

## 1 Introduction

Welcome to the first Pleasanton Math Circle (PMC)! Today we will be exploring some math and logic games. Feel free to ask a teacher if you need some help. We will be going over some of these questions throughout the class as well.

## 2 Warm Up\*

This is a magic square—the numbers in each row, column, and diagonal have to add up to 2.

	4	-7	6
	5		
8			-3
		7	-4

## 3 Think Outside the Box\*

1. How can you add eight 8's to get the number 1,000? (only use addition)
2. Two fathers and two sons sat down to eat eggs for breakfast. They ate exactly three eggs, each person had an egg. The riddle is for you to explain how.

## 4 The River

A farmer is trying to cross a river. He is taking with him a rabbit, carrots and a fox, and he has a small raft. He can only bring 1 item a time across the river because his raft can only fit either the rabbit, the carrots or the fox. But, the rabbit wants to eat the carrots, and the fox wants to eat the rabbit. How does he bring all 3 of the items across the river?

## 5 3 Musketeers\*

Three guys rent a hotel room for the night. When they get to the hotel they pay the \$30 fee, then go up to their room. Soon the bellhop brings up their bags and gives the lawyers back \$5 because the hotel was having a special discount that weekend. So the three lawyers decide to each keep one of the \$5 dollars and to give the bellhop a \$2 tip. However, when they sat down to tally up their expenses for the weekend they could not explain the following details:

Each one of them had originally paid \$10 (towards the initial \$30), then each got back \$1 which meant that they each paid \$9. Then they gave the bellhop a \$2 tip. HOWEVER,  $3 \bullet \$9 + \$2 = \$29$

The guys couldn't figure out what happened to the other dollar. After all, the three paid out \$30 but could only account for \$29. What happened?

## 6 Knights, Knaves, and Spies

There are three people (Alex, Brook and Cody), one of whom is a knight, one a knave, and one a spy. The knight always tells the truth, the knave always lies, and the spy can either lie or tell the truth.

- Alex says: "Cody is a knave."
- Brook says: "Alex is a knight."
- Cody says: "I am the spy."

Who is the knight, who the knave, and who the spy?

## 7 Dark Coins

You have just found a treasure chest that has 100 coins in them. Congratulations! One side of the coin is gold and the other side is silver. Currently there are only 20 coins that have the silver side facing up. There is a tricky dragon guarding the treasure and will only allow you to take all the coins if you create 2 piles that each have an equal amount of silver facing coins. The tricky dragon turns off the light so you can no longer see the color of the coins. How is it possible to do what the dragon says?

## 8 Challenge: Autobiographical Numbers

Autobiographical numbers are a special kind of numbers that describe themselves.

Lets look at the autobiographical number 1210. Start off by numbering the position each digit is in, starting from 0. In the image below, the positions are in the red box.

The first digit(1) tells us how many 0's there will be in our number, the seconds digit(2) tells us how many 1's there will be in our number, the third digit(1) tells us how many 2's will be in our number, and so on. For this example there is one 0, two 1's, one 2, and 0 3's. There are some special characteristics about autobiographical numbers. Lets look at some.



1. What is the sum of the digits in the autobiographical number 1210? How about the sum of the autobiographical number 3211000? What do you notice?

Now that you know a bit about auto biographical number here is your challenge. You are trying to get into a secret room that has a secret treasure inside. There is a 10 digit pass code that you need to unlock in order to enter. You over heard a someone say that the pass code is an autobiographical number. Find the code.

0	1	2	3	4	5	6	7	8	9
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>