

PROBABILITY FUN ON THE PIER

GRADE LEVEL(S) 4-9

LESSON OBJECTIVE

Students will understand sampling and theoretical probability.

BACKGROUND/PRIOR KNOWLEDGE NEEDED

- Proportional reasoning and basic probability
- California Math Council (cmc.org) and National Council of Teachers of Mathematics (nctm.org) online resources
- Pictorial Math by Guillermo Mendieta Jr to help with number sense: fractions, decimals, percents and their various representations

EDUCATION STANDARDS

CA 4th Grade: Statistics, Data Analysis, and Probability 2.0 Students make predictions for simple probability situations. 2.2 Express outcomes of experimental probability situations verbally and numerically (e.g., 3 out of 4; $\frac{3}{4}$).

CA 5th Grade: Mathematical Reasoning 3.0 Students move beyond a particular problem by generalizing to other situations. Apply fraction and decimal Number Sense standard as well as work with variables in Algebra and Functions standard to basic probability

CA 6th Grade: Statistics, Data Analysis, and Probability 2.0 Students use data samples and 3.0 Students determine theoretical and experimental probabilities and use these to make predications about events.

CA 7th Grade: Number Sense 1.6 Calculate the percentage of increases and decreases.

General CA Standards for grades 7-9, pre Algebra I students.
Standards in Statistics, Data Analysis, and Probability.

MATERIALS NEEDED

- Basketballs and basketball court with hoops
- CA Holt Mathematics Course 1 (sixth grade text) online resource and/or other basic probability practice and summary sheets
- Data Collection and directions sheet for probability at the pier

MOTIVATION

Students will begin by looking at their free throw rate at school. Teacher could also set up sample tossing games such as ones at a carnival in and around the classroom.

DIRECT INSTRUCTION

1. Students shoot minimum of 5 shots and record free throws made.
2. Teacher guides students to compute % of free throws made.
 $\text{Shots made into basket} \div \text{Total shots thrown} (5)$
3. Teacher leads proportional thinking: "If 3 out of 5 free-throws are made, how many would be made if the student had thrown 20 shots, if the rate stays the same for the student?"
4. Teacher can conduct discussion of larger class sample and compute the class's percentage free-throws.

Classes may be ready after the Probability Fun on the Pier, to repeat #1 and 2 and compute the % increase or decrease depending on class's prerequisite skills in doing so.

Sheets from CA Holt Mathematics Course 1

5. Focus on Vocabulary and Reading strategies to review meaning of Probability.
6. Whole class gets led through Practice B sheet.
7. Groups of 3-4 do Practice C sheet.

The above steps are in preparation for a trip to the Santa Monica Pier's Arcade and Games area.

GROUP/INDEPENDENT WORK

At the Pier:

Use Data Collection sheet to gather data done in teams.

Back at school:

Students take ten foul shots (free throws) and record how many they get in the basket.

Probability Analysis Questions done in groups of four. Use Jigsaw to peer correct. Each student in the group letters off A, B, C, and D. They move into expert groups for their particular letter. The A's correct #1 and #2; the B's #3 and #4; the C's #5 and #6; the D's #7 and #8. The "experts" then return to their original group and share the solutions to the Analysis Questions.

MODIFICATION(S)

The pairing and grouping are instrumental in accommodating all learners.

Combination of teacher directed, student active engagement, and group interactions.

Frontloading of vocabulary and meaning review are addressed via Vocabulary and Reading.

ASSESSMENT/WRAP UP

Exit Question done individually and turned in at the end of class. The level of the question depends on the grade level of students.

SAMPLE:

You get 3 out of your 5 rings around the bottlenecks at the carnival. What is this as a fraction _____? What is this as a decimal? _____ What is this as a percent? _____

If you tossed 20 rings, how many would you expect to get around the bottlenecks?

Probability at the Pier



Data Collection

1. Choose a game to observe for ten minutes. Make sure that it's a game that is attracting customers. Describe how the game works. How much does it cost to play?
2. Keep track of how many people play the game during this ten-minute period. Record the attempts and outcomes below using tally marks. (If you are not able to observe many people play, ask the person running the game to estimate how often people win. Example - 1 out of 10, 1 out of 20, etc.)
3. After watching the game for ten minutes, try it yourself! Record how you did.
4. Do you think you have a better chance of winning this game or making a free throw shot in basketball?
5. Back at the school basketball court, take ten free throws. Be careful not to cross over the line. Record how many you make below.

Probability Analysis Questions

1. What is the likelihood that a person will win the game that you observed? Express your answer as a
 - a. Fraction
 - b. Decimal
 - c. Percent
2. If 250 people played the game that you observed, how many people would you expect to win?
3. Another game at the Pier boasts that 1 out of 5 people will win.
 - a. What percentage of people who play this game will win?
 - b. If 400 people played this game, how many would be expected to win?
4. Game A boasts that 1 out of 8 people will win. Game B claims that 15% of the people who play will win. Which game has better odds?
5. What is the likelihood that you will make a foul shot when handed a basketball? Express your answer as a
 - a. Fraction
 - b. Decimal
 - c. Percent
6. If you took 80 shots, how many would you expect to make?
7. After a game, a basketball player realizes she made 80% of the shots she took. If she made 12 shots, how many shots did she take?
8. Based on what you observed about others and yourself, do you have a better chance of winning the game you watched and played on the pier or making a foul shot?

Answer Key
Probability Analysis Questions

1. What is the likelihood that a person will win the game that you observed? Express your answer as a
 - a. Fraction **1/8*** ***Answers to this question will vary.**
 - b. Decimal **0.125**
 - c. Percent **12.5%**

2. If 250 people played the game that you observed, how many people would you expect to win?
$$0.125 \times 250 = 31.25 \quad \mathbf{31 \text{ people}^*}$$

3. Another game at the Pier boasts that 1 out of 5 people will win.
 - a. What percentage of people who play this game will win?

20%
 - b. If 400 people played this game, how many would be expected to win?
$$.20 \times 400 = \boxed{80 \text{ people}}$$

4. Game A boasts that 1 out of 8 people will win. Game B claims that 15% of the people who play will win. Which game has better odds?
$$1/8 = 0.125 \quad .15 > .125 \quad \boxed{\text{Game B}}$$

- What is the likelihood that you will make a foul shot when handed a basketball? Express your answer as a
 - a. Fraction **3/10***
 - b. Decimal **0.3**
 - c. Percent **30%**

5. If you took 70 shots, how many would you expect to make?
$$\mathbf{0.3 \times 70 = 21 \text{ shots}^*}$$

6. After a game, a basketball player realizes she made 80% of the shots she took. If she made 12 shots, how many shots did she take?
$$12/x = 0.8 \quad \text{rearranging, } x = 12/.8 \quad x = \boxed{15 \text{ shots}}$$

7. Based on what you observed about others and yourself, do you have a better chance of winning the game you watched and played on the pier or making a foul shot?
Answers to this question will vary.