

Study Guide

Graphing Other Trigonometric Functions

The period of functions $y = \csc k\theta$ and $y = \sec k\theta$ is $\frac{2\pi}{k}$, where $k > 0$. The period of functions $y = \tan k\theta$ and $y = \cot k\theta$ is $\frac{\pi}{k}$, where $k > 0$. The phase shift and vertical shift work the same way for all trigonometric functions. For example, the phase shift of the function $y = \tan(k\theta + c) + h$ is $-\frac{c}{k}$, and its vertical shift is h .

Example 1 Graph $y = \tan x$.

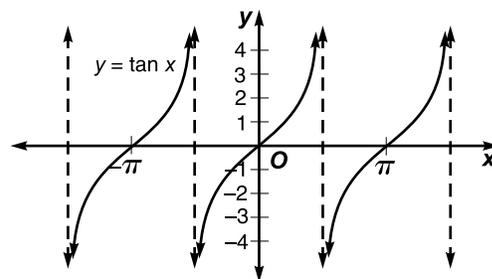
To graph $y = \tan x$, first draw the asymptotes located at $x = \frac{\pi}{2}n$, where n is an odd integer. Then plot the following coordinate pairs and draw the curves.

$$\left(-\frac{5\pi}{4}, -1\right), (-\pi, 0), \left(-\frac{3\pi}{4}, 1\right), \left(-\frac{\pi}{4}, -1\right),$$

$$(0, 0), \left(\frac{\pi}{4}, 1\right), \left(\frac{3\pi}{4}, -1\right), (\pi, 0), \left(\frac{5\pi}{4}, 1\right)$$

Notice that the range values for the interval $-\frac{3\pi}{2} \leq x \leq -\frac{\pi}{2}$ repeat for the intervals $-\frac{\pi}{2} \leq x \leq \frac{\pi}{2}$ and $\frac{\pi}{2} \leq x \leq \frac{3\pi}{2}$.

So, the tangent function is a periodic function with a period of $\frac{\pi}{k}$ or π .



Example 2 Graph $y = \sec(2\theta + \pi) + 4$.

Since $k = 2$, the period is $\frac{2\pi}{2}$ or π . Since $c = \pi$, the phase shift is $-\frac{\pi}{2}$. The vertical shift is 4.

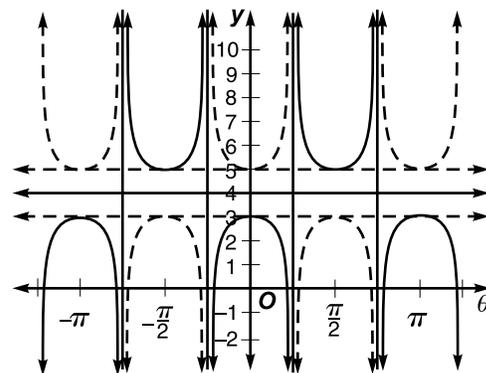
Using this information, follow the steps for graphing a secant function.

Step 1 Draw the midline, which is the graph of $y = 4$.

Step 2 Draw dashed lines parallel to the midline, which are 1 unit above and below $y = 4$.

Step 3 Draw the secant curve with a period of π .

Step 4 Shift the graph $\frac{\pi}{2}$ units to the left.



Practice

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Find each value by referring to the graphs of the trigonometric functions.

1. $\tan\left(-\frac{3\pi}{2}\right)$

2. $\cot\left(\frac{3\pi}{2}\right)$

3. $\sec 4\pi$

4. $\csc\left(-\frac{7\pi}{2}\right)$

Find the values of θ for which each equation is true.

5. $\tan \theta = 0$

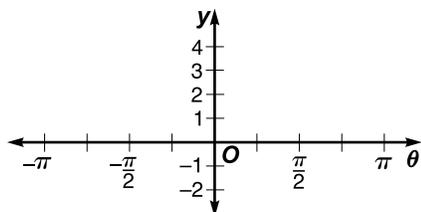
6. $\cot \theta = 0$

7. $\csc \theta = 1$

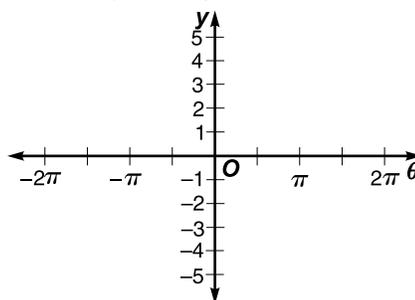
8. $\sec \theta = -1$

Graph each function.

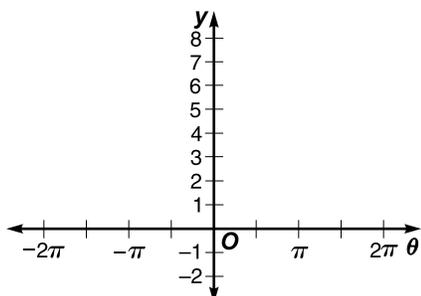
9. $y = \tan(2\theta + \pi) + 1$



10. $y = \cot\left(\frac{\theta}{2} - \frac{\pi}{2}\right) - 2$



11. $y = \csc \theta + 3$



12. $y = \sec\left(\frac{\theta}{3} + \pi\right) - 1$

