8th Grade Individual

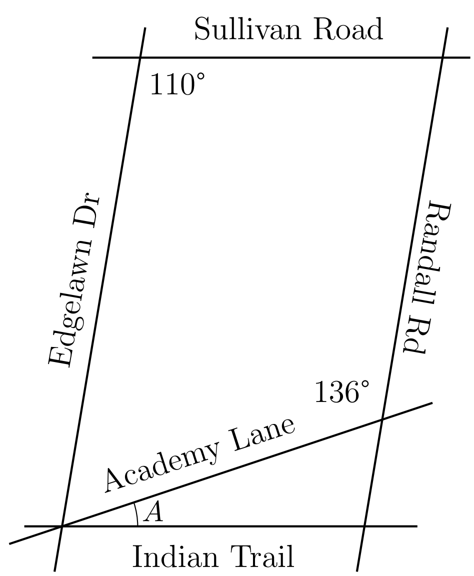
IMSA *Mu Alpha Theta*

June 7, 2026

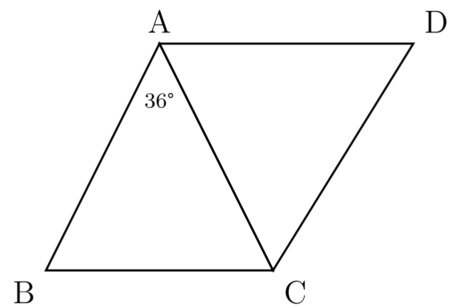
1. What is $(2 + 0 \times 2 + 5) + (2 \times 0 + 2 \times 6)$?

2. Sonit is designing a triangular sail for his ship. Two of the edges of the sail have lengths 3 and 4, and the third length is an integer. What is the largest possible length that the third side can be?

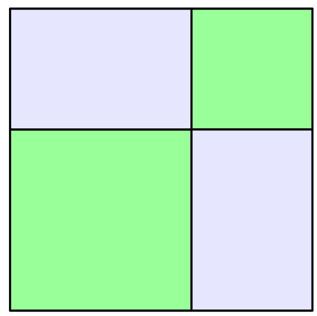
3. In the following road map, Sullivan Road, Edgelawn Drive, Randall Road, and Indian Trail form a parallelogram. The city proposes adding Academy Lane, which will intersect Indian Trail and Edgelawn Drive, as shown below. Based on the diagram, what is the measure of angle A?



4. A quadrilateral is created by drawing an isosceles triangle and an equilateral triangle that shares a side with one of the legs of the isosceles triangle. If the vertex of the isosceles triangle has angle 36°, what is the value of the largest angle in this quadrilateral?



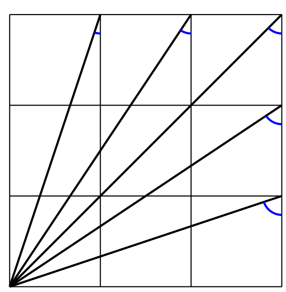
5. A square enclosure of area 169 m^2 consists of two square gardens and two congruent rectangular water fixtures. If the total area of the water fixtures is 84 m^2, what is the ratio of the smaller garden's area to the larger garden's area?



6. Roy is looking for a polynomial of degree three, $f(x)$. He knows that 3, 5, and 7 are roots of this polynomial. If $f(4) = 6$, what is $f(2)$?

7. Let a, b be two real numbers such that $a+b = 13$ and $ab = 17$. Find the value of $\frac{1}{a}+1+\frac{1}{b}$, and express your answer as a simplified fraction.

8. What is the sum of the angles indicated in the following 3x3 square grid, in degrees?



9. An isosceles triangle with legs of length $70\sqrt{2}$ and base of length $112\sqrt{2}$ has area equal to the surface area of a cube C. What is the length of one of the sides of cube C?

10. Eric is picking candy from some bowls. Each bowl is assigned a number 0 to 100, and Eric will only take candy from a pair of bowls m, n if they satisfy $mn + 7m + 6n = 6$. What is the sum of all possible m and n? **Hint**: $(m+1)(n+1) = mn+m+n+1$. How can you rewrite the given equation in a similar way?

11. Let $x = \cfrac{1}{2+\cfrac{1}{0+\cfrac{1}{2+\cfrac{1}{6+\cfrac{1}{2+\cfrac{1}{0+\cfrac{1}{2+\cfrac{1}{6+\cfrac{1}{\cdots}}}}}}}}}$. We can rewrite this in the form $ax^2 + bx + c = 0$, where a, b, and, c have no common factors. What is $a + b + c$? Hint: What is $\cfrac{1}{2+\cfrac{1}{0+\cfrac{1}{2+\cfrac{1}{6+\frac{1}{x}}}}}$?

12. A triangle is said to be magical if its perimeter P satisfies the inequality $P^2+14P+63 < 239$. How many magical isosceles triangles can be made with only positive integer side lengths?

13. An audience is seated in rows of 9 chairs, in which all even-numbered rows are empty and all odd-numbered rows are filled from least row number to greatest. When Eric adds up the row number of every occupied chair, the sum is 561. How many people are in the audience? You might find it useful that the sum of the first n odd numbers is equal to n^2.

14. The floor of a number $\lfloor x \rfloor$ is equivalent to the greatest integer less than or equal to x. (Ex, $\lfloor 3.2 \rfloor = 3$. Roy is tutoring two students. When he gives student A a math problem n seconds after the session begins, it takes them $\lfloor \frac{n}{60} \rfloor$ seconds to solve it. When he gives student B a math problem n seconds after the session begins, it will take them $\lfloor \frac{60-3n}{60} \rfloor$ seconds to solve the problem. What is the minimum amount of time Roy should wait after the class starts to ensure that it takes Student 1 and Student 2 the same amount of time to solve the problem?

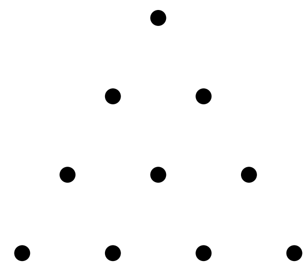
15. Triangle ABC has sides of length 5, 5, and 6, and has an area of 12. The side length of the largest possible square that can be inscribed in triangle ABC can be written as the simplified fraction $\frac{a}{b}$. What is $a - b$?

16. Sonit is thinking of a number S. He tells Eric that when S is divided by 13, the remainder is 1, and when S^2 is divided by 8, the remainder is odd. How many possible numbers between 1 and 1000, inclusive, could Sonit be thinking of? **Hint:** Consider the two cases when S is odd and when S is even. Try rewriting S in terms of another variable.

17. Quadrilateral $ABCD$ is inscribed inside of a circle O of radius 5. The diagonals AC and BD intersect at point E such that $EO = 3$ and $AB = 2CD$. If the segments AE and BE are used to form a right triangle, what is the length of the hypotenuse? Hint: Another form of Power of a Point says that in this case, $EO^2 - r^2 = -AE \cdot CE$.

18. Kelsie is shading a big target-shaped design made of many rings in alternating colors. She shades the first ring from radius 0 to 1 red, the second ring with radius 1 to 2 blue, the third ring from radius 2 to 3 red, the fourth blue, and so on. Kelsie keeps shading rings until the total red area is at least 2025π. What is the least number of rings needed to make this happen?

19. 3 points are randomly chosen from below. What is the probability that they form a right triangle?



20. Kalyan likes counting hours on the clock. He wants to predict what time it would be if he counts in n-time, specifically counting hours by $11^n + 5^n$. Kalyan starts at 12:00. If he counts 2-time, or $11^2 + 5^2 = 146$ hours, for example, he ends at 1:00. What is the least n-time, with $n > 3$, such that Kalyan is back at 4:00?