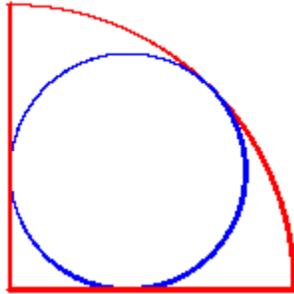


Harder Problems of the Week

Due May 28

1. Consider a quarter of a circle of radius 8. Let r be the radius of the circle inscribed in this quarter of a circle. Find r . Round your answer to the nearest integer.



2. What is the least integer value of m such that $3^m + 2^m$ is a 10-digit number?

3. If you begin counting 2 consecutive whole numbers each second, starting January 1, 2000, at 12:00 a.m., in what year will you reach 9 billions ?

4. A rectangle with vertices $A(0,0)$, $B(10,0)$, $C(10,5)$ and $D(0,5)$ is graphed in a coordinate plane. The rectangular region determined by these points is rotated 360 degrees about the y -axis forming a geometric solid. The rectangular region is then rotated 360 degrees about the x -axis forming a geometric solid. How many square units are in the positive difference between the total surface areas of these two geometric solids? The answer is $x \pi$. Find x .

5. Let ABC be an equilateral triangle. Let M, N and P be the midpoints of AB, BC and CA . Shade the triangle MNP . We completed now Stage 1. Repeat this process with each of the three remaining unshaded triangles by taking the midpoints of each side of each triangle and by shading the middle triangle. We completed now Stage 2. We have now 4 shaded triangle in total. To finish Stage 3, repeat the same process to the 9 remaining unshaded triangles by taking the midpoints of each side of each triangle and by shading the middle triangle. We have now 13 shaded triangle in total. Continuing this process, what is the number of the stages when the shaded area is first larger than 72% of the area of the original triangle?

