

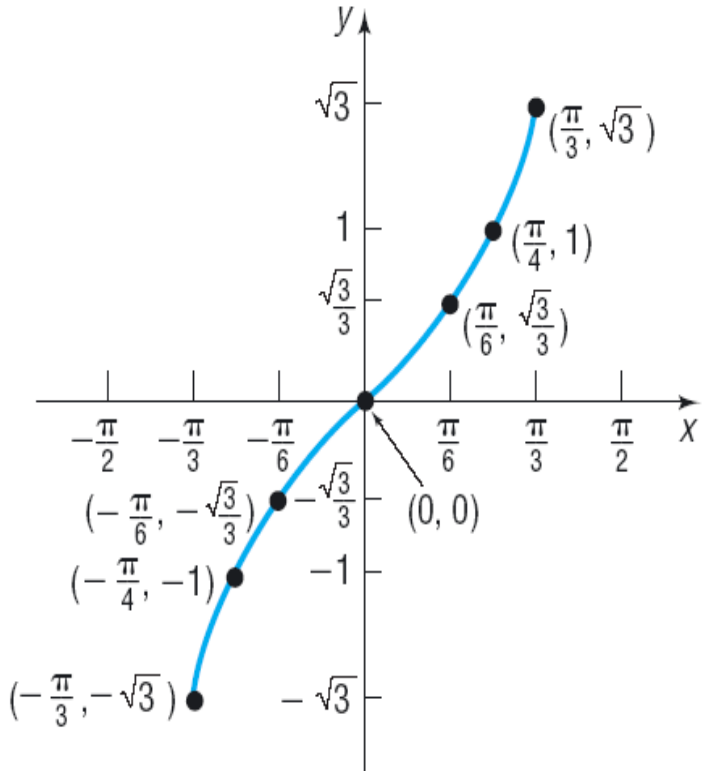
Section 5.5

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

OBJECTIVE 1

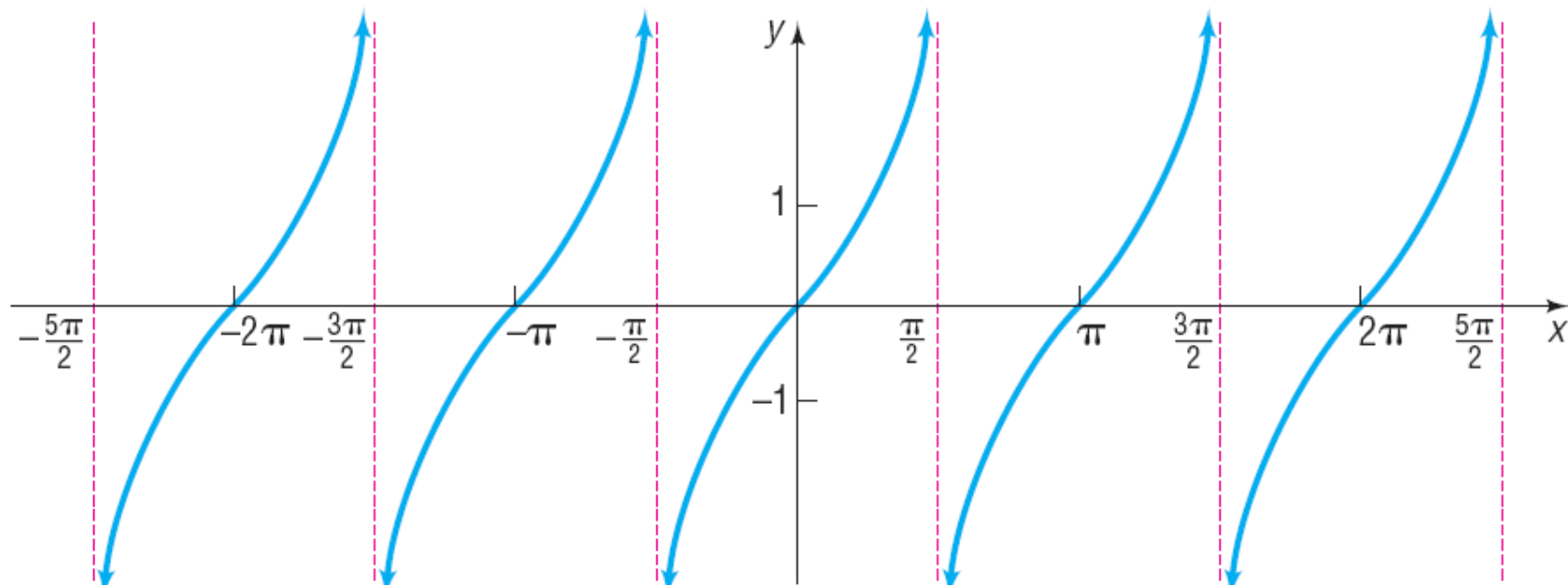
- 1 ✓ **Graphs Transformations of the Tangent Function and Cotangent Function**

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

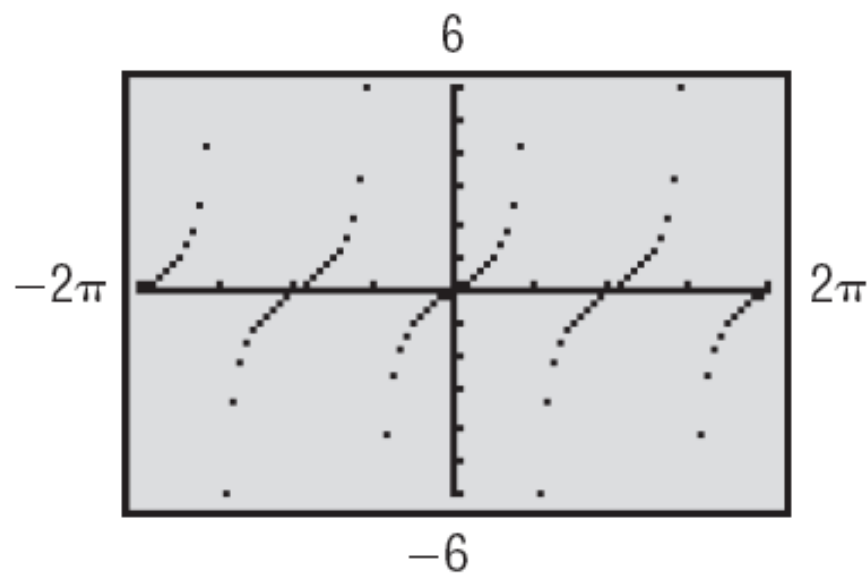


X	Y_1
1.5	14.101
1.57	1255.8
1.5707	10381
1.5708	ERROR
-1.5	-14.1
-1.57	-1256
-1.571	ERROR

$Y_1 = \tan(X)$



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

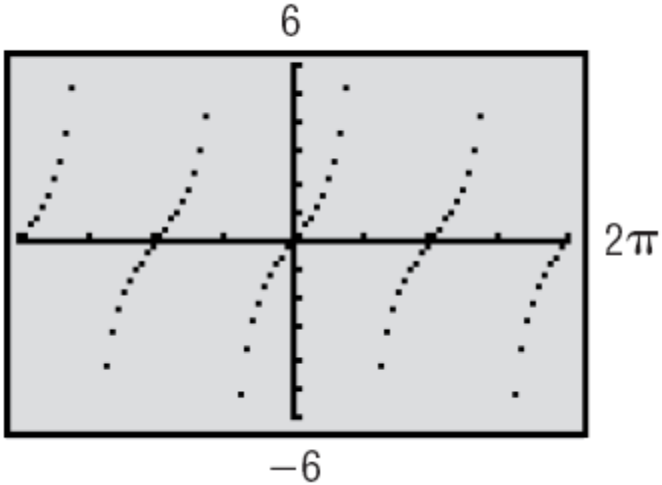


Properties of the Tangent Function

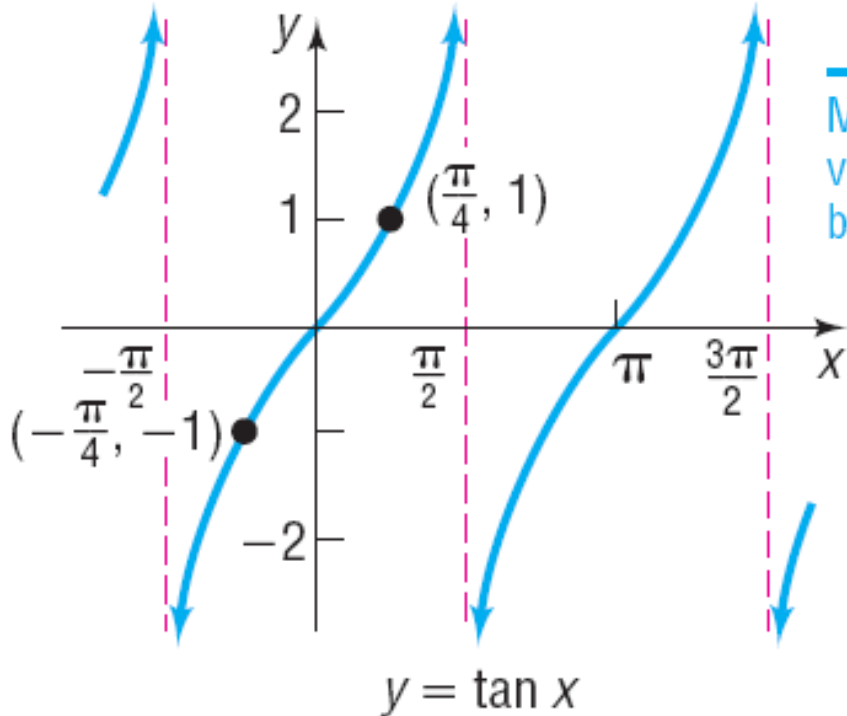
1. The domain is the set of all real numbers, except odd multiples of $\frac{\pi}{2}$.
2. The range is the set of all real numbers.
3. The tangent function is an odd function, as the symmetry of the graph with respect to the origin indicates.
4. The tangent function is periodic, with period π .
5. The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

EXAMPLE

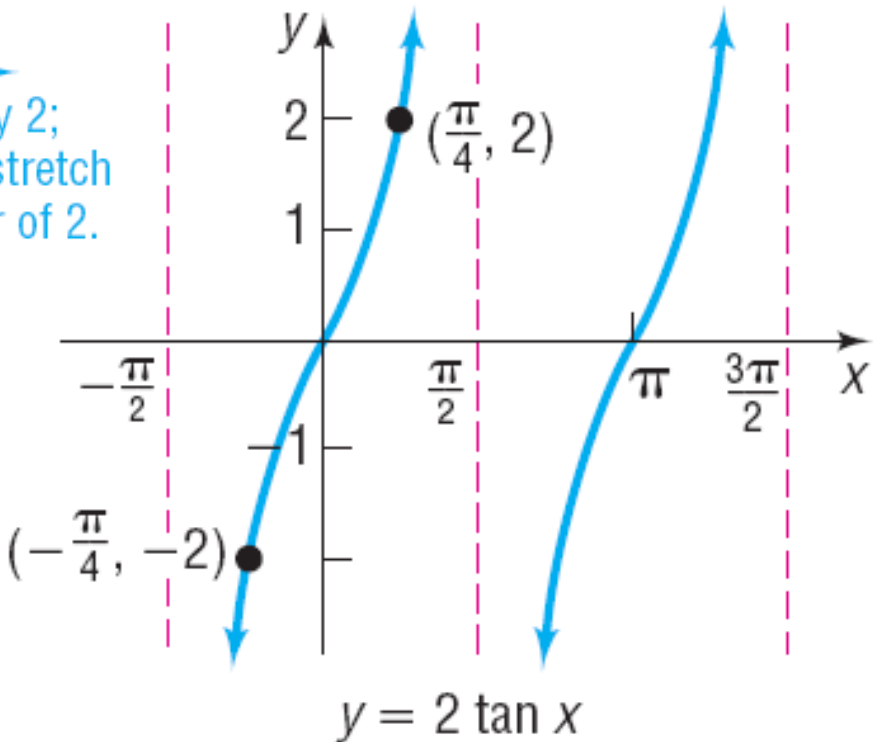
Graphing Variations of $y = \tan x$ Using



Graph: $y = 2 \tan x$



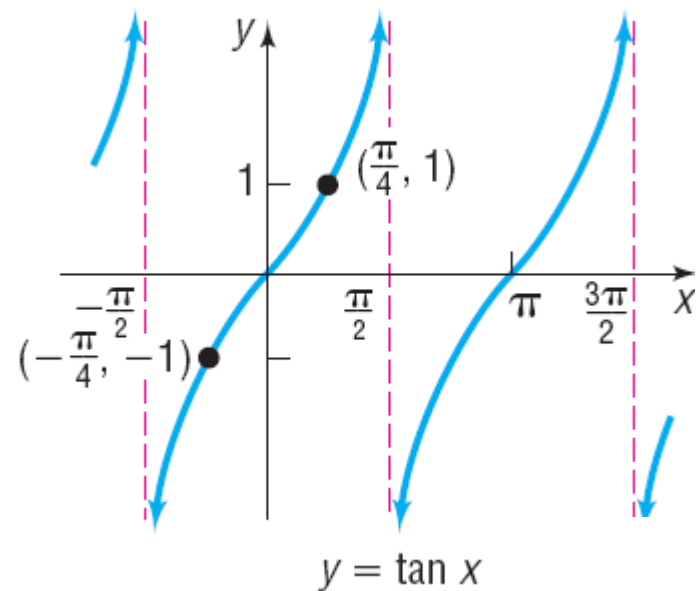
Multiply by 2;
vertically stretch
by a factor of 2.



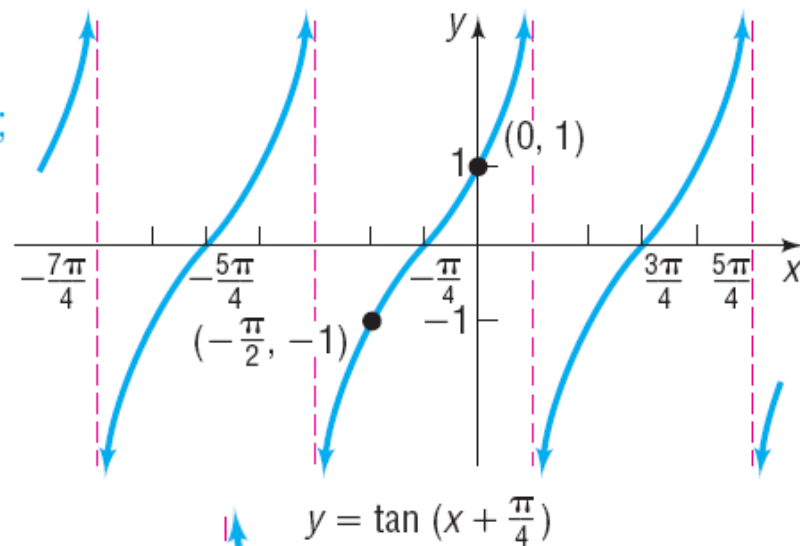
EXAMPLE

Graphing Variations of $y = \tan x$ Using Transformations

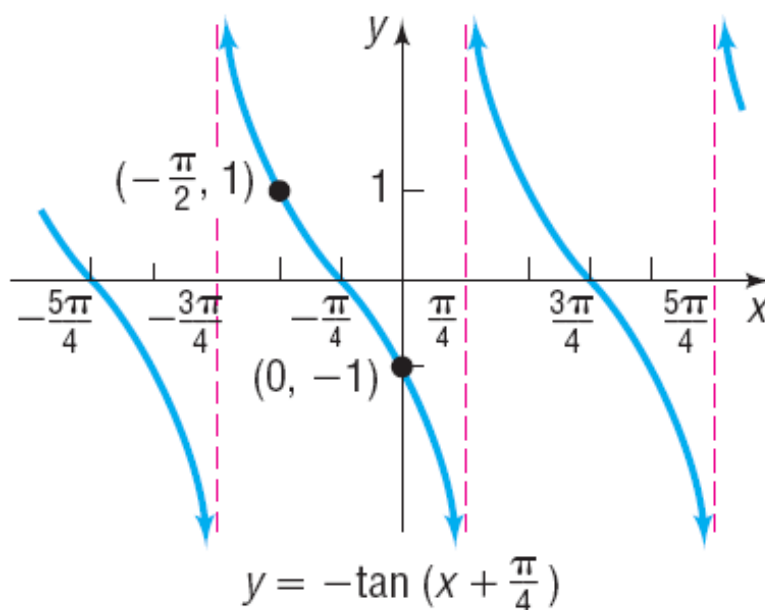
Graph: $y = -\tan\left(x + \frac{\pi}{4}\right)$



Replace x by $x + \frac{\pi}{4}$;
shift left $\frac{\pi}{4}$ units.

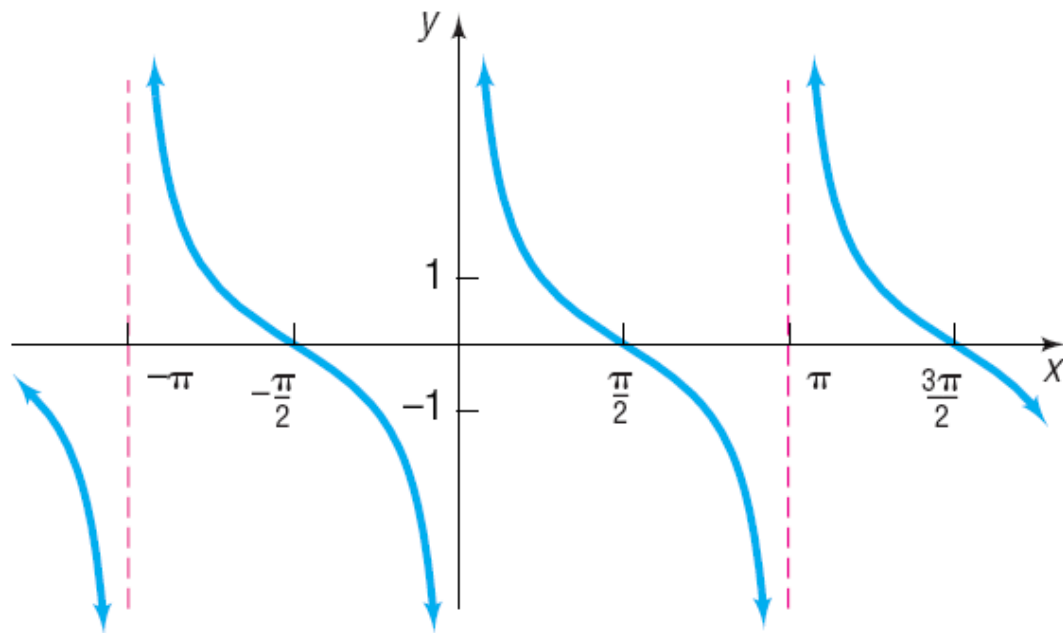


Multiply by -1 ;
reflect about x -axis.

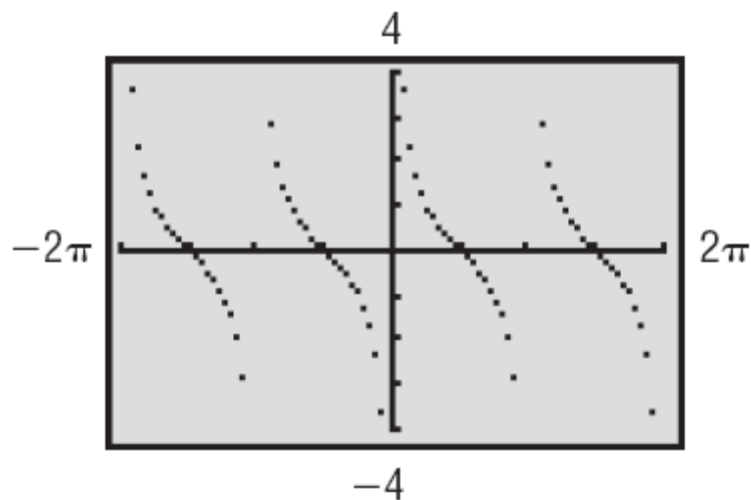


EXAMPLE

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

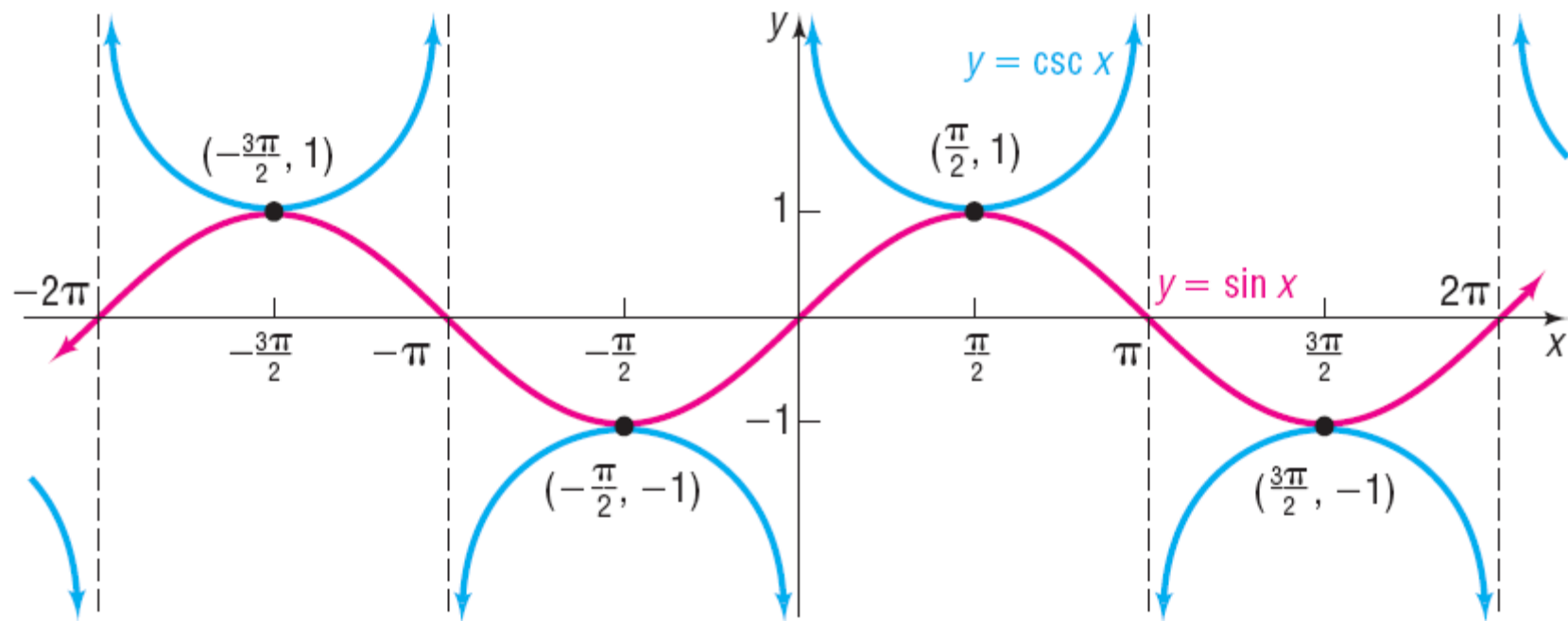


$y = \cot x, -\infty < x < \infty, x$ not equal to integer multiples of $\pi, -\infty < y < \infty$

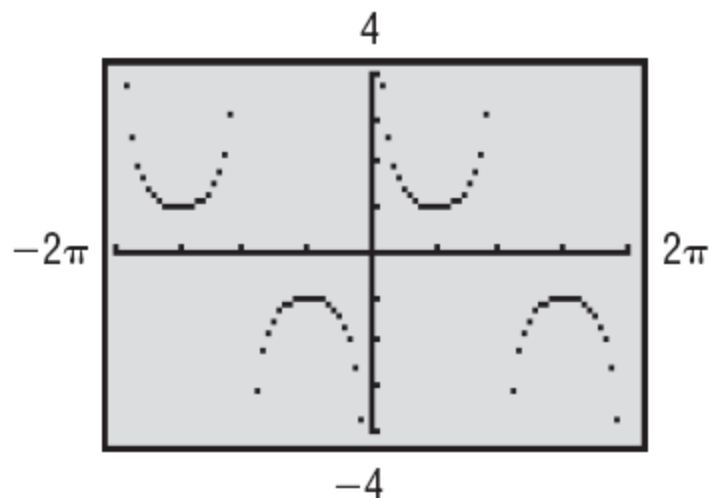


OBJECTIVE 2

- 2 Graph Transformations of the Cosecant Function and Secant Function



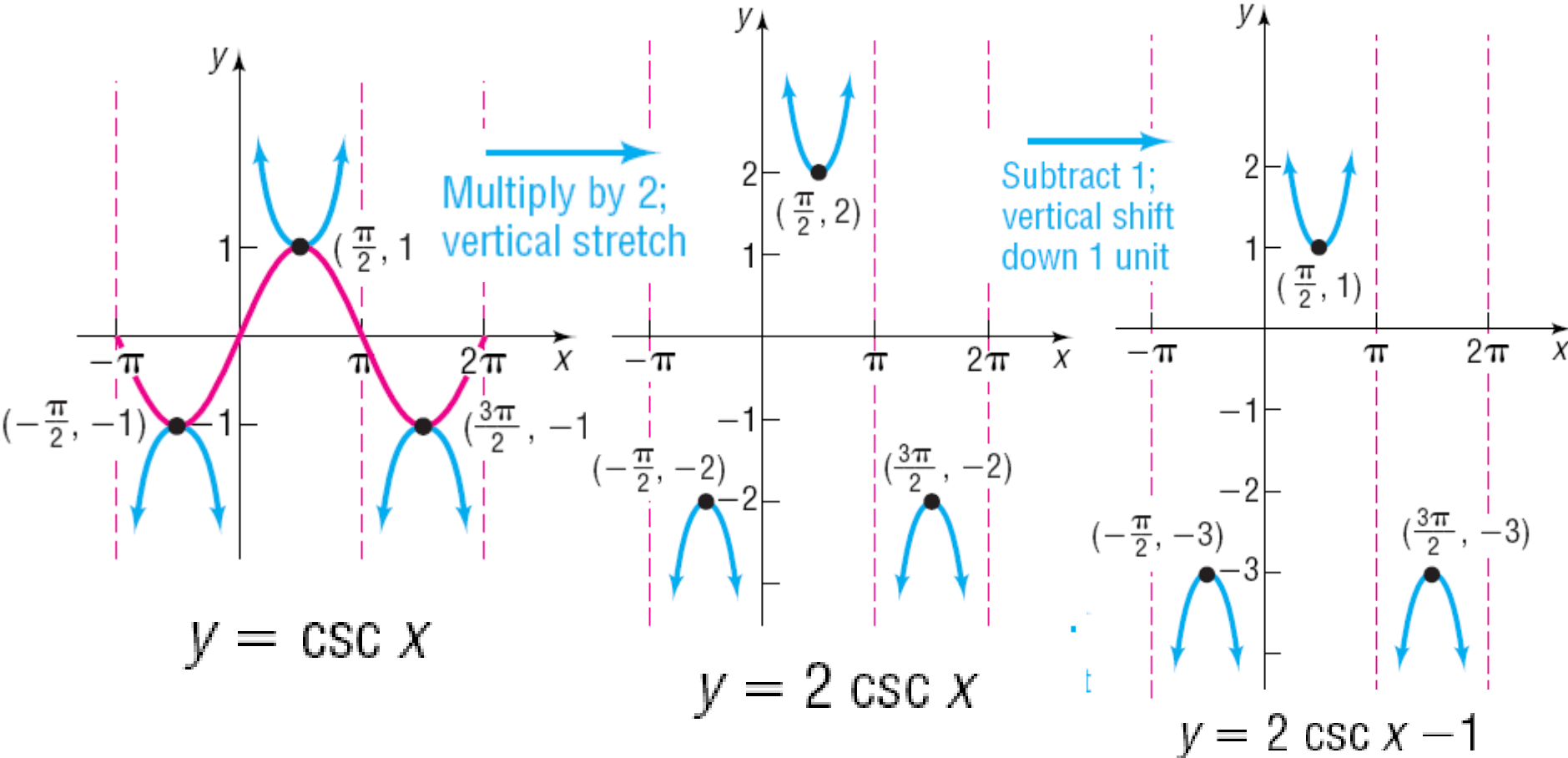
$y = \csc x, -\infty < x < \infty, x$ not equal to integer multiples of $\pi, |y| \geq 1$

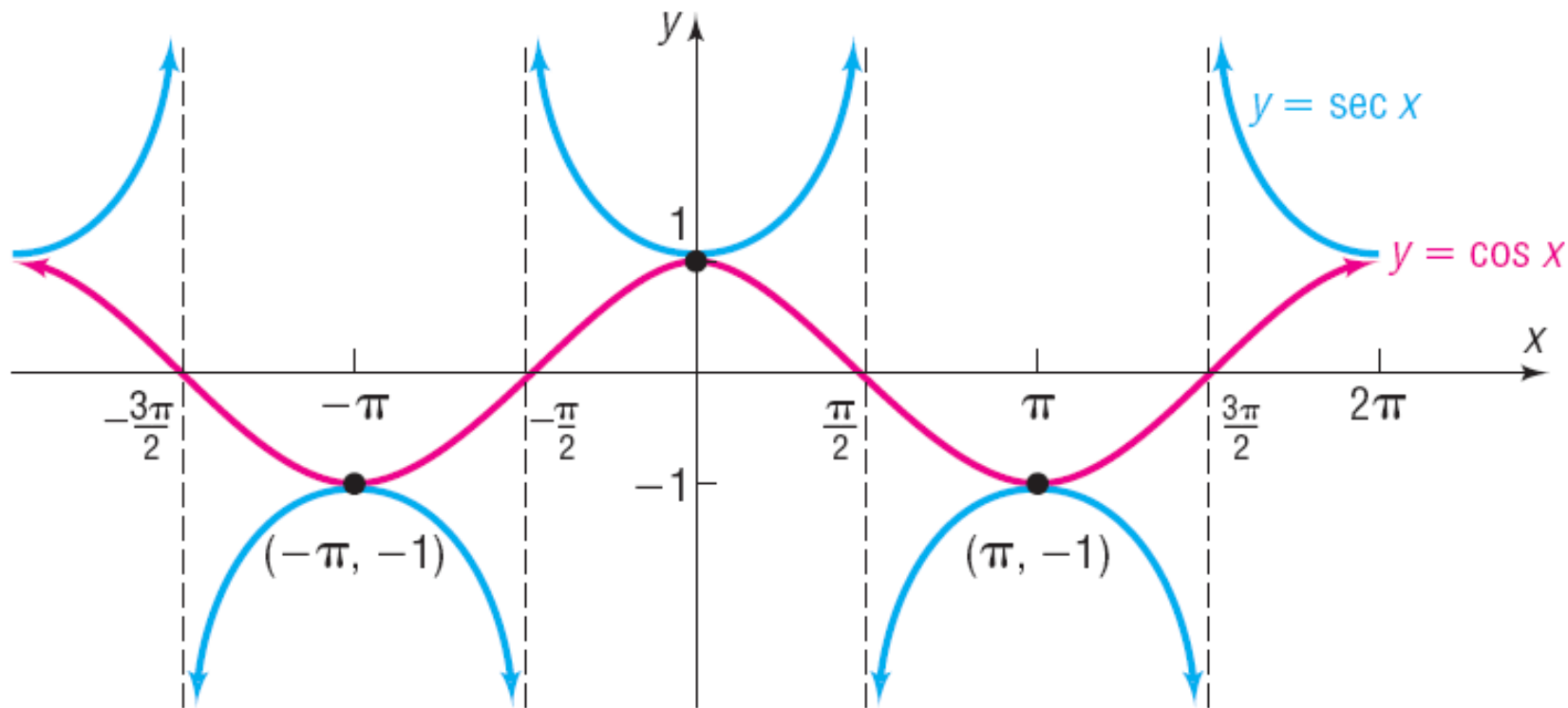


EXAMPLE

Graphing Variations of $y = \csc x$ Using Transformations

Graph: $y = 2 \csc x - 1$





$y = \sec x, -\infty < x < \infty, x$ not equal

to odd multiples of $\frac{\pi}{2}, |y| \geq 1$