

Exercise 176

A total of 250,000 m² of land is needed to build a nuclear power plant. Suppose it is decided that the area on which the power plant is to be built should be circular.

- Find the radius of the circular land area.
- If the land area is to form a 45° sector of a circle instead of a whole circle, find the length of the curved side.

Solution

Part (a)

The area of a circle is given by

$$A = \pi r^2,$$

where r is the radius and $\pi \approx 3.14$. Solve the equation for r by dividing both sides by π

$$\frac{A}{\pi} = r^2$$

and then taking the square root of both sides.

$$\sqrt{\frac{A}{\pi}} = r$$

Therefore, plugging in the area of the plant,

$$r = \sqrt{\frac{250,000 \text{ m}^2}{\pi}} \approx 280 \text{ m.}$$

Part (b)

The area of a sector of a circle is given by

$$A = \frac{1}{2}r^2\theta,$$

where r is the radius and θ is the angle in radians. Solve this equation for r .

$$2A = r^2\theta$$

$$\frac{2A}{\theta} = r^2$$

$$\sqrt{\frac{2A}{\theta}} = r$$

The formula for the length of the curved side of this sector is

$$s = r\theta.$$

Therefore, substituting the formula for r ,

$$\begin{aligned} s &= \left(\sqrt{\frac{2A}{\theta}} \right) \theta \\ &= \sqrt{2A\theta} \\ &= \sqrt{2(250,000 \text{ m}^2) \left(45^\circ \times \frac{\pi}{180^\circ} \right)} \\ &\approx 630 \text{ m.} \end{aligned}$$