Archimedes' Recipe for Pi

One of Archimedes' many mathematical accomplishments was his computation of pi, which is the ratio of the circumference of a circle to its diameter. In this activity, you will duplicate the method he used to arrive at his estimate.

Procedure

1 Construct a data table on a sep rate piece of paper that contains the headings shown in the table below.

2 Use your compass to draw three circles on another piece of paper. Each circle can be a different size, but each should be at least 2.4 inches (6 centimeters) across.

3 Use a ruler to divide one circle into four equal pie-shape pieces. Be sure to extend your lines outside the circle. Then, using the ruler, create a square by drawing straight lines inside the circle to connect the points where the lines meet the circle.

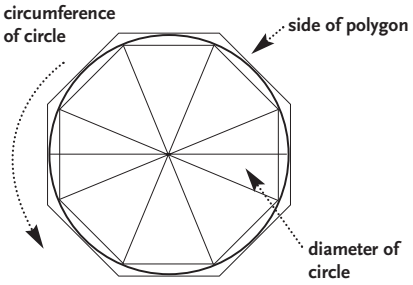
4 Connect the lines around the outside of the circle to create a second square that just touches the circle's outside edge. Make sure that the straight line for each segment touches the circle at the segment's halfway point.

5 Measure one side of the inside square. Multiply that length by the number of sides in the square (four) to find the perimeter of the inside square. Record your results in the table. Repeat the process for the outside square.

6 Use the ruler to find the diameter of the circle and record this measurement.

7 The perimeters of the squares give approximate values for the circumference of the circle. Determine the value of pi by dividing the length of each perimeter by the diameter of the circle. Record your results for both the inside and outside squares.

8 Repeat the process for the second circle, using octagons (eight-sided polygons) instead of squares. Make eight equal pie-shape pieces. Then



repeat the process again for the third circle, using hexadecagons (16-sided polygons).

Questions

Write your answers on a separate piece of paper.

1 The actual value of pi to four decimal places is 3.1415. Compare the range of values you found for each set of polygons to this number. Do all three ranges include the actual value of pi? Which type of polygon gave the most accurate range of values?

2 Archimedes calculated the value of pi for polygons containing 96 sides. Do you think his calculations were more or less accurate than yours? Explain.

Polygon Name	# of Sides	Length of Side (in cm)		Perimeter of Polygon (= number of sides x length of 1 side)		Diameter of Circle (in cm)	Value of Pi (=perimeter/diameter)	
		inside polygon	outside polygon	inside polygon	outside polygon		inside polygon	outside polygon
Square	4							
Octagon	8							
Hexadecagon	16							