

Odle Math Club
2022-2023 Mathcounts Team Selection Test

Target (Problems 1-2)
6 minutes

Write your four-digit unique ID legibly and neatly on the line below. If you are unsure of your ID, please call a proctor for assistance. Do not write any other identifying information.

ID: _____

Instructions:

DO NOT BEGIN UNTIL YOU ARE INSTRUCTED TO DO SO.

The target consists of 4 sets of 2 problems each. You will have 6 minutes to complete each set. You **are** allowed to use calculators, but no books or other aids during this test. Calculations may be done on scratch paper. All answers must be complete, legible, and simplified to lowest terms. Round answers as instructed. Record only final answers **in the provided box**, which you will see once the test begins. If you complete the problems before time is called, use the remaining time to check your answers.

On this test, units are not required, but **must be correct if written**. Answer only in the unit that the question suggests. For instance, if the question asks for the answer in kilograms, the answer “3000 grams” will not be accepted even if it is correct.

Remember to write your ID on this sheet. **Do not write your name.** All answers must be written legibly or they may be graded incorrectly. Coaches retain the discretion to disqualify any individual who fails to comply with procedure.

DO NOT FILL OUT THE SCORING BOXES BELOW.

Total Points	Scorer's Initials

Problem 1. I have a 2022-sided dice with the numbers 1 through 2022 written on the sides. The dice is fair, so each number has an equal chance of showing up. If I roll the dice five times, what is the probability that I roll an even number all five times?

Write your answer to Problem 1 in the box below.

Problem 2. Lance has a set of three numbers, S , and notices that the mean, median, and unique mode are all the same! Moreover, every number in S is a positive integer between 1 and 100, inclusive. How many sets S satisfy these conditions?

Write your answer to Problem 2 in the box below.

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Target (Problems 3-4)
6 minutes

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On this test, the required unit for the answer is included in the answer blank. The plural form of the unit is always used, even if the answer appears to require the singular form of the unit. The unit provided in the answer blank is the only form of the answer that will be accepted.

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Problem 3. Julian starts at 0 meters on a number line. Every day, he moves either one meter to the left or one meter to the right. How many different locations could Julian be at after 2023 days?

Write your answer to Problem 3 in the box below.

Problem 4. Lucas is teaching a class and wants to make some money. So, for every letter that a student says, they have to pay a certain amount, with “A” costing 1 cent, “B” costing 2 cents, and so on. Only the standard 26 letters cost money. If Justin, a very confused student, screams:

$$\underbrace{AAA \cdots A}_{26} A \underbrace{AAA \cdots A}_{26} B \underbrace{AAA \cdots A}_{26} C \cdots \underbrace{AAA \cdots A}_{26} Y \underbrace{AAA \cdots A}_{26} Z \underbrace{AAA \cdots A}_{26} A,$$

what is the smallest amount of coins (penny, nickel, dime, quarter) he can use to pay Lucas? (The word that Justin says is just the alphabet, except we insert 26 consecutive A’s in between letters and at the beginning and end).

Write your answer to Problem 4 in the box below.

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Target (Problems 5-6)
6 minutes

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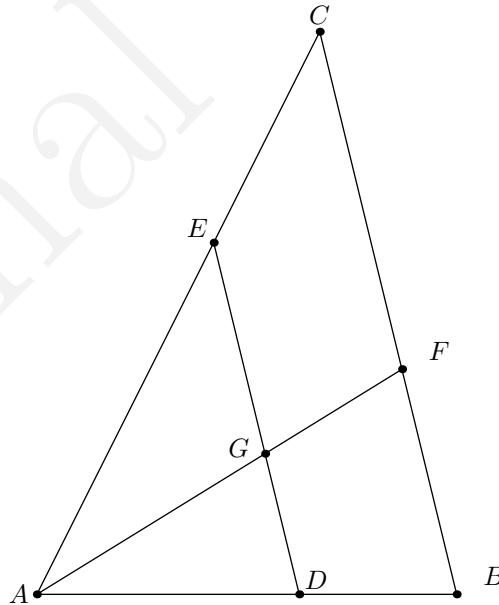
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Total Points	Scorer's Initials

Problem 5. A certain frog is trying to puff up into a very large sphere. If air weighs 1.2 kilograms per cubic meter, how many grams heavier, to the nearest gram, will the frog get when expanding from a sphere of radius 1 meter to a sphere of radius 2 meters?

Write your answer to Problem 5 in the box below.

Problem 6. Suppose we have a triangle ABC with $AB = 8$ and $AC = 12$. Let D and E be on AB and AC respectively, so that $AD = 5$ and $AE = \frac{15}{2}$, let F be on BC so that AF is an angle bisector, and let AF intersect DE at G . What is the ratio $\frac{[BDGF]}{[AGE]}$, where $[AGE]$ denotes the area of polygon AGE ?



Write your answer to Problem 6 in the box below.

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Target (Problems 7-8)
6 minutes

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Problem 7. A positive integer n is *delicious* if $1^1 + 2^2 + \cdots + n^n$ is divisible by 3. Find the value of the 2022nd smallest delicious number.

Write your answer to Problem 7 in the box below.

Problem 8. Define the *factorial function* of n , denoted $\partial(n)$, as the sum of the factorials of the digits of n . For example, $\partial(2022) = 2! + 0! + 2! + 2! = 7$. There are four positive integers such that $\partial(\partial(n)) = n$ and $\partial(n) \neq n$. Given that $n = 871$ is one of them, compute the sum of the other three.

Write your answer to Problem 8 in the box below.