0.22	0.3	0.33	0.11	0.04

Find the probability that the Gator girls:

a. score more than two goals.

b. score at least two goals.

c. do not score exactly 3 goals.

Which has higher probability?

a. Scoring 0 goals or 2 goals?

b. Scoring 1 goal or 4 goals?

Double Coin Toss Game

Directions:

1. Play with a parent or friend.
2. Decide who will be Player A and who will be Player B.
3. Make a T-Chart to record your results.

A Name:	B Name:

Rules:

1. Flip 2 coins at the same time. (Each player can flip a coin)
2. If **2 Heads appear**, Player A gets a point.
3. If **1 Head and 1 Tail appear**, Player B gets a point.
4. If **2 Tails appear**, no one gets a point.
5. Flip the coins a total of **40** times.

Analysis: **(Use math to justify your answers)**

1. Who did you play with? Who was A and who was B?

2. Who won the game? What was the score?

	Total Points	Percentage
A		
B		

3. Was this a **fair** game? **Explain why or why not.**

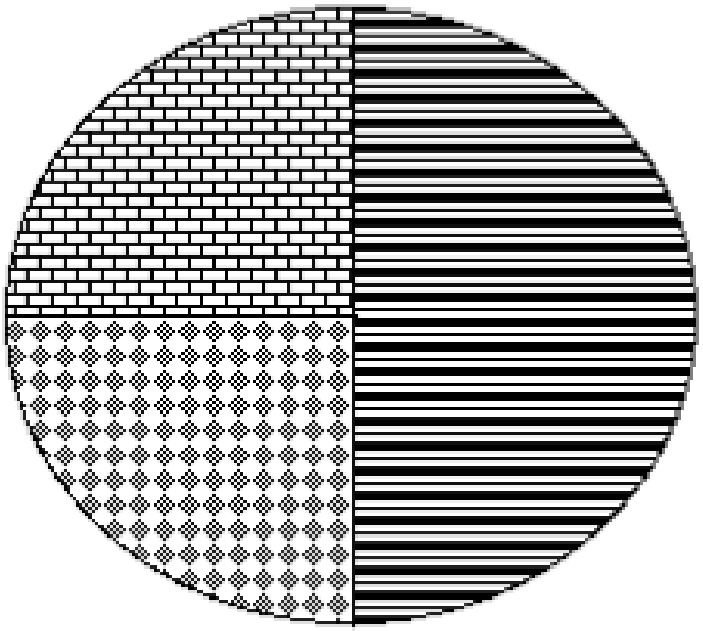
4. How would you improve this game? Which **rules** would you add or change? Explain your reasons.

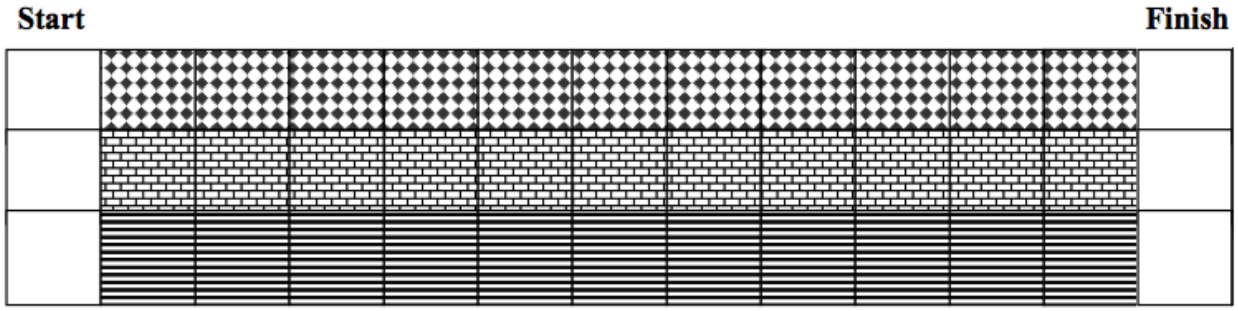
5. If you played this game again, which player would you want to be? **Explain why?**

Problem of the Month: "Fair Games"

Level A: The Race

Rules:
There are three players: Brick, Stripe, and Diamond. Each player puts a token on the Start square of their pattern path. The players take turns by spinning the spinner. The player whose pattern comes up on the spinner moves their token one space on the game board. The other players do not move their tokens. The game continues as each player takes turns with the spinner and a move is made, until one player reaches the Finish Line. That player wins.





Problem of the Month: "Fair Games"

Level A (continued): The Race

What is a fair game? Explain.

In groups of three, play The Race game five times. Keep track of who won each game, who came in second and who came in third.
Which player won the most?

How many times?

Which player came in second the most?

Is this a fair game? Explain why this game is fair or not fair.

How could you change this game to make it better?

Problem of the Month: "Fair Games"

Level B: The Race

Play The Race game five times. This time keep track of each spin, listing who moved each time.
Draw a bar graph showing the outcome of the spins. Label the horizontal axis by pattern and the vertical axis by the number of spins that occurred.

How many more times did Stripe move than Brick?

Between Brick and Diamond, which player moved more times in all 10 games?

How much of the spinner is a stripe pattern?

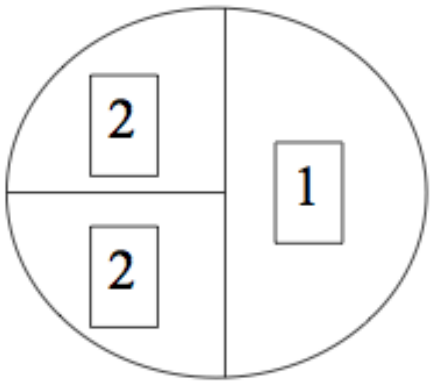
How much of the spinner is a diamond pattern?

How much of the spinner is a brick pattern? How could you change the spinner to make the game more fair?

Problem of the Month: "Fair Games"

Level C: Alex's Version

Your friend Alex says that he can make the game more fair. He makes a second spinner with numbers on it. He says the number stand for the number of spaces a token is moved. He modified the rules as follows: First the pattern spinner is spun to find out who moves. Then the number spinner is spun to find out how many spaces the token is moved. Below is the spinner he made.



What is the probability that Diamond comes up on the first spinner? Explain.

What is the probability that 1 comes up on the second spinner? Explain.

What is the probability that Stripe moves 1 space on any turn? Explain.

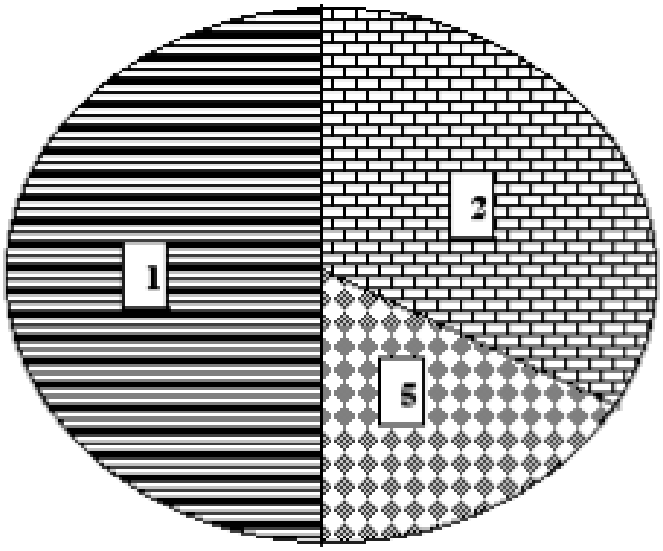
What is the probability that Brick moves 2 spaces on any turn? Explain.

Alex says that the new spinner makes the game fair because Stripe will mostly move 1 space and the Brick and Diamond players will mostly move 2 spaces. Explain why you either agree or disagree with Alex.

Problem of the Month: "Fair Games"

Level D: Dolores' Version

Another friend, Dolores, says that she made the game fair by drawing just one new spinner, but using both patterns and numbers on the same spinner. When the spinner is spun, the player with that pattern moves the number of spaces indicated in that sector of the spinner. She said she made the spinner by first drawing the diameter and then making the central angle of the brick sector 120 degrees.



What is the probability of Brick moving on any spin?

How many times would Diamond have to move to win a game?

How much bigger in area is the Stripe sector than the Diamond sector?

Problem of the Month: "Fair Games"

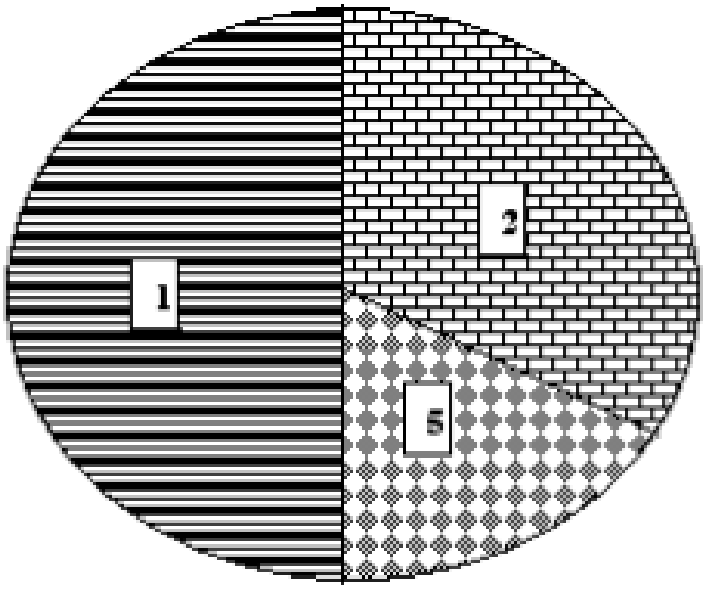
Level D (continued): Dolores' Version

Dolores' spinner makes the game unfair. Use mathematics to explain why her game is unfair.

How could you change the spinner to make her game fair?

Problem of the Month: "Fair Games"

Level E: Last-Minute Changes



Dolores has already made several copies of her spinner. You don't want to hurt her feelings by not using her spinner, but you need to make sure the game is fair. You decide to make a new track in the shape of an oval where racers near the inside of the track have fewer spaces to travel than racers near the outside of the track. Design an oval track that can be used with Dolores' spinner. Design the game board track so that the game will be fair to all players, but Dolores' spinner isn't changed.

Use mathematics to justify why your game board makes the game fair to all players.

Unit 6: Probability
Overview

Big Idea:

Essential Questions:

Standards:

- ☐ Describe the likelihood of a chance event happening as a number between 0 and 1. **(MCC7.SP.5)**
- ☐ Understand that the probability of an event is a fraction of the fraction of outcomes in the sample space for which the event occurs. **(MCC7.SP.8a)**
- ☐ Approximate the probability of a chance event occurring by collecting data and observing its long-term frequency **(MCC7.SP.6)**
- ☐ Predict relative frequency based given the probability. **(MCC7.SP.6)**
- ☐ Develop a probability model and use it to find the probability of events. **(MCC7.SP.7)**
- ☐ Perform and record experiments using
  - Tallies
  - Charts
  - Tree diagram
  - Venn diagram
  - Graphs
- ☐ Find probability of compound events. **(MCC7.SP.8)**
- ☐ Represent sample spaces for compound events **(MCC7.SP.8b)** using
  - Organized lists
  - Tables
  - Tree Diagrams
- ☐ Design and use a simulation to generate frequencies for compound events. **(MCC7.SP.8c)**

Glossary

1. Probability

2. Theoretical probability

3. Empirical (Experimental probability)

4. Simple events

5. Compound events

6. Certain event

7. Impossible event

8. Equally likely events

9. Sample Space

10. Probability model

11. Relative frequency of outcomes

12. Simulation