

## 1 Introduction

Welcome to Pleasanton Math Circle (PMC)! Today we will be playing some math and logic games, and we hope you have fun!

## 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 Photo Time!

It is time for beginning of the year photos for the yearbook! The photographer wants 6 students(Lex, Ann, Jem, May, Bob, and Sam) to line up tallest to shortest where the tallest person is at the far left and the shortest is at the far right. Find the order (tallest to shortest) given these conditions.

- Lex is shorter than Sam and Lex is closer to Sam than she is to Ann
- Jem is taller than Sam and Jem is closer to Ann than Bob is
- Ann is 3 places to the right from May

- May is taller than Lex and Sam is next to Ann
- Bob is obviously taller than the students to below him but is not shorter than the person above him. Yet he is not first in line either.

Hint: Start off by understanding how the last condition is possible.

## 7 Seems Difficult, But Is It?

The following questions seem like they would take forever to solve, but they actually don't. Instead of writing out all the numbers or possibilities, try finding patterns!

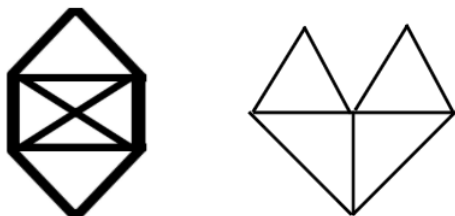
- What digit is the most frequent between the numbers 1 and 1,000 (inclusive)?
- What digit is the least frequent between the numbers 1 and 1,000?
- What is the sum of all the whole numbers from 1 to 350?

## 8 The Faulty Scale

You are given 12 identical coins and are asked to find the counterfeit. You know that the fake coin weighs slightly less than the others but the difference is too insignificant to feel with your hand. You are provided with a very precise but old scale that breaks after three uses. How do you figure which is the counterfeit coin?

## 9 Connect the Dots

Try to draw the following images without lifting your pencil off of the paper or retracing an existing line.



Now try connecting all the dots on a 3x3 grid only using 4 lines.

## 10 The 24 Game

Try to make 24 with the given four numbers. You can only use each number once, and you can only use addition, subtraction, multiplication, and division. Here's an example: 1,1,4,6

$$6 * 4 * 1/1 = 24 \quad (1)$$

Your turn!

- 1,3,4,6
- 3,6,6,11
- 3,5,7,13
- 2,5,5,10
- 2,3,5,12