



$$\sin \theta = \frac{y}{r}$$

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

$$\tan \theta = \frac{y}{x} = \frac{\sin \theta}{\cos \theta}$$

$$\cot \theta = \frac{x}{y} = \tan\left(\frac{\pi}{2} - \theta\right) = \frac{1}{\tan \theta}$$

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

$$\csc \theta = \frac{r}{y} = \frac{1}{\sin \theta} = \sec\left(\frac{\pi}{2} - \theta\right)$$

θ		$\sin \theta$	$\cos \theta$	$\tan \theta$	$\cot \theta$	$\sec \theta$	$\csc \theta$
0°	0	0	1	0	<i>undef.</i>	1	<i>undef.</i>
30°	$\frac{\pi}{6}$	$\frac{1}{2}$	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{3}}{3}$	$\sqrt{3}$	$\frac{2\sqrt{3}}{3}$	2
45°	$\frac{\pi}{4}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{2}}{2}$	1	1	$\sqrt{2}$	$\sqrt{2}$
60°	$\frac{\pi}{3}$	$\frac{\sqrt{3}}{2}$	$\frac{1}{2}$	$\sqrt{3}$	$\frac{\sqrt{3}}{3}$	2	$\frac{2\sqrt{3}}{3}$
90°	$\frac{\pi}{2}$	1	0	<i>undef.</i>	0	<i>undef.</i>	1
120°	$\frac{2\pi}{3}$	$\frac{\sqrt{3}}{2}$	$-\frac{1}{2}$	$-\sqrt{3}$	$-\frac{\sqrt{3}}{3}$	-2	$\frac{2\sqrt{3}}{3}$
135°	$\frac{3\pi}{4}$	$\frac{\sqrt{2}}{2}$	$-\frac{\sqrt{2}}{2}$	-1	-1	$-\sqrt{2}$	$\sqrt{2}$
150°	$\frac{5\pi}{6}$	$\frac{1}{2}$	$-\frac{\sqrt{3}}{2}$	$-\frac{\sqrt{3}}{3}$	$-\sqrt{3}$	$-\frac{2\sqrt{3}}{3}$	2
180°	π	0	-1	0	<i>undef.</i>	-1	<i>undef.</i>
210°	$\frac{7\pi}{6}$	$-\frac{1}{2}$	$-\frac{\sqrt{3}}{2}$	$\frac{\sqrt{3}}{3}$	$\sqrt{3}$	$-\frac{2\sqrt{3}}{3}$	-2
225°	$\frac{5\pi}{4}$	$-\frac{\sqrt{2}}{2}$	$-\frac{\sqrt{2}}{2}$	1	1	$-\sqrt{2}$	$-\sqrt{2}$
240°	$\frac{4\pi}{3}$	$-\frac{\sqrt{3}}{2}$	$-\frac{1}{2}$	$\sqrt{3}$	$\frac{\sqrt{3}}{3}$	-2	$-\frac{2\sqrt{3}}{3}$
270°	$\frac{3\pi}{2}$	-1	0	<i>undef.</i>	0	<i>undef.</i>	-1
300°	$\frac{5\pi}{3}$	$-\frac{\sqrt{3}}{2}$	$\frac{1}{2}$	$-\sqrt{3}$	$-\frac{\sqrt{3}}{3}$	2	$-\frac{2\sqrt{3}}{3}$
315°	$\frac{7\pi}{4}$	$-\frac{\sqrt{2}}{2}$	$\frac{\sqrt{2}}{2}$	-1	-1	$\sqrt{2}$	$-\sqrt{2}$
330°	$\frac{11\pi}{6}$	$-\frac{1}{2}$	$\frac{\sqrt{3}}{2}$	$-\frac{\sqrt{3}}{3}$	$-\sqrt{3}$	$\frac{2\sqrt{3}}{3}$	-2
360°	2π	0	1	0	<i>undef.</i>	1	<i>undef.</i>

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

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

$$\csc^2 \theta - \cot^2 \theta = 1$$

$$\sin(\theta + \phi) = \sin \theta \cos \phi + \cos \theta \sin \phi$$

$$\sin(\theta - \phi) = \sin \theta \cos \phi - \cos \theta \sin \phi$$

$$\cos(\theta + \phi) = \cos \theta \cos \phi - \sin \theta \sin \phi$$

$$\cos(\theta - \phi) = \cos \theta \cos \phi + \sin \theta \sin \phi$$

$$\tan(\theta + \phi) = \frac{\tan \theta + \tan \phi}{1 - \tan \theta \tan \phi}$$

$$\tan(\theta - \phi) = \frac{\tan \theta - \tan \phi}{1 + \tan \theta \tan \phi}$$

$$\sin 2\theta = 2 \sin \theta \cos \theta$$

$$\begin{aligned} \cos 2\theta &= \cos^2 \theta - \sin^2 \theta \\ &= 1 - 2 \sin^2 \theta \\ &= 2 \cos^2 \theta - 1 \end{aligned}$$

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

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

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

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

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

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

$$\tan \frac{\theta}{2} = \pm \sqrt{\frac{1 - \cos \theta}{1 + \cos \theta}}$$

$$\sin \theta \cos \phi = \frac{\sin(\theta + \phi) + \sin(\theta - \phi)}{2}$$

$$\sin \theta \sin \phi = \frac{\cos(\theta - \phi) - \cos(\theta + \phi)}{2}$$

$$\cos \theta \cos \phi = \frac{\cos(\theta - \phi) + \cos(\theta + \phi)}{2}$$

$$\sin \theta + \sin \phi = 2 \sin \frac{\theta + \phi}{2} \cos \frac{\theta - \phi}{2}$$

$$\cos \theta + \cos \phi = 2 \cos \frac{\theta + \phi}{2} \cos \frac{\theta - \phi}{2}$$

$$\frac{d}{dx} \sin \theta = \cos \theta$$

$$\frac{d}{dx} \cos \theta = -\sin \theta$$

$$\frac{d}{dx} \tan \theta = \sec^2 \theta$$

$$\frac{d}{dx} \cot \theta = -\csc^2 \theta$$

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

$$\frac{d}{dx} \csc \theta = -\csc \theta \cot \theta$$

$$\frac{d}{dx} \sin^{-1} \theta = \frac{1}{\sqrt{1 - \theta^2}}$$

$$\frac{d}{dx} \cos^{-1} \theta = -\frac{1}{\sqrt{1 - \theta^2}}$$

$$\frac{d}{dx} \tan^{-1} \theta = \frac{1}{1 + \theta^2}$$

$$\frac{d}{dx} \cot^{-1} \theta = -\frac{1}{1 + \theta^2}$$

$$\frac{d}{dx} \sec^{-1} \theta = \frac{1}{|\theta| \sqrt{\theta^2 - 1}}$$

$$\frac{d}{dx} \csc^{-1} \theta = -\frac{1}{|\theta| \sqrt{\theta^2 - 1}}$$

$$\sinh \theta = \frac{e^\theta - e^{-\theta}}{2}$$

$$\cosh \theta = \frac{e^\theta + e^{-\theta}}{2}$$

$$\tanh \theta = \frac{e^\theta - e^{-\theta}}{e^\theta + e^{-\theta}} = \frac{\sinh \theta}{\cosh \theta}$$

$$\coth \theta = \frac{e^\theta + e^{-\theta}}{e^\theta - e^{-\theta}} = \frac{1}{\tanh \theta}$$

$$\operatorname{sech} \theta = \frac{2}{e^\theta + e^{-\theta}} = \frac{1}{\cosh \theta}$$

$$\operatorname{csch} \theta = \frac{2}{e^\theta - e^{-\theta}} = \frac{1}{\sinh \theta}$$