Exploring Pi with Archimedes

To find the decimal value of π, Archimedes use inscribed and circumscribed polygons to approximate the circumference of a circle. In this activity you will follow in his footsteps to discover π for yourself. Use what you know about special right triangles to answer find the perimeters and areas below. Note that the radius of the circle is the radius of the inscribed polygon and it is also the apothem of the circumscribed polygon.

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**For the each of the regular polygons to follow, you will be finding the perimeter and area. For the triangles, squares, and hexagon, use what you know about special right triangles to find the missing radii and apothem lengths.**

**Regular Triangle:**

1. Find the perimeter of the
	1. Inscribed Triangle:
	2. Circumscribed Triangle:
	3. Average these to approximate the Circumference:
	4. Divide the circumference by 2 (since the diameter is 2) to get your pi approximation
	 π≈
2. Use $A=\frac{1}{2}a∙P$ to find the area of the
	1. Inscribed Triangle:
	2. Circumscribed Triangle:
	3. Average these to approximate the area of the circle:

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**Regular Quadrilateral:**

1. Find the perimeter of the
	1. Inscribed Quadrilateral:
	2. Circumscribed Quadrilateral:
	3. Average these to approximate the Circumference:
	4. Divide the circumference by 2 (since the diameter is 2) to get your pi approximation

	 π≈
2. Use $A=\frac{1}{2}a∙P$ to find the area of the
	1. Inscribed Quadrilateral:
	2. Circumscribed Quadrilateral:
	3. Average these to approximate the area of the circle:

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**Regular Hexagon:**

1. Find the perimeter of the
	1. Inscribed hexagon:
	2. Circumscribed hexagon:
	3. Average these to approximate the Circumference:
	4. Divide the circumference by 2 (since the diameter is 2) to get your pi approximation
	 π≈
2. Use $A=\frac{1}{2}a∙P$ to find the area of the
	1. Inscribed hexagon:
	2. Circumscribed hexagon:
	3. Average these to approximate the area of the circle:



**Now you can see the process that Archimedes went through to approximate pi. However, these approximations are still not very accurate because the polygons do not have enough sides. Let’s try one more, an inscribed and circumscribed Dodecagon (12 sides). Since these triangles are not special right triangles, use the following measurements to find the perimeters and areas.**

$$a=\frac{\sqrt{6}+\sqrt{2}}{4}≈0.965926$$$$ x=\frac{\sqrt{6}-\sqrt{2}}{4} ≈0.258819$$$$r=\sqrt{6}-\sqrt{2}≈1.035276$$$$ y=2-\sqrt{3} ≈0.267949$$

 *You can use the decimal approximates in your calculations. Don’t round off to any less than 4 digits.*

**Regular Dodecagon:**

1. Find the perimeter of the
	1. Inscribed dodecagon:
	2. Circumscribed dodecagon:
	3. Average these to approximate the Circumference:
	4. Divide the circumference by 2 (since the diameter is 2) to get your pi approximation
	 π≈
2. Use $A=\frac{1}{2}a∙P$ to find the area of the
	1. Inscribed dodecagon:
	2. Circumscribed dodecagon:
	3. Average these to approximate the area of the circle: