

# Inverse Tangent with atan2

## atan (arctangent) Function

Recall:

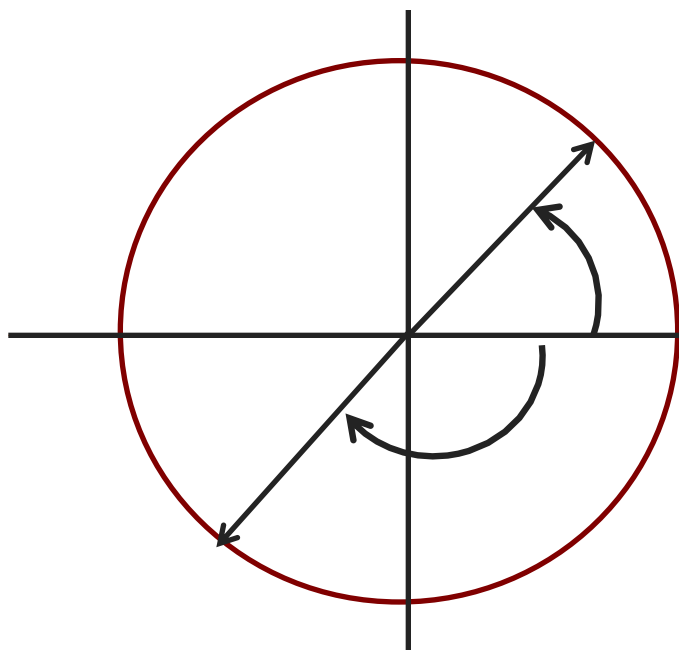
$$\tan(\theta) = \frac{\sin(\theta)}{\cos(\theta)} = \frac{y}{x}$$

The function  $\theta = \tan^{-1}(\frac{y}{x})$  returns the angle  $\theta$  for which  $\tan(\theta) = \frac{y}{x}$ .

$$\tan\left(\frac{\pi}{6}\right) = \frac{1}{\sqrt{3}} \longrightarrow \tan^{-1}\left(\frac{1}{\sqrt{3}}\right) = \frac{\pi}{6}$$

$$\text{atan}\left(\frac{y}{x}\right) = \tan^{-1}\left(\frac{y}{x}\right)$$

## atan (arctangent) Function



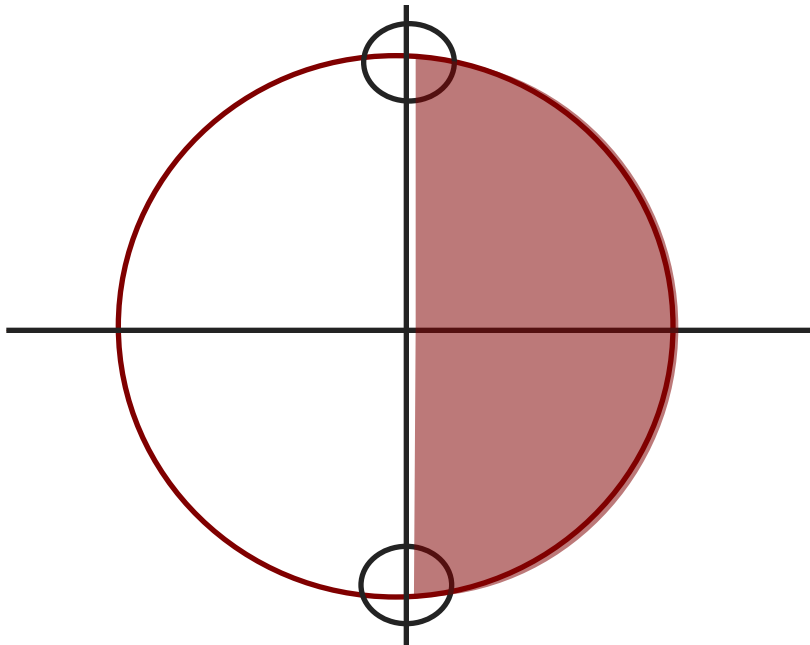
$$\theta = \frac{\pi}{4} \rightarrow \begin{aligned} \sin(\theta) &= \frac{\sqrt{2}}{2} \\ \cos(\theta) &= \frac{\sqrt{2}}{2} \\ \tan(\theta) &= 1 \end{aligned}$$

$$\theta = -\frac{3\pi}{4} \rightarrow \begin{aligned} \sin(\theta) &= -\frac{\sqrt{2}}{2} \\ \cos(\theta) &= -\frac{\sqrt{2}}{2} \\ \tan(\theta) &= 1 \end{aligned}$$

$$\tan^{-1}\left(\frac{1}{1}\right) = \tan^{-1}\left(\frac{-1}{-1}\right)$$

The atan function cannot distinguish between opposite points on the unit circle.

# atan (arctangent) Function



$$\frac{\sin(\theta)}{\cos(\theta)} = \frac{y}{x} = \frac{\pm 1}{0} = \text{undefined}$$

The atan function fails  
when  $\theta = \pm \frac{\pi}{2}$ .

Returns values in range  $(-\frac{\pi}{2}, \frac{\pi}{2})$

## atan2

$\text{atan2}(y, x)$  is an implementation of the atan function that takes into account ratio and the signs of  $y$  and  $x$ .

