

ITHACA COLLEGE 2009 MATH DAY COMPETITION

Please write your final answer in the box provided.

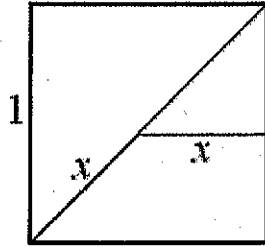
1. Human hair grows at a rate of approximately one-half inch per month. To the nearest power of 10, how many miles per hour is this?

2. Find $f\left(f\left(f\left(\frac{1}{7}\right)\right)\right)$ where $f(x)$ is defined as follows: $f(x) = \begin{cases} 2x & \text{if } 0 \leq x < \frac{1}{2} \\ 2 - 2x & \text{if } \frac{1}{2} \leq x \leq 1 \end{cases}$

3. A line segment connects the points (1,7) and (22,42) in the plane. How many points (including the endpoints) on this segment have the property that both coordinates are integers?

4. What is the sum of all the odd numbers from 1 to 2008?

5. The large square in the picture is 1 inch on a side. The point on the diagonal is equally distant from the bottom left corner and the right side. What is that distance (in inches)?

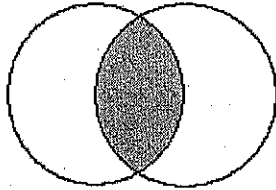


6. Stan's Algebra I test average will be an 88 if he gets a 72 on the next exam and a 91 if he gets a 90 on the next exam. If all exams are weighted the same, how many exams has Stan taken so far?

7. For what value of m will the triangle formed by the lines $y = 4$, $x = 0$, and $y = mx - 2$ have an area of 42?

8. For what value of b will $|2x - 1| = x + b$ have a unique solution?

9. Two circles of radius 1 are drawn so that each circle passes through the center of the other. What is the perimeter of the region of overlap?



10. Let operator \otimes be defined on the set $\{p, r, s, t, u\}$, and assume \otimes is associative and commutative. If $p \otimes r = s$, $p \otimes p = t$, and $r \otimes t = u$, find $p \otimes s$.

11. We just blew some air into a spherical balloon and doubled its volume. By how much did we multiply the surface area?

12. The lengths of the sides of a triangle are 8, 10, 12. Find the perimeter of a similar triangle whose area is 9 times that of the original triangle.

13. Solve $9^x - 3^x = 12$ for an expression which gives an exact solution for x .

14. On Planet Tris, which circles the star Poly, the natives use length units of dee's and doe's; one dee equals seven doe's. They don't use square units to measure area, but triangular units: this works fine, since triangles can tile the plane, and one triangular dee is exactly an equilateral triangle whose side is one dee. How many triangular doe's are there in a triangular dee?

15. Let $a * b$ be defined by $a * b = \frac{1}{a} + \frac{1}{b}$. Find the solution set for $x * (x * 1) = 2$.

16. The following is a cryptarithm: each letter stands for a digit (0 through 9), no digit is represented by two different letters, and no number can begin with a 0.

$$SQ \times LQ = RRR$$

What is the value of $S + Q + L + R$?

17. The equation $||x + 5| - 3| = c$ where c is a real number has exactly three distinct solutions. Find the value of c .

18. The following is a 5×5 Sudoku puzzle. The digits 1-5 appear exactly once in each row, each column, and each region. Which of the digits should be in the shaded square?

1				
		?	2	
				3
	4			

19. Find the last two digits of 17^{107} .

20. A triangle has sides of length 24, 10, and 26. What is the radius of the inscribed circle?