# Periodic Functions

1 Unit Circle

The **unit circle** is the circle on a coordinate plane with center at $(0,0)$ and radius 1. The equation of the unit circle is $x^2 + y^2 = 1$. Let t be an angle centered at the origin, let the initial side be the x-axis, and the terminal side intersect the unit circle at (x, y), then

$\sin t = y$	$\csc t = \frac{1}{y}$
$\cos t = x$	$\sec t = \frac{1}{x}$
$\tan t = \frac{y}{x}$	$\cot t = \frac{x}{y}$

2 Periodic Function

Periodic function: a function f is a **periodic function** if there exists a positive real number c such that $f(t) = f(t + c)$ for all t in the domain of f. The smallest value of c for which f is periodic is called the **period** of f.

y = sin(x)

y = cos(x)
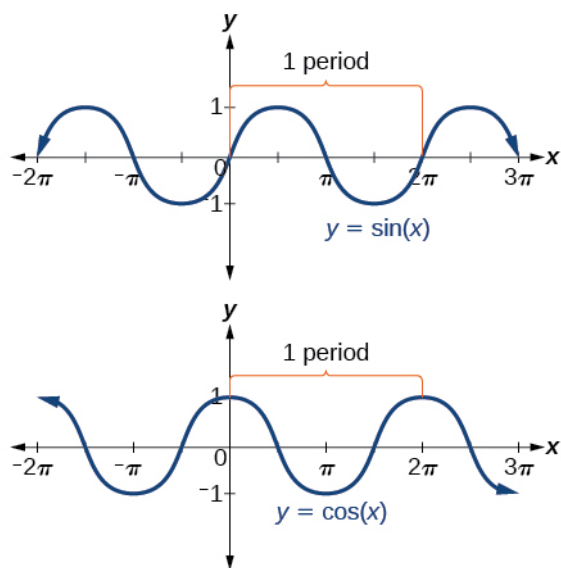
Function	$y = \sin x$	$y = \cos x$
Amplitude	1	1
Zeros	$x = \pi n$	$x = \pi/2 + \pi n$
Minimums	$(3\pi/2 + 2\pi n, -1)$	$(\pi + 2\pi n, -1)$
Maximums	$(\pi/2 + 2\pi n, 1)$	$(2\pi n, 1)$
Period	2π	2π

Function	$y = a\sin x$	$y = a\cos x$
Amplitude	a	a
Zeros	$x = \pi n$	$x = \pi/2 + \pi n$
Minimums	$(3\pi/2 + 2\pi n, -a)$	$(\pi + 2\pi n, -a)$
Maximums	$(\pi/2 + 2\pi n, a)$	$(2\pi n, a)$
Period	2π	2π