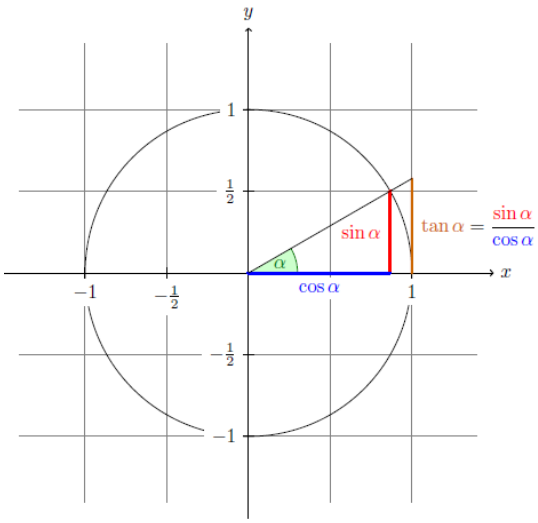
1 Tutorial: A Picture for Karl's Students

1.1 Overview

The expected outcome of this tutorial:



The angle α is 30° in the example ($\pi/6$ in radians). The sine of α, which is the height of the red line, is

$$\sin\alpha = 1/2.$$

By the Theorem of Pythagoras we have $\cos^2\alpha + \sin^2\alpha = 1$. Thus the length of the blue line, which is the cosine of α, must be

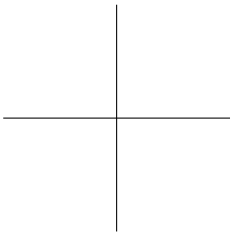
$$\cos\alpha = \sqrt{1 - 1/4} = \tfrac{1}{2}\sqrt{3}.$$

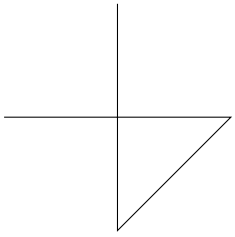
This shows that $\tan\alpha$, which is the height of the orange line, is

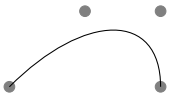
$$\tan\alpha = \frac{\sin\alpha}{\cos\alpha} = 1/\sqrt{3}.$$

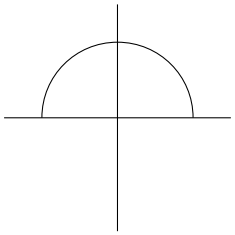
Figure 1: Expected outcome but in Tikz.

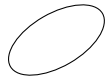
1.2 Execution

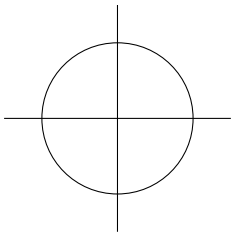


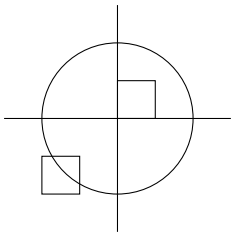


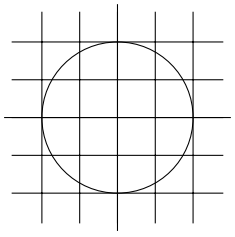


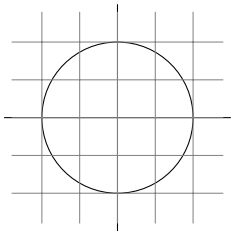


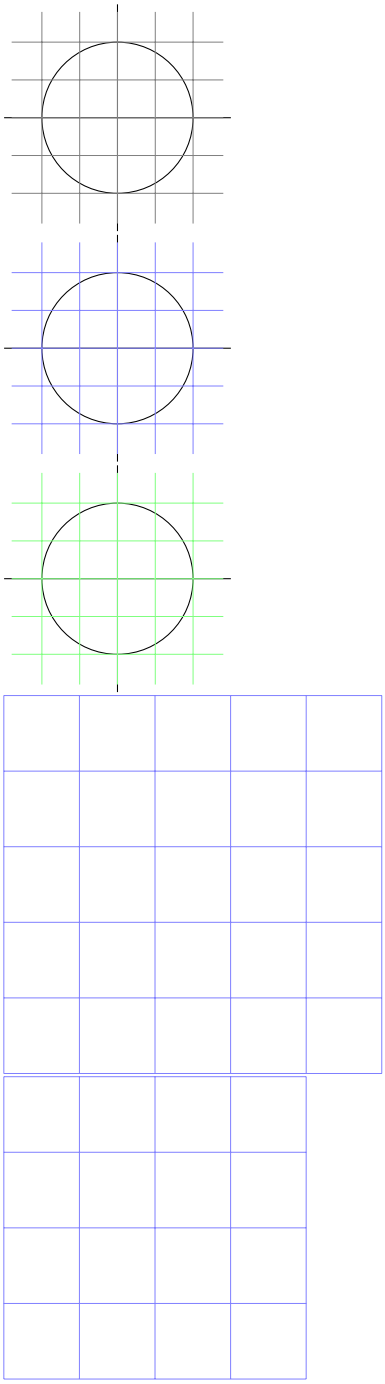


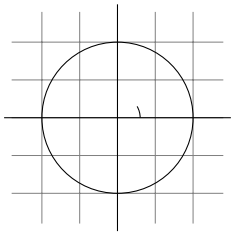


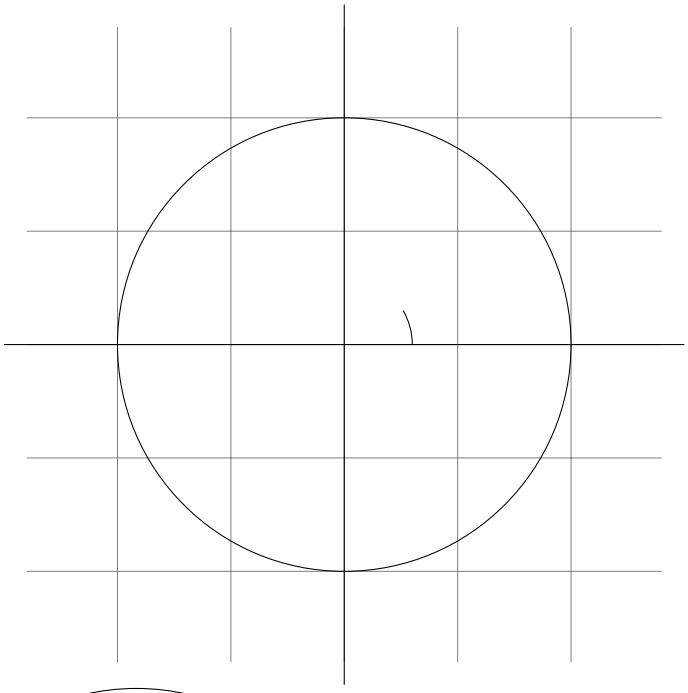


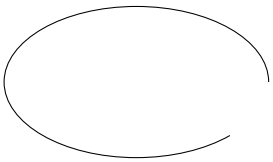


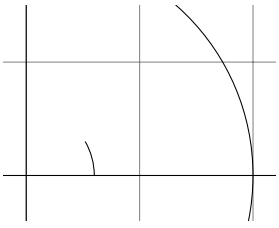


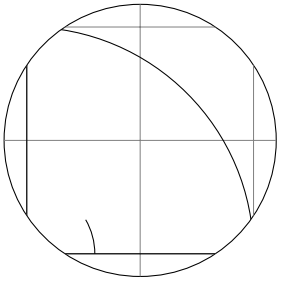




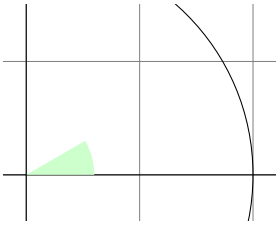


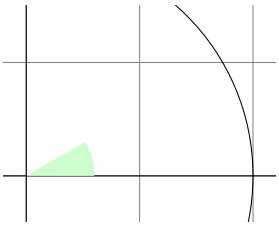


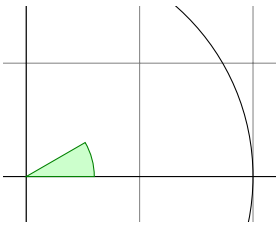


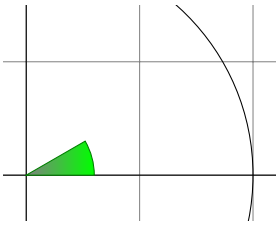


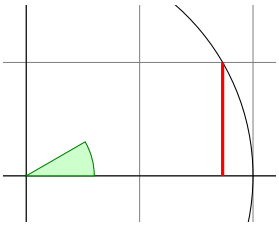
A sine ⌜ curve.
A cos ⌟ curve.

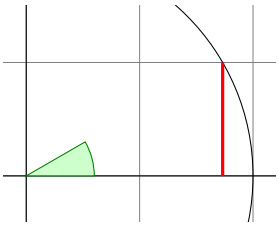


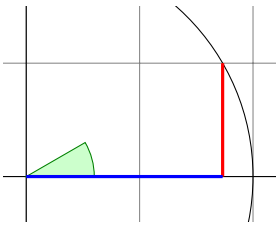


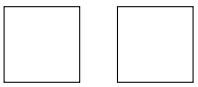


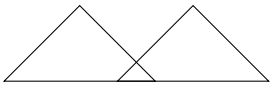


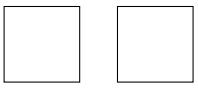


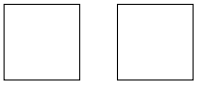


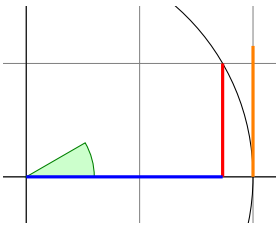


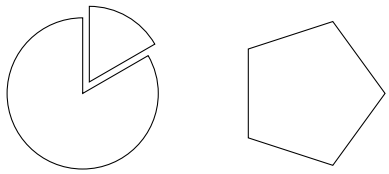


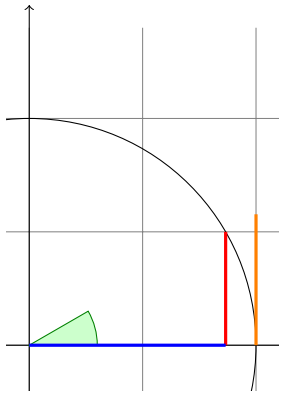


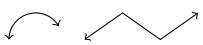


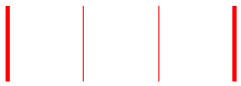


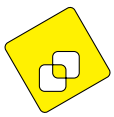


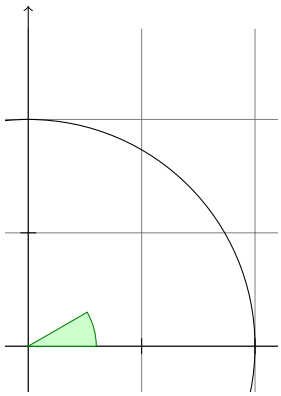


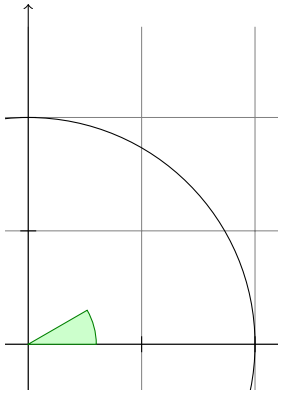


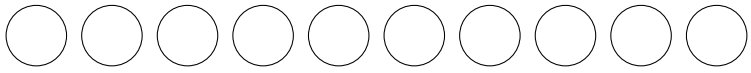












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1,3	2,3	3,3	4,3	5,3
1,2	2,2	3,2	4,2	5,2
1,1	2,1	3,1	4,1	5,1

7,5	8,5	9,5	10,5	11,5	12,5
7,4	8,4	9,4	10,4	11,4	12,4
7,3	8,3	9,3	10,3	11,3	12,3
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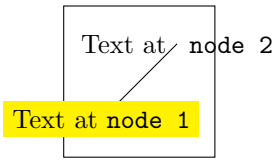
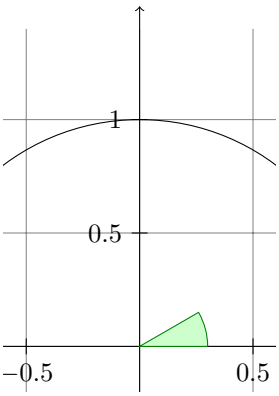
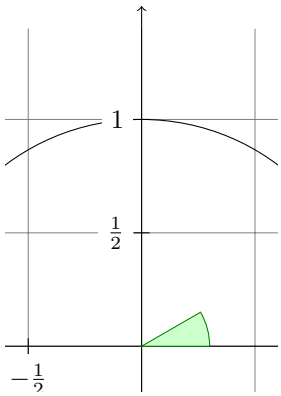
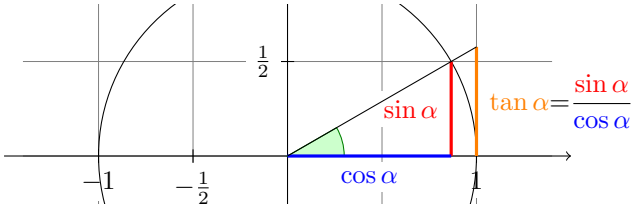
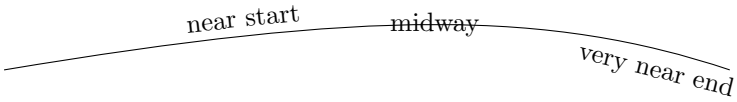
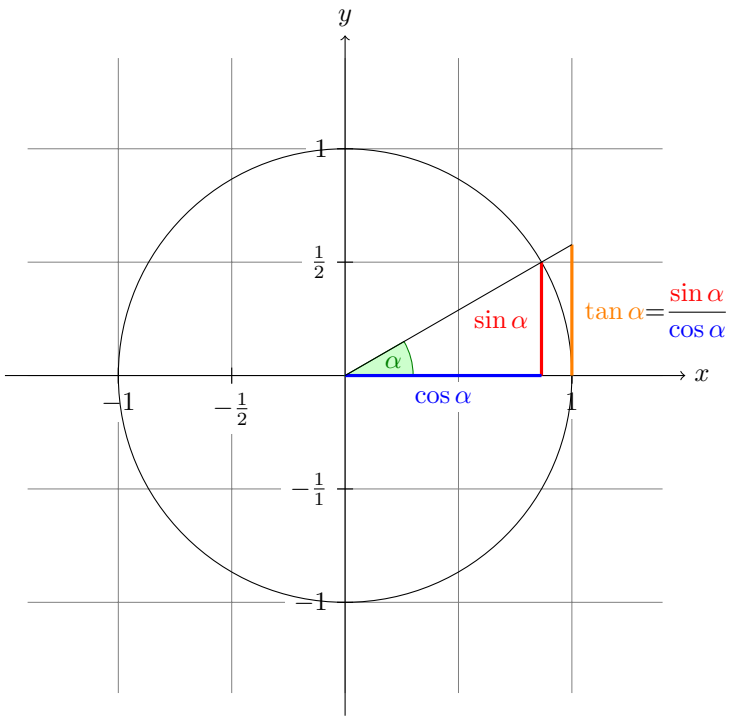





1
$\frac{1}{2}$
$-\frac{1}{2}$


$\frac{1}{2}$
$\sin\alpha$
$\tan\alpha = \frac{\sin\alpha}{\cos\alpha}$
-1
$-\frac{1}{2}$
$\cos\alpha$
1


near start
midway
very near end



The angle α is $30°$ in the example ($\pi/6$ in radians). The sine of α, which is the height of the red line, is

$$\sin\alpha = 1/2$$

By the Theorem of Pythagoras we have $\cos^2\alpha + \sin^2\alpha = 1$. Thus the length of the blue line, which is the cosine of α, must be

$$\cos\alpha = \sqrt{1 - 1/4} = \frac{1}{2}\sqrt{3}$$

This shows that $\tan\alpha$, which is the height of the orange line, is

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