

Title: Something's Fishy! Probability Unit

Brief Overview:

This unit emphasizes that the theory of probability is an important branch of mathematics with many practical applications in the physical, medical, biological, and social sciences. Since students have many misconceptions about probability situations, developing an understanding of this theory is essential to understanding weather reports, medical findings, political doings and the state lotteries.

NCTM Content Standard/National Science Education Standard:

NCTM Data Analysis and Probability Standards for grades 3-5:

- Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them
- Select and use appropriate statistical methods to analyze data
- Develop and evaluate inferences and predictions that are based on data
- Understand and apply basic concepts of probability

NSES Science as Inquiry for grades K-4:

- Develop abilities necessary to do scientific inquiry:
 - Ask a question
 - Plan and conduct a simple investigation
 - Gather data
 - Use data to construct a reasonable explanation
 - Communicate investigations and explanations

Grade/Level:

Grades 3-5

Duration/Length:

3 days

Student Outcomes:

Students will:

- State and apply the rule (definition) for probability
- Identify possible outcomes
- Identify the probability of one simple event

- Determine the probability of one simple event comprised of equally likely events
- Conduct a simple experiment, collect, record, and display data.

Materials and Resources:

Lesson 1

- Probability semantic map (Student Resource Sheet 1)
- Odds, Evens, Says Shoot worksheet (Student Resource Sheet 2)
- What's Your Chances? (Student Resource Sheet 3)
- Life-size probability scale (Student Resource Sheet 4)
- Reward system Student Resource Sheet (Student Resource Sheet 5)
- Brief Constructed Response (Student Resource Sheet 6)

Lesson 2

- Probability semantic map (Student Resource Sheet 1)
- Rock, Paper, Scissors worksheet (Student Resource Sheet 7)
- Statistics and Probability sheet (Student Resource Sheet 8)
- Statistics and Probability answer sheet (Teacher Resource Sheet 1)
- Internet access

Lesson 3

- Internet access
- Brief Constructed Response (Student Resource Sheet 10)
- Summative Assessment (Student Resource Sheet 11)

Development/Procedures:

Lesson 1

Preassessment

Use a probability semantic web (Student Resource Sheet 1) to spark class conversation. This will help you assess where students are with their knowledge of probability and help you make connections to real world experiences. Guide students' understandings to help them articulate that probability studies the likelihood of something happening. Tell students that probability can be expressed as a fraction, decimal, or percent that connects to other branches of mathematics.

Launch

Do something familiar. Play the game Odds, Evens, Says Shoot. **ODDS, EVENS:** Two players pick either "odds" or "evens." Then they make a fist, shake it, say, "odds, evens, says...shoot," and stick out one or two fingers. If the total is an odd number, the player who picked odds wins. Same goes for evens. Have students record their results on chart (Student Resource Sheet 2).

Teacher Facilitation

Developing Understanding:

What's Your Chances? (Student Resource Sheet 3)

Make a life-size probability scale like the one on Student Resource Sheet 4. A plastic ribbon could be used. Have students use the scale to express the probability of the situations on Student Resource Sheet 3 occurring.

Give students a copy of Student Resource Sheet 5. They can place the number of the situation on the scale in the position that reflects their ideas about the probability of the event.

Tell students that they will be using a probability reward system for the week during this unit. Students will earn fish tickets to put in the tank. This will be included in the culminating activity. Students will be given a list of ticket winning activities. Use a small container, such as a fish bowl to collect tickets. At the end of the week, pull tickets out of the bowl and award various prizes.

Reward System:

100% Attendance

No tardies

All due assignments in on time

Room ready at end of day

Good behaviors if a visitor "drops by"

No timeouts throughout the day

Class quiet while teacher answers phone

Quiet, straight, lines

Treats others with respect and receives a compliment

Student Application

What's Your Chances?

Is it certain, highly likely, unlikely, or impossible?

1. Ask students to name events in their lives that are certain, impossible, highly likely, and unlikely.
2. Divide students into groups. Students will assign events to a place on the probability scale.
3. Use a long piece of tape or paper to make the life-size probability scale.
4. Have students rank the events in order from impossible to certain.

Embedded Assessment

Brief Constructed Response on Probability Vocabulary (Student Resource Sheet 6): Use the brief constructed response to facilitate math in writing class. Look for student use of vocabulary and understanding of probability theory. Answer Key can be found on Teacher Resource Sheet 1.

Reteaching/Extension –

Use the following websites for reteaching and enrichment opportunities:

- <http://mathforum.org/dr.math/>
- <http://mathforum.org/dr.math/faq/faq.prob.world.html>

Lesson 2

Preassessment

Use a probability semantic map to make more connections and include the new information taught in class.

Launch

Ask students if they have heard of the game “Rock, Paper, Scissors” (Student Resource Sheet 7). Explain the rules to them if necessary. Demonstrate a mock game. Partner students together and have them play the game 10 times. Students should record the results on the Rock, Paper, Scissors page.

1. Introduce activity with a demonstration of game: rock, scissors, paper.
2. Divide class into pairs (player A and player B) and have them play the game 10 times.

Teacher Facilitation

3. Use overhead graph grid to graph the wins of player A in red (How many A players won one game, two games etc. Do the same for all B players in a different color.)
4. Do a tree diagram to determine the possible outcomes. In any probability problem, it is very important to identify all the different outcomes that could occur.
5. Compare the mathematical model with what happened when the students played the game.

Student Application

Aquarium Fishing- Fishing for Fish: Fish Intro: Introduce vocabulary. Teacher is fisherman, with aquarium (fake lake) and asks students which fish is he/she most likely to catch if there are 7 Yellow (7/10) and 3 blue fish (3/10). What are your chances of catching a yellow fish? A blue fish? Is it certain, very likely, or likely, or impossible for me to catch (a certain attribute fish)?

Embedded Assessment

Statistics and Probability Sheet (Student Resource Sheet 8/Teacher Resource Sheet 2):

Lesson 3

Preassessment

Launch

Use the following website to help students identify the probability of an event:

<http://www.bbc.co.uk/education/mathsfife/shockwave/games/fish.html>

Teacher Facilitation

1. Give each pair of students one paper bag of Goldfish crackers.
2. Ask students to open their bag, sort the goldfish, and classify them by their color.
3. Have students record the information on a chart.
4. Illustrate results in the form of a pictograph or bar graph and compare the different ways to display data.
5. Compare graphs and have students discuss the similarities and differences of the graphs.
6. Tell students to write a paragraph discussing the graphical representation they like the best and summarize the data.

Student Application

Fish Raffle:

Begin raffle by having a student count the number of tickets in the bowl. Have each student indicate how many tickets they have put in the bowl and calculate the probability of each student winning today's raffle. Have students work in groups of four in order to discuss their chances of winning.

Embedded Assessment

Brief Constructed Response (Student Resource Sheet 9): Use the brief constructed response to facilitate math in writing class. (Student Resource Sheet 9 and Teacher Resource Sheet 3.)

Reteaching/Extension

Use the following websites for reteaching and enrichment opportunities:

- <http://pbskids.org/cyberchase/games/probability/cointoss.html>
- <http://nces.ed.gov/nceskids/probability/>
- Try this quick activity with your class:

Probability of Picking Coins (TAG Extension)

Sharif has 5 coins in his pocket that total 47 cents. What is the probability that he will reach into his pocket and pull out a dime, and then without replacing it reach in and pull out a quarter?

- A. $1/20$
- B. $1/10$
- C. $1/25$
- D. $2/25$

Could it be $1/10$?

Let's first think about the coins that Sharif has in his pocket: five coins equaling 47 cents. He has to have two pennies in order to make the 47, so that takes care of two of the coins. Now we need to think how he could have three coins that make 45 cents. How could he get the five cents of the 45? If he had a nickel that would mean we need to get two coins to make 40 cents and that can't happen. Therefore, he has to have a quarter, which leaves us with making 20 cents with two coins. That gives him two dimes.

So in Sharif's pocket he has 2 pennies, 2 dimes, and 1 quarter.

$$2/5 \times 1/4 = 2/20 = 1/10$$

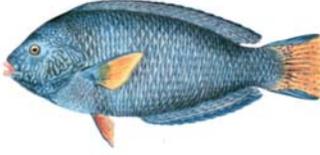
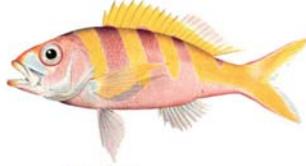
Summative Assessment:

Use this summative assessment to check student understanding. (Student Resource Sheet 10). Answers can be found on Teacher Resource Sheet 4.

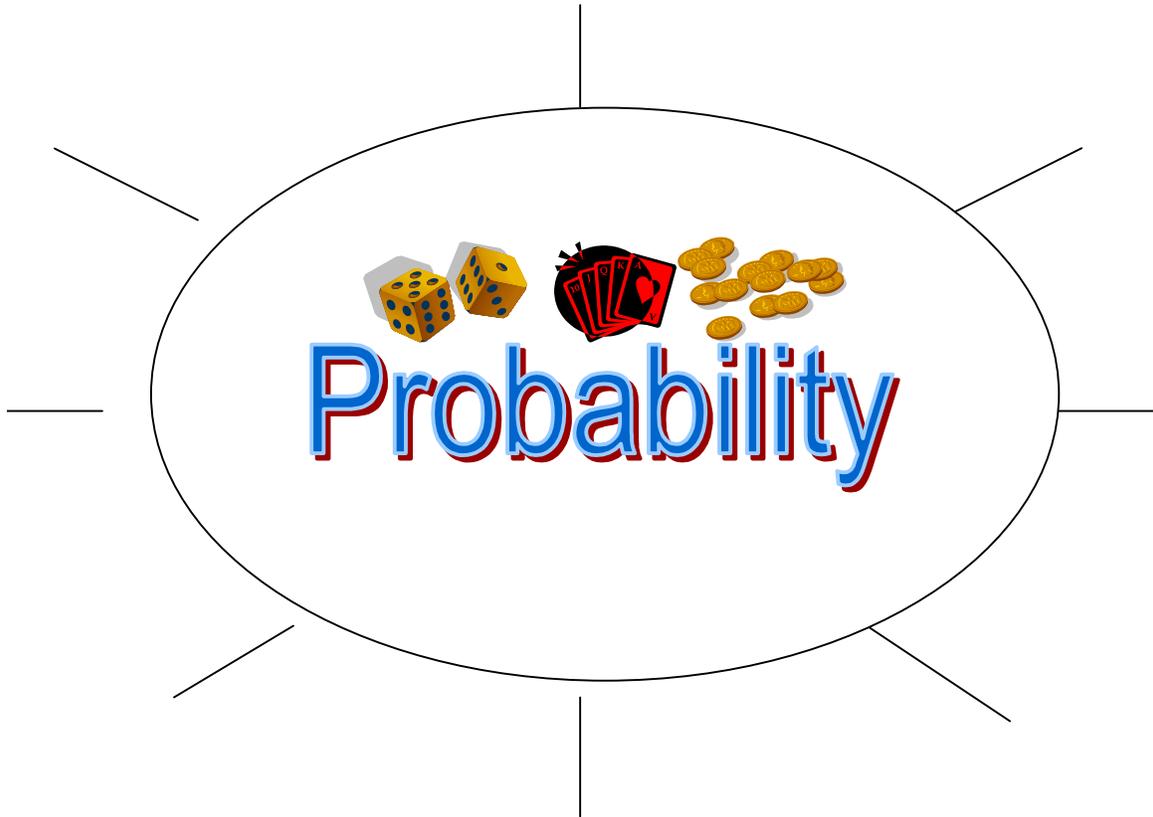
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Probability Semantic Map



Odds, Evens, Says Shoot!

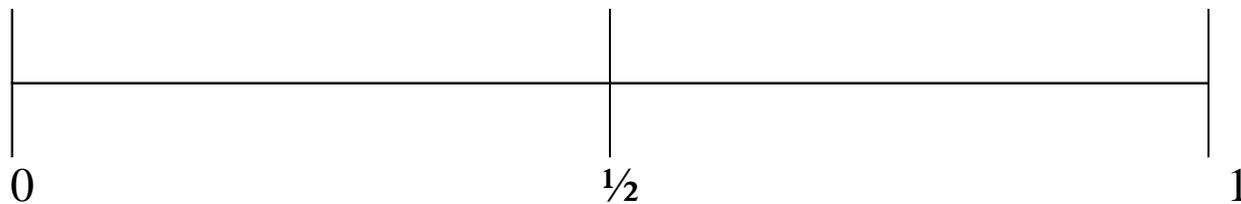
	Player A:	Player B:	Who Won?
Trial 1			
Trial 2			
Trial 3			
Trial 4			
Trial 5			
Trial 6			
Trial 7			
Trial 8			
Trial 9			
Trial 10			

What's Your Chances?

Directions: Read the following statements. Is each situation *certain*, *highly likely*, *unlikely*, or *impossible*? Write your answer on the line provided.

- 1) You will have recess today. _____
- 2) You will have fish for dinner tonight. _____
- 3) Someone will smile at you in the hallway. _____
- 4) School will be closed for a week next month. _____
- 5) Your mother will buy you a pet gold fish. _____
- 6) The weather is cold here in the wintertime. _____
- 7) You will not watch Animal Planet on television tonight. _____
- 8) The last day of school is in June. _____
- 9) Your pet goldfish will read a bedtime story to you tonight. _____
- 10) You will eat or drink something purple tomorrow. _____

Probability Scale



Fish Raffle Reward System

I will be using a probability reward system for the week during this unit. There are many ways that you can earn fish tickets to put into the fish bowl. For each criterion that you meet on a daily basis, you will receive a fish ticket. The more tickets you receive, the greater your chances will be to win a prize at the end of the unit. Good luck!

- ✓ 100% Attendance
- ✓ No tardies
- ✓ All due assignments in on time
- ✓ Room ready at end of day
- ✓ Good behaviors if a visitor "drops by"
- ✓ No timeouts throughout the day
- ✓ Class quiet while teacher answers phone
- ✓ Quiet, straight, lines
- ✓ Treats others with respect and receives a compliment
- ✓ Stays on task during independent work time

Brief Constructed Response

There are 15 Swedish fish in a bag: 7 are red, 5 are green, and 3 are yellow.

Step A

Which color are you most likely to select?

Step B

Use what you know about probability to explain why you chose your answer. Use words, numbers, or symbols in your explanation.

Rock, Paper, or Scissors?

	Player A Rock, Paper, or Scissors?	Player B Rock, Paper, or Scissors?	Who Won? Player A or Player B
Trial 1			
Trial 2			
Trial 3			
Trial 4			
Trial 5			
Trial 6			
Trial 7			
Trial 8			
Trial 9			
Trial 10			

Name _____

Date _____

Statistics & Probability: Cards

Directions: In the space to the right, determine the probability of each question in fraction form. What is the probability of...

1) Drawing a 6 from a deck of cards? _____

2) Drawing a Queen from a deck of cards, if I've already
drew a Queen? _____

3) Drawing a Diamond? _____

4) Drawing a 3? _____

5) Drawing an Ace, if I've already drew 2 Aces? _____

6) Drawing a Heart? _____

Answers To Statistics and Probability: Cards & Dice

ANSWERS
1. $\frac{4}{52}$ or $\frac{1}{13}$
2. $\frac{3}{52}$
3. $\frac{13}{52}$ or $\frac{1}{4}$
4. $\frac{4}{52}$ or $\frac{1}{13}$
5. $\frac{2}{52}$ or $\frac{1}{26}$
6. $\frac{13}{52}$ or $\frac{1}{4}$

Brief Constructed Response

Jessica rolled two number cubes each labeled 1-6. She then added the numbers.



Step A

Which is more likely, the sum of 6 or the sum of 10?

Step B

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

Brief Constructed Response

Jessica rolled two number cubes each labeled 1-6. She then added the numbers.



Step A

Which is more likely, the sum of 6 or the sum of 10?

_____The sum of 6_____

(6: 1+5, 2+4, 3+3, 4+2, 5+1) (10: 6+4, 5+5, 4+6)

Step B

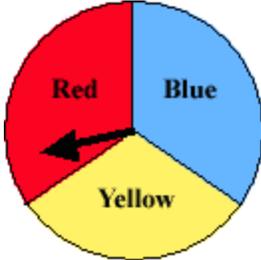
Use what you know about probability and determining outcomes to explain why your answer is correct. Use words and/or numbers in your explanation.

I know that I can determine the outcome of rolling a 6 by finding the numbers that add up to 6 and I can do the same for 10. I have found 1 and 5, 2 and 4, 3 and 3, 4 and 2, and 5 and 1 add up to the sum of 6; that's 5 outcomes and rolling 6 and 4, 5 and 5, and 4 and 6 add up to the sum of 10. There are more possibilities that add up to 6 than 10.

Summative Assessments

Selected Response Item 1

Becky and John are playing a game with a spinner. The spinner is shown below.



What can be said about the spinner?

- A. All of the colors are equally likely.
- B. Red is more likely than yellow.
- C. Yellow is more likely than red.
- D. Red is more likely than blue.

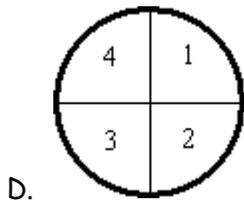
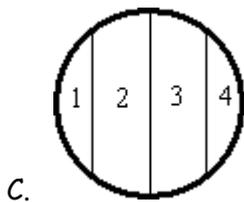
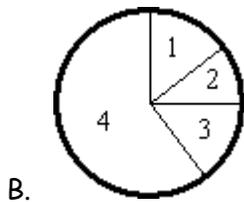
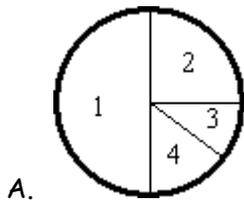
Selected Response Item 2

Jose tossed a penny and it landed on 'heads.' Which statement is correct about his next coin toss?

- A. The penny is more likely to land 'heads.'
- B. The penny is equally likely to land 'heads' or 'tails.'
- C. The penny is more likely to land 'tails.'
- D. The penny must land on 'tails.'

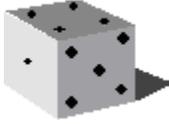
Selected Response Item 3

Find the spinner that has been divided so that each number has an equally likely chance.



Selected Response Item 4

Jessica rolls a six-sided number cube with 1, 2, 3, 4, 5, and 6 dots on a side.

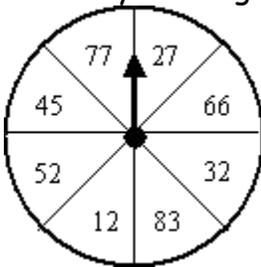


What is the probability of her rolling the side with four dots?

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

Selected Response Item 5

Kimberly is using the spinner below.



She spins the arrow. What is the probability that the arrow will land on a number greater than 50?

- A. $\frac{1}{8}$
- B. $\frac{1}{6}$
- C. $\frac{1}{4}$
- D. $\frac{1}{2}$

Summative Assessments
ANSWER KEY

Selected Response Item 1 = A

Selected Response Item 2 = B

Selected Response Item 3 = D

Selected Response Item 4 = A

Selected Response Item 5 = D