

Graphing Trigonometry Functions

General Directions:

Let $y = a \operatorname{trig}(bx + c) + d$ represent a trigonometry function where 'trig' stands for any of the six functions. First find the period, phase shift, vertical shift, and vertical stretch (called the amplitude in the case of sine and cosine) of your trig function.

$$\text{period} = \frac{\text{period of the trig function (denoted per below)}}{b}$$

$$\text{phase shift} = \frac{-c}{b}$$

$$\text{vertical shift} = d$$

$$\text{vertical stretch (amplitude)} = |a|$$

Note: There is also a vertical reflection through the line $y = d$ if a is negative.

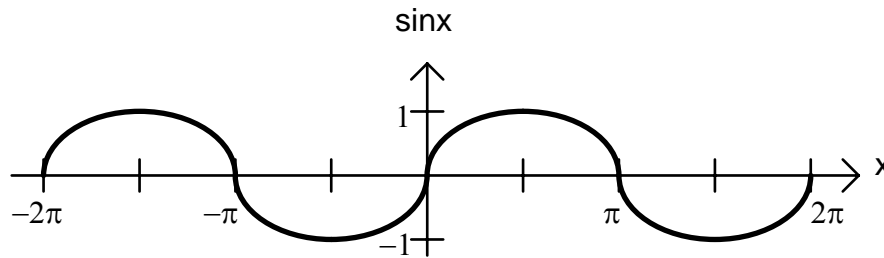
Plotting guidelines:

1. Use the period and phase shift above to decide what kind of scale you need on your axis (i.e. a scale in terms of rational numbers or in terms of π).
2. Label at least one tick mark on each axis. Then each tick mark stands for the same distance.
3. Keep in mind what the basic shape of your trig function looks like.
4. Let $x = \text{phase shift}$ and $y = a \operatorname{trig}(0) + d$. Plot this point first.
5. Move one period to the right (and/or left) and plot a point at the same y value as in number two. Repeat this process for as many periods as desired.
6. (In the horizontal direction) go halfway between the two endpoints of each period that you are plotting. Plot that x value with its corresponding y value $\left(y = a \operatorname{trig}\left(\frac{\text{per}}{2}\right) + d \right)$.
7. (Also in the horizontal direction) go one-fourth and three-fourths of the way between your endpoints (i.e. halfway between the points you already have plotted). Plot these points with their corresponding y values $\left(y = a \operatorname{trig}\left(\frac{\text{per}}{4}\right) + d \right)$ and $y = a \operatorname{trig}\left(\frac{3\text{per}}{4}\right) + d$ respectively.
8. Now draw the trig function.

Specific Guidelines: (Do not memorize these steps. Instead get a feel for the process as you through it. Then you can apply the process for all trigonometry graphs of this type.) On all of the following assume we want to plot one period.

A. Let $y = a \sin(bx + c) + d$. Then the period equals $2\pi/b$.

3.



4. Plot $\left(\frac{-c}{b}, d\right)$ 5. Plot $\left(\frac{-c}{b} + \frac{2\pi}{b}, d\right)$

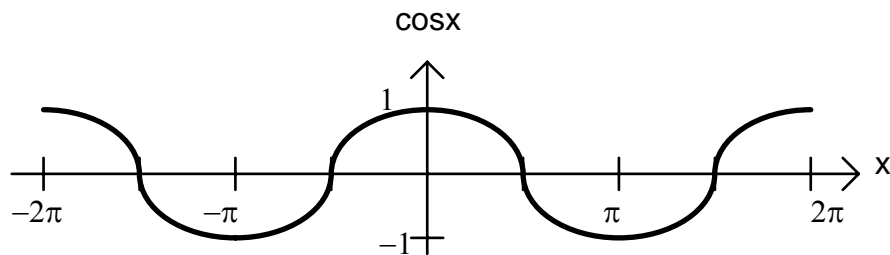
6. Plot $\left(\frac{-c}{b} + \frac{\pi}{b}, d\right)$

7. Plot $\left(\frac{-c}{b} + \frac{\pi}{2b}, d + a\right)$ & $\left(\frac{-c}{b} + \frac{3\pi}{2b}, d - a\right)$

8. Now draw the sine graph through these points.

B. Let $y = a \cos(bx + c) + d$. Then the period equals $2\pi/b$.

3.



4. Plot $\left(\frac{-c}{b}, d + a\right)$ 5. Plot $\left(\frac{-c}{b} + \frac{2\pi}{b}, d + a\right)$

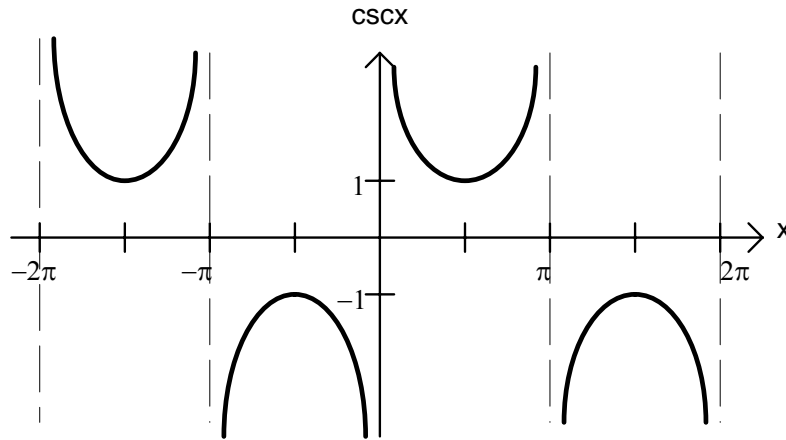
6. Plot $\left(\frac{-c}{b} + \frac{\pi}{b}, d - a\right)$

7. Plot $\left(\frac{-c}{b} + \frac{\pi}{2b}, d\right)$ & $\left(\frac{-c}{b} + \frac{3\pi}{2b}, d\right)$

8. Now draw the cosine graph through these points.

C. Let $y = a \csc(bx + c) + d$. Then the period equals $2\pi/b$.

3.



4. Plot a vertical asymptote at $x = \frac{-c}{b}$.

5. Plot a vertical asymptote at $x = \frac{-c}{b} + \frac{2\pi}{b}$.

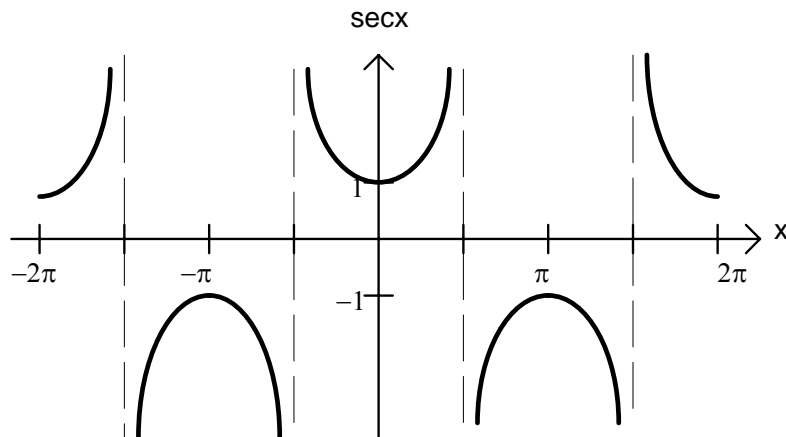
6. Plot a vertical asymptote at $x = \frac{-c}{b} + \frac{\pi}{b}$.

7. Plot $\left(\frac{-c}{b} + \frac{\pi}{2b}, d + a\right)$ & $\left(\frac{-c}{b} + \frac{3\pi}{2b}, d - a\right)$.

8. Now draw the cosecant graph.

D. Let $y = \sec(bx + c) + d$. Then the period equals $2\pi/b$.

3.



4. Plot $\left(\frac{-c}{b}, d + a\right)$ 5. Plot $\left(\frac{-c}{b} + \frac{2\pi}{b}, d + a\right)$

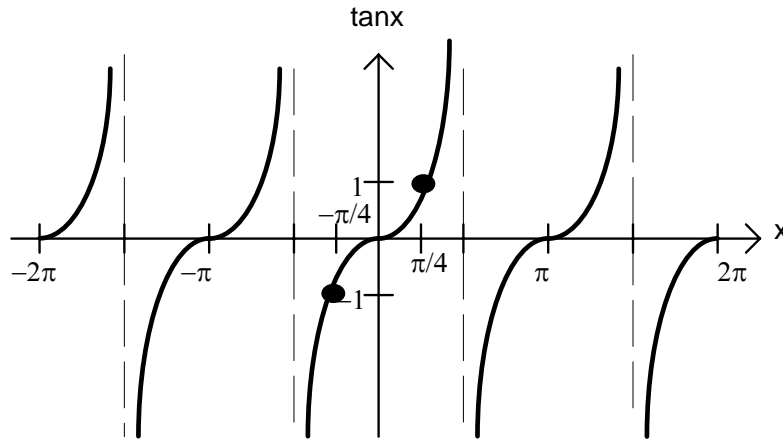
6. Plot $\left(\frac{-c}{b} + \frac{\pi}{b}, d - a\right)$

7. Plot a vertical asymptote at $x = \frac{-c}{b} + \frac{\pi}{2b}$ & at $x = \frac{-c}{b} + \frac{3\pi}{2b}$.

8. Now draw the secant graph.

E. Let $y = \tan(bx + c) + d$. Then the period equals π/b .

3.



4. Plot $\left(\frac{-c}{b}, d\right)$ 5. Plot $\left(\frac{-c}{b} + \frac{\pi}{b}, d\right)$

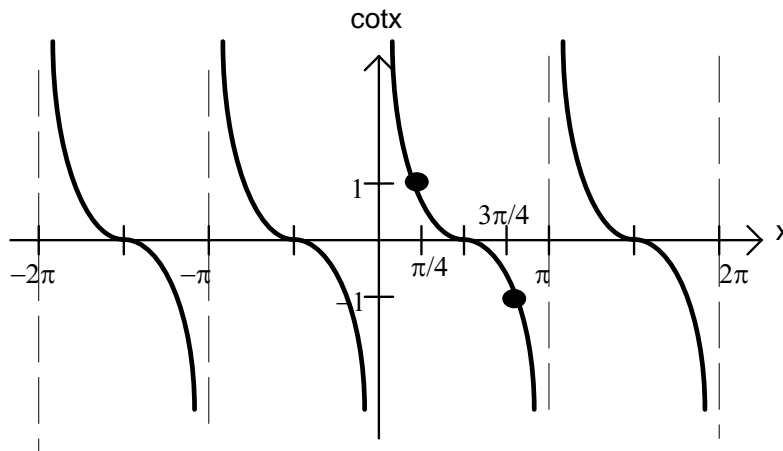
6. Plot a vertical asymptote at $x = \frac{-c}{b} + \frac{\pi}{2b}$.

7. Plot $\left(\frac{-c}{b} + \frac{\pi}{4b}, d + a\right)$ & $\left(\frac{-c}{b} + \frac{3\pi}{4b}, d - a\right)$.

8. Now draw the tangent graph.

F. Let $y = \cot(bx + c) + d$. Then the period equals π/b .

3.



4. Plot a vertical asymptote at $x = \frac{-c}{b}$.

5. Plot a vertical asymptote at $x = \frac{-c}{b} + \frac{\pi}{b}$.

6. Plot $\left(\frac{-c}{b} + \frac{\pi}{2b}, d\right)$

7. Plot $\left(\frac{-c}{b} + \frac{\pi}{4b}, d + a\right)$ & $\left(\frac{-c}{b} + \frac{3\pi}{4b}, d - a\right)$

8. Now draw the cotangent graph.