

Circumference: 2π

Square: 2^2 -gon

side length $s_2 = \sqrt{2}$

$$\pi_2^i = \frac{4\sqrt{2}}{2} = 2\sqrt{2} \approx 2.828\dots$$

Octagon: 2^3 -gon

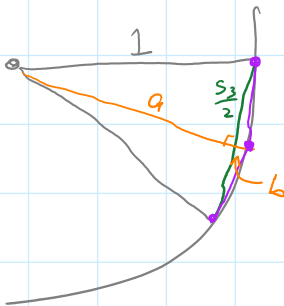
$$a = \sqrt{1^2 - \left(\frac{s_2}{2}\right)^2} = \frac{1}{\sqrt{2}}$$

$$b = 1 - a = 1 - \frac{1}{\sqrt{2}}$$

side length:

$$s_3 = \sqrt{b^2 + \left(\frac{s_2}{2}\right)^2} = \sqrt{2 - \sqrt{2}}$$

$$\pi_3^i = \frac{8s_3}{2} = 4\sqrt{2 - \sqrt{2}} \approx 3.06\dots$$



16-gon:

$$a = \sqrt{1 - \left(\frac{s_3}{2}\right)^2} = \frac{1}{2}\sqrt{2 + \sqrt{2}}$$

$$b = 1 - a$$

$$s_4 = \sqrt{b^2 + \left(\frac{s_3}{2}\right)^2} = \sqrt{2 - \sqrt{2 + \sqrt{2}}}$$

$$\pi_4^i = \frac{16s_4}{2} \approx 3.12\dots$$