2026 IC Math Exploration Day Team Competition

1. What is the sum of every multiple of 7 from 1 to 2026?

2. The Giant Pacific Octopus has (like most octopi) has eight arms with large suction cups arranged in two rows along each arms. Each row contains 100 - 140 suction cups. What is the difference between the maximum total number of suction cups and minimum total number of suction cups on such an octopus.

3. Start with $n = 10^{100}$ and compute its square root, then compute the square root of the result, then compute the square root of that result, and so on. What is the minimum number of times that you must repeatedly apply the square root to $n = 10^{100}$ in this way so that the result is less than 2?

4. Define the binary operation $*$ by $x * y = x^2 - 2y^2 + xy$. If $x * y = 22$ and $x = 8$ and y is positive, then what is the numerical value of y?

5. A bag contains 12 marbles, some of which are blue. If 6 blue marbles are added to the bag, the probability of drawing a blue marble is double what it was before. How many blue marbles were originally in the bag?

6. The minute hand on Cornell University's McGraw Tower clock is five feet long. Find the average speed of the tip of the minute hand in miles per hour. Give your answer to 4 decimal places.

7. A large bin contains 100 pounds of a dog food mix that is 50 percent beef, 30 percent chicken, and 20 percent salmon. A second mix of dog food containing 20 percent beef, 40 percent chicken, and 40 percent salmon is added to the bin. The combined mixes contains 40 percent beef. How many pounds of salmon are now in the bin?

8. How many pairs of integers (x, y) satisfy the following system of inequalities?

$$
\begin{aligned}
x + y &\leq 20 \\
y - x &\leq 10 \\
x + y &\geq 10 \\
y &\geq x
\end{aligned}
$$

9. You planted an orchard of apple trees in rows to form a square, and when you were done, you had 148 trees left over. You purchased 32 more trees and planted these and the previously leftover ones to expand the square by one more row in each direction. How many trees were planted when you were done?

10. You leave your house at 12:30pm on your bicycle traveling due west at a constant speed of 6 miles per hour. Your sister leaves your house at 1:30pm on her bicycle traveling due south at 10 miles per hour. At what time are you both exactly the same distance from your house?

11. The area of a right triangle is 330 and its hypotenuse has length 61. What is the absolute value of the difference between the two non-hypotenuse sides of the triangle?

12. The sum of the cube of a number x and the reciprocal of its cube is 7. Find the sum of x^6 and its reciprocal.

13. Consider the follow set of numbers $S = \{3, 4, 7, 4, 1, 6, 8, 13\}$. You create a new set T by adding an additional number to S. What number do you need to add so that the average of T is equal to the median of S?

14. What is the value of $\dfrac{1001! - 1000!}{999!}$?

15. For what value of t does $3^t \cdot 9^{4t} = 81^9$?

16. In the rhombus $ABCD$, we have $\overline{DE} \perp \overline{AB}$ and $\overline{EB}$ has length 4 and is 40% of the length of $\overline{AB}$. What is the area of the rhombus?
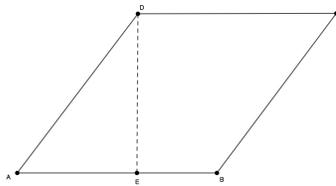
17. For how many values of b does the polynomial $x^2 + bx + 100$ have two distinct integer roots?

18. You begin an epic sneezing fit at 2:00pm one day, sneezing then and every 15 seconds thereafter. At what time do you have your 1000th sneeze?

19. Let $z = 3 + i$. If we draw, in the complex plane, the line determined by z and z^2, what purely real number, x, is on this line?

20. Four circles are tangent to each other, as in the figure below. The centers of the circles are shown. Compute the ratio of the shaded area to the non-shaded area. Express your answer in the form $\dfrac{a}{b}$, with a and b whole numbers.

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