

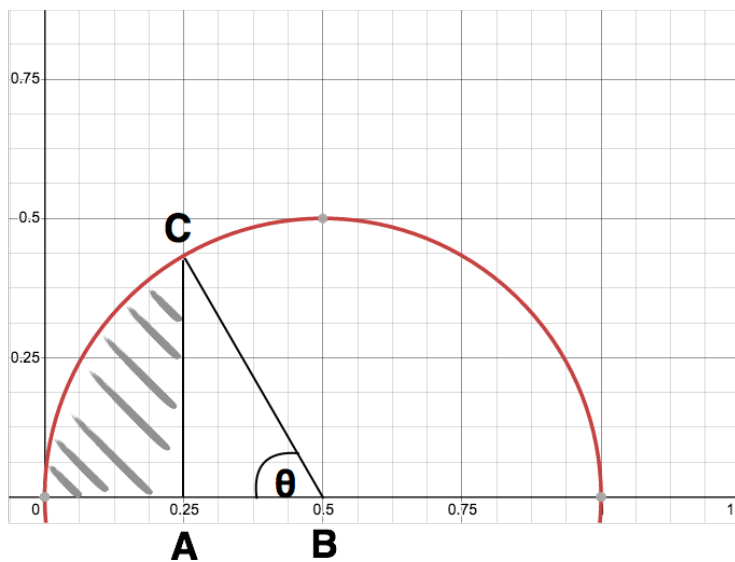
# NEWTON'S APPROXIMATION FOR PI

In 1666 Newton found Pi to 16 decimal places by evaluating the first 22 terms of this sum:

$$\pi = \frac{3\sqrt{3}}{4} + 24 \left( \frac{1}{12} - \frac{1}{5 \times 2^5} - \frac{1}{28 \times 2^7} - \frac{1}{72 \times 2^9} \dots \right)$$

**Where does this sum come from? Why does it give Pi?**

Newton generated this expression for Pi by considering the shape below. His method revolved around **finding the shaded area below using two different methods.**



We can find the shaded area with **integration**.

Alternatively, we can find the shaded area with **geometrical methods**.

We can then equate the two expressions for the shaded area and re-arrange to find an expression for Pi.

**Task:** Can you follow in Newton's footsteps and derive the expression for Pi in this way?

**Hint:** To integrate  $\sqrt{1-x}$  first find an expression for it using the **binomial expansion**.