

◆ Trigonometric ratios of some specific angles

	0°	$\frac{\pi}{6}$	$\frac{\pi}{4}$	$\frac{\pi}{3}$	$\frac{\pi}{2}$	π	$\frac{3\pi}{2}$	2π
sin	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1	0	-1	0
cos	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0	-1	0	1
tan	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	not defined	0	not defined	0

Sign of trigonometric functions

The following table shows the sign of trigonometric functions in the quadrants.

Quadrant T. ratio	I	II	III	IV
$\sin\theta$	+	+	-	-
$\cos\theta$	+	-	-	+
$\tan\theta$	+	-	+	-
$\operatorname{cosec}\theta$	+	+	-	-
$\sec\theta$	+	-	-	+
$\cot\theta$	+	-	+	-

- $\sin(-\theta) = -\sin\theta$
- $\cos(-\theta) = \cos\theta$
- $\tan(-\theta) = -\tan\theta$
- $\sec(-\theta) = \sec\theta$
- $\operatorname{cosec}(-\theta) = -\operatorname{cosec}\theta$
- $\cot(-\theta) = -\cot\theta$

For all real θ (1) $\sin^2\theta + \cos^2\theta = 1$

(2) $1 + \tan^2\theta = \sec^2\theta$ (3) $1 + \cot^2\theta = \operatorname{cosec}^2\theta$

◆ The behaviour of values of trigonometric functions

	Ist quadrant	IInd quadrant	IIIrd quadrant	IVth quadrant
$\sin\theta$	increases from 0 to 1	decreases from 1 to 0	decreases from 0 to -1	increases from -1 to 0
$\cos\theta$	decreases from 1 to 0	decreases from 0 to -1	increases from -1 to 0	increases from 0 to 1
$\tan\theta$	increases from 0 to ∞	increases from $-\infty$ to 0	increases from 0 to ∞	increases from $-\infty$ to 0
$\cot\theta$	decreases from ∞ to 0	decreases from 0 to $-\infty$	decreases from ∞ to 0	decreases from 0 to $-\infty$
$\sec\theta$	increases from 1 to ∞	increases from $-\infty$ to -1	decreases from -1 to $-\infty$	decreases from ∞ to 1
$\operatorname{cosec}\theta$	decreases from ∞ to 1	increases from 1 to ∞	increases from $-\infty$ to -1	decreases from -1 to $-\infty$

$$1. \cos x = \frac{-1}{2}$$

$$\text{We have, } \sin^2 x = 1 - \cos^2 x = 1 - \frac{1}{4} = \frac{3}{4}$$

$$\Rightarrow \sin x = \pm \sqrt{\frac{3}{4}} = \pm \frac{\sqrt{3}}{2}$$

Since x is in IIIrd quadrant, $\sin x$ is negative.

$$\therefore \sin x = \frac{-\sqrt{3}}{2} \quad \therefore \tan x = \frac{\sin x}{\cos x} = \frac{\frac{-\sqrt{3}}{2}}{\frac{-1}{2}} = \sqrt{3},$$

$$\operatorname{cosec} x = \frac{1}{\sin x} = \frac{-2}{\sqrt{3}},$$

$$\sec x = \frac{1}{\cos x} = -2, \quad \cot x = \frac{1}{\tan x} = \frac{1}{\sqrt{3}}.$$

$$2. \sin x = \frac{3}{5}, \quad x \text{ is in IIInd quadrant.}$$

$$\therefore \cos^2 x = 1 - \sin^2 x = 1 - \frac{9}{25} = \frac{16}{25}$$

$$\Rightarrow \cos x = \pm \frac{4}{5}$$

Since x is in IIInd quadrant, $\cos x$ is negative.

$$\therefore \cos x = \frac{-4}{5}$$

$$\tan x = \frac{-3}{4}, \quad \operatorname{cosec} x = \frac{5}{3}, \quad \sec x = \frac{-5}{4}, \quad \cot x = \frac{-4}{3}.$$