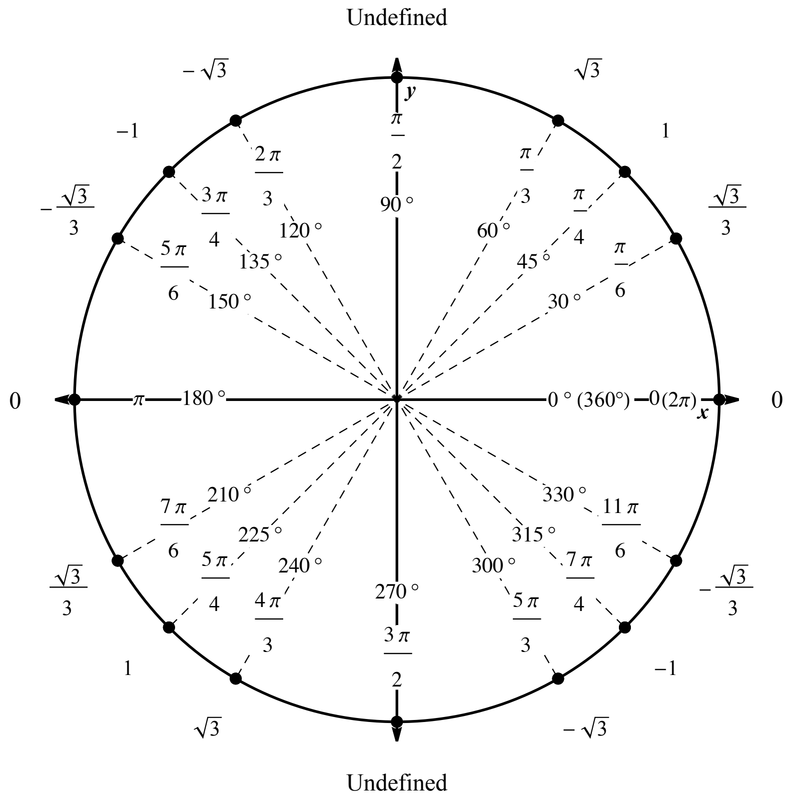
# Trigonometry 26: Inverse Functions: Arctangent

Let's revisit the unit circle and ask the question, "At what angle is the tangent equal to $\sqrt{3}$?".




Using the unit circle, we can see that there are two answers to that question: $\theta = 60^o$ and $\theta = 240^o$. Another way of stating this is:

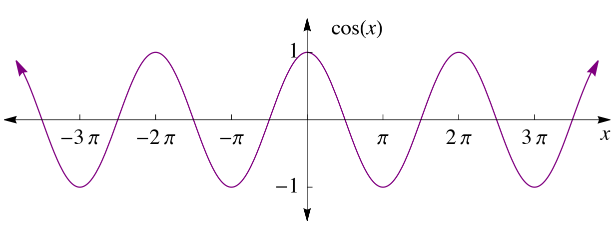
$$\tan 60^o = \sqrt{3} \qquad \text{and} \qquad \tan 240^o = \sqrt{3}$$

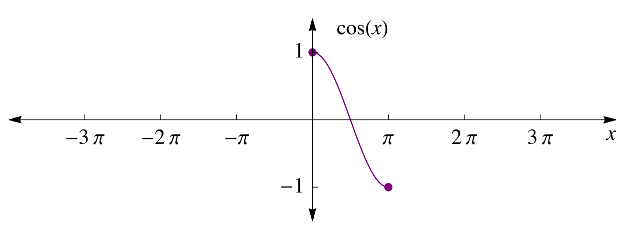
If we were to put our original question in equation form, we could write: "Solve for $\theta$: $\tan\theta = \sqrt{3}$". Solving for $\theta$ is the inverse of finding the tangent of $\theta$. In trigonometry, the inverse of the tangent function is called the **arctangent function**:

$$\theta = \arctan(x) = \arctan\left(\sqrt{3}\right) = 60^o$$

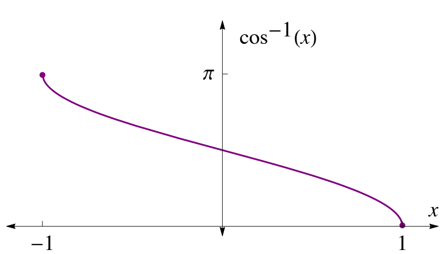
Arctangent is a function, which means that for each input, $x$, there can only be one output, $\theta$. As we saw above, using the unit circle, there were two outputs: 60º and 240º. To get around this problem, the range of the arctangent function is restricted to the Quadrants I and IV.

More insight into the arctangent function by looking at the graph of the tangent function:




The cosine function does not pass the horizontal line test; however if we restrict the domain of $\cos(x)$ to $[0, \pi]$ it does. The function $\arccos(x)$ is the inverse of the cosine function with its domain restricted. Here's it's graph:



Note that $\arccos(x)$ is often written as $\cos^{-1}(x)$.