Why Pi is more than 3

Pi Day Notes March 14th, 1998

At the Goudreau Museum Of Mathematics in Art and Science)

Visualizing **proportionality** and **ratio** is basic in order to understand the concept of Pi. There are many ways to visualize this.

One is to compare the lengths of the radius and circumference of any given circle. And also circles of differing sizes. This can be done with string.

Just as our hands on lesson with coffeecan covers helps us visualize that the 2 radii (or diameter) passes through the center of the inscribed hexagon, 6 chords that make up the hexagon inscribes the circle in a single rotation. We can literally see that the ratio of the perimeter of the hexagon to its diameter is exactly 1:3.

Using assorted sizes of circles, measure each diameter and circumference. You will discover that the proportion is *more than* 3. Regardless of the sizes of the circles you measure *the ratio is a* **constant**!

We express this constant, this proportionality of the circle as Pi

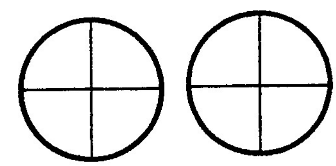
$$\text{Pi} = \frac{\text{Circumference}}{\text{Diameter}}$$

We use algebra to rewrite the formula:

Diameter Pi = Circumference

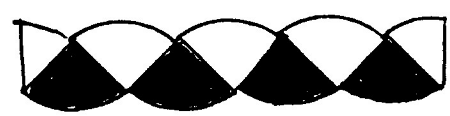
or 2 radius Pi = Circumference

Fig. 2



2 pi r + 2 pi r

Fig. 2



2 pi r (black) + 2 pi r (white)

Visualize the 4 sectors of 2 circles as in figure 2 becoming a rectangle such as seen in figure 3.

Fig. 3

Area of 2 circles
= length x width or r (2pi r)

The area of one circle = 1/2 r (2 pi r)
or rewritten as = pi r squared!

The Greek geometer Archimedes was one of the earliest to estimate pi close to our modern calculation if 3.14. He arrived at it being a fraction of approximately 3 1/7.

As with one other constant or ratio, the Pythagorean triangle, pi is not a fraction or whole number. Modern geometers have it identified as 'transcendental'. To learn more, check out a great book about this called 'A History of Pi' by Petr Beckmann, St. Martins Press, NY.