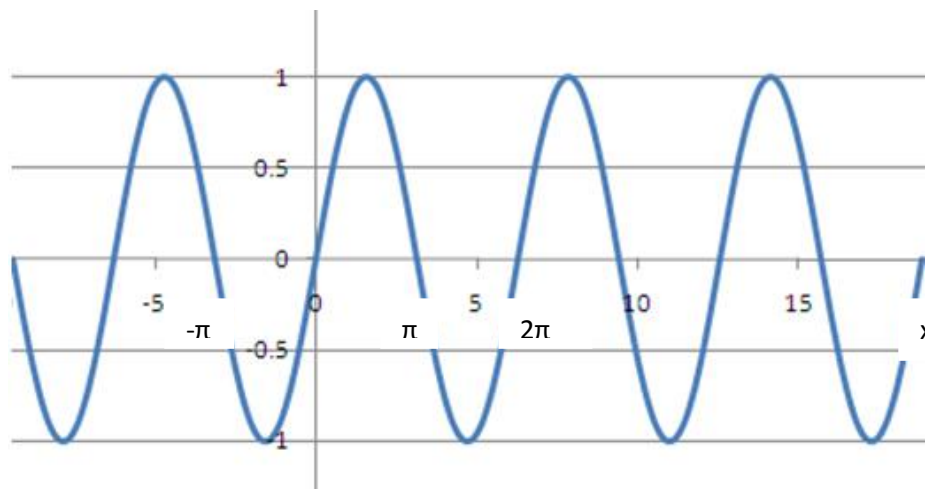


Trigonometric Functions

In trigonometry, the functions sine, cosine and tangent are defined as ratios of the lengths of sides in a right-angled triangle. However, sine, cosine and tangent extend to be functions, as do the reciprocal functions of secant, cosecant and cotangent. Since the basic functions of sine, cosine and tangent crop up so often in mathematics, science and engineering, it is useful to be able to sketch graphs of the functions to assist with their interpretation. The trigonometric functions are *periodic*.

Sine (sin)

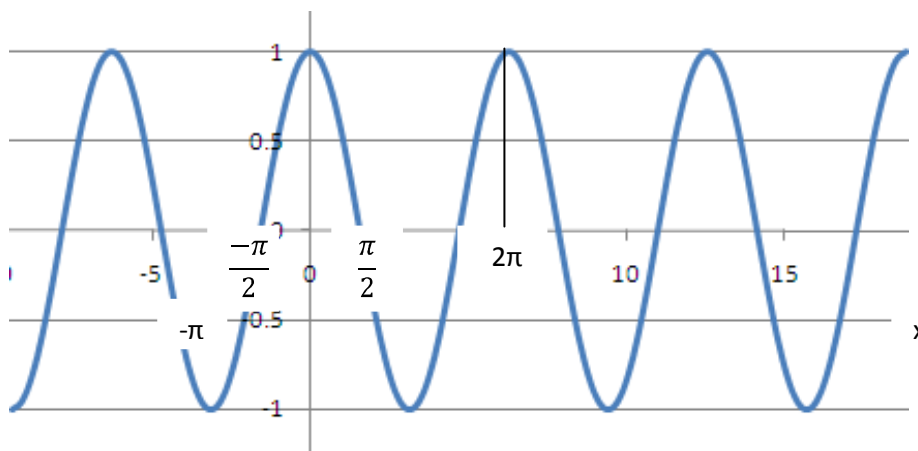
$\sin(x)$ has the following graph



Points to note include that $\sin(0) = 0$ or more generally $\sin(n\pi) = 0$ for any integer n , the period is 2π , the amplitude is 1 and the graph oscillates between -1 and +1.

Cosine (cos)

$\cos(x)$ has the following graph

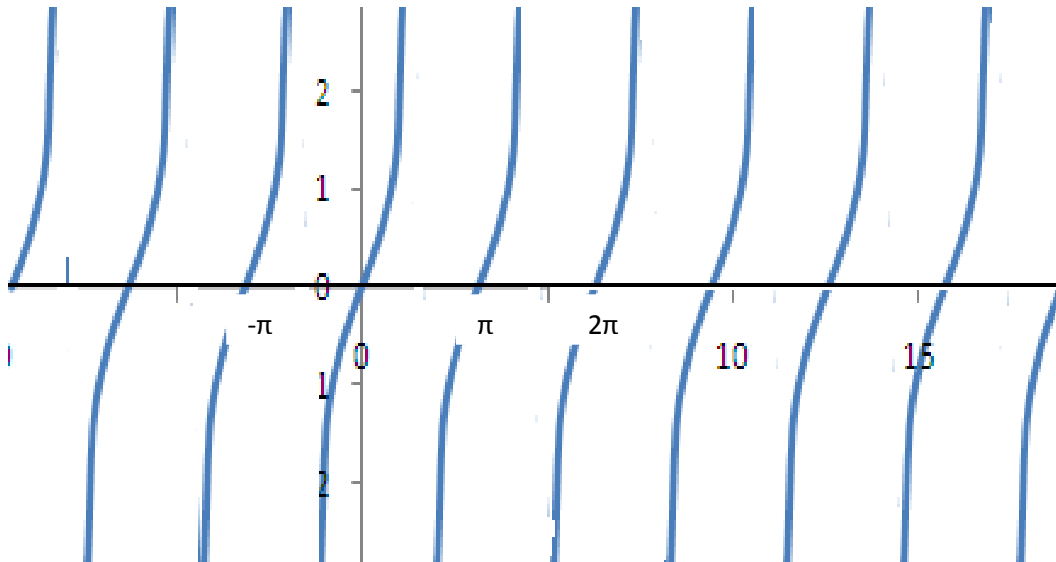


Points to note include that $\cos(0) = 1$ or more generally $\cos(n\pi) = (-1)^n$ for any integer n , the period is 2π , the amplitude is 1 and the graph oscillates between -1 and +1.

$\cos(x) = \sin(x + \frac{\pi}{2})$; the graphs for cos and sin are the same except for a phase shift of $\frac{\pi}{2}$.

Tangent or tan

tan x has the following graph:



Points to note include that $\tan = 0$ or more generally $\tan(n\pi) = 0$ for any integer n , the period is π the graph is $\pm\infty$ at... $\frac{-\pi}{2}, \frac{\pi}{2}, \frac{3\pi}{2} \dots$.

Reciprocal functions: Secant (sec), Cosecant (cosec) and Cotangent (cot)

The reciprocal functions are defined as follows:

$$\sec(x) = \frac{1}{\cos(x)},$$

$$\operatorname{cosec}(x) = \frac{1}{\sin(x)},$$

$$\cot(x) = \frac{1}{\tan(x)}.$$