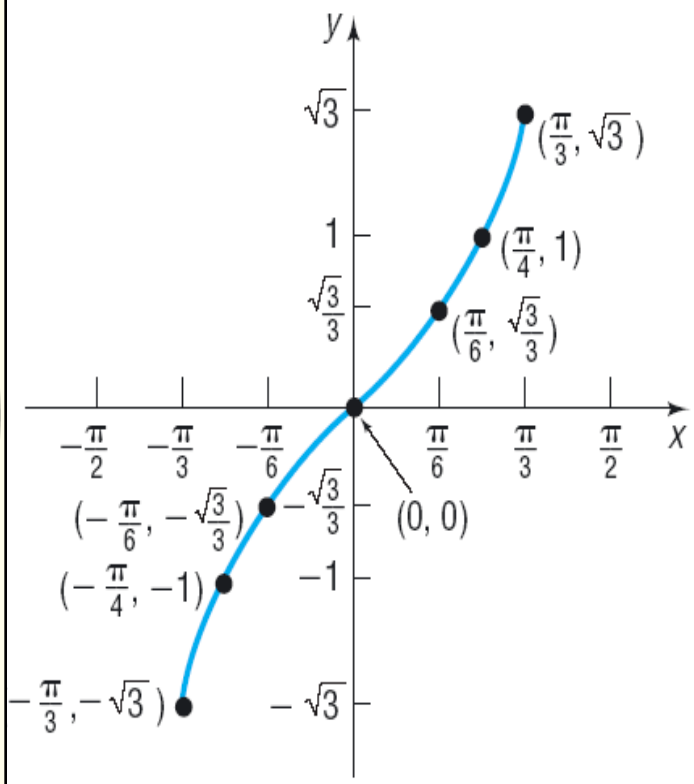
Section 7.7

Graphs of the Tangent, Cotangent, Cosecant, and Secant Functions

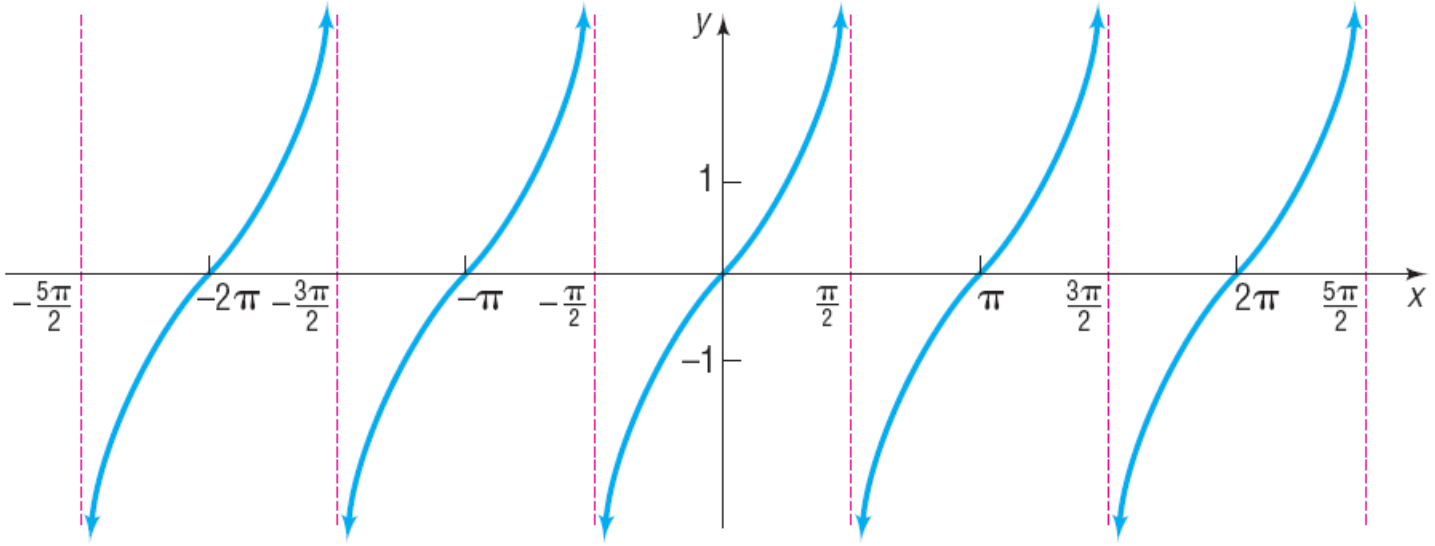
The Graph of the Tangent Function

x	$y = \tan x$	(x, y)
$-\frac{\pi}{3}$	$-\sqrt{3} \approx -1.73$	$\left(-\frac{\pi}{3}, -\sqrt{3}\right)$
$-\frac{\pi}{4}$	-1	$\left(-\frac{\pi}{4}, -1\right)$
$-\frac{\pi}{6}$	$-\frac{\sqrt{3}}{3} \approx -0.58$	$\left(-\frac{\pi}{6}, -\frac{\sqrt{3}}{3}\right)$
0	0	$(0, 0)$
$\frac{\pi}{6}$	$\frac{\sqrt{3}}{3} \approx 0.58$	$\left(\frac{\pi}{6}, \frac{\sqrt{3}}{3}\right)$
$\frac{\pi}{4}$	1	$\left(\frac{\pi}{4}, 1\right)$
$\frac{\pi}{3}$	$\sqrt{3} \approx 1.73$	$\left(\frac{\pi}{3}, \sqrt{3}\right)$

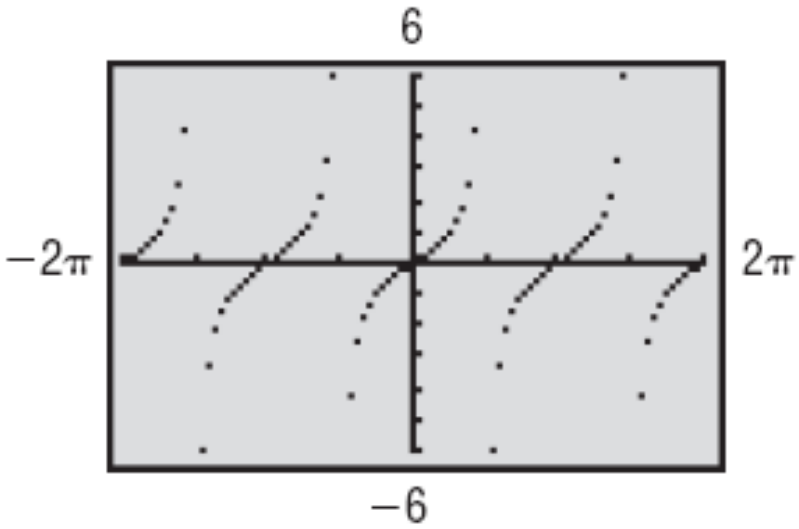


$$\tan x = \frac{\sin x}{\cos x}$$

x	$\sin x$	$\cos x$	$y = \tan x$
$\frac{\pi}{3} \approx 1.05$	$\frac{\sqrt{3}}{2}$	$\frac{1}{2}$	$\sqrt{3} \approx 1.73$
1.5	0.9975	0.0707	14.1
1.57	0.9999	$7.96E^{-4}$	1255.8
1.5707	0.9999	$9.6E^{-5}$	10,381
$\frac{\pi}{2} \approx 1.5708$	1	0	Undefined



$y = \tan x, -\infty < x < \infty, x$ not equal to odd multiples of $\frac{\pi}{2}$



Properties of the Tangent Function

1. The domain is the set of all real numbers, except odd multiples of $\frac{\pi}{2}$.
2. The range is the set of all real numbers.
3. The tangent function is an odd function, as the symmetry of the graph with respect to the origin indicates.
4. The tangent function is periodic, with period π.
5. The x-intercepts are $\ldots, -2\pi, -\pi, 0, \pi, 2\pi, 3\pi, \ldots$; the y-intercept is 0.
6. Vertical asymptotes occur at $x = \ldots, -\frac{3\pi}{2}, -\frac{\pi}{2}, \frac{\pi}{2}, \frac{3\pi}{2}, \ldots$.

OBJECTIVE 1

1 Graph Functions of the Form $y = A\tan(\omega x) + B$

EXAMPLE

Graphing Functions of the Form $y = A\tan(\omega x) + B$

Graph $y = \frac{1}{2}\tan x + 2$. Use the graph to determine the domain and the range of $y = \frac{1}{2}\tan x + 2$.

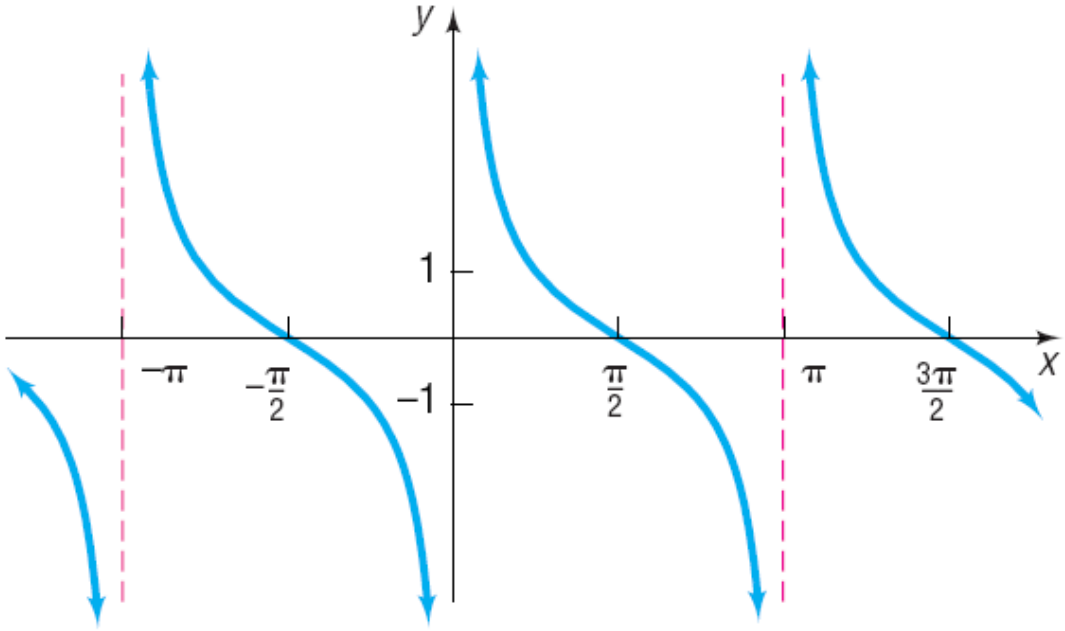
EXAMPLE

Graphing Functions of the Form $y = A\tan(\omega x) + B$

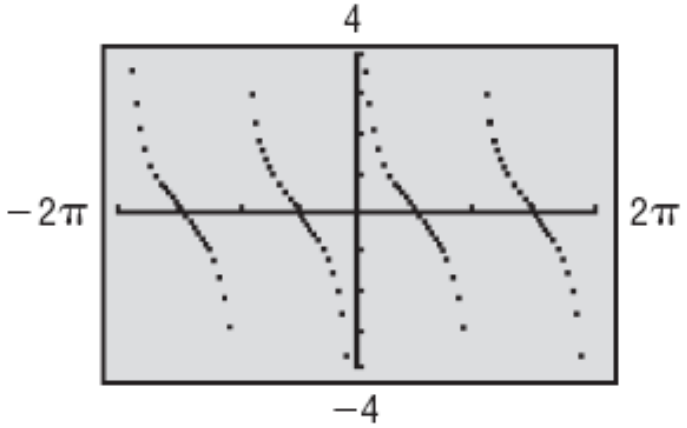
Graph $y = 3\tan\left(\frac{1}{2}x\right) - 1$. Use the graph to determine the domain and the range of $y = 3\tan\left(\frac{1}{2}x\right) - 1$.

The Graph of the Cotangent Function

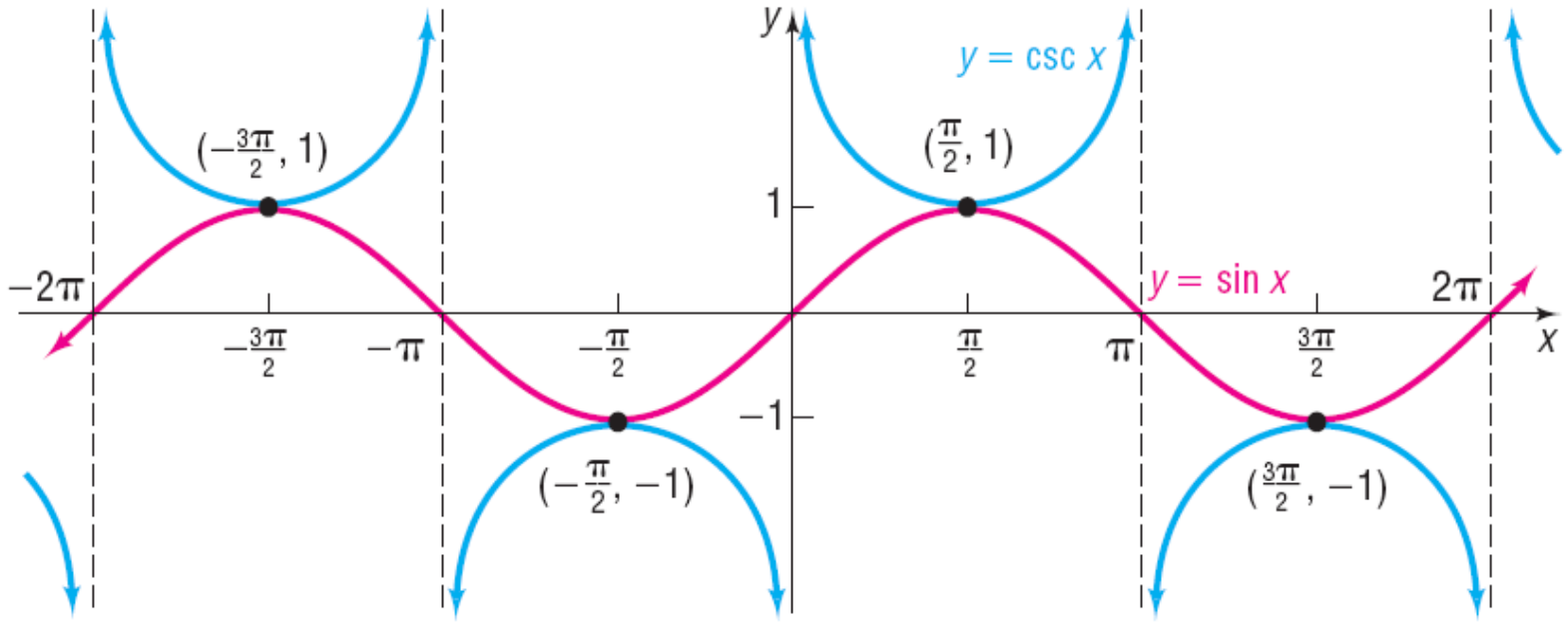
x	$y = \cot x$	(x, y)
$\frac{\pi}{6}$	$\sqrt{3}$	$\left(\frac{\pi}{6}, \sqrt{3}\right)$
$\frac{\pi}{4}$	1	$\left(\frac{\pi}{4}, 1\right)$
$\frac{\pi}{3}$	$\frac{\sqrt{3}}{3}$	$\left(\frac{\pi}{3}, \frac{\sqrt{3}}{3}\right)$
$\frac{\pi}{2}$	0	$\left(\frac{\pi}{2}, 0\right)$
$\frac{2\pi}{3}$	$-\frac{\sqrt{3}}{3}$	$\left(\frac{2\pi}{3}, -\frac{\sqrt{3}}{3}\right)$
$\frac{3\pi}{4}$	-1	$\left(\frac{3\pi}{4}, -1\right)$
$\frac{5\pi}{6}$	$-\sqrt{3}$	$\left(\frac{5\pi}{6}, -\sqrt{3}\right)$



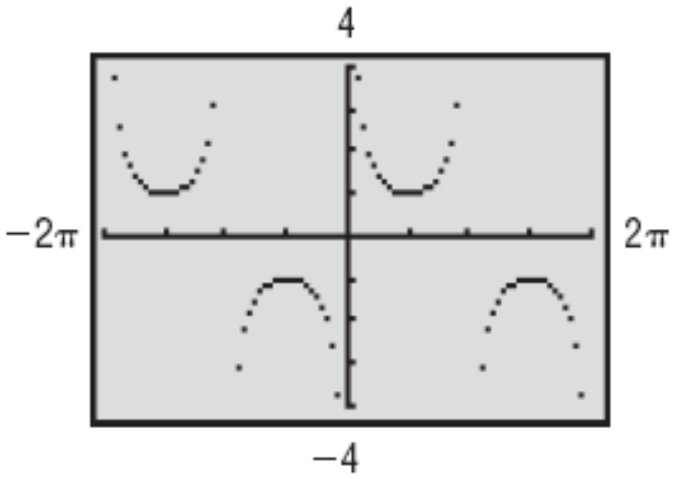
$y = \cot x, -\infty < x < \infty, x$ not equal to integer multiples of $\pi, -\infty < y < \infty$



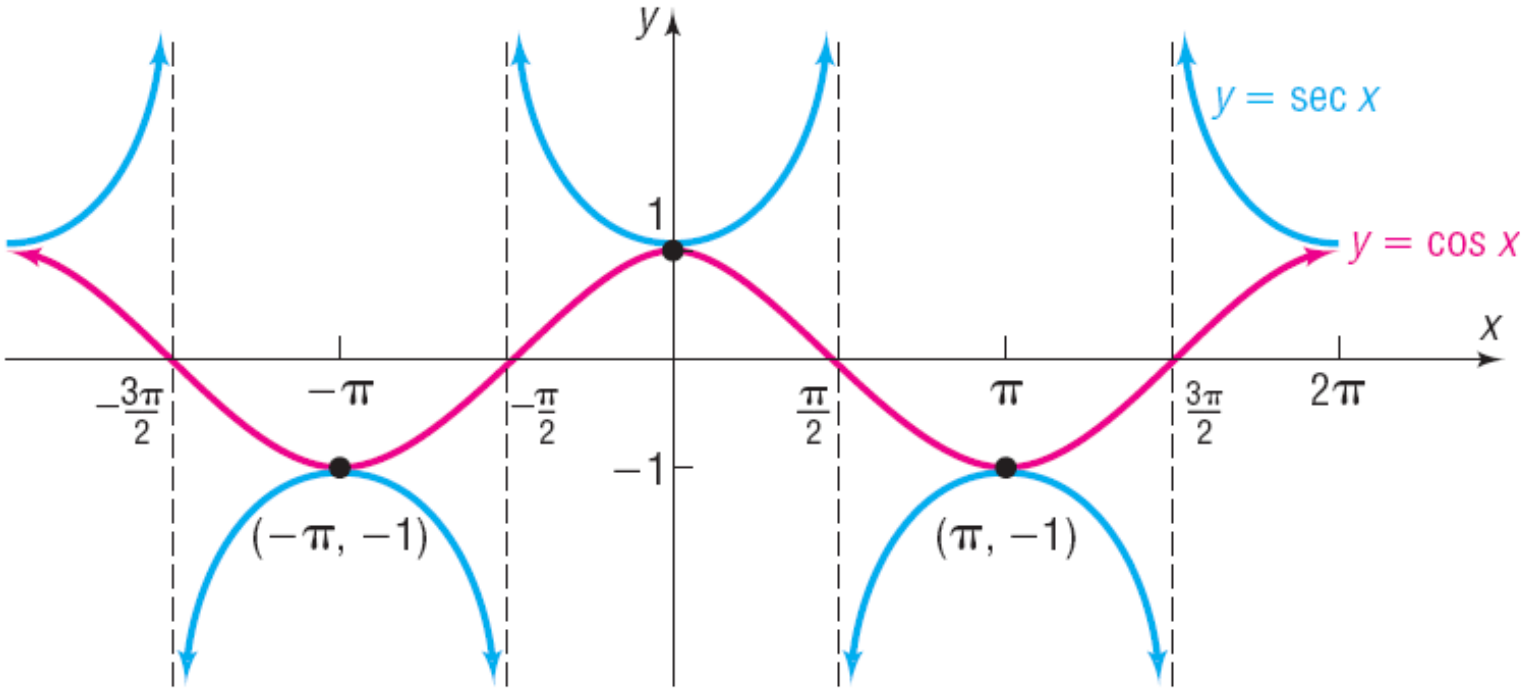
The Graph of the Cosecant Function



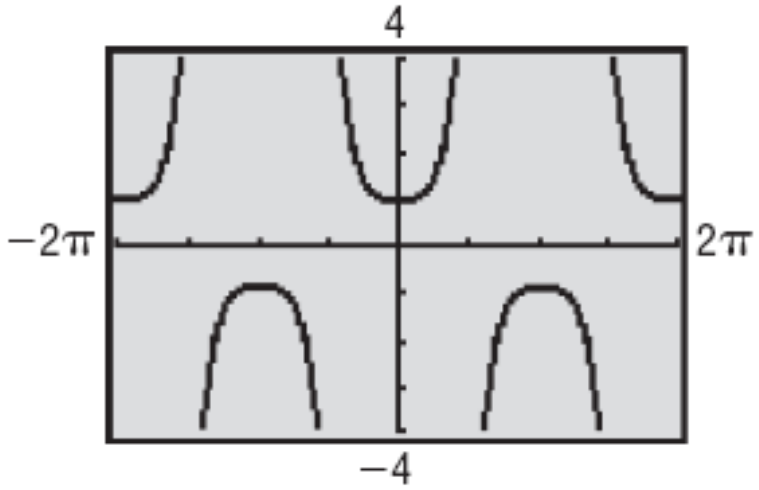
$y = \csc x, -\infty < x < \infty$, x not equal to integer multiples of π, $|y| \geq 1$



The Graph of the Secant Function



$y = \sec x, -\infty < x < \infty, x$ not equal to odd multiples of $\frac{\pi}{2}, |y| \geq 1$



OBJECTIVE 2

✓ 2 Graph Functions of the Form $y = A\csc(\omega x) + B$ and $y = A\sec(\omega x) + B$

EXAMPLE

Graphing Functions of the Form $y = A\csc(\omega x) + B$

Graph $y = -\csc(2x) - 1$. Use the graph to determine the domain and the range of $y = -\csc(2x) - 1$.