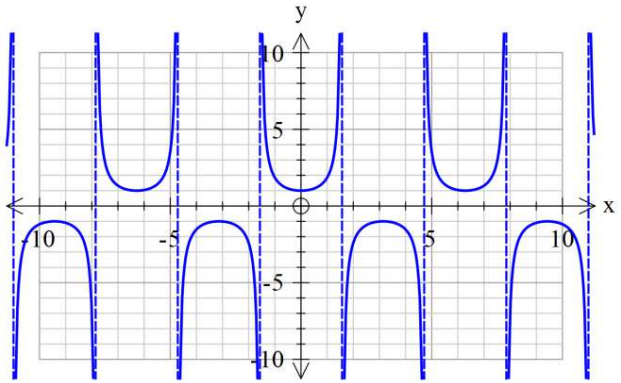
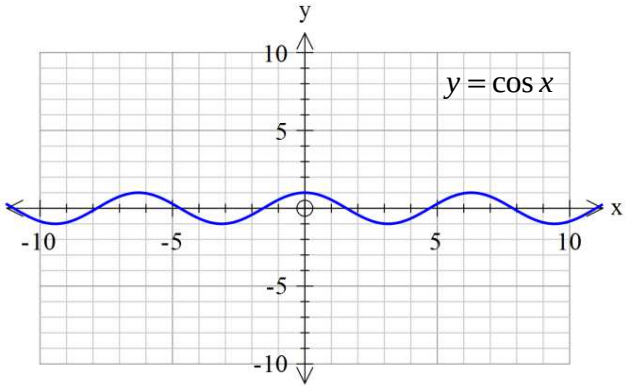
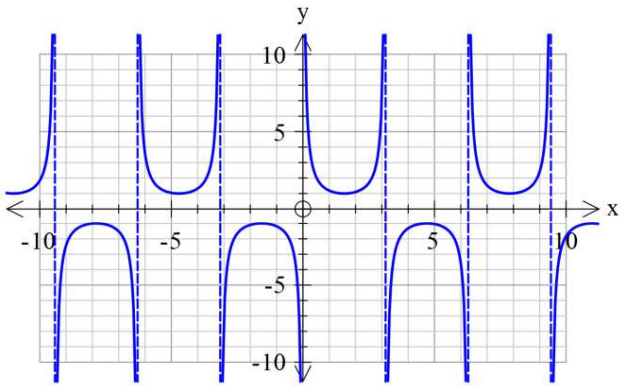
Sec, **cosec** and **cot** are the *reciprocals* of the basic trigonometric functions cosine, sine and tangent. They regularly occur in applied mathematics (e.g. the projectile equation) so justify their existence as 'basic' functions! These definitions also increase the number of useful trigonometric identities.

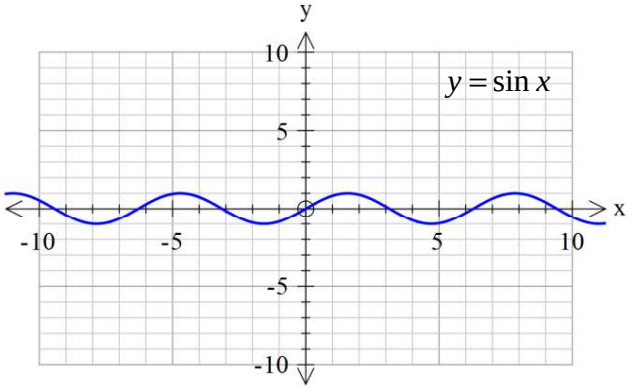
$$\sec x = \frac{1}{\cos x}$$



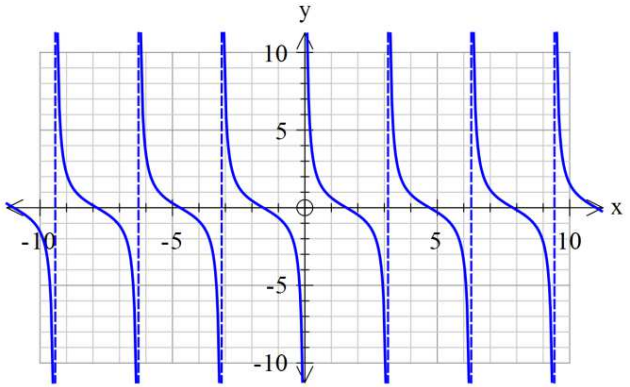


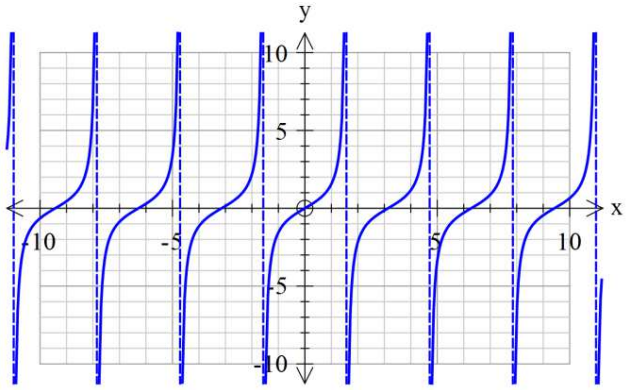
$$\text{cosec } x = \frac{1}{\sin x}$$





$$\cot x = \frac{1}{\tan x}$$





$y = \tan x$

Note angle x is in *radians* for all graphs here

Identities

$$\sin^2\theta + \cos^2\theta = 1$$

$$\therefore 1 + \frac{\cos^2\theta}{\sin^2\theta} = \frac{1}{\sin^2\theta}$$

$$1 + \cot^2\theta = \text{cosec}^2\theta$$

$$\sin^2\theta + \cos^2\theta = 1$$

$$\therefore \frac{\sin^2\theta}{\cos^2\theta} + 1 = \frac{1}{\cos^2\theta}$$

$$\tan^2\theta + 1 = \sec^2\theta$$

Calculus

$$\frac{d}{dx}\tan x = \sec^2 x \qquad \frac{d}{dx}\cot x = -\text{cosec}^2 x$$

$$\frac{d}{dx}\sec x = \sec x \tan x$$

$$\frac{d}{dx}\text{cosec } x = -\cot x \times \text{cosec } x$$

$$\int \tan x dx = -\ln|\cos x| + c$$

$$\int \cot x dx = \ln|\sin x| + c$$

$$\int \sec x dx = \ln|\sec x + \tan x| + c$$

$$\int \text{cosec } x dx = -\ln|\text{cosec } x + \cot x| + c$$