

Gaming the System of Gaming: The Expected and Unexpected Results of Probability

Big Concepts:

- Introduction to Probability using Rock, Paper, Scissors
Rock, Paper, Scissors is a simple game that can be used to explain how probability works, the cornerstone of how all luck based games work. This is a good opportunity to discuss the Gambler's Fallacy.
- The Monty Hall Problem
The Monty Hall Problem serves as a demonstration that probabilities are not always obvious.
- Expected Value using the Lottery
Expected value helps us determine if a game of chance is fair. The lottery is an excellent example of a game that does not favor the player.

Materials:

- Game Sheets (1 per student).
- Boxes With Images of a Goat (2) or a Car (1) on the Inside for the Monty Hall Problem

Prep Before Lesson:

- Print Game Sheets
- Prepare Boxes for Monty Hall Problem

Lesson Plan:

:00–:15 *Introduction* Introduce self, and use first couple slides to introduce probability and games of chance.

:15–:30 *Rock, Paper, Scissors* Explain rules, and have students play rock, paper, scissors. Students should find a partner and circle each of their wins on their game sheet. Make sure students agree on their timing. A win gives the student a point. The first student in the room to ten points should raise his hand. The instructor will then end the game.

:30–:45 *Knowledge and Probability* Explain the solution to the game, what to do with leftover points (for the games that didn't finish), how knowledge effects the game, and the Gambler's Fallacy. This sets up for the next game.

:45–:70 *The Monty Hall Problem* Explain what the Monty Hall Problem is then have the students play a game. Ten students are asked to volunteer to go up and play the game (for a total of ten rounds). The student first selects a box, (but it isn't opened yet). Then the instructor opens a box with goat in it that isn't the one the student chose. From here the student is given the option to open the box they selected or switch to the remaining box. All students should play along on their game sheets and mark down if they stayed or switched and if they won or lost.

:70 –:80 *Monty Hall Solution* After the students are done playing, explain how the Monty Hall Problem works using the next few slides.

:80 –:90 *The Lottery* Explain the setup of the lottery found on the next slide, then have each student write down 6 numbers in any order on their game sheet. Proceed to reveal the winning numbers on the next slide.

:90 –:105 *Expected Value* Use the rest of the slides to explain to students how expected value works, how the lottery will never be in your favor, and other unfair games of chance.

Math Circles 2019: Gaming the System of Gaming

Name: _____

Game 1: The Problem of Points



Number of Games Won: 1 2 3 4 5 6 7 8 9 10



Game 2: The Monty Hall Problem



Did You Switch or Stay?	Did You Win or Lose?
1.	1.
2.	2.
3.	3.
4.	4.
5.	5.
6.	6.
7.	7.
8.	8.
9.	9.
10.	10.



Game 3: The Lottery



Choose 6 different numbers between from 1 to 42.

