# Symbolab Trigonometry Cheat Sheet

## Basic Identities:

- $\tan(x) = \frac{\sin(x)}{\cos(x)}$
- $\tan(x) = \frac{1}{\cot(x)}$
- $\cot(x) = \frac{1}{\tan(x)}$
- $\cot(x) = \frac{\cos(x)}{\sin(x)}$
- $\sec(x) = \frac{1}{\cos(x)}$
- $\csc(x) = \frac{1}{\sin(x)}$

## Pythagorean Identities

- $\cos^2(x) + \sin^2(x) = 1$
- $\sec^2(x) - \tan^2(x) = 1$
- $\csc^2(x) - \cot^2(x) = 1$

## Double Angle Identities

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

## Sum Difference Identities

- $\sin(s + t) = \sin(s)\cos(t) + \cos(s)\sin(t)$
- $\sin(s - t) = \sin(s)\cos(t) - \cos(s)\sin(t)$
- $\cos(s + t) = \cos(s)\cos(t) - \sin(s)\sin(t)$
- $\cos(s - t) = \cos(s)\cos(t) + \sin(s)\sin(t)$
- $\tan(s + t) = \frac{\tan(s)+\tan(t)}{1-\tan(s)\tan(t)}$
- $\tan(s - t) = \frac{\tan(s)-\tan(t)}{1+\tan(s)\tan(t)}$

## Product To Sum Identities

- $\cos(s)\cos(t) = \frac{\cos(s-t)+\cos(s+t)}{2}$
- $\sin(s)\sin(t) = \frac{\cos(s-t)-\cos(s+t)}{2}$
- $\sin(s)\cos(t) = \frac{\sin(s+t)+\sin(s-t)}{2}$
- $\cos(s)\sin(t) = \frac{\sin(s+t)-\sin(s-t)}{2}$

## Triple Angle Identities

- $\sin(3x) = -\sin^3(x) + 3\cos^2(x)\sin(x)$
- $\sin(3x) = -4\sin^3(x) + 3\sin(x)$
- $\cos(3x) = \cos^3(x) - 3\sin^2(x)\cos(x)$
- $\cos(3x) = 4\cos^3(x) - 3\cos(x)$
- $\tan(3x) = \frac{3\tan(x)-\tan^3(x)}{1-3\tan^2(x)}$
- $\cot(3x) = \frac{3\cot(x)-\cot^3(x)}{1-3\cot^2(x)}$

Symbolab

**Function Ranges:**

| | | | |
|---|---|---|---|
| $\sin(x)$ | $-1 \le y \le 1$ | $\arcsin(x)$ | $-\frac{\pi}{2} \le y \le \frac{\pi}{2}$ |
| $\cos(x)$ | $-1 \le y \le 1$ | $\arccos(x)$ | $0 \le y \le \pi$ |
| $\tan(x)$ | $\infty < y < \infty$ | $\arctan(x)$ | $-\frac{\pi}{2} < y < \frac{\pi}{2}$ |
| $\cot(x)$ | $\infty < y < \infty$ | $\operatorname{arccot}(x)$ | $0 < y < \pi$ |
| $\csc(x)$ | $-\infty < y \le 1 \cup 1 \le y < \infty$ | $\operatorname{arccsc}(x)$ | $0 \le y < \frac{\pi}{2} \cup \pi \le y < \frac{3\pi}{2}$ |
| $\sec(x)$ | $-\infty < y \le 1 \cup 1 \le y < \infty$ | $\operatorname{arcsec}(x)$ | $-\pi < y \le -\frac{\pi}{2} \cup 0 < y < \frac{\pi}{2}$ |

**Function Values:**

| | $\sin(x)$ | $\cos(x)$ | $\tan(x)$ | $\cot(x)$ |
|---|---|---|---|---|
| $0$ | $0$ | $1$ | $0$ | Undefined |
| $\frac{\pi}{6}$ | $\frac{1}{2}$ | $\frac{\sqrt{3}}{2}$ | $\frac{\sqrt{3}}{3}$ | $\sqrt{3}$ |
| $\frac{\pi}{4}$ | $\frac{\sqrt{2}}{2}$ | $\frac{\sqrt{2}}{2}$ | $1$ | $1$ |
| $\frac{\pi}{3}$ | $\frac{\sqrt{3}}{2}$ | $\frac{1}{2}$ | $\sqrt{3}$ | $\frac{\sqrt{3}}{3}$ |
| $\frac{\pi}{2}$ | $1$ | $0$ | Undefined | $0$ |
| $\frac{2\pi}{3}$ | $\frac{\sqrt{3}}{2}$ | $-\frac{1}{2}$ | $-\sqrt{3}$ | $-\frac{\sqrt{3}}{3}$ |
| $\frac{3\pi}{4}$ | $\frac{\sqrt{2}}{2}$ | $-\frac{\sqrt{2}}{2}$ | $-\frac{\sqrt{3}}{3}$ | $-\sqrt{3}$ |
| $\frac{5\pi}{6}$ | $\frac{1}{2}$ | $-\frac{\sqrt{3}}{2}$ | $-1$ | $-1$ |
| $\pi$ | $0$ | $-1$ | $0$ | Undefined |
| $\frac{7\pi}{6}$ | $-\frac{1}{2}$ | $-\frac{\sqrt{3}}{2}$ | | |
| $\frac{5\pi}{4}$ | $-\frac{\sqrt{2}}{2}$ | $-\frac{\sqrt{2}}{2}$ | | |
| $\frac{4\pi}{3}$ | $-\frac{\sqrt{3}}{2}$ | $-\frac{1}{2}$ | | |
| $\frac{3\pi}{2}$ | $-1$ | $0$ | | |
| $\frac{5\pi}{3}$ | $-\frac{\sqrt{3}}{2}$ | $\frac{1}{2}$ | | |
| $\frac{7\pi}{4}$ | $-\frac{\sqrt{2}}{2}$ | $\frac{\sqrt{2}}{2}$ | | |
| $\frac{11\pi}{6}$ | $-\frac{1}{2}$ | $\frac{\sqrt{3}}{2}$ | | |