Inverse Tangent with atan2

atan (arctangent) Function

Recall:

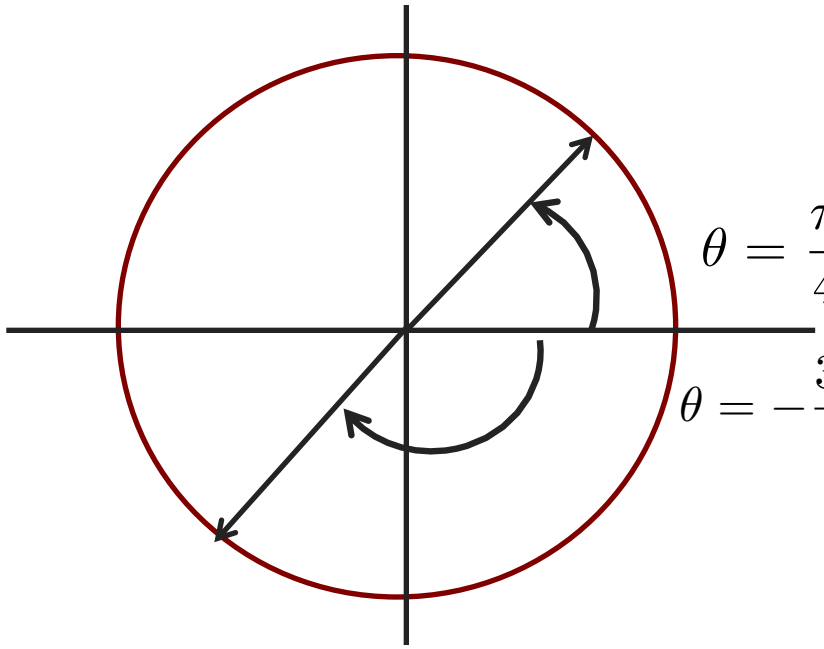
$$\tan(\theta) = \frac{\sin(\theta)}{\cos(\theta)} = \frac{y}{x}$$

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

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

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

atan (arctangent) Function



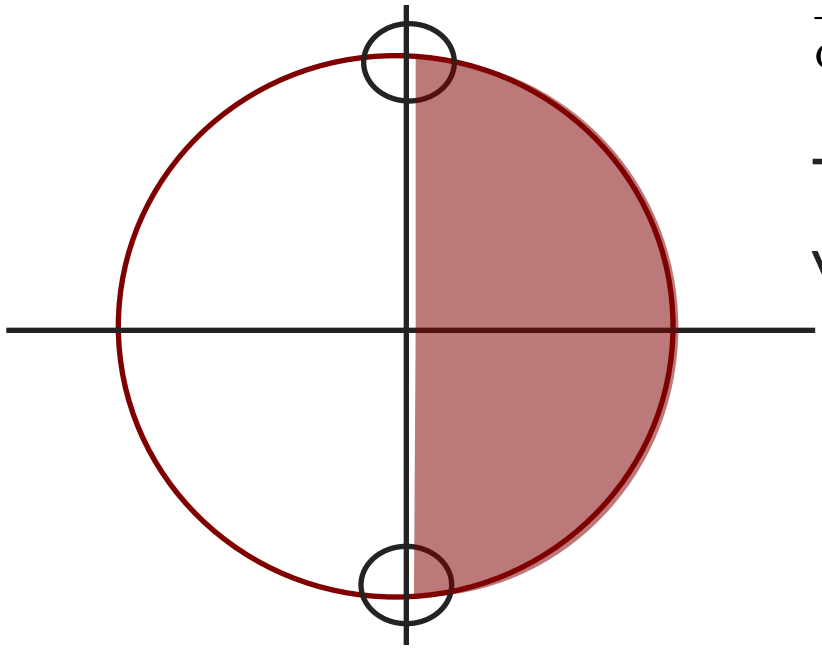
$\theta = \frac{\pi}{4}$ → $\sin(\theta) = \frac{\sqrt{2}}{2}$, $\cos(\theta) = \frac{\sqrt{2}}{2}$, $\tan(\theta) = 1$

$\theta = -\frac{3\pi}{4}$ → $\sin(\theta) = -\frac{\sqrt{2}}{2}$, $\cos(\theta) = -\frac{\sqrt{2}}{2}$, $\tan(\theta) = 1$

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

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

atan (arctangent) Function



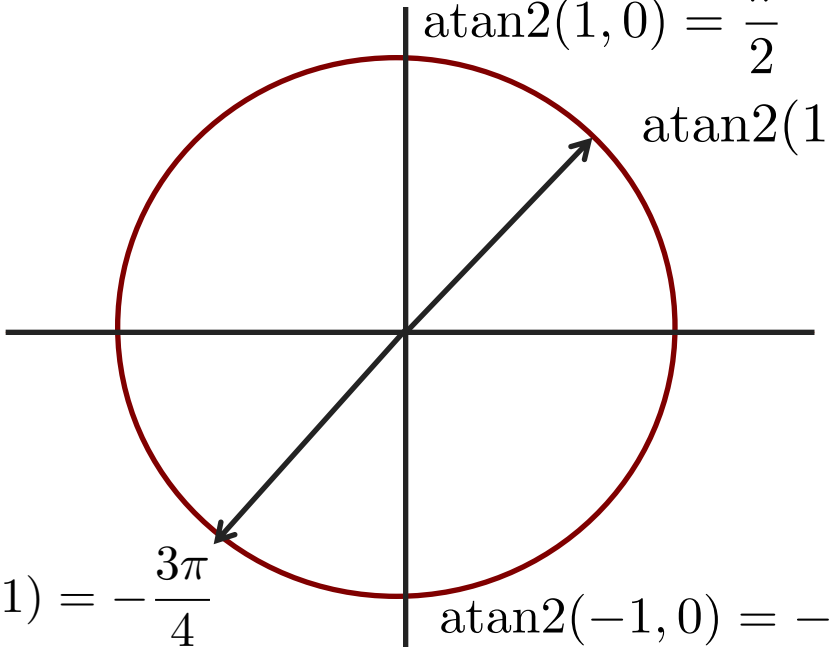
$$\frac{\sin(\theta)}{\cos(\theta)} = \frac{y}{x} = \frac{\pm 1}{0} = \text{undefined}$$

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.



Returns values in range $(-\pi, \pi]$