# 1   Introduction

Welcome to the first Pleasanton Math Circle (PMC) meeting of the year! We are so excited to finally be in-person this year and we can't wait to work with all of you! Today we will be working on several logic puzzles and riddles.

2   Warm-up Puzzles

1. Using only addition, how can you add eight 8's to get the number 1,000?

2. Kevin, Joseph, and Nicholas are 3 brothers. If all of the following statements are true, which of them is the youngest?
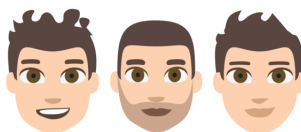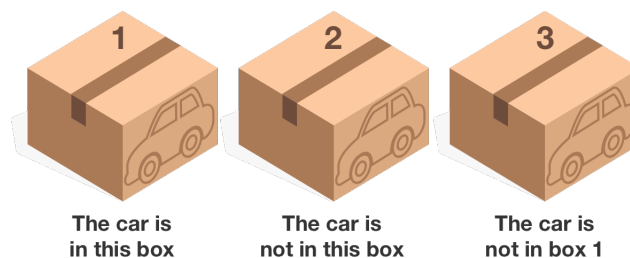
   - Kevin is the oldest.
   - Nicholas is not the oldest.
   - Joseph is not the youngest.

3. 5 brothers compare their heights and find that:

   - Alex is taller than Brian but shorter than Charlie.
   - Daniel is taller than Edward but shorter than Alex.

   Who is the tallest brother? Who is the second tallest?

4. Cornwallis, Geoffrey, and Markett are outside the Pearly Gates discussing theology. One of them is an angel who always tells the truth, one of them is a demon who always lies, and one of them is a spirit who can either tell the truth or tell a lie.

   - Cornwallis says: "I am a spirit."
   - Geoffrey says: "Cornwallis is a demon."
   - Markett says: "Geoffrey is an angel."

   Who is the spirit?

5. In the below image, a cube is painted so that each side is a different number. If each of the colors 1, 2, 3, 4, 5, and 6 are to be used, then what side is opposite the side colored 2?

Perspective 1   Perspective 2   Perspective 3
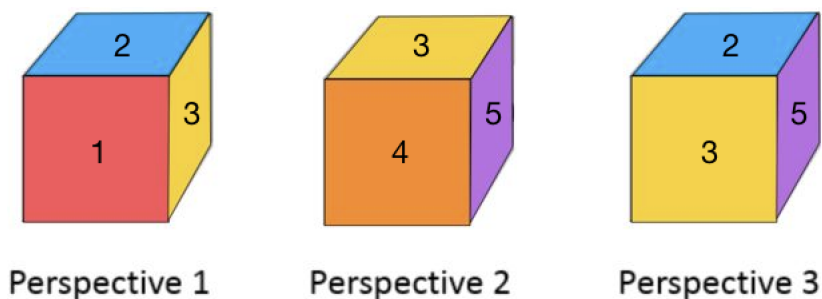
3   Truth or Lie?

1. Only **one** of the below statements is true! Where is the car?

The car is in this box   **The car is not in this box**   **The car is not in box 1**

2. You walk into the forest and find a lion and a tiger. The lion lies every Monday, Tuesday, and Wednesday. The unicorn lies on Thursdays, Fridays, and Saturdays. The lion tells you, "Yesterday I was lying." The unicorn says, "I was too." What day is it today?

3. (2010 AMC 10) In a magical swamp there are two species of talking amphibians: toads, whose statements are always true, and frogs, whose statements are always false. Four amphibians, Brian, Chris, LeRoy, and Mike live together in this swamp, and they make the following statements.

   Brian: "Mike and I are different species."

   Chris: "LeRoy is a frog."

   LeRoy: "Chris is a frog."

   Mike: "Of the four of us, at least two are toads."

   How many of these amphibians are frogs?

4   Burning a Rope

You have a lighter and two ropes. Each rope burns up in 60 minutes from end to end. The rope does not burn evenly, so this does not mean that half of the rope burns in 30 minutes, for example.

1. How can you measure 120 minutes with these ropes and a lighter?

2. How can you measure 30 minutes with these ropes and a lighter?

3. **(Hard)** How can you measure 45 minutes with these ropes and a lighter?

5   Standing in a Line

1. I am standing in a line of people. The person standing right in front of my friend, who is two spots ahead of me, sees that there are twice as many people behind him as there are in front of him. If I am sixth in line, how many people are in this line?

2. I am standing in a line of people, and I am wearing a hat. The person in the front of the line is not wearing a hat. Each person in this line **can only see the person directly in front of them and whether or not the person is wearing a hat**. Can a hat-wearing person see a non-hat wearing person (Everyone is either wearing a hat or not)? Why?

3. **(Hard)** Three people are in a line. They are all blindfolded and hats are placed on their heads, chosen from three black hats and two white hats. The extra two hats are hidden then the blindfolds are removed. The person in the back of the line can see the hats on the first and second person. The person in the second spot can see what hat the person in the front is wearing. When the person in third place is asked what color hat he is wearing, he says he does not know. When the person in second place is asked the same, he says he does not know. What color is the hat on the first person?

4. **(Hard)** Ten people are standing in a line. Everyone is either wearing a red hat or a blue hat. Each person in this line **can see every person in front of them in the line and what color hats those people are wearing**. First, the tenth person in the line is told to guess what color hat they are wearing. If the person guesses their hat color correctly, the team will have 1 point. If the person guesses their hat color incorrectly, the team will have 0 points. Then, the ninth person guesses the color of their own hat. If the ninth person guesses their hat color correctly, the team will get one more point, but if the guess is incorrect, the team's amount of points stays the same. This process continues for every person in the line until the front of the line, where the team is awarded 1 point if a person's guess is correct and no points if the guess is incorrect. How can the team guarantee to get at least 9 points?