

$$y = \cot x$$

$$y = -\tan\left(x + \frac{\pi}{2}\right)$$

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Notes—4.7 Graphing Tangent, Cotangent, Secant, Cosecant Functions

In each of the grids below the sine and cosine functions are graphed. Use the values of $y = \sin x$ and $y = \cos x$ to determine the values of each of the following... hints are provided.

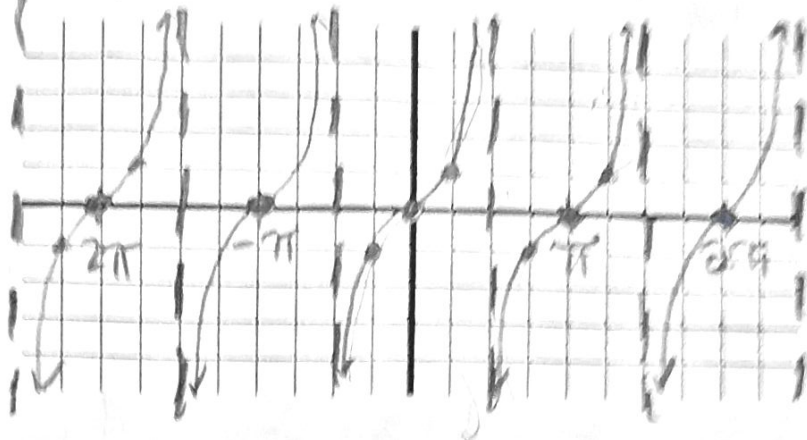
1) $y = \tan x$ period = π

angle x	ratio
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$$\tan \theta = \frac{\sin \theta}{\cos \theta}$$

0	0
$\frac{\pi}{2}$	und
$-\pi$	0
$\frac{3\pi}{2}$	und

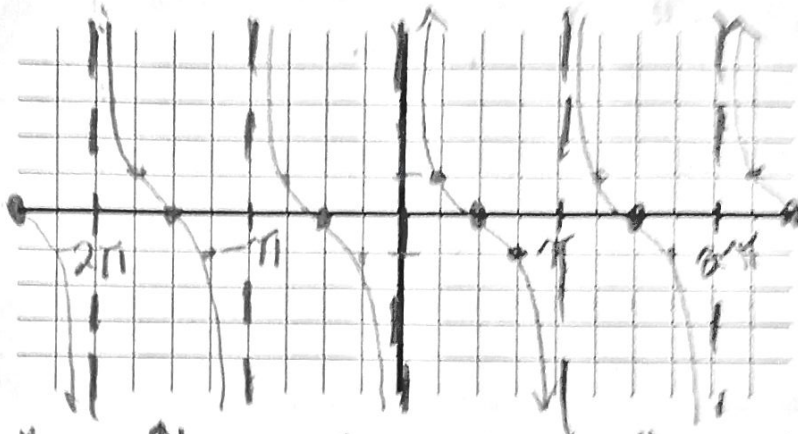


2) $y = \cot x$

x	ratio
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$x \neq \pm k\pi$
K is integer

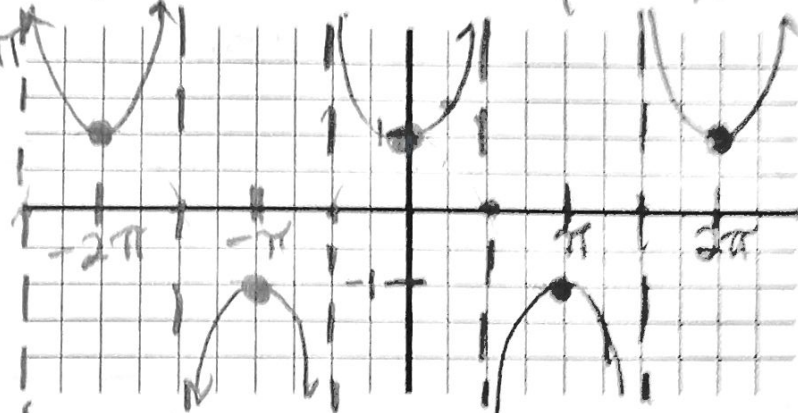
0	und
$\frac{\pi}{2}$	0
π	und
$\frac{3\pi}{2}$	0



3) $y = \sec x = \frac{1}{\cos x}$ period 2π

Domain
 $x \neq \frac{k\pi}{2}$
 $k \in \mathbb{Z}$
↑ integers

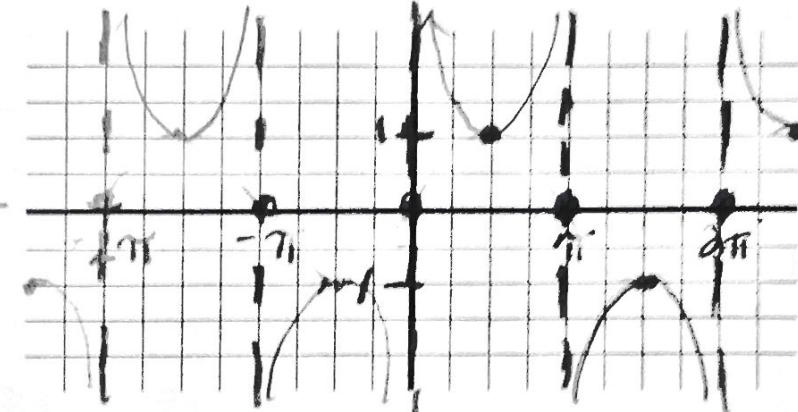
Range
 $(-\infty, -1] \cup [1, \infty)$



4) $y = \csc x = \frac{1}{\sin x}$

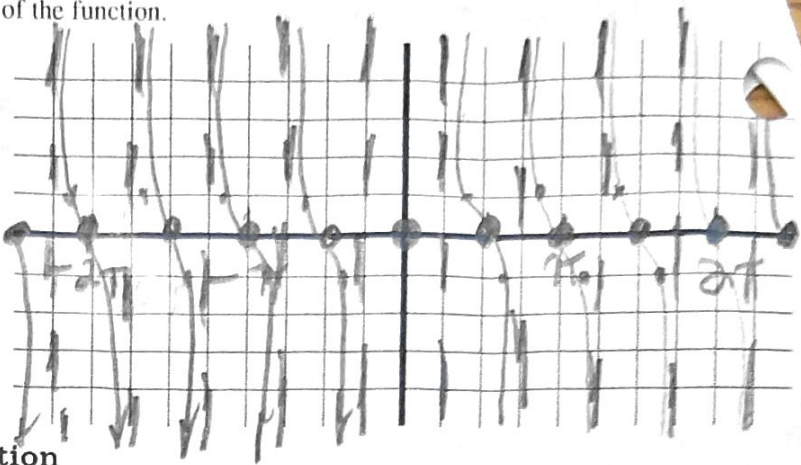
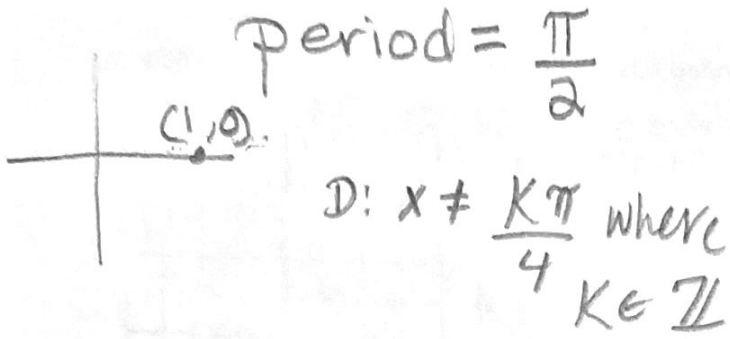
D: $x \neq k\pi, k \in \mathbb{Z}$

R: $(-\infty, -1] \cup [1, \infty)$



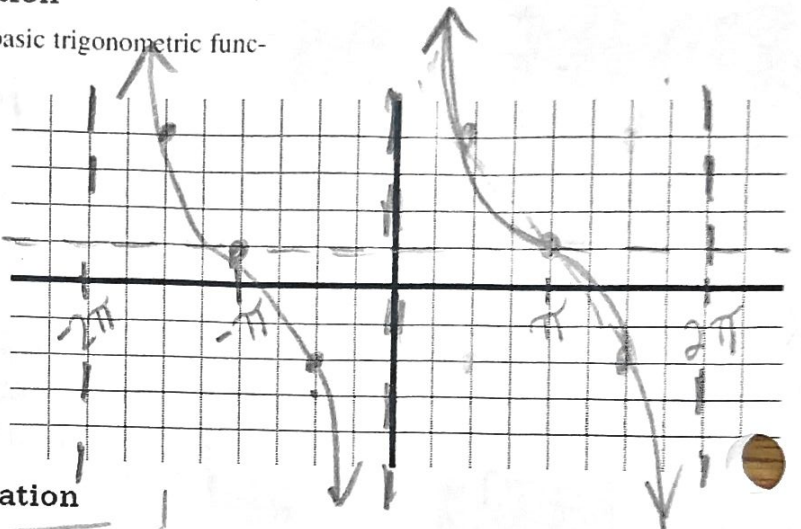
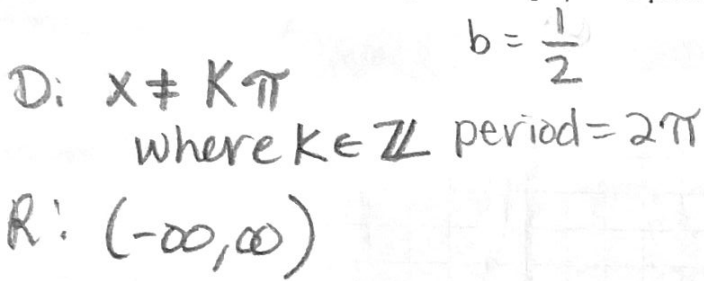
EXAMPLE 1 Graphing a Tangent Function

Describe the graph of the function $y = -\tan 2x$ in terms of a basic trigonometric function. Locate the vertical asymptotes and graph four periods of the function.



EXAMPLE 2 Graphing a Cotangent Function

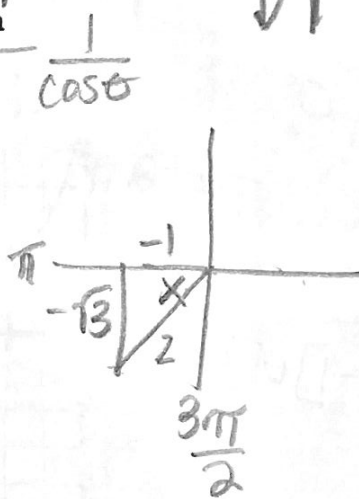
Describe the graph of $f(x) = 3 \cot(x/2) + 1$ in terms of a basic trigonometric function. Locate the vertical asymptotes and graph two periods.



EXAMPLE 3 Solving a Trigonometric Equation Algebraically

Find the value of x between π and $3\pi/2$ that solves $\sec x = -2$.

$$x = \frac{4\pi}{3}$$



Function	Period	Domain	Range	Asymptotes	Zeros	Even/Odd
$\sin x$	2π	All reals	$[-1, 1]$	None	$n\pi$	Odd
$\cos x$	2π	All reals	$[-1, 1]$	None	$\pi/2 + n\pi$	Even
$\tan x$	π	$x \neq \pi/2 + n\pi$	All reals	$x = \pi/2 + n\pi$	$n\pi$	Odd
$\cot x$	π	$x \neq n\pi$	All reals	$x = n\pi$	$\pi/2 + n\pi$	Odd
$\sec x$	2π	$x \neq \pi/2 + n\pi$	$(-\infty, -1] \cup [1, \infty)$	$x = \pi/2 + n\pi$	None	Even
$\csc x$	2π	$x \neq n\pi$	$(-\infty, -1] \cup [1, \infty)$	$x = n\pi$	None	Odd