

## Pre Prob 3.2c

## Fair Games

### I A Game of Chance—fair or not?

**Materials:** 1 die for each student, graph paper for record keeping, large posters or drawing paper and markers.

**The Game:** Helen and Simon are playing a game with one die each. If the roll is a 5 or 6, Helen gets the points on the die and Simon gets 0. If the roll is a 1, 2, 3, or 4, Simon gets the points on the die and Helen gets 0 points. The object of the game is to roll the die, one person at a time, until someone reaches 20 points to win.

- Who do you think will win the game? Why?
  - Is this game fair? Why or why not?
- 1) Play the game 5 times—keep a record of the games and the winners.
    - Has your opinion changed or not? Explain.
  - 2) Prepare your poster with the following criteria in mind.

Score	Criteria
5	Answers the questions. Has proof of 5 games with winners. The poster communicates the outcomes and explains the fairness or unfairness of the game clearly
3	Record keeping and poster completed—responses are adequate.
1	Poster and record keeping are less than adequate

## II. Rock, Paper, Scissors

In a fair game, each player has an equal chance to win. A fair game doesn't necessarily mean that in an actual game each player will win an equal number of times. Compare it to the toss of a coin, which is fair. Ten tosses of the coin will not always result in a five-heads-five-tails outcome. In an unfair game, players do not have an equal chance of winning. For example, a die which has three 3's, one 1, one 4, and one 5 wouldn't be a fair game if a win came from an outcome of 3,4, or 5.

In the game Rock, Paper, Scissors, two players count to three and then form their hand into one of the following:

- A fist representing a rock
- A flat hand representing paper
- The index and third finger extended representing scissors

The following combinations win the game:

- Rock wins over scissors
- Paper wins over rock
- Scissors win over paper

1) Play twenty rounds of Rock, Paper, Scissors with a partner and record the results of each round in the table at the right. Find the total number of times each player wins and how many times there is a tie.

Round	Player A	Player B	Tie
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
<b>Total</b>			

2) Create a probability tree showing all possible outcomes. Then answer the questions below.

3) How many different combinations or outcomes are possible?

4) How many ways can Player A win?

5) How many ways can Player B win?

6) How many outcomes are ties?

7) Is each outcome equally likely?

8) Is Rock, Paper, Scissors a fair game? Explain

### III. ABC Counters

You will need three counters for this activity. On the first counter, put a “A” on one side and a “B” on the other. On the second counter, put an “A” on one side and a “C” on the other. On a third counter, put a “B” on one side and a “C” on the other. In this game, all three counters are tossed. Player 2 wins if any two counters match. Player 2 wins if all three counters are different.

9) Predict whether or not this is a fair game.

10) Play twenty rounds of the game, alternating the toss between players and recording the outcome on a frequency table.

Player 1	Player 2

11) Based upon your game results, explain why you now think the game is fair or why you think it is not fair.

12) Find all possible outcomes by making a list.

13) How many outcomes are possible?

14) How many ways can Player 1 win?

15) How many ways can Player 2 win?

16) Is it possible to have a draw (no winner) in this game?

17) Is each outcome equally likely?

18) Is the game fair or unfair? Explain.

19. Express the probability for each player to win as a probability ratio and as a percent.

20. Compare the theoretical and experimental results.