

Geometry of Circles

Students who successfully complete this primer will be able to:

- Calculate the area and circumference of a circle.
- Apply the relationship between the radius of a circle and an arc length.

Radius, radians, and arc length

In many physics applications, it is necessary to convert between the distance from the center of a circle, the radius r , and the distance along the circumference, called the arc length s . These two parameters are related by the angle θ swept out from the starting point of the arc, typically defined as the x -axis, and the end point ([Figure 1](#)).

Scientists and mathematicians typically measure the angle θ in radians rather than degrees, which is defined as

$$\theta(\text{radians}) = \frac{s}{r} \rightarrow s = r\theta$$

This second formula is another way to write the definition of circumference with s being an arc that comprises an entire circle and r being the radius of the circle. That means that 2π must be the angle of the entire circle:

$$\theta_{\text{full circle}} = 2\pi \text{ radians} = 360^\circ$$

In fact, the radius of a circle can be thought of as a conversion factor between the angular position θ and the arc length s :

$$1 \text{ radius} = 1 \text{ radius} \left(\frac{2\pi \text{ radians}}{1 \text{ full circle}} \right) = 2\pi \theta$$

[Click here](#) to watch a video that walks through the geometry of circles, including a worked-out example. Then answer the questions that follow.



Part C - Determining arc length

What is the length of an arc on a circle of radius 30.0 cm when $\theta = 60^\circ$?

Express your answer (in cm) to three significant figures.

[Hint](#)

s =cm

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