

# Fresno Math Circle

## Preview Problems for Math Circle Helpers

Name: \_\_\_\_\_

- These preview problems are similar to those we do in our Math Circle meetings. In addition, we play various math games and do fun hands-on group activities.
- Spend as much time as needed on these problems. For each problem, explain how you solved it (and show your calculations), and write your answer in the answer box. Please provide good and clear explanations in full sentences. We would like to see your reasoning, not just a correct answer.
- Have fun! If you enjoy working with kids and solving problems and puzzles like these, you will definitely enjoy helping with the Fresno Math Circle.
- Please send your work to [fresnomathcircle@gmail.com](mailto:fresnomathcircle@gmail.com) no later than 1 week after the application date. Please write “Student Helper Application” in the “Subject” line of your e-mail. Your work will be reviewed along with the application form.

1. Three water pipes are used to fill a swimming pool. The first pipe alone takes 8 hours to fill the pool, the second pipe alone takes 12 hours to fill the pool, and the third pipe alone takes 24 hours to fill the pool. If all three pipes are opened at the same time, how long will it take to fill the pool?

Answer:

2. Patrick likes to construct sequences by multiplying the terms by a certain number. For example, one day he started with 1 and multiplied by 3, so he got the sequence

$$1, 3, 9, 27, 81, 243, \dots$$

He also recently learned about base 5, so today he decided to construct his sequence in base 5. He started with  $3_5$ , and multiplied each term by the same number. The first five terms of his sequence are:

$$3_5, 11_5, 22_5, 44_5, 143_5.$$

What are the next three terms?

Answer:

3. How many ways are there to arrange a tetrahedron, a cube, an octahedron, a dodecahedron, and an icosahedron in a row on a shelf so that the tetrahedron and the cube are next to each other?

Answer:

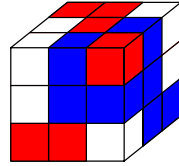
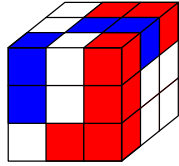
4. At the end of a math camp, participants were exchanging their phone numbers. Zack wrote his new friend Jack's phone number on a piece of paper, which later got wet and two digits were no longer legible. He could only read the following:

5 5 9 1 3 5 2 \_ \_ 0.

However, Zack remembered Jack telling him that his phone number was divisible by both 4 and 9. In the worst case how many numbers will Zack have to dial to reach Jack? In other words, how many numbers of the form 5 5 9 1 3 5 2 \_ \_ 0 are divisible by both 4 and 9?

Answer:

5. Math Circle participants built a  $3 \times 3 \times 3$  cube out of 27 small cubes, 9 of which are red, 9 are blue, and 9 are white. Two views of this cube are shown below. What is the color of the small cube in the center (and thus not visible in either of the pictures)?



Answer:

6. In this puzzle, each letter represents a digit. If a letter appears more than once in one puzzle, then it represents the same digit in all of those instances. However, different letters represent different digits. Determine the value of each letter.

$$\begin{array}{r} D O S \\ D O S \\ + T R E S \\ \hline S I E T E \end{array}$$

Answer: