1. Find the area of the annulus between the two concentric circles given that the length of any cord of the outer circle, tangent to the inner circle, is 40 cm.

2. Gamma rays strike a pentagonal flat surface with uniform probability. There is a disk on the surface. What should its diameter be so that the probability of striking it is 1/3?

3. How many roots in [0, 4] does the following function have?

\[ f(t) = (t^3 - 7t^2 - 34t + 40) \sin^2 \left( \frac{7t}{2} \right) \]

4. What is \( i^i \) in standard complex form? \( (i = \sqrt{-1}) \)

5. Assuming the radius of the Earth to be 1 unit, what are the Cartesian Coordinates of a location whose longitude is 30°w and whose latitude is 60° north? Assume that the equator is in the \( x - y \) plane, the \( z \) axis goes through the north and south poles, and the \( x - z \) plane passes through 0° longitude.

6. For the function \( f(x) = x^2 + 1 \), find \( f(f(\frac{1}{2})) \).

7. Find a 3rd point so an equilateral triangle is formed where two of the points are (2, 1) and (5\sqrt{3} + 2, 6)

9. In the following graph, what is the ratio of the area of triangle $T_1$ to the area of triangle $T_2$?

![Graph with triangles $T_1$ and $T_2$]

10. In the following drawing, what is the relationship between angle $\alpha$ and angle $\theta$?

![Drawing with triangle $ABC$ and angles $\alpha$ and $\theta$]

11. What is the sum of the following series?

$$41 + 45 + 49 + 53 + \ldots + 437$$

12. If $f(x) = \log \left( \frac{1+x}{1-x} \right)$ for $-1 < x < +1$ then $f \left( \frac{3x+x^3}{1+3x^2} \right)$ in terms of $f(x)$ is what?

13. The area of a rectangle remains unchanged when it is made 2 1/2 inches longer and 2/3 inch narrower, or when it is made 2 1/2 inches shorter and 4/3 inch wider. What is its area in square inches?

14. A triangle has sides with lengths of 25, 15 and 20. It is inscribed in a circle. What is the radius of the circle?