EMCC 2025

Accuracy Test

January 25, 2025

Do not open the booklet until you are instructed to do so.

This is the Accuracy Round of the EMCC. There are 10 problems, worth 9 points each, to be solved in 45 minutes. There is no penalty for guessing. As with all other rounds, calculators, graph paper, lined paper, rulers, protractors and compasses are prohibited.

The answer to a problem may not necessarily be an integer. See the provided *Acceptable Forms of Answers* sheet for a breakdown of correct and incorrect ways to express an answer.

The opposite side of this page contains the answer form. Once you are instructed to begin the test, tear this page off of the booklet. At the conclusion of the Accuracy Round, only this page will be collected. Anything written elsewhere on the booklet will not be read or scored.

Best of luck!

Name: _____ **Team:** _____

ID #: ___ ___ ___ - ___ ___

Accuracy Test Answer Form

Tear this page off the rest of the booklet; this is the only sheet of paper that will be collected. Make sure that all identifying information has been filled in on the other side of this page.

Please write legibly!

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

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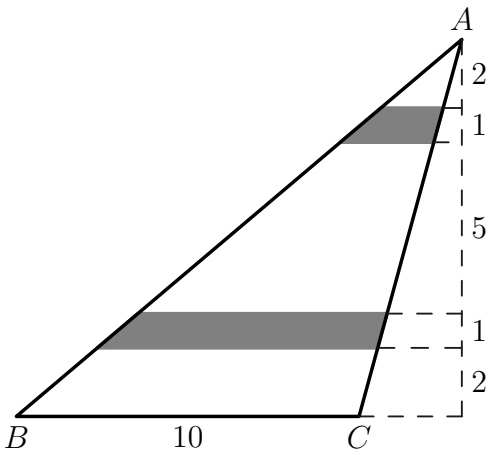
January 25, 2025

There are 10 problems, worth 9 points each, to be solved in 45 minutes. Answers must be simplified and exact unless otherwise specified. There is no penalty for guessing.

1. What is the integer k in the equation below?

$$2025^{2025} = (20 + 25)^k$$

2. In triangle ABC with $BC = 10$, Benny draws four lines parallel to BC, dividing the triangle into 5 stripes, with widths as shown in the diagram. He then shades in two of these stripes, as shown. What is the total area of the shaded regions?



3. Alexandra and Barbara go to a party. Alexandra counts that $\frac{3}{5}$ of the people other than herself are wearing a black shirt, while Barbara counts that $\frac{5}{8}$ of the people other than herself are wearing a black shirt. How many people are at the party in total?

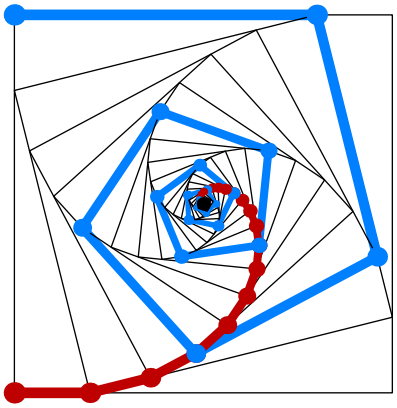
4. The six-digit base-two integer $ABCDEF_{\text{two}}$ and the six-digit base-ten integer $ABCDEF_{\text{ten}}$ are both multiples of 6. What is the value of the six-digit base-six integer $ABCDEF_{\text{six}}$, expressed in base ten?

5. If
$$0.01 \times 0.02 \times \cdots \times 0.99 \times 1.00 = 0.\overbrace{00\ldots0}^{42\text{ zeroes}}\overbrace{933\ldots864}^{k\text{ digits}},$$
what is k?

6. Six equilateral triangles are drawn in the coordinate plane such that each triangle has a side parallel to the x-axis. Given that a finite number N of points lie on two or more of the triangles' perimeters, what is the maximum possible value of N?

7. A room contains one person. Then, fifty more people come in, one by one. Each person entering the room forms a friendship with one person already in the room, at random. Once everybody is in the room, what is the expected number of people with exactly one friend? (None of the people are initially friends.)

8. In the diagram below, an infinite sequence of nested squares is drawn such that the areas of the squares form a geometric sequence. The highlighted red and blue infinite spirals have lengths of 2 and 11, respectively. What is the side length of the largest square?



9. The intersection between a plane and a cube is a convex pentagon $ABCDE$ satisfying $AB = BC = 10$, $CD = AE = 8$, and $DE = 3$. What is the surface area of the cube?

10. There exists a polynomial P of degree 124 with real coefficients such that for $i = 1, 2, \ldots, 125$, the sum of the coefficients of

$$\underbrace{P(P(P(\ldots(P}_{i \text{ instances of } P}(x))))$$

is $\frac{1}{i+1}$. If $|P(2)|$ can be expressed as $\frac{m}{n}$ for coprime integers m and n, what is the largest nonnegative integer k for which 2^k divides n?