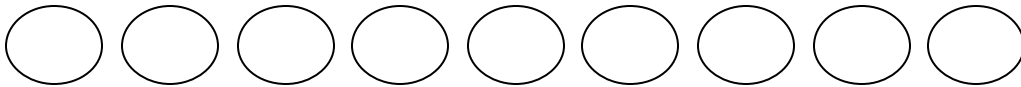


Problem of the Month

Game Show

Level A:

On television there is a new game show called *Take Two*. The game is played with two players. There are nine coins lined up in a row.



Each player takes turns. On a turn a player must take two coins away. So the game starts with the first player taking away two coins. Then it is the other player's turn. The second player takes two coins away. The game continues with alternate turns. The player who can't pick up exactly two coins loses. If there is only one coin left when it is a player's turn then the player whose turn it is loses. The other player wins.

Which player do you want to be, the first player or the second player?

Explain your choice.

Is this a fair game? Why or why not?

Level B:

Many viewers complained about the game show called *Take Two*. So the producers changed the show's name and rules. The new show is called *Pick Up Coins*.

They also changed the number of coins from 9 to 22 and changed the rules so on a turn a player could choose to pick up either one coin or two coins.

So the new rules are: Start with 22 coins. Each player takes turns. On a turn a player must take either one or two coins away. Then it is the other player's turn. The second player takes either one or two coins away. The game continues with alternate turns. The player who picks up the last coin loses. The other player wins.

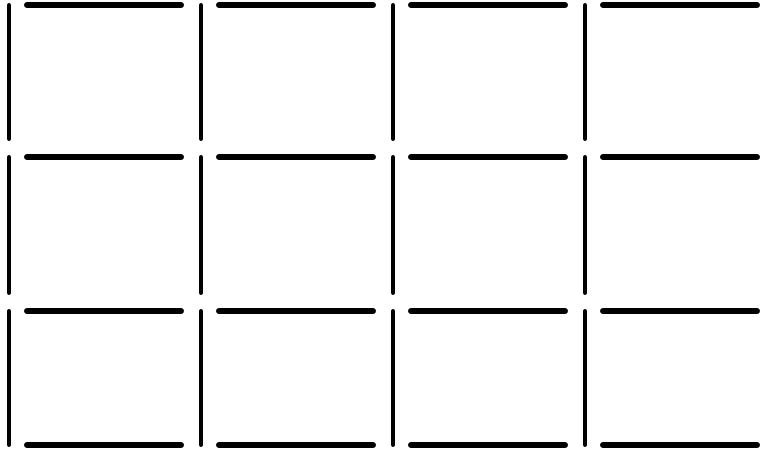
Determine a strategy for playing this game.

Explain a strategy that may ensure you win the game.

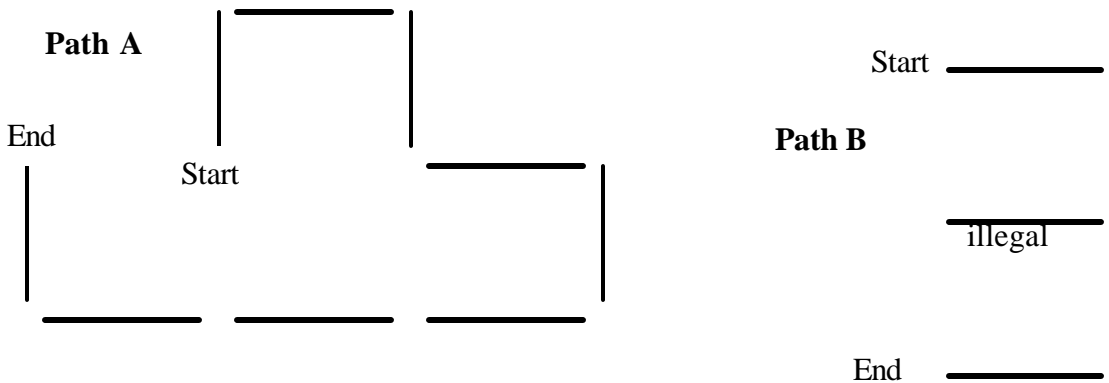
Is this a fair game? Explain your reasoning.

Level C:

The game show *Pick Up Coins* is getting top ratings. So the rival network has begun a new show called *Pick Up Sticks*. The game starts with an arrangement of 31 sticks in a 3 by 4 rectangular shaped grid as shown below:



The game is played by two players who alternately take turns. A turn consists of picking up sticks along a path. During any one turn, a player may start wherever they like and pick up as many sticks as he or she wishes as long as the sticks follow a path. A path is a sequence of adjacent sticks, starting at one end of the stick, leading to a stick at the opposite end, and so on. For example, path A is legal and path B is illegal because the path has been retraced.

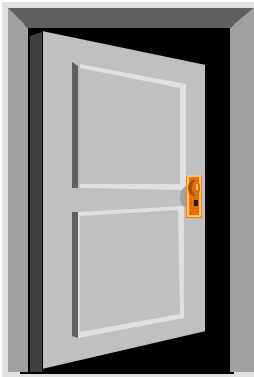


The winner is the player who picks up the **last stick!**

Determine a strategy for playing this game. Should you start first or second? Explain a method for ensuring you win.

Level D:

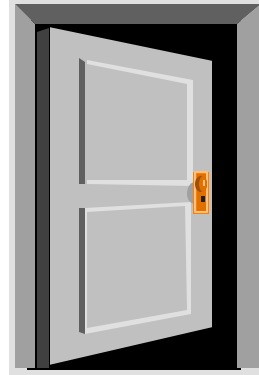
It's time to play *Let's Make It Real* hosted by Mighty Fall.



Door 1



Door 2



Door 3

As you know, there are three doors. Behind one door is a fabulous prize. Behind the other two doors are bogus prizes. When you pick the first door another door will open and show you a bogus prize, leaving the door you picked and the third door closed. You once again pick one of the two closed doors. You will either get the fabulous prize or the bogus prize.

Determine the best strategy for winning the fabulous prize.

Explain using mathematics why your strategy is the best.

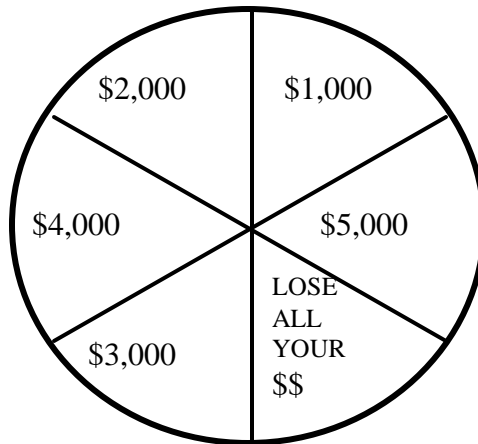
Level E:

“Hi, I’m Pat Saywhat and this is Banana and welcome to

WHEEL OF TORTURE!

Today we have several contestants who will try their luck and risk their earnings to become today’s Big Wheel winner. (Crowd roars)

The rules of the game are quite simple. We have several contestants backstage in soundproof booths. One by one we will invite a contestant to come out and try their luck at the Big Wheel. As you can see our Big Wheel has six equal sectors (pie shaped regions). In each of the sectors is a dollar amount, except for one that is labeled, LOSE ALL YOUR \$\$”.



“A contestant may spin the wheel as many times as she or he would like until either she or he decides to stop and keep the money or the big wheel lands on LOSE ALL YOUR \$\$\$. If that happens the contestant loses the game, but we have some very nice consolation prizes. The outcome of each player’s turn is unknown to the other contestants, so each player must use the best strategy, since she or he is not aware of what has transpired prior to her/his turn. After the last contestant has completed her/his turn at the Big Wheel, the player with the most money wins the game and keeps all the money. (Crowd roars) Banana, I sure hope these contestants have come up with a sound mathematical strategy!”

Use your knowledge of mathematics to determine the optimum strategy to use to play the game. Describe your strategy. Please instruct a player of the steps to follow in playing the game and at what point to stop and keep the cash. Explain the reasoning behind your game strategy. What mathematics did you use to arrive at your game strategy? Why do you believe that it is the best possible strategy?

Problem of the Month

Game Show

Primary Version Level A

Materials: Nine chips or tokens for each group.

Discussion on the rug: (Teacher starts a discussion about fair games) "What makes a game fair? Tell us about a game that is unfair." (Teacher demonstrates how to play the game with two players) "Each player picks up two coins on each turn. If you can't pick up two coins, then the game is over. The last player to pick up two coins is the winner."

In small groups: (Each group plays the game several times. Have the pairs switch who starts first. After the games, the teacher polls the class and records the outcomes for the entire class)

"Which player has the best chance of winning? Does the same player always win?"

"Explain why you think it happens."

(Teacher asks the following questions)

"Is this a fair game?"

"Why this game is fair or not fair?"

"How could you change this game to make it better?"

(At the end of the investigation have students either discuss or dictate a response to the summary questions above)