

# MATHSCOUNT<sup>®</sup>

## 2023 Mock National Competition Target Round problems 1-8

Name \_\_\_\_\_

### DO NOT BEGIN UNTIL YOU ARE INSTRUCTED TO DO SO.

This section of the competition consists of eight problems, which will be presented in pairs. Work on one pair of problems will be completed and answers will be collected before the next pair is distributed. The time limit for each pair of problems is six minutes. The first pair of problems is on the other side of this sheet. When told to do so, turn the page over and begin working. This round assumes the use of calculators, and calculations also may be done on scratch paper, but no other aids are allowed. All answers must be complete, legible and simplified to the lowest terms. Record only final answers in the blanks in the left-hand column of the competition booklet. If you complete the problems before time is called, use the remaining time to check your answers.

*The ZeMC competition series is made possible by the contributions of the  
following problem-writers and test-solvers:*

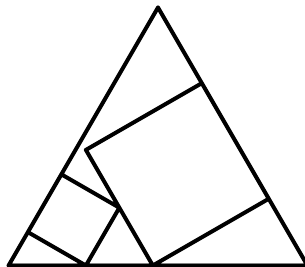
Anchovy, asbodke, bissue, Geometry285, iamhungry, ihatemath123,  
Jiseop55406, kante314, Olympushero, peace09, P\_Groudon, and  
Significant.

1. \_\_\_\_\_ Edward runs at a pace of  $x$  minutes per kilometer. He walks twice as slow as he runs, at a pace of  $x$  kilometers per hour. What is  $x$ , to the nearest hundredth?

2. \_\_\_\_\_ A list of positive integers has a mean of 3, a median of 3 and a unique mode of 4. What is the minimum possible sum of all the elements in this list?

3. \_\_\_\_\_  $\text{units}^2$

Two squares are inscribed in an equilateral triangle, as shown below. If the squares have areas of 12 and 27, what is the area of the triangle? Express your answer in simplest radical form.

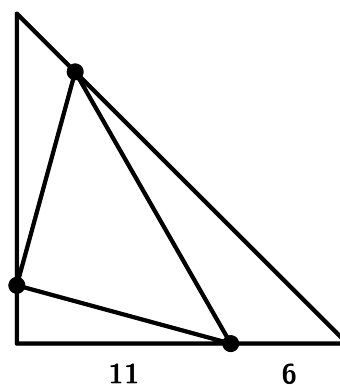


4. \_\_\_\_\_

Alex and Oron are playing a game. They take turns rolling a fair six sided die, with Alex going first. If the sum of all the previous rolls ever equals a multiple of 7, the game ends. The last person to roll the die loses, and the other person wins. What is the probability that Alex loses the game? Express your answer as a common fraction.

5. \_\_\_\_\_ units<sup>2</sup>

Inside a right isosceles triangle, a smaller right isosceles triangle is inscribed, as shown below. What is the area of the smaller right isosceles triangle?



6. \_\_\_\_\_

Let  $a$ ,  $b$ ,  $c$ ,  $d$  and  $e$  be positive real numbers such that the following system of equations is satisfied:

$$\begin{cases} 19abc &= a + b + c \\ 15bcd &= b + c + d \\ 7cde &= c + d + e \\ 9dea &= d + e + a \\ 16eab &= e + a + b. \end{cases}$$

What is  $a \times b \times c \times d \times e$ ? Express your answer as a common fraction in simplest radical form.

7. \_\_\_\_\_ : \_\_\_\_\_ AM

Cara and Mara leave their house at 9:30 AM to walk to the library. They travel at constant, but different rates. Cara arrives at the library first, at 10:00 AM. As soon as she arrives, she turns around and walks in the other direction along the same route, meeting Mara at 10:05 AM. The two girls then walk together at Mara's pace to the library. What time do they arrive at the library?

8. \_\_\_\_\_

Geoff draws a 3 by 4 grid of squares. Then, inside each square, he draws an arrow pointing up, right, down or left. Call a square *pointed to* if an arrow in an adjacent square points to it. How many ways can Geoff draw the arrows such that every square is pointed to?

(For example, every square is pointed to in the 2 by 2 grid on the left, while the top left square is *not* pointed to in the 2 by 2 grid on the right.)

