

Graphs of Other Trigonometric Functions

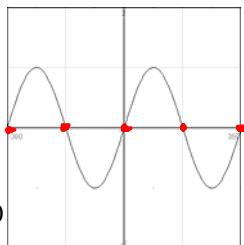
$y = \tan x$

$$\tan x = \frac{\sin x}{\cos x}$$

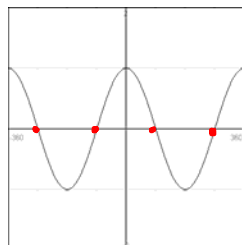
$\tan x = 0$ when $\sin x = 0$

$\tan x = \text{undefined}$ when $\cos x = 0$

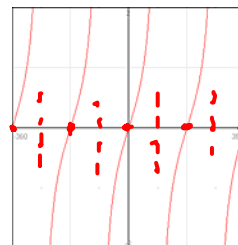
$y = \sin x$



$y = \cos x$



$y = \tan x$



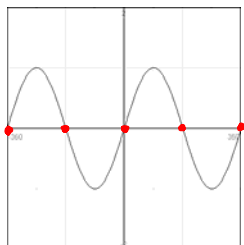
$y = \cot x$

$$\cot x = \frac{\cos x}{\sin x}$$

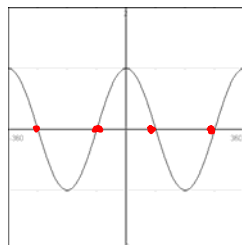
$\cot x = 0$ when $\cos x = 0$

$\cot x = \text{undefined}$ when $\sin x = 0$

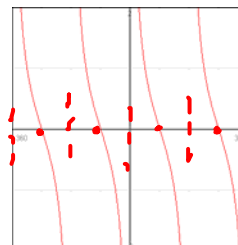
$y = \sin x$



$y = \cos x$



$y = \cot x$



$y = a \tan bx$

$y = a \cot bx$

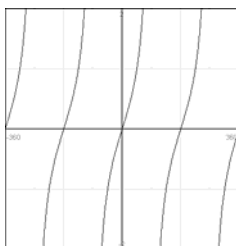
b = frequency - the number of cycles in π radians

$\frac{\pi}{b}$ = period - how long it takes to complete one cycle

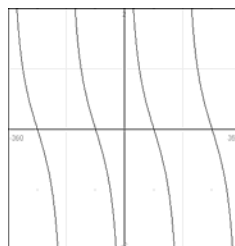
Transformations of the Tangent and Cotangent Functions

$a > 0$

$y = \tan x$



$y = \cot x$



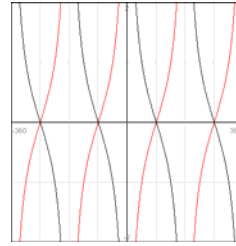
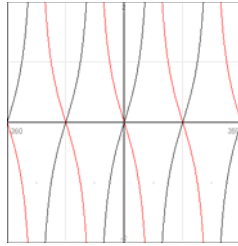
$y = \tan x$

$y = -\tan x$

$y = \cot x$

$y = -\cot x$

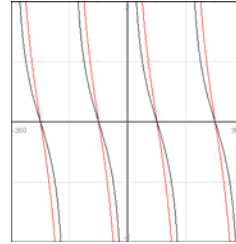
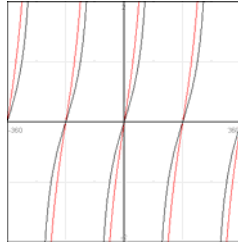
$a < 0$



$y = \tan x$
 $y = 2 \tan x$ $a = 2$

$y = \cot x$
 $y = 2 \cot x$

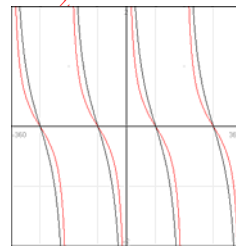
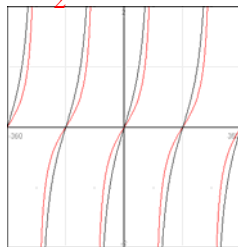
$|a| > 1$



$y = \tan x$
 $y = \frac{1}{2} \tan x$ $a = \frac{1}{2}$

$y = \cot x$
 $y = \frac{1}{2} \cot x$

$0 < |a| < 1$



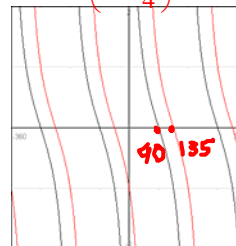
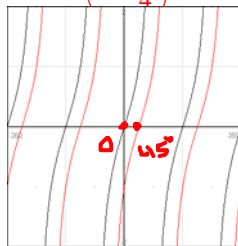
$y = \tan(x-h)$

$y = \cot(x-h)$

Shift graph h units to the right

$y = \tan x$
 $y = \tan\left(x - \frac{\pi}{4}\right)$

$y = \cot x$
 $y = \cot\left(x - \frac{\pi}{4}\right)$



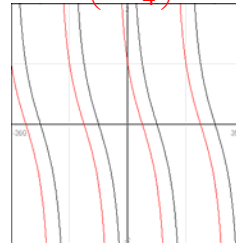
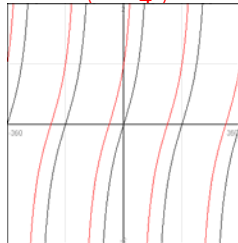
$y = \tan(x+h)$

$y = \cot(x+h)$

Shift graph h units to the left

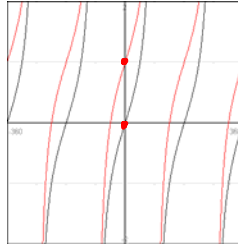
$y = \tan x$
 $y = \tan\left(x + \frac{\pi}{4}\right)$

$y = \cot x$
 $y = \cot\left(x + \frac{\pi}{4}\right)$

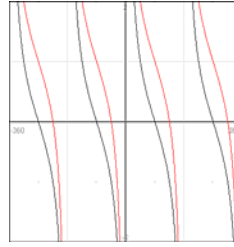


$y = \tan x + k$
 $y = \cot x + k$
 Shift graph k units up

$y = \tan x$
 $y = \tan x + 1$

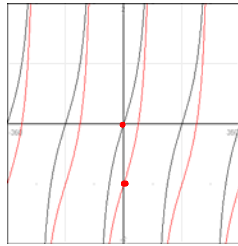


$y = \cot x$
 $y = \cot x + 1$

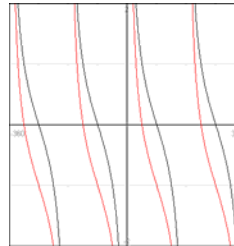


$y = \tan x - k$
 $y = \cot x - k$
 Shift graph k units down

$y = \tan x$
 $y = \tan x - 1$

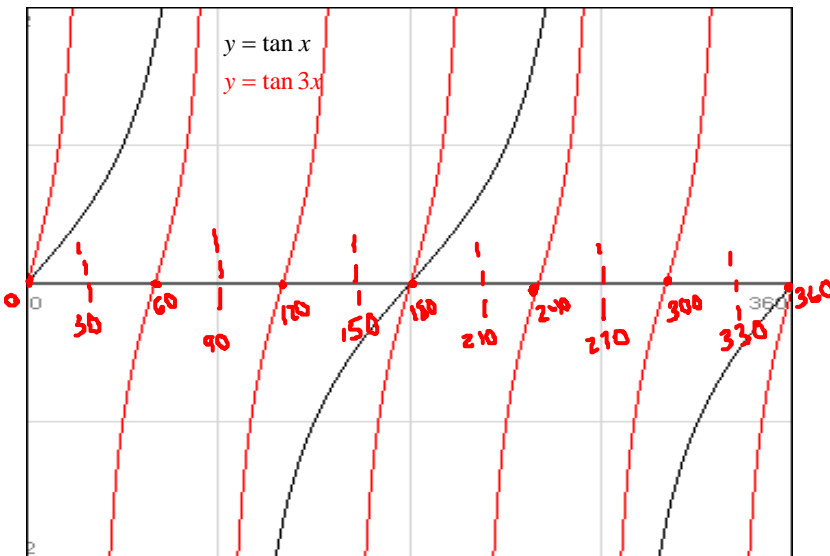


$y = \cot x$
 $y = \cot x - 1$

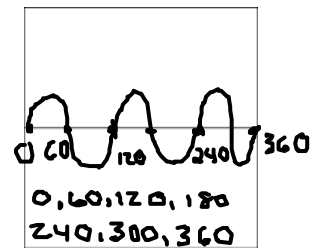


Directions: Sketch the graph of each function in the interval $[0, 2\pi]$.

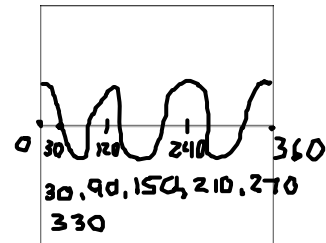
1. $y = \tan 3x$ $y = \frac{\sin 3x}{\cos 3x}$



$y = \sin 3x$

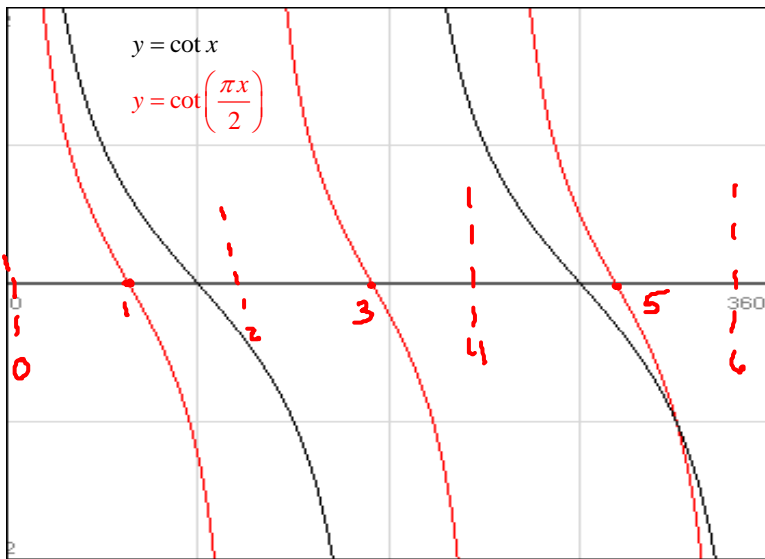


$y = \cos 3x$

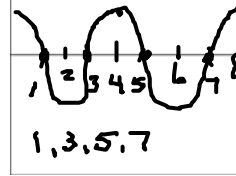


2. $y = \cot\left(\frac{\pi x}{2}\right)$
 $y = \frac{\cos \frac{\pi x}{2}}{\sin \frac{\pi x}{2}}$

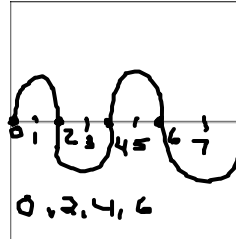
$\frac{\cos \frac{\pi x}{2}}{\sin \frac{\pi x}{2}}$
 $\frac{2\pi}{\pi} = 2\pi \cdot \frac{2}{\pi} = 4$



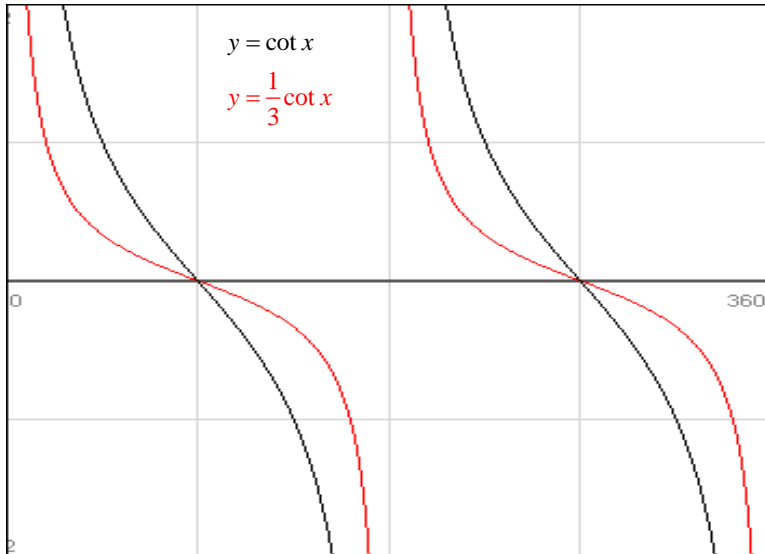
$$\frac{2\pi}{\frac{\pi}{2}} = 2\pi \cdot \frac{2}{\pi} = 4$$



$$\sin\left(\frac{\pi x}{2}\right)$$



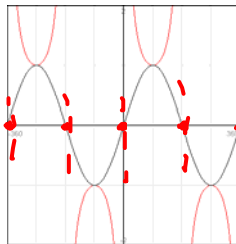
3. $y = \frac{1}{3} \cot x$ $a = \frac{1}{3}$ wider



$$y = \csc x$$

$$\csc x = \frac{1}{\sin x}$$

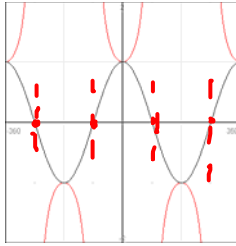
$\csc x = \text{undefined}$ when $\sin x = 0$



$$y = \sec x$$

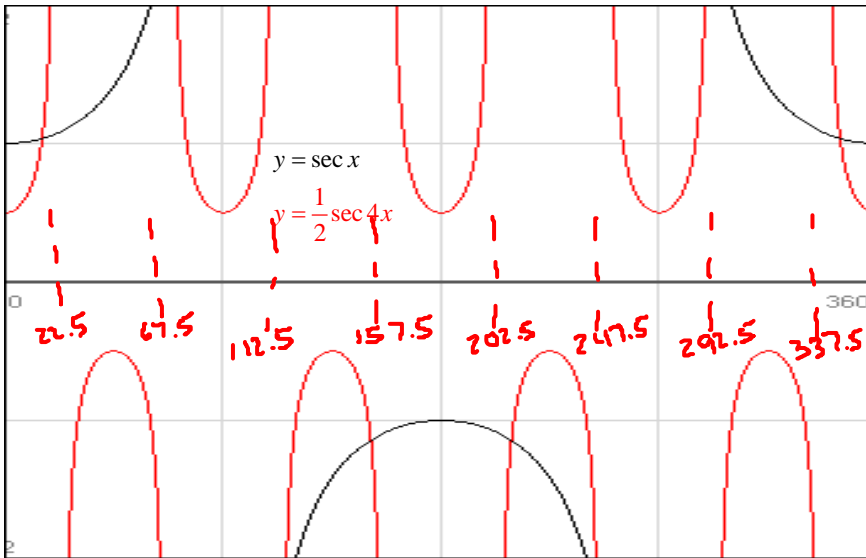
$$\sec x = \frac{1}{\cos x}$$

$\sec x = \text{undefined}$ when $\cos x = 0$

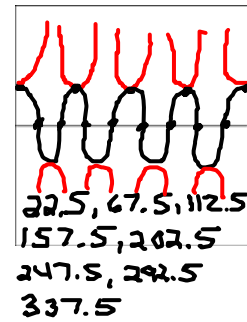


Directions: Sketch the graph of each function in the interval $[0, 2\pi]$.

4. $y = \frac{1}{2} \sec 4x$ $a = \frac{1}{2}$



$$\frac{2\pi}{4} = \frac{2\pi}{4} = \frac{\pi}{2}$$



5. $y = \csc\left(x - \frac{\pi}{2}\right)$ shift graph 90° right

