Name: _____ Score: _____ / 160

Grade: _____ Team: _____

This is a round consisting of 10 challenging problems to be done in 30 minutes. You may communicate and discuss problems with people on your team. Problems are in roughly ascending difficulty, and each problem is worth 16 points. Any figures in the test may not be to scale.

No aids are permitted aside from pencils, pens, and provided scratch paper. In particular, no calculators or other computers are permitted. Communication with other people on your own team is allowed.

Record your answers in the box corresponding to the correct problem. Only answers printed in the boxes below will be scored.
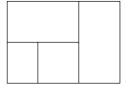
## Your Answers

| 1. | 3. | 5. | 7. | 9. |
|----|----|----|----|----|
| 2. | 4. | 6. | 8. | 10. |

1. How many rectangles can be traced along the edges in the figure?



2. In a football field, Julia stands exactly 15 meters east of Gómez. Julia knows that Gómez will run directly south at a rate of 4 meters per second, and wants to tackle him in exactly 5 seconds. At what speed, in meters per second, must Julia run to catch up with Gómez?

3. In the addition problem below, different letters represent different digits. What is the four-digit number WINM? (M and W are not 0.)

$$
\begin{array}{ccccc}
 & W & I & N \\
+ & M & N & W \\
\hline
W & I & N & M \\
\end{array}
$$

4. A very productive hamster eats broccoli, runs on a wheel, and writes novels. For every broccoli she eats, she runs 5 loops on the wheel. Every 14 loops she runs, she gathers the inspiration to write one novel. If she doesn't complete a novel when a day ends, she continues writing the same one the next day. If the hamster eats 10 broccoli in a day, how many novels will she write in a week?

5. Allan is playing the new hit game Wordle, where he tries to guess a 5-letter word. A "word" can be any combination of distinct letters, and no letters are repeated (it can't be something like CLASS). The answer "word" does not have to be a real word. When a correct letter in the correct place is guessed, it turns green. When a correct letter in the wrong place is guessed, it turns yellow. A letter that does not show up anywhere in the correct word does not change color. Allan has guessed the following two words:

M A T H S
B O A T S

How many possible 5-letter "words" could be the answer?

6. Tic-tac-toe is a game where two players take turns marking the 9 spaces in a square grid with X or O. If the player who uses "X" goes first, how many different possibilities are there for the configuration of a tic-tac-toe board after 3 total turns? Configurations created by rotation and reflection are counted as different.

7. A factor, also known as a divisor, is a number that divides into another number. For example, 3 is a factor of 672 because $3 \times 224 = 672$. What is the smallest positive integer that has the same number of factors as 2022?

8. Jonathon and Mary ran a 12-mile marathon, starting with the same speed. At the 4-mile and 8-mile marks, Jonathon tripled his speed. At the 3-mile, 6-mile, and 9-mile marks, Mary doubled her speed. By the last mile of the race, Jonathon was running at 9 times his original speed while Mary was running at 8 times her original speed. Let $\frac{a}{b}$ be Mary's average speed divided by Jonathon's average speed expressed as a fraction in simplest form (Average speed is distance traveled divided by time taken). What is $10000a + b$?

9. In the afternoon, a customer enters a sushi store and demands a "jumbo" sushi roll from the chef. An advertisement for jumbo sushi reads, "A jumbo sushi roll has 116% more volume than a regular sushi roll, and is 1.5 times as tall!" If the diameter of regular roll is 5 cm, how much longer, in cm, is the diameter of a jumbo roll? Assume both jumbo and regular sushi rolls are cylinders.

10. Anna draws two straight lines randomly across a circular wooden table, and then cuts the table into pieces along those lines. The probability that the table is cut into exactly three pieces can be expressed as the simplified fraction $\frac{p}{q}$. What is $100p + q$?