

4.1 Angles & Their Measure

ESSENTIAL QUESTIONS

How do we

1. convert angles to degrees/minutes/seconds,
2. convert degrees \Leftrightarrow radians,
3. find circular arc lengths
4. solve problems involving angular & linear motion?

In geometry, we solved problems involving angles measured in degrees.

Each degree of an angle can be divided into 60 minutes, and each minute can be divided into 60 seconds.

$$\begin{aligned} 1^\circ &= 60' \\ 1' &= 60'' \end{aligned}$$

How many seconds are in 1° ?

Convert from DMS (degrees/minutes/seconds to decimal form.

1. $35^\circ 24' 45''$

2. $12^\circ 30' 18''$

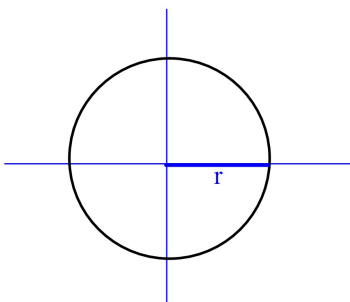
Convert from decimal form to DMS.

3. 49.7°

4. 99.37°

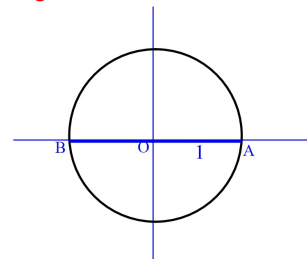
Measuring Angles in Radians

A central angle of a circle has a measure of 1 radian if it intercepts an arc with the same length as the radius.



What is the circumference of this circle?

How many degrees are in $\angle AOB$?



How many radians are in 180° ?

$$180^\circ = \pi \text{ radians}$$

Convert from degrees to radians:

1. 135°
2. 90°
3. 11.92°

Convert from radians to degrees:

4. $\frac{\pi}{4}$
5. $\frac{3\pi}{5}$
6. 1.3

Arc Length in Circles

Let θ be a central angle, **in radians**, of a circle with radius r . The length of the intercepted arc s is

$$s = r \cdot \theta$$

Find the arc length if

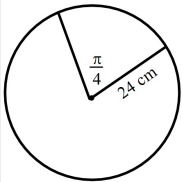
1. $r = 10$ and $\theta = \pi/6$
2. $r = 6.8$ and $\theta = 120^\circ$

Area of Sectors in Circles

Let θ be a central angle, **in radians**, of a circle with radius r . The area of the sector of the circle is

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

Find the perimeter and the area of the sector of the circle.



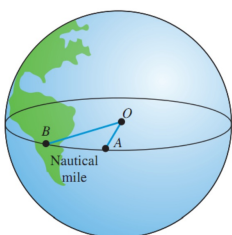
Linear and Angular Motion

Revolutions per minute

Albert Juarez's truck has wheels 36 inches in diameter. If the wheels are rotating at 630 rpm (revolutions per minute), find the truck's speed in miles per hour.

Nautical Miles

A **nautical mile** is an arc on the Earth's surface that would be the length of an arc on the equator formed by a central angle of $1/60^\circ$ (1 minute).



The arc length formula $s = r \cdot \theta$ allows us to convert between nautical miles and **statute** (regular) miles.

Megan McCarty, a pilot for Western Airlines, frequently pilots flights from Boston to San Francisco, a distance of 2698 stat mi. Captain McCarty's calculations of flight time are based on nautical miles. How many nautical miles is it from Boston to San Francisco?

$$1 \text{ naut mile} = \text{arc length } s$$

$$\text{central angle } \theta = \frac{1^\circ}{60}$$

$$\text{radius of Earth} = 3956 \text{ stat. miles}$$

