

Precalculus

Conversions between degrees and radians

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Degrees and radians

- Degrees is a unit for measuring angles, denoted by $^{\circ}$.
- The relationship between degrees and radians is:

$$\begin{aligned}\pi \text{ rad} &= 180^{\circ} \\ 1 \text{ rad} &= \frac{180^{\circ}}{\pi} \approx 57.3^{\circ} \\ 1^{\circ} &= \frac{\pi}{180} \text{ rad} \approx 0.017 \text{ rad}.\end{aligned}$$

- In other words, a half-turn is measured by $\pi \text{ rad}$ or 180° .
- Degrees are useful because the most frequently encountered fractions of a half turn are measured by a whole number of degrees.
- If a measurement unit is not specified, it is implied to be radians. For example, in $\sin 5$, the number 5 stands for 5 radians.

$$t^\circ = \frac{t}{180}\pi \text{ (radians).}$$

Example

Convert from degrees to radians.

Deg.	45°	36°	-20°	360°	-720°	-225°	2015°
Rad.	$\frac{\pi}{4}$	$\frac{\pi}{5}$	$-\frac{\pi}{9}$	2π	-4π	$-\frac{5\pi}{4}$	$\frac{403}{36}\pi$

$$x = \frac{x}{\pi}180^\circ.$$

Example

Convert from radians to degrees.

Rad.	$\frac{\pi}{3}$	$\frac{\pi}{10}$	$\frac{11\pi}{6}$	$\frac{7\pi}{4}$	$\frac{\pi}{7}$	$\frac{13\pi}{6}$	$-\frac{5\pi}{4}$	2
Deg.	60°	18°	330°	315°	$\frac{180^\circ}{7} \approx 25.7^\circ$	390°	-225°	$\frac{2}{\pi}180^\circ \approx 114.6^\circ$