**AMTNJ High School Contest 48 Problems January 21, 2026**

## Directions:

- Your answers should be in the form specified in the problem to receive credit. Approximate answers must be at least three decimal places rounded or truncated (ex: $\frac{2}{3} \approx 0.666$ *or* $0.667$), and exact answers must be in simplest form (ex: $\frac{5}{15}$ will not be accepted for $\frac{1}{3}$, and $\sqrt[3]{48}$ will not be accepted for $2\sqrt[3]{6}$).
- Only **scientific calculators** are allowed on this contest.
- Do **NOT** use calculators that**:**
  can access the internet,
  can communicate with other devices,
  store programs, formulas, or notes,
  use a computer algebra system
  have dynamic geometry software
- You may write on this contest and use additional paper you receive from your teacher, but you should write your answers on the **Individual Student Cover Page** to be official and receive credit.
- You will have exactly 45 minutes to complete the 9 problems in this contest.
  Work carefully and with accuracy.

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## Problems:

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1. If a is an integer, and if both roots $x^2 + ax + 17 = 0$ are positive integers, what is the value of a?

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2. What is the minimum value of $|x + y + z|$, given that $|x| = 2027$, $|y| = 2028$ and $|z| = 2029$.

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3. All five sides of a *Pythagorean Pentagon* have integral lengths, and the sum of the squares of the lengths of the four smallest sides is equal to the square of the length of the longest side. What is the least possible perimeter of a Pythagorean Pentagon?

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4. For all real numbers x, the function f is periodic, with $f(x + 6) = f(x + 10) = f(x)$ If $f(22) = 22$, what is the value for $f(44)$?

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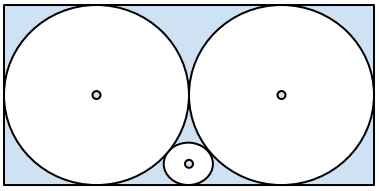
5. As shown below, two congruent circles are inscribed in a rectangle so that each is tangent to three sides of the rectangle and to the other circle. A third circle, smaller than the other two, is tangent to both congruent circles and one side of the rectangle. If the area of each congruent circle is $64\pi$, what is the area of the small circle?



6. What are all the pairs of positive integers (a,b) for which $a^2 + b$ exceeds $a + b^2$ by 36?

7. Factor $x^4 + 4$; that is, write $x^4 + 4$ as a product of two quadratic polynomials with integral coefficients.

8. A bag of 5 apples, 7 bananas and 3 carrots cost \$4.41; and a bag of 6 apples, 2 bananas and 1 carrot costs \$2.37. At these prices, how much should a bag of 3 apples, 17 bananas, and 7 carrots cost?

9. The cost (in cents) of n candies is equal to the number of candies that I can buy for 98 cents. At the same cost per candy, how many cents do 14 candies cost?