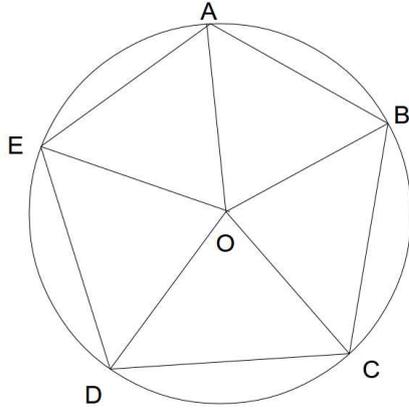


What is the area of a regular pentagon with a radius of 7?



Let us have regular pentagon ABCDE. Then if O the centre of the circle then $OA=OB=OC=OD=OE$ and for angles:

$$\angle AOB = \angle BOC = \angle COD = \angle DOE = \angle EOA$$

Then we have that corresponding triangles are equal:

$$\triangle AOB = \triangle BOC = \triangle COD = \triangle DOE = \triangle EOA$$

Thus area of pentagon equals to 5 areas of:

$$S(ABCDE) = 5S(\triangle AOB)$$

Now we must find area of $\triangle AOB$. We know that $AO=BO=7$, and from equation for angles we get that $\angle AOB = \frac{2\pi}{5}$.

$$\text{But } S(\triangle AOB) = 0.5 * AO * BO * \sin(\angle AOB) = 0.5 * 7 * 7 * \sin \frac{2\pi}{5} = 24.5 * \sin \frac{2\pi}{5}$$

And finally

$$\begin{aligned} S(ABCDE) &= 5S(\triangle AOB) = 5 * 24.5 * \sin \frac{2\pi}{5} = 122.5 * \sin \frac{2\pi}{5} = \\ &= 122.5 * \sqrt{\frac{5}{8} + \frac{\sqrt{5}}{8}} \approx 116.5 \end{aligned}$$