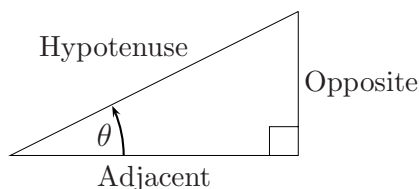


## MATH 150 – TOPIC 17 TRIG "CHEAT SHEET"

### Definition of the Six Trigonometric Functions

Right triangle definitions, where  $0 < \theta < \pi/2$ .

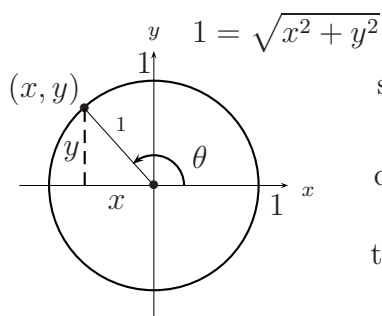


$$\sin \theta = \frac{\text{opposite}}{\text{hypotenuse}} \quad \csc \theta = \frac{\text{hypotenuse}}{\text{opposite}}$$

$$\cos \theta = \frac{\text{adjacent}}{\text{hypotenuse}} \quad \sec \theta = \frac{\text{hypotenuse}}{\text{adjacent}}$$

$$\tan \theta = \frac{\text{opposite}}{\text{adjacent}} \quad \cot \theta = \frac{\text{adjacent}}{\text{opposite}}$$

Unit circle definitions, where  $\theta$  is any angle.



$$\begin{aligned} \sin \theta &= \frac{y}{1} = y & \csc \theta &= \frac{1}{y} \\ \cos \theta &= \frac{x}{1} = x & \sec \theta &= \frac{1}{x} \\ \tan \theta &= \frac{y}{x} & \cot \theta &= \frac{x}{y} \end{aligned}$$

Thus,  $x = \cos \theta$ ,  $y = \sin \theta$

### Reciprocal Identities

$$\begin{aligned} \sin x &= \frac{1}{\csc x} & \sec x &= \frac{1}{\cos x} & \tan x &= \frac{1}{\cot x} \\ \csc x &= \frac{1}{\sin x} & \cos x &= \frac{1}{\sec x} & \cot x &= \frac{1}{\tan x} \end{aligned}$$

### Tangent and Cotangent Identities

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

### Pythagorean Identities

$$\begin{aligned} \sin^2 x + \cos^2 x &= 1, & 1 + \tan^2 x &= \sec^2 x, \\ 1 + \cot^2 x &= \csc^2 x \end{aligned}$$

### Reduction Formulas

$$\begin{aligned} \sin(-x) &= -\sin x & \cos(-x) &= \cos x \\ \csc(-x) &= -\csc x & \tan(-x) &= -\tan x \\ \sec(-x) &= \sec x & \cot(-x) &= -\cot x \end{aligned}$$

### Sum and Difference Formulas

$$\sin(u \pm v) = \sin u \cos v \pm \cos u \sin v$$

$$\cos(u \pm v) = \cos u \cos v \mp \sin u \sin v$$

$$\tan(u \pm v) = \frac{\tan u \pm \tan v}{1 \mp \tan u \tan v}$$

### Cofunction Identities

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

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

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

### Double Angle Formulas

$$\sin 2u = 2 \sin u \cos u$$

$$\cos 2u = \cos^2 u - \sin^2 u = 2 \cos^2 u - 1 = 1 - 2 \sin^2 u$$

$$\tan 2u = \frac{2 \tan u}{1 - \tan^2 u}$$

### Half Angle Formulas

$$\sin^2 u = \frac{1 - \cos 2u}{2}$$

$$\cos^2 u = \frac{1 + \cos 2u}{2}$$

$$\tan^2 u = \frac{1 - \cos 2u}{1 + \cos 2u}$$

**Product-to-Sum Formulas**

$$\sin u \sin v = \frac{1}{2}[\cos(u - v) - \cos(u + v)]$$

$$\cos u \cos v = \frac{1}{2}[\cos(u - v) + \cos(u + v)]$$

$$\sin u \cos v = \frac{1}{2}[\sin(u + v) + \sin(u - v)]$$

$$\cos u \sin v = \frac{1}{2}[\sin(u + v) - \sin(u - v)]$$

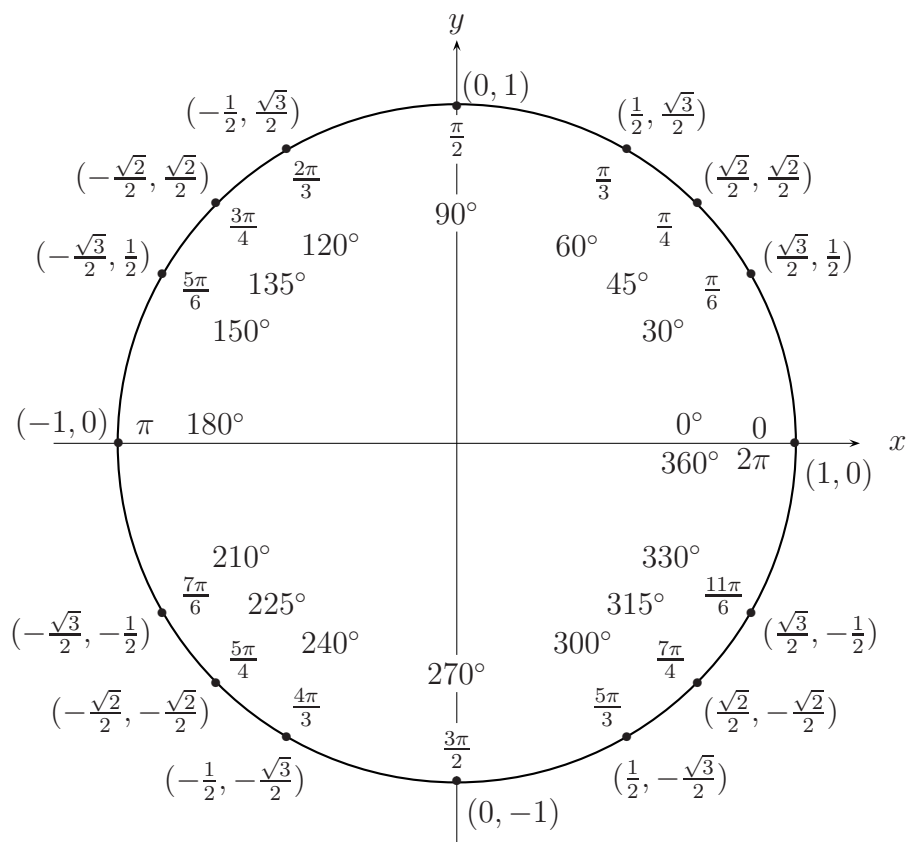
**Sum-to-Product Formulas**

$$\sin u + \sin v = 2 \sin \left( \frac{u + v}{2} \right) \cos \left( \frac{u - v}{2} \right)$$

$$\sin u - \sin v = 2 \cos \left( \frac{u + v}{2} \right) \sin \left( \frac{u - v}{2} \right)$$

$$\cos u + \cos v = 2 \cos \left( \frac{u + v}{2} \right) \cos \left( \frac{u - v}{2} \right)$$

$$\cos u - \cos v = -2 \sin \left( \frac{u + v}{2} \right) \sin \left( \frac{u - v}{2} \right)$$



For any pair  $(x, y)$ ,

$$x = \cos \theta$$

$$y = \sin \theta$$

where  $\theta$  is the indicated angle.

[Previous Page](#)

[Skills Assessment](#)