

Radians to Degrees

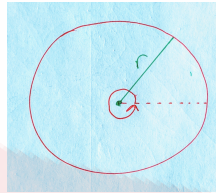
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## Change of angle: Radians to Degrees

We're used to measuring angles in degrees however, there is another measure for angles, radians. What is a radian? Let's consider a circle and it's perimeter. The perimeter of a circle is the length of the line that wraps around the circle.



The perimeter of the circle is given by  $P$  and the formula below,

$$\begin{aligned} P &= \text{length of the distance around the circle} \\ &= 2\pi r \end{aligned}$$

If we solve for  $2\pi$  we get the following,

$$\frac{P}{r} = 2\pi$$

which is the angle revolved around to go around edge of the circle one time. In degrees we know that one revolution around a circle is  $360^\circ$ . This means,

$$\begin{aligned} 2\pi &= 360^\circ \\ \pi &= 180^\circ \text{ or} \\ \pi \text{ radians} &= 180^\circ \end{aligned}$$

Given that  $\pi$  radians =  $180^\circ$  we can convert degrees to radians and vice versa. Let's consider some examples.

### Example

Convert the following radian measure to degrees.

**Solution:**

$$\frac{5\pi}{3}, \frac{\pi}{2}, -\pi, \frac{\pi}{6}, \frac{7\pi}{4}, \frac{5\pi}{7}$$

Convert  $\frac{5\pi}{3}$  radians to degrees.

$$\begin{aligned}\frac{5\pi}{3} &= x^\circ \\ \pi &= 180^\circ \\ \frac{5\pi/3}{\pi} &= \frac{x}{180} \\ \frac{5(180)}{30} &= x \\ \therefore 300^\circ &= x\end{aligned}$$

Convert  $\frac{\pi}{2}$  radians to degrees.

$$\begin{aligned}\frac{\pi}{2} &= x \\ \pi &= 180^\circ \\ \frac{\pi/2}{\pi} &= \frac{x}{180} \\ \frac{180}{2} &= x \\ \therefore 90^\circ &= x\end{aligned}$$

Convert  $-\pi$  radians to degrees.

$$\begin{aligned}-\pi &= x \\ \pi &= 180^\circ \\ \frac{-\pi}{\pi} &= \frac{x}{180} \\ \therefore -180^\circ &= x\end{aligned}$$

Convert  $\frac{\pi}{6}$  radians to degrees.

$$\begin{aligned}\frac{\pi}{6} &= x \\ \frac{\pi/6}{\pi} &= \frac{x}{180} \\ \frac{180}{6} &= x \\ \therefore 30^\circ &= x\end{aligned}$$

Convert  $-\frac{7\pi}{4}$  radians to degrees.

$$\begin{aligned}\frac{7\pi}{4} &= x \\ \frac{7\pi/4}{\pi} &= \frac{x}{180} \\ \frac{7(180)}{4} &= x \\ 7(45) &= x \\ \therefore 315^\circ &= x\end{aligned}$$

Convert  $\frac{5\pi}{7}$  radians to degrees.

$$\begin{aligned}\frac{5\pi}{7} &= x \\ \frac{5\pi/7}{\pi} &= \frac{x}{180} \\ \frac{5(180)}{7} &= x \\ \therefore 128.6^\circ &= x\end{aligned}$$

## Exercises

Convert the following to degrees.

a)  $-\pi$

f)  $\frac{7\pi}{3}$

b)  $\frac{7\pi}{2}$

g)  $\frac{5\pi}{4}$

c)  $\frac{9\pi}{5}$

h)  $\frac{\pi}{2}$

d)  $\frac{6\pi}{5}$

i)  $\frac{5\pi}{6}$

e)  $\frac{7\pi}{11}$

j)  $\frac{3\pi}{2}$