Trigonometric Properties and Identities

Math 4C

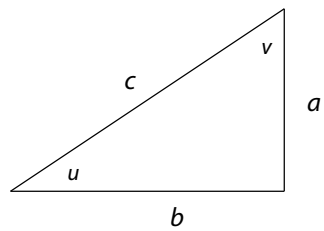
Fall 2011

Right angle trigonometry (soh-cah-toa)

$$\cos u = \frac{b}{c} \qquad \sec u = \frac{c}{b}$$

$$\sin u = \frac{a}{c} \qquad \csc u = \frac{c}{a}$$

$$\tan u = \frac{a}{b} \qquad \cot u = \frac{b}{a}$$



Trigonometric identities

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

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

$$1 + \cot^2 x = \csc^2 x$$

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

$$\csc x = \frac{1}{\sin x}$$

$$\cot x = \frac{\cos x}{\sin x}$$

Trigonometric angle changes

$$\cos(-x) = \cos x$$

$$\sin(-x) = -\sin x$$

$$\tan(-x) = -\tan x$$

$$\cos(\tfrac{\pi}{2} - x) = \sin x$$

$$\sin(\tfrac{\pi}{2} - x) = \cos x$$

$$\tan(\tfrac{\pi}{2} - x) = \cot x$$

Addition and subtraction formulas

$$\sin(x \pm y) = \sin x \cos y \pm \cos x \sin y$$

$$\cos(x \pm y) = \cos x \cos y \mp \sin x \sin y$$

$$\tan(x \pm y) = \frac{\tan x \pm \tan y}{1 \mp \tan x \tan y}$$

Double angle formulas

$$\sin(2x) = 2 \sin x \cos x$$

$$\cos(2x) = \cos^2 x - \sin^2 x = 2\cos^2 x - 1 = 1 - 2\sin^2 x$$

$$\tan(2x) = \frac{2 \tan x}{1 - \tan^2 x}$$

Half-angle formulas

$$\cos \frac{x}{2} = \pm\sqrt{\frac{1 + \cos x}{2}}$$

$$\sin \frac{x}{2} = \pm\sqrt{\frac{1 - \cos x}{2}}$$

$$\tan \frac{x}{2} = \frac{1 - \cos x}{\sin x} = \frac{\sin x}{1 + \cos x}$$