

Central Jersey Mathematics League Contest

[Problems]

December 10, 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. Find the sum of all 3-digit numbers divisible by 7.

Answer: _____

2. If $f(x) = \frac{x+1}{x-1}$ and $f(a) = 5$, what is the value of $f(2a)$?

Answer: _____

3. Drew is skiing faster than Victor but slower than Evan. They all simultaneously started from point A , moving in the same direction along a circular path and stopped when all three were at point B . During this time, Evan passed Victor 13 times (not including the final stop). Find the total number of overtakes.

Answer: _____

4. It is known that $a_1, a_2, \dots, a_n$ form an arithmetic sequence and $a_3 + a_9 = 8$. Find $a_1 + a_2 + \dots + a_{11}$.

Answer: _____

5. In a right triangle ABC where angle C is a right angle, the angle bisector of angle A intersects the leg $\overline{CB}$ at point D . A segment that connects point D with a point of intersection of the medians, is perpendicular to $\overline{CB}$. Find the measure of angle B .

Answer: _____

6. Two different integer numbers m and n are such that $(\frac{1}{m} - 2)$ and $(\frac{1}{n} - 2)$ are integer solutions of $x^2 + ax + b = 0$ with integer coefficients a and b . Find all possible values of $a + b$.

Answer: _____

7. Solve for x : $3(\log_2(\sin x))^2 + \log_2(1 - \cos 2x) = 2$ for $0 \leq x < 2\pi$.

Answer: _____

8. The lengths of the diagonals of a rhombus are in a ratio 3 : 4. How many times is the area of a rhombus larger than the area of the circle inscribed in it? Express as a ratio.

Answer: _____

9. If $f(x) = mx + b$ for $m < 0$ and $f(x) = 4f^{-1}(x) + 3$, what is $m + b$?

Answer: _____

10. Find all values of b such that $\frac{x^2 - (3b - 1)x + 2b^2 - 2}{x^2 - 3x - 4} = 0$ has exactly one real solution.

Answer: _____