Objective: Graph Basic Trigonometric Functions

Using the Unit Circle

You can graph basic trigonometric functions in the Cartesian Plane by using what you know about the Unit Circle. Recall that each point on the Unit Circle is of the form $(\cos \theta, \sin \theta)$ and $\tan \theta = \frac{\sin \theta}{\cos \theta}$.
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Graphing sine and cosine

First we will explore the graph of \( y = \sin x \) using a graphics calculator. You can set the table and graph beginning at \(-2\pi\) in increments of \(\frac{\pi}{12}\) to see the common angles. You know that \( y = \sin \frac{\pi}{2} = 1 \). The table shows that

\[
y = \sin \frac{-3\pi}{2} = \sin \frac{\pi}{2} = 1
\]

Likewise the graph shows that \( y = \sin \frac{-3\pi}{2} = \sin \frac{\pi}{2} = 1 \)

You can see from the graph that the **domain**, the set of all \( x \) values for which the function is defined, is all real numbers. The **range**, or the set of outputs, \( y \), is the interval \([-1, 1]\), since sine generates values between -1 and 1. The graph of \( y = \sin x \) is **periodic**, that is, it the graph repeats. The graph takes on all of its values over the interval \([0, 2\pi]\). The **period** is then \(2\pi\). You should be familiar with all of the points on the graph \( y = \sin x \) from your work with the unit circle and be able to sketch a graph as shown \( y = \sin x \). An easy way to remember how
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to graph \( y = \sin x \) by beginning with \( y = \sin 0 = 0 \) and noting that the graph contains the points \((0,0),\left(\frac{\pi}{2},1\right),\(\pi,0\),\(\frac{3\pi}{2},-1\),\(2\pi,0\)).

\[ y = \sin x \]

It is also easy to sketch the graph of \( y = \cos x \) by beginning with \( y = \cos 0 = 1 \) and noting that the graph contains the points \((0,1),\left(\frac{\pi}{2},0\right),\(\pi,-1\),\(\frac{3\pi}{2},0\),\(2\pi,1\)).

\[ y = \cos x \]

The **domain**, the set of all all real numbers. The **range**, or the set of outputs, \( y \), is the interval \([-1,1]\), since sine generates values between -1 and 1. The **period** is \(2\pi\).
Graphing tangent

You can explore the graph of \( y = \tan x \) using a graphics calculator. The graph shows that \( y = \tan \frac{\pi}{4} = 1 \).

Note the asymptotes at \( x = -\frac{3\pi}{2}, x = -\frac{\pi}{2}, x = \frac{\pi}{2}, x = \frac{3\pi}{2} \), where \( y = \tan x \) is undefined. The **domain** is the set all real numbers with the restriction, \( x \neq n\pi + \frac{\pi}{2} \), where \( n \) is an integer. The **range** is all real numbers. The **period** is \( \pi \).

An easy way to remember how to graph \( y = \tan x \) by beginning with \( y = \tan 0 = 0 \) and sketching in the asymptotes.

\[ y = \tan x \]