

Central Jersey Mathematics League Contest

[Problems]

November 12, 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. The managing partner of a business is to receive a bonus equal to 20% of the profit after deducting the bonus. This year, the profit before deducting the bonus is \$18,000. Find the amount of the bonus, in dollars.

Answer: _____

2. Every day, an engineer commutes by train to the city where he works. At 8:30 am, as soon as he gets off the train, a car arrives to pick him up and take him to the plant. One day, the engineer takes a train arriving earlier, and starts walking toward the plant. He meets the car on its way to pick him up. He gets in, and he arrives at the plant 10 minutes earlier than he usually arrives. What time does the engineer meet the car? Present your answer as time in hh:mm format.

Answer: _____

3. If it is known that $\log 2 = a$ and $\log 17 = b$, find $\log_5(5.78)$. Express your answer in terms of only a and b .

Answer: _____

4. Find the area of a triangle given that two of its sides are 1 and $\sqrt{15}$, and the median dropped to the third side is 2.

Answer: _____

5. In a sequence $\{x_n\}$, it is known that $x_1 = 20, x_2 = 17, x_{n+1} = x_n - x_{n-1} (n \geq 2)$. Find x_{2025} .

Answer: _____

6. Find all values of a , such that the system $\begin{cases} x^2 + y^2 = z \\ x + y + z = a \end{cases}$ has one real solution.

Answer: _____

7. Find all three-digit numbers $\overline{LOM}$, consisting of different digits L , O , and M , for which $(LOM) = (L + O + M)^2 + L + O + M$.

Answer: _____

8. In triangle ABC , points D and E are located on $\overline{AC}$ and $\overline{BC}$, respectively. $\overline{AE}$ and $\overline{BD}$ intersect at F . Find the area of triangle CDE , if the areas of triangles ABF , ADF , and BEF are 1 , $\frac{1}{2}$, and $\frac{1}{4}$, respectively.

Answer: _____

9. For every x , where $x \neq 0$ and $x \neq 1$, function f satisfies $(x - 1)f(x) + f(\frac{1}{x}) = \frac{1}{x-1}$. Find $f(\frac{2024}{2025})$.

Answer: _____

10. Solve for x : $81^{\sin^2 x} + 81^{\cos^2 x} = 30$, where $0 \leq x < \pi$.

Answer: _____