Central Jersey Mathematics League Contest

[Problems]

September 17, 2025

Name: _____ Score: _____

School:

__ Bridgewater-Raritan HS

__ Colonia HS

__ East Brunswick HS

__ Edison Academy Magnet HS

__ Edison HS

__ Highland Park HS

__ Hillsborough HS

__ J.F. Kennedy HS

__ Metuchen HS

__ Middlesex HS

__ Monroe Twp. HS

__ Montgomery HS

__ South Plainfield HS

__ Union County AIT

__ Union County AAHS / APA

__ Union County Magnet HS

__ Union County Vo-Tech HS

__ Other

Directions:

Put all significant work related to the solution of the problem in the space provided, and place the final answer on the indicated line.

Note: Depending on the wording of the problem, answers may be required in specific format.

Always leave answers in simplest form: specifically, in your answer the following are required:

1. Fractions will be reduced ($\frac{4}{8}$ is not acceptable)
2. Denominators will be rationalized ($\frac{1}{\sqrt{3}}$ is not acceptable)
3. Radicals will be simplified ($\sqrt{18}$ is not acceptable)
4. Like terms will be combined ($2x + 3x$ is not acceptable)
5. Trigonometric functions of special right angles will be evaluated ($\sin\frac{\pi}{2}$ is not acceptable)
6. Log expressions with a rational result will be simplified ($\ln e$ is not acceptable)

Decimal answers must be exact. Never approximate π or radicals.

Although the problems vary in difficulty, in scoring, each problem has an equal value of one point and no partial credit is given.

1. If k, m, and n are positive numbers, and k is m percent of n, what percent of m is nk?

Answer: _____

2. Find the maximum number of points of intersection among three circles and two lines in the same plane.

Answer: _____

3. There are 13 weights on the table, stacked in a row and ordered by their mass (the lightest is on the left, and the heaviest is on the right). It is known that the mass of each weight in grams represents an integer, the masses of two neighboring weights differ by no more than 5g, and the sum mass of all weights does not exceed 2025g. Find the maximum possible mass of the heaviest weight.

Answer: _____

4. Four vertices of a square grid where each square is 1by1, have been chosen to form a parallelogram. It turns out that neither the parallelogram's sides nor its interior contain any other vertices of the grid, and it is known that the parallelogram is not a rectangle. Find the area of the parallelogram.

Answer: _____

5. Emma took the word $GEOMETRY$ and replaced each of its eight letters with a number corresponding to the code $A = 1, B = 2, \dots, Z = 26$. Then she multiplied six of these numbers to get a cube of an integer. Find this integer.

Answer: _____

6. Calculate the sum
$1^2 + 2^2 - 3^2 - 4^2 + 5^2 + 6^2 - 7^2 - 8^2 + 9^2 + 10^2 - \cdots - 2023^2 - 2024^2 + 2025^2$.

Answer: _____

7. Find real a such that one solution of $x^2 - (3a + 2)x + 2a - 1 = 0$ is greater than 1 and the other solution is less than 1?

Answer: _____

8. Solve $\sqrt{x - 4} + \sqrt{x + 1} + \sqrt{2x} - \sqrt{33 - x} > 4$. Find the sum of all integer solutions.

Answer: _____

9. A coloring of the number in the set $\{2;\ 3;\ 4,\ \ldots\ ,\ n\}$ in blue and red is called a "good" one if the product of every two (maybe equal) red numbers is blue, and the product of every two (maybe equal) blue numbers is red. Find the largest n for which "good" coloring exists.

Answer: _____

10. In a right triangle ABC, angle B is a right angle. Point M is located on line AB (M is not the midpoint of line AB), and it is known that $AM = BC$. Point N is located on line BC, and it is known that $CN = MB$. Find the measurement of an acute angle between line AN and line CM.

Answer: _____