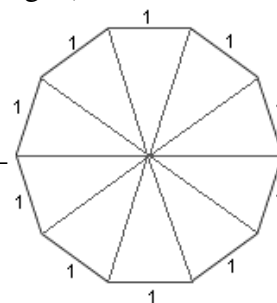


Approximating Pi

Over 1500 years ago, a gentleman in China by the name of Liu Hui calculated pi as 3.14159 by using a polygon having over 3000 sides. We are going to use some basic trigonometry and our knowledge of regular polygons to do something similar! We are going to be using a regular polygon having 3000 sides. Remember, the more sides a polygon has, the more it looks like a circle. For this activity, we are going to let each side length of our 3000-sided polygon be equal to 1.

- 1) What is the perimeter of our 3000-sided polygon? _____
- 2) What is the sum of the interior angles of the polygon? _____
- 3) What is the measure of each interior angle of the polygon? _____
- 4) If a segment is drawn from the center of the polygon to each of the 3000 vertices, the segments divide each of the interior angles in half. What is the measure of each half of the interior angle? _____

5) Doing the above divides the polygon into 3000 triangles (see example below with a decagon) where the base of each triangle is one of the sides of the 3000 polygon, and the other two sides are the segments connecting the center of the polygon to the vertex (let's call the segments the "radii" just for the sake of ease). What kinds of triangles are these? _____



6) Since these triangles are isosceles, then the (perpendicular) height of the triangle cuts the base in half and makes a right angle with the base. Using the fact that

$\cos \theta = \frac{\text{adjacent}}{\text{hypotenuse}}$, find the length of this hypotenuse. _____



7) This hypotenuse is the "radius" of the polygon! Find the length of the "diameter" of the polygon.

8) Since the circumference C of a circle $= \pi \cdot d$, and thus $\frac{C}{d} = \pi$, use #1 and #7 to find the value you get for $\frac{P}{d}$ for the 3000-sided polygon. _____

9) Hit the pi key on your calculator. What value do you get? _____.

How close are you to pi in your calculations? _____

Are you more or less accurate than Liu Hui was in his calculations? _____

*Note: Liu Hui didn't use this method to calculate pi.