Summer 6-2013

Take a Chance on Probabiliy - 7th grade

Melanie R. Webb
Trinity University, melanierwebb@gmail.com

UNDERSTANDING BY DESIGN

Unit Cover Page

Unit Title: Take a Chance! On Probability

Grade Level: 7th Grade Pre-AP

Subject/Topic Area(s): Independent, Dependent, Experimental, and Theoretical Probability

Designed By: Melanie Webb

Time Frame: 8 – 10 days

School District: North East ISD

School: Jackson Middle School

School Address and Phone: Jackson Middle School
4538 Vance Jackson
San Antonio, TX 78230
Phone: 210-356-4400

Brief Summary of Unit (Including curricular context and unit goals):

The goal of this unit is for students to understand that probability is a measure that we use to make predictions about future events. Whereas some outcomes are independent of one another, others are dependent on the outcome of previous events, which affects the probability.

Throughout the unit, students will explore probabilities through experimental and theoretical situations and problems.

The unit culminates with the students creating what they perceive to be a fair and fun game of chance.

Some supplementary materials were collected and adapted from many teachers in North East Independent School district.

Take a Chance! on Probability

7th Grade Pre-AP

Stage 1 – Desired Results

Standards

TEKS 7.10 The student recognizes that a physical or mathematical model (including geometric) can be used to describe the experimental and theoretical probability of real-life events. The student is expected to:
(A) construct sample spaces for simple or composite experiments; and
TEKS 8.11 The student applies concepts of theoretical and experimental probability to make predictions. The student is expected to
(A) find the probabilities of dependent and independent events;
(B) use theoretical probabilities and experimental results to make predictions and decisions; and
(C) select and use different models to simulate an event.

Adopted TEKS 2013

7.6 The student applies mathematical process standards to use probability and statistics to describe or solve problems involving proportional relationships. The student is expected

Transfer

Students will independently use their learning to…

Create a game of chance of their choice that uses knowledge of probability to entertain and amuse.

Meaning

Understandings

Students will understand that….

• Real world experiments, trials, and simulations are used to predict the probability of a given event.

• Chance has no memory. For repeated trials of a simple experiment, the outcome of prior events has no effect on the next.

• The experimental probability or relative frequency of outcomes of an event can be used to estimate the exact probability of an event.

Essential Questions

- How can theoretical and experimental probabilities be used to make predictions or draw conclusions?
- In what situations can the outcome of one event affect the outcome of another?
- How can we use the data to interpret events in the physical world and our society?
- How can understanding probability help someone win a game of chance?

Acquisition

Knowledge

Students will know…

• Probabilities are fractions between 0 and 1 derived from modeling real world experiments and simulations of chance.
• A probability of 0 means an outcome has 0% chance of happening and a probability of 1 means that the outcome will happen 100% of the time. A probability of 50% means an even

Skills

Students will be able to…

• Construct and use tree diagrams for describing relatively small sample spaces and computing probabilities, as well as for visualizing why the number of outcomes can be extremely large.
• Use simulations to collect data and estimate

to: (A) represent sample spaces for simple and compound events using lists and tree diagrams (B) select and use different simulations to represent simple and compound events with and without technology (C) make predictions and determine solutions using experimental data for simple and compound events (D) make predictions and determine solutions using theoretical probability for simple and compound events (E) find the probabilities of a simple event and its complement and describe the relationship between the two (H) solve problems using qualitative and quantitative predictions and comparisons from simple experiments (I) determine experimental and theoretical probabilities related to simple and compound events using data and sample spaces	chance of the outcome occurring. • The probabilities of every outcome in a sample space should add to 1. • Sometimes the outcome of one event does not affect the outcome of another event. (This is when the outcomes are called independent.) • Sometimes the outcome of one event does affect the outcome of another event. (This is when the outcomes are called dependent.) • Experimental probability approaches theoretical probability when the number of trials is large.	probabilities for real situations that are sufficiently complex that the theoretical probabilities are not obvious. • Calculate probability for simple, compound, independent, and dependent events. • Perform experimental trials to find experimental probability. • Compare experimental and theoretical probability

Stage 2 – Evidence

Performance Task

Students will demonstrate meaning-making and transfer by…

Take a Chance!

Students will create a game of chance using at least two types of probability in groups or individually, no more than 3 to a group. The game must require no skill to play. They will write a descriptive essay describing their game's rules, and how to play, as well as discussing the probabilities of the turns, addressing the theoretical probability that they designed and then experimenting with their game to show any difference with the experimental probability and how that might affect outcome.

Other Evidence (e.g., formative)
Exit Slips, Class Assignments

Stage 3 – Learning Plan

Pre-Assessment

How will you check students' prior knowledge, skill levels, and potential misconceptions?

Pre-test over Simple Probability and Tree Diagrams

HW: Watch and complete handout on video notes/vocabulary for sample spaces, tree diagrams, and simple probability.

Learning Activities	Progress Monitoring (e.g., formative data)
<u>Day 1:</u> Learning Goal: Students will be able to construct sample spaces. Students will use sample spaces to find probability of desired events. Warm-Up: Card Sort "Impossible, Maybe or Certain?" Given cards with different fractions, percents, scenarios, words, and pictures, students will sort them into groups with like probabilities. Lesson: Group exercise Tree Diagrams with Odd One Out (NE Intranet). Discuss independent compound events via tree diagrams. Learning Task: **Heads Wins? for assessment** HW: Watch and complete handout on video notes/vocabulary for independent/compound events	Observe Warm-Ups/Share Collect Heads Wins
<u>Day 2:</u> Learning Goal: Students will be able to find probabilities of independent/compound events. Lesson: Using the learning task Heads Wins? to discuss <u>probability</u> of compound events occurring. Then complete Passing without Studying Part 1. *Essential Question: In what situations can the outcome of one event affect the outcome of another?* Learning Task: Assignment to practice calculating probability of compound events. **Exit Ticket. 3 Compound Event probabilities.** HW: Watch and complete handout on video notes/vocabulary for dependent events	Collect Assignment Exit ticket for quick check
<u>Day 3:</u> Learning Goal: Students will be able to find probabilities of dependent events. Warm-Up: Dependent or Independent. Given 3 scenarios, students will decide if the events are Independent or Dependent.	

Lesson: With a bag full of marbles discuss probability of events occurring if marbles are selected without replacement. Discuss probability of choosing a marble that has been removed from the bag. The next probability is dependent on the outcome of the first! *Essential Question: In what situations can the outcome of one event affect the outcome of another?* Learning Task: **Sock Drawer Assignment** HW: Watch and complete handout on video notes/vocabulary for Theoretical v Experimental Probability. <u>Day 4:</u> Learning Goal: Students will understand the difference between theoretical and experimental probability. Students will perform experiments and use the results to predict probabilities for future events. Lesson: With a bag of two color counters, shake it up and spill the contents. Ask the students how many they think would land on yellow (answer should about half). Is this what the experiment shows? Repeat trials, as the experiments show different result, adjust probability to reflect experiments. Discuss the difference from theoretical probability. Predict what would happen if you performed the experiment with 100 color counters of 4500 counters. How would we decide this? *Essential Questions: How can we use theoretical and experimental probabilities to make predictions or draw conclusions? How can we use the data to interpret events in the physical world and our society?* Learning Task: **It's a Boy!** **Exit Ticket:** Why aren't half the babies always boys? HW: Finish Learning Task <u>Day 5:</u> Learning Goal: Students will understand the difference between theoretical and experimental probability. Students will perform experiments and use the results to predict probabilities for future events. Lesson: Passing Without Studying Part 2, Simulated. Revisit the same situation with the previous discussion from Day 2, except this time, using a deck of cards, see how the quiz turns out this time. *Essential Questions: How can theoretical and experimental probabilities be used to make predictions or draw conclusions? How can we use the data to interpret events in the physical world and our society?* Learning Task: **Probability graphing.** Students will flip a coin and record their results on a table and graph as they go to see if the experimental probability approaches the theoretical probability of	Collect Sock Drawer. Collect It's a Boy! Exit Ticket for quick check Collect Probability Graphing

flipping heads. HW: Finish Learning Task Day 6: Learning Goal: Students will apply probability to situation/problem stations. Lesson: The Sum of the Dice – What makes a game fair? *Essential Questions: How can understanding probability help someone win a game of chance?* Learning Task: **Probability Figures** (NE Intranet), **Score 2** (NE Intranet), HW: Come to class tomorrow with idea for Performance Task Game Day 7: Learning Goal: Students will create a game using probability. Lesson: Go over rubric and expectations for probability game. *Essential Questions: How can understanding probability help someone win a game of chance?* Learning Task: Work Day on Performance Task HW: Complete Game to be ready to participate in class tomorrow Day 8: Learning Goal: Use knowledge about probability to play and attempt to win games of chance. Lesson: Using Strategy to play and win each other's games *Essential Questions: How can understanding probability help someone win a game of chance?* Learning Task: Students will take notes on how their games are played and if they are successful. They should record outcomes to use as experimental probability data. HW: Complete Performance Task Reflection Essay	Collect Sum of the Dice Summative assessment Game and Essay

Name:
Period:

Take a Chance!

Probability Unit Performance Task assignment sheet

Your task: Create a game that relies entirely on chance to win.

Design a game we will play in class, using what you have learned about probability. You will have one day in class to work on your game, and we will play the games in class the next day.

Possible Options:

- Design a board game like Chutes and Ladders or Candyland
- Make rules for the roll of two or more dice.
- Make a spinner or die (or dice) that you design with actions or rules to win.

The choice is yours. You will decide the rules for your game. Side note: Try to create at least one rule that includes independent compound or dependent probability.

The math:

- You must give a list of the sample space for your game. For each possible outcome of your game, you will calculate the theoretical probability.
- When we play the game in class, you must play your game and at least one other game by the class and record the outcomes.
    - You will use these outcomes to calculate the experimental probability of each outcome if you were to play again.

The essay: You will be required to turn in a reflection essay about your game that covers this information

- You must describe you game, how to play it with rules included.
- Include your sample space and your initial theoretical probability.
- Describe how your game went when it was played, did you win? Was it fair?
- Include your recording sheet for how often each outcome occurred. Discuss how your experimental probability differs from your initial theoretical probability.
- Answer what you have learned about probability by making this game, what would you do differently next time?

Take a Chance! Rubric Name(s): _____

Per: _____

	Needs Improvement (0-5)	Approaching Expectations (6-15)	Meeting Expectations (16-25)	Exceeding Expectations (26-30)	Total
Product (30pts)	Student did not have a completed product by due date OR student's product was unfinished and student was not able to participate.	Student had completed product, though design was not well thought out or executed. Students may have had difficulty participating.	Student had completed product with well explain rules of the game, adhering to the guidelines specified on assignment sheet.	Student had a completed product, with well explained rules of their game, exhibiting creativity while adhering to guidelines	
Calculations (30pts)	Not included or mostly incorrect calculations	Calculations are included and mostly correct with up to 5 errors. Calculations may be unorganized or difficult to follow.	Calculations are included and mostly correct with up to 2 errors. Different types of probability are specified	Calculations are correct, thoughtfully organized and easily followed. Different types of probability are specified	
Essay (30pts)	Not included or incomplete	Essay is included, and complete, but not organized in paragraph form. Does not answer all required questions.	Essay is included, in paragraph form, and addresses all questions listed on assignment sheet.	Essay is included, in paragraph form, well written and addresses all questions listed on assignment sheet thoughtfully.	
Neatness/Organization (10pts)	(0-2) If included, Product is messy and work on calculations is not	(3-5) Product is in pencil, calculations are not easily followed. Essay is not written in best	(6-8) Product is colored, calculations are written legibly. Essay is	(9-10) Product is colored and legible, calculations are written on lined paper	

	easily followed. Essay is illegible.	handwriting or typed.	handwritten legibly or typed.	in step by step manner. Essay is written in best handwriting or typed.	

Website Info Name: _____

Period: _____

Introduction to Probability Video: Vocabulary and Notes Handout

Watch the video and fill in accompanying notes, definitions, and diagrams. Answer the comprehension questions at the end independently

Simple Probability Definition:

How to find Simple Probability: ----------

Example 1: Probability of flipping Heads also written _____

Example 2: Probability of rolling a multiple of 3 on a six-sided die, _____

Desired outcomes:

Possible outcomes:

Sample Spaces Definition:

Sample Space of a coin:

Sample Space of a six-sided die:

When more than _____ is occurring, a _____ is an organizational tool used to create a _____.

Example 1: Flipping a coin AND rolling a die:

Example 2: For Breakfast

Website Info Name: _____

Period: _____

How many different combinations are there when given choices for breakfast?

Drink: {coffee, OJ, milk}
Bread: {toast, biscuit}
Meat: {sausage, bacon, ham}

Tree Diagram!

Complete the Sample Space: {C/T/S, C/T/Ba, C/T/H, C/Bi/S,

Comprehension/ Thinking Questions:

Use the Breakfast information above and your tree diagram for the following questions.

1. There are an equal amount of sausage, bacon, and ham sandwiches. What is the probability that you grab a ham sandwich?

2. What is the probability that your meal consists of Milk, Toast, and Sausage?

3. What is the probability that your sandwich is on a biscuit with either ham or bacon?

Write any questions you have here:

Website Info Name: _____

Period: _____

Probability of Compound Events Video: Vocabulary and Notes Handout

Independent Events Definition:

Montel is flying from New York to London. The airline has a history of landing on time about 12 out of every 25 flights. This airline also reports to lose luggage only about 5% of the time. Montel wants to know what the probability is that he will arrive on time **and** that the airline does NOT lose his luggage.

Draw a diagram modeling this situation:

Does Event A affect Event B?

If two or more events are _____, then the probability of

_____ events occurring is the _____ of probability of A and probability B.

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

Using the tree diagram example from the previous notes:

P(coffee) = P(Toast) = P(Ham) =

Probability of Coffee/Toast/Ham =

Coffee/Toast/Ham is only one (1) combination out of how many total, according to our diagram?

Website Info

Name: _____

Period: _____

Back to Montel:

What is the probability that his flight will arrive on time? P(A) =

What is the probability that his luggage WILL arrive? P(B) =

What is the probability of both of these events occurring?
P (A **and** B) =

Practice Independent Compound Events:

A bag contains 6 black marbles, 9 blue marbles, 4 yellow marbles and 1 green marble. A marble is selected without looking, replaced in the bag, and then a second marble is selected. Find the probability of the following events.

1. Selecting a black marble, then a yellow marble.

2. Probability (blue, green)

3. P(not black, blue)

4. P(green, green)

Write any questions you have here:

Probability of Dependent Events Video: Vocabulary and Notes Handout

Website Info Name: _____

Period: _____

Dependent Events Definition:

In dependent events, the _____ changes after the initial event.

P(A and/then B) = P(_____) P(_____)

Example:

Maury only likes red and orange jellybeans. Her bag of jelly beans contains 10 red, 6 green, 7 yellow, and 7 orange jellybeans. After a jellybean is chosen, she eats it. What is the probability of choosing a red jellybean, another red jellybean, and then an orange jellybean?

Find each event separately first, then find the product

P (red) = $\frac{\#\ of\ red\ jellybeans}{total\ jelly\ beans}$ = ----------

P (red *again*) = $\frac{\#\ of\ red\ jellybeans\ left}{total\ jelly\ beans\ left}$ = ----------

P (orange) = $\frac{\#\ of\ orange\ jellybeans}{total\ jelly\ beans\ left}$ = ----------

Find the product: ---------- X ---------- X ---------- = ----------

Is this probability likely?

Practice.

Website Info Name: _____

Period: _____

The principal is choosing two students at random from a class of 25 students to represent our middle school at a city conference about getting kids to go to college. There are 10 girls and 15 boys in the class.

1. What is the probability that a girl is chosen and then a boy is chosen?
   P(girl) =

   P(boy) = *Remember one student has already been chosen!* =

   P(girl, boy) = P(girl) X P(boy after girl) =

2. What is the probability that a boy is chosen and then a girl is chosen?

3. What is the probability that two girls are chosen?

4. What is the probability that two boys are chosen?

Write any questions you have here:

Website Info Name: _____

Period: _____

Experimental v Theoretical Probability Video: Vocabulary and Notes Handout

Theoretical Probability Definition:

P(event) = ----------

We have been working mostly with theoretical probability, using what we know about our possible outcomes to predict the likelihood of an event.

Experimental Probability Defnition:

Experimental P (event) = $\frac{\#\ of\ times\ event\ occurs}{total\ \#\ of\ trials}$

Example: Rolling a Die

Theoretical Probability of rolling a 1 on a six-sided die: P(1) = --------

Experiment:

Outcome									
1s									
Trials	1	2	3	4	5	6	7	8	9
Probability									

The more trials you perform, the more accurate your data.

Using the experimental probability, how many 1s could you expect (predict) to roll if you rolled the die

50 times? 100 times? 500 times?

Probability Card Sort.

Teacher Notes: Copy and Cut these cards to be sorted into groups as students see fit, using their mathematical logic. You may give students who need scaffolding five groups: Impossible, Unlikely, Maybe, Likely, and Certain. Feel free to add more situations to create more cards. You may want to include pictures.

Impossible	Maybe	Certain	Good Chance
Unlikely	Likely	Probable	Small Chance
Even Chance	No Chance	0%	100%
10%	25%	50%	75%
90%	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{3}{4}$
0.25	0.5	0.75	$\frac{1}{6}$
$\frac{5}{6}$	The Rangers will win the World Series	You will have two birthdays this year	If today is Tuesday, tomorrow is Wednesday
You will meet the President of the United States	You will meet Benjamin Franklin on your way home from school	The sun will rise tomorrow morning	You will go to the beach this summer
At least one student will be absent tomorrow	You will be in the 8^{th} grade next year	If you drop a rock in water, it will sink	It will snow this week
You will watch TV after school	It will rain tomorrow	Add your own word!	Add your own Fraction!
Add your own decimal!	Add your own percent!	Add your own picture!	Add your own sentence!

Name:
Period:

Heads wins?

1. Suppose you are approached by a classmate who invites you to play a game with the following rules: Each of you take a turn flipping a coin. You toss your coin first, he tosses his coin second.
   - He gives you 50¢ each time one of the coins lands on tails.
   - You give him 50¢ each time one of the coins lands on heads.

   a. Create a tree diagram for the four possible outcomes and probabilities for the two tosses.

   b. What are the possible outcomes (sample space)?

   c. What are your winnings for each outcome?

   d. Would you play the game?

2. Your classmate suggests changing the rules to the game to make it interesting. You'll flip first.
   - If you get heads, you give him $2
   - If you get tails, he flips his coin.
   - If he gets heads, you give him $1
   - If he gets tails, he gives you $2

   a. Create a tree diagram for the possible outcomes and probabilities. Write your outcomes as fractions, decimals, or percents.

   b. Who is likely to win this game? Explain your Answer. Would you play this game?

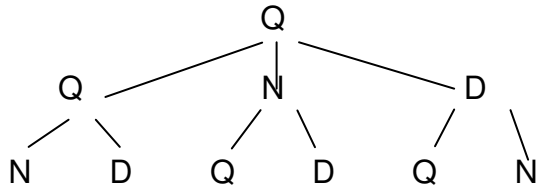
Adapted from Georgia Dept of Education.

Odd One Out

For each situation, you are given 4 options. Three belong and one does not. Find the odd one out.

1. You have 2 quarters, 3 dimes, and 1 nickel in your pocket. If you take 3 coins from your pocket, what could they be?

QQN	QDN
QQD	DDD
QDD	DDN



Quarter	Quarter	Nickel
Quarter	Quarter	Dime
Quarter	Dime	Dime
Quarter	Dime	Nickel
Dime	Dime	Dime
Dime	Dime	Nickel

(quarter, dime, nickel)
(quarter, dime, dime)
(dime, dime, dime)
(quarter, quarter, dime)
(quarter, quarter, nickel)
(dime, dime, nickel)

2. <u>Possible Sandwiches:</u> Turkey or Beef or Ham
Cheddar or Swiss Cheese
Wheat or Rye Bread

TCW	BCW	HCW
TCR	BCR	HCR
TSW	BSW	HSW
TSR	BSR	HSR

T B H

C S C S C S

W R W R W R W R W R W R

turkey	Cheddar	Wheat
Turkey	Cheddar	Rye
Turkey	Swiss	Wheat
Turkey	Swiss	Rye
beef	Cheddar	Wheat
Beef	Cheddar	Rye
Beef	Swiss	Wheat
Beef	Swiss	Rye
Ham	Cheddar	Wheat
Ham	Cheddar	Rye
Ham	Swiss	Wheat
Ham	Swiss	Rye

(turkey, beef, ham)

(cheddar, Swiss)

(wheat, rye)

Name:
Period:

Passing without Studying Part 1

Frank is interested in knowing how likely it is that he will pass a multiple choice quiz without studying. There are ten questions and each question has 4 choices.

1. How many questions does Frank need to answer correctly to pass?
2. What is the probability that he will guess correctly on the first question?
3. What is the probability that he will guess correctly on the first AND second question?

4. Continue this pattern to find the probability that he will answer ALL ten questions correctly.

P (3 Questions):

P (4 Questions):

P (5 Questions):

P (6 Questions):

P (7 Questions):

P (8 Questions):

P (9 Questions):

P (10 Questions):

Remember, Frank wants to pass this quiz, so he needs _____ questions correct. What is the probability Frank will pass the quiz?

Do you think Frank should study?

Exit Ticket Compound Probability Name:

Period:

1. If a coin is flipped 4 times, what is the probability of getting Tails all 4 times?

2. What is the probability of rolling two even numbers in a row with a six-sided die?

3. What is the probability of flipping heads on a coin and rolling a 3 on a die?

Exit Ticket Compound Probability Name:

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1. If a coin is flipped 4 times, what is the probability of getting Tails all 4 times?

2. What is the probability of rolling two even numbers in a row with a six-sided die?

3. What is the probability of flipping heads on a coin and rolling a 3 on a die?

Name:
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Warm – Up: Independent or Dependent?

1. A toy bin contains 12 toys, 8 stuffed animals, and 3 board games. Marsha randomly chooses 2 toys for the child she is babysitting to play with. What is the probability that she chose 2 stuffed animals as the first two choices?

2. A fruit basket contains 6 apples, 5 bananas, 4 oranges, and 5 peaches. Drew randomly chooses on piece of fruit, eats it, and chooses another piece of fruit. What is the probability that he chooses a banana and then an apple?

3. Nick has 4 quarters, 3 dimes, and 2 nickels in his pocket. Nick randomly picks two coins out of his pocket. What is the probability that Nick did not choose a dime either time if he replaced the first coin back in his pocket before choosing a second coin?

Name:
Period:

Warm – Up: Independent or Dependent?

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3. Nick has 4 quarters, 3 dimes, and 2 nickels in his pocket. Nick randomly picks two coins out of his pocket. What is the probability that Nick did not choose a dime either time if he replaced the first coin back in his pocket before choosing a second coin?

Name:
Period:

Passing without Studying Part 2

Remember Frank? He was trying to pass a quiz without studying. This time, however, we will run trials of an experiment to find his probability of passing the quiz. There are ten questions and each question has 4 choices.

Let a deck of cards represent his answer choices, since there are 4 choices and 4 suits. Let Hearts represent the correct answer. Shuffle the deck, pick a card and record your result. Replace the card and repeat to represent the next question. Do this ten times for the ten questions on the quiz.

Run this experiment 10 – 20 times. Find an average for your results. Does Frank Pass? How does this experimental probability differ from the probability you found previously?

Name:
Period:

Probability Graphing

To explore the probability of getting heads in a coin toss, run an experiment of 30 trials. Count how many heads you get in 30 trials to investigate how experimental probability changes with each trial. In your table, record how many heads have come up in your experiment, the number of trials you completed, and the experimental probability as a percentage after each trial.

For Example, if your first six trials resulted in Tails, Heads, Tails, Heads, Heads, Heads, your table would look like this:

OUTCOME	**T**	**H**	**T**	**H**	**H**	**H**
HEADS	0	1	1	2	3	4
TRIALS COMPLETED	1	2	3	4	5	6
EXPERIMENTAL PROBABILITY	0%	50%	33%	50%	60%	66%

Record your results below:

OUTCOME										
HEADS										
TRIALS COMPLETED	1	2	3	4	5	6	7	8	9	10
EXPERIMENTAL PROBABILITY										

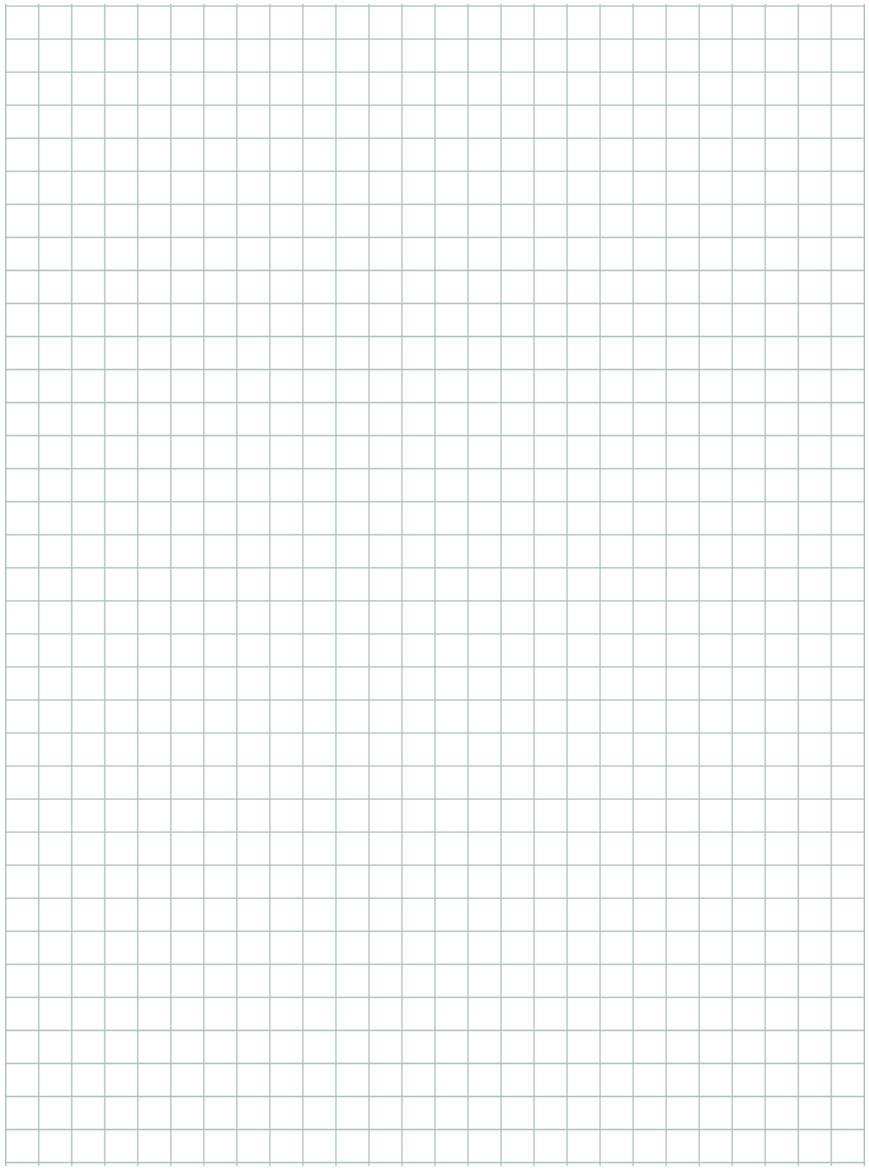
OUTCOME										
HEADS										
TRIALS COMPLETED	11	12	13	14	15	16	17	18	19	20
EXPERIMENTAL PROBABILITY										

OUTCOME										
HEADS										
TRIALS COMPLETED	21	22	23	24	25	26	27	28	29	30
EXPERIMENTAL PROBABILITY										

Adapted from Georgia Dept of Education

Create a Graph showing the change in the probability as the number of trials is increased.

Percent Heads (y)



Trials Completed (x)

What did you notice as you performed more trials?

Name:
Period:

The Sum of the Dice

Discuss what you think makes a game fair with a classmate.

Next you will play a game with a partner. In this game, you will roll two dice and receive points based on the sum.

- Person A will receive a point if the sum of the dice is 1, 2, 3, 4, 10, 11, or 12
- Person B will receive a point if the sum is 5, 6, 7, 8, or 9

A. Before you start playing: Is this game fair? Why or why not?

B. Roll the dice 10 times and record the points. Who won?

C. Repeat the game 5 more times. Did your results change?

D. Create a Bar Graph that displays the number of times the sum occurred on a separate sheet of paper.

E. What would happen if you played the game with 100 rolls?

F. Who wins this game more often? Why do you think that is?

G. Show all the possible sums (sample space). How many are there.

H. Is there a way to change the rules of the game so that each player has an equal chance to win? Explain

Adapted From Georgia Dept of Education