The Area of a Circle

“A bell cannot tell time, but it can be moved in just such a way as to say twelve o’clock. Similarly, we cannot calculate infinite numbers, but we can be moved in just such a way as to say $\pi$.”

– Daniel Tammet
Today’s Questions.

■ What is the area of a circle?
Think - Pair - Share.

Without any words or algebra, demonstrate that the two regions below have the same area.

$s = 2$

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Can you describe a general relationship between the perimeter of an $n$-sided regular polygon and a rectangle of height equal to 1?
Partners.

1. Use trigonometry to solve for \( s \) in each of the following figures.

\[
\begin{align*}
\text{Hexagon:} & \quad s \quad \text{(1)} \\
\text{Octagon:} & \quad s \quad \text{(2)}
\end{align*}
\]

2. Find a formula for \( s \), the side length of a regular polygon with \( n \) sides.

3. We saw that a regular polygon with \( n \) sides and “radius” 1 has area, \( A = n \cdot s/2 \).

\[
\begin{align*}
\text{Regular Polygon:} & \quad s \quad \text{(3)} \\
\text{Area Formula:} & \quad n \cdot s/2 \quad \text{(4)}
\end{align*}
\]

Write a formula for \( A \) in terms of \( n \) using your answer to (2).

4. **Challenge:** Evaluate the limit: \( \lim_{n \to \infty} A \).
Today’s Questions.

- What is the area of a circle?
- Why do I care?