

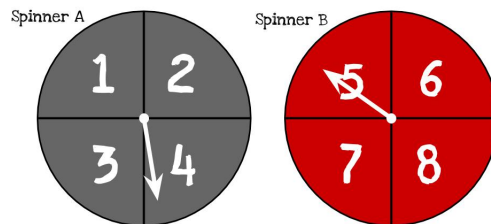
# 2020 Team Math Attack Contest

## Team Contest

December 12, 2020

### 1 Easy

1. A 1 GHz processor can run 1 billion operations in 1 second. How many operations can it run in 1 hour?
2. Joe has two spinners labeled A and B. As shown, Spinner A is split into four equal sections, labeled with 1, 2, 3, and 4, while Spinner B is split into four equal sections labeled with 5, 6, 7, and 8. To create a two digit number, he spins Spinner A to obtain the value of the ten's digit, and then spins Spinner B to obtain the one's digit. What is the probability that the number Joe gets is a multiple of 3?



3. Point A(2,5) and B(6,5) and C(6,8) form a triangle on a grid. Calculate the product of the side lengths of the triangle.
4. In 2019, 72 students were enrolled in the geometry class. 59 were enrolled in the algebra class. If 34 were enrolled in both, how many students in total were enrolled in these math classes?
5. Alex is planning on starting a company called Cai Foundations, and he had \$2673 before borrowing some money from the bank. After borrowing money, he spent  $\frac{1}{2}$  of his money on company resources,  $\frac{1}{4}$  of his money on renting a facility, and  $\frac{1}{6}$  of his money on hiring new workers. Afterwards, he had exactly the same amount of money remaining as the amount that he borrowed from the bank. How much money did he borrow from the bank?

## 2 Medium

- The sum of 2025 and a non-zero perfect square results in a new perfect square. Find the smallest possible value of the new perfect square.
- Stefanie flips a coin five times and records the results. What are the chances that she lands more than one tail?

Use the following information for questions 9 and 10.

Reverse polish notation is a different way of writing mathematical expressions. Instead of going in between the numbers, the operators come directly after. That is, "1 3 +" is equivalent to  $1 + 3$ , and "4 3 6 / -" is equivalent to " $4 (3 6 /) -$ " which is equivalent to  $4 - \frac{3}{6} = 3.5$ .

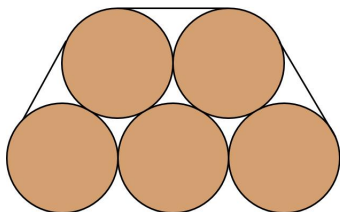
- Evaluate "4 1 3 / 1 2 / - /".
- Using the numbers 1, 3, 4, and 6 in any order, you can form the number 24 using the elementary operations of
  - Addition (+)
  - Subtraction (-)
  - Multiplication (\*)
  - Division (/).

Express your solution in the form  $abcdijk$ , where  $a, b, c,$  and  $d$  form some ordering of 1, 3, 4, and 6, and  $i, j,$  and  $k$  are each one of  $+, -, *,$  or  $/$ , corresponding to the operations above, such that the expression "a b c d i j k" equals 24 using reverse polish notation.

- How many different ways can you rearrange the letters in "MATHATTACK" if 1) the vowels must be together and 2) the letters C and K must NOT be together?

## 3 Hard

- Five circular logs of the same size are tied together using a piece of rope as shown. If the length of the rope is  $85 + 17\pi$  inches, what is the radius of each log in inches?



12. The first term of a sequence is AB. To create each subsequent term, each A in the term before is replaced with AB, and each B in the term before is replaced with BAB. The first three terms of the sequence are below. Find the number of B's in the eighth term.
- (a) AB
  - (b) ABBAB
  - (c) ABBABBABABBAB
13. Varth Dader is building the biggest Steath Dar ever seen in the galaxy. To do this, he instantaneously creates 2020 self-replicating drones. Each hour, each drone produces 2019 replicas of itself.
- After 1 week of replication, Varth needs to hide the drones from the Emperor. He has drone docks which can fit exactly 2021 drones each. If he hides as many drones as possible in his docks, how many drones will be left over?
14. Suppose that you're an eccentric chef at a restaurant! For dinner, you decide to prepare some soup. In front of you, you arrange some number of cans of Campbell's soup in a grid on the floor with  $m$  rows and  $n$  columns, where both  $m$  and  $n$  are less than 1000 because your restaurant is not large enough to house more soup and  $m$  is less than  $n$ . You soon realize that you have too many cans of soup, so you remove 32 rows and 32 columns from your grid of cans of soup. You are now left with 2021 cans of soup, the perfect amount for today's restaurant orders! Knowing this, find  $m + n$ .
15. A group of soup-loving pirates happened to stumble upon a giant grid of soup cans. The first pirate said, "We should split the cans all equally, and there will be 2 cans left over." The second pirate said, "We can kick out Johnny because they didn't swab the deck yesterday, and then we'll be able to split the cans evenly." The third pirate, who was practicing to be a mathematician, said, "In fact, we can take out any number  $n$  pirates except for  $n = 3$  and  $n = 5$  and still end up with an even split."
- What is the least number of pirates in the group?