

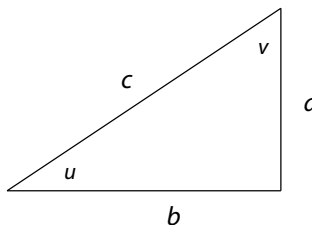
# Trigonometric Properties and Identities

Math 1060Q – Summer 2014

Professor Hohn

## Right angle trigonometry (soh-cah-toa)

$$\begin{aligned}\cos u &= \frac{b}{c} & \sec u &= \frac{c}{b} \\ \sin u &= \frac{a}{c} & \csc u &= \frac{c}{a} \\ \tan u &= \frac{a}{b} & \cot u &= \frac{b}{a}\end{aligned}$$



## 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

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

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

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

$$\cos\left(\frac{\pi}{2} - x\right) = \sin x$$

$$\sin\left(\frac{\pi}{2} - x\right) = \cos x$$

$$\tan\left(\frac{\pi}{2} - x\right) = \cot x$$

## 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

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

$$\begin{aligned}\cos(2x) &= \cos^2 x - \sin^2 x \\ &= 2 \cos^2 x - 1 \\ &= 1 - 2 \sin^2 x\end{aligned}$$

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

## Half-angle formulas

$$\cos\left(\frac{x}{2}\right) = \pm \sqrt{\frac{1 + \cos x}{2}}$$

$$\sin\left(\frac{x}{2}\right) = \pm \sqrt{\frac{1 - \cos x}{2}}$$

$$\tan\left(\frac{x}{2}\right) = \frac{1 - \cos x}{\sin x} = \frac{\sin x}{1 + \cos x}$$