

Radians

Degrees are a convenient way to measure angles in real life, but in calculus they actually make things more complicated. Instead, mathematicians measure angles using *radians*, which makes using trig functions in calculus a lot simpler.

Here is the basic idea: With degrees, we break up the unit circle into 360 parts, each one degree. That same unit circle has a circumference of 2π . Radians measure angles in terms of distance around the (unit) circle. So a full circle is 2π radians. A half circle (180°) is π radians. A quarter circle (90°) is $\pi/2$ radians.

In general, to convert from degrees to radians use the fact that 180° is the same as π radians. To convert from degrees to radians, multiply by $\pi/180$. To go the other way, multiply by $180/\pi$.

Example 1 Convert 120° to radians.

Solution: $120 \times \frac{\pi}{180} = \frac{2\pi}{3} \approx 2.09 \text{ rad}$

Example 2 Convert 2 radians to degrees.

Solution: $2 \times \frac{180}{\pi} = \frac{360}{\pi} \approx 114.6^\circ$

Exercises

1. Convert the following from degrees to radians.

(a) 45°

(b) 60°

(c) 225°

2. Convert the following from radians to degrees.

(a) 1 radian

(b) $\pi/6$ radians

(c) $7\pi/4$ radians

Answers

1. (a) $45 \times \frac{\pi}{180} = \frac{\pi}{4}$
(b) $60 \times \frac{\pi}{180} = \frac{\pi}{3}$
(c) $225 \times \frac{\pi}{180} = \frac{5\pi}{4}$

2. (a) $1 \times \frac{180}{\pi} \approx 57.3^\circ$
(b) $\frac{\pi}{6} \cdot \frac{180}{\pi} = 30^\circ$
(c) $\frac{7\pi}{4} \cdot \frac{180}{\pi} = 315^\circ$