1. Find the distance $OE$ in the figure below. Note: each of the angles at A, B, C, and D are right angles.

![Diagram](image)

2. Let $x$ and $y$ be two distinct positive real numbers whose average is 13 and whose product is 144. Find $x$ and $y$.

3. Let $C$ be a circle inscribed in a square $S$. The area of $S$ is 36 square inches. What is the minimal distance from a corner of the square to the circle?

![Diagram](image)

4. Three teenagers can eat 6 pizzas in half an hour. Assuming that their friends eat at the same rate, how many pizzas can 5 teenagers eat in 90 minutes?

5. What is the last digit of $3^{118}$?
6. In the circle below, both circles are centered at the point \( O \). The segment \( AB \), which is tangent to the smaller circle, has length 20 inches. What is the area between the two circles?

![Diagram of two circles with a tangent segment AB]

7. Find the exact value of \( \sin(\tan^{-1} 3) \).

8. The sum of the \( x \) and \( y \) intercepts of the line tangent to the curve \( x^{1/2} + y^{1/2} = 4 \) at any \( x \) value in the interval \( 0 < x < 16 \) is constant. What is the value of this constant?

9. Find all values of \( x \) which satisfy the inequality

\[
\frac{x + 2}{2x - 1} < \frac{1}{3}.
\]

10. A \( 4 \times 4 \times 4 \) cube made of white Styrofoam is painted maroon, and then cut into 64 unit cubes. How many of these small cubes have paint on exactly two sides?

11. There are \( n \) people in a room. Each person shakes the hand of all the other people in the room. No one shakes hands twice with the same person. How many handshakes are there?

12. A regular \( n \)-gon is inscribed inside a circle. If the length of one side of the \( n \)-gon equals the radius of the circle, what is \( n \)?

13. The number 257 in base 10 means \( 2 \times 10^2 + 5 \times 10 + 7 \), in base 12, 257 means \( 2 \times 12^2 + 5 \times 12 + 7 \). In base \( k \) the following addition occurs. What is \( k \)?

\[
521 + 2110 = 3031.
\]

14. A gives B as many pennies as B has and C as many pennies as C has. B then gives A as many pennies as A has, and C as many pennies as C has. C then similarly follows suit. If each finally has 16 pennies, how many pennies does B start with?

15. A snowflake curve is constructed as follows: The sides of an equilateral triangle are trisected, and the middle third of the trisection serves as a base for a new equilateral triangle, following which this segment is deleted from the figure. The process is continued. If the side of the
initial equilateral triangle is of length 1, what is the area enclosed by the snowflake curve if the process is continued without end?

16. A survey of 60 freshmen business students at a large university produced the following results.

- 19 read Business Week
- 18 read The Wall Street Journal
- 50 read Fortune
- 13 read Business Week and The Wall Street Journal
- 11 read The Wall Street Journal and Fortune
- 13 read Business Week and Fortune
- 9 read all three

(a) How many read none of the publications?
(b) How many read only Fortune?
(c) How many read Business Week and The Wall Street Journal, but not Fortune?

17. Let $L$ be the line segment from $(1,1)$ to $(2,2)$. Let $S$ be the set of all points in the $xy$-plane that are within a distance of 1 from the line segment $L$. What is the area of $S$?
18. A circular table is pushed into the corner of a square room so that a point $P$ on the edge of the table is 8 inches from one wall and 9 inches from the other. Find the radius of the table in inches.

19. What is the smallest value of $y$ that satisfies the inequality

$$|4 + x| + |5 + y| \leq 100.$$ 

20. Let $f(x) = \log_5 \left( \frac{2x + 4}{3x} \right)$. Find the domain of $f$.

21. A segment of length 2 is divided into two parts such that the ratio of the larger piece to the whole equals the ratio of the smaller piece to the larger. What is the length of the larger piece?

22. Suppose the $xy$ plane represents a level floor with the units along each axis measured in inches. A ball of radius 3 inches is sitting at the origin, and is suddenly rolled along the line $y = 3x$ into the first quadrant until it strikes a vertical wall that is placed along the line $y = 20 - x$. Give the $x$-coordinate of the point on the line which lies directly below the point of contact of the ball with the wall when the ball strikes the wall.

23. A particle sits at the point in the $xy$ plane and awaits instructions. Every second, it is told to take its current coordinates $(x, y)$ and move to a new point given by

$$\left( 3 - \frac{1}{3}x + \frac{1}{4}y, 2 + \frac{1}{2}x - \frac{1}{4}y \right).$$

Where should the particle be initially if it wants to move as little as possible during the first 100 seconds?