4.5

Graphs of Tangent, Cotangent, Secant, and Cosecant

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Precalculus

## Graphical, Numerical, Algebraic

EIGHTH EDITION
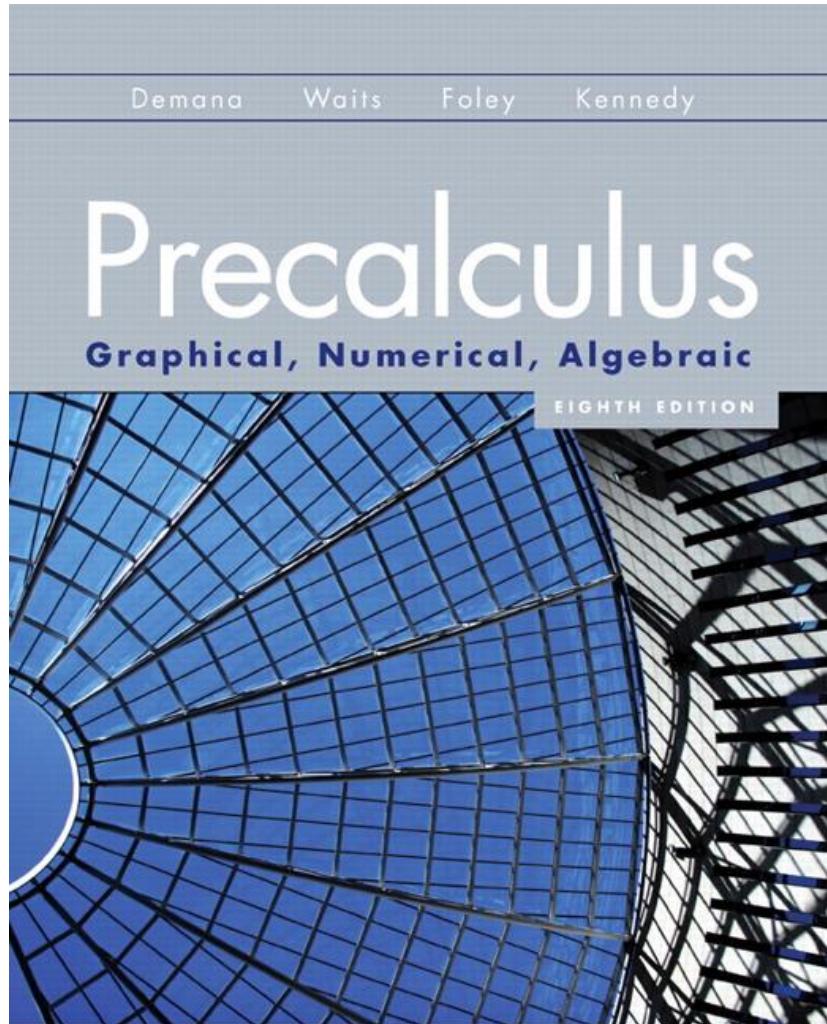
What you'll learn about

- The Tangent Function
- The Cotangent Function
- The Secant Function
- The Cosecant Function

… and why

This will give us functions for the remaining trigonometric ratios.

Asymptotes of the Tangent Function
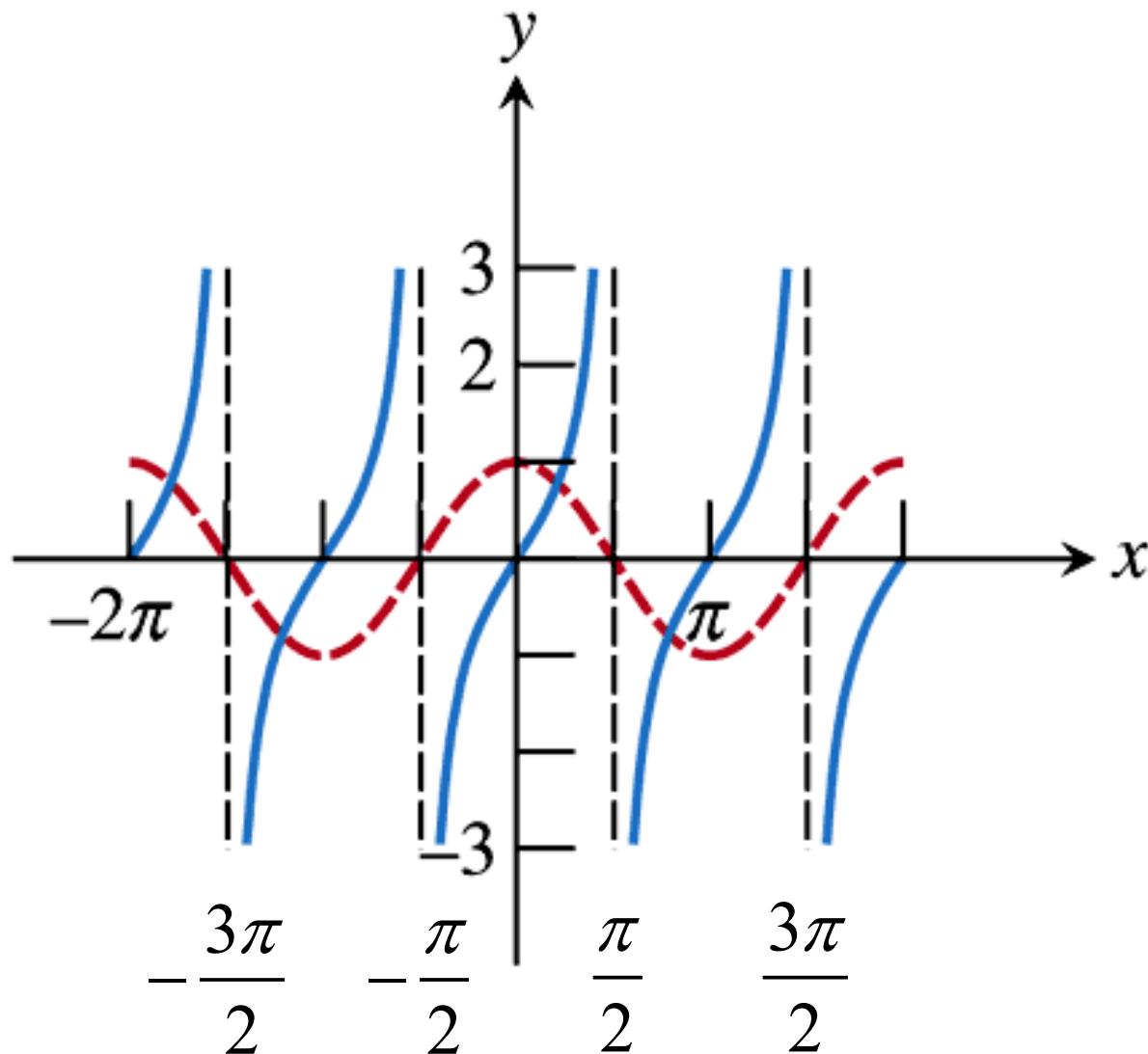
Zeros of the Tangent Function
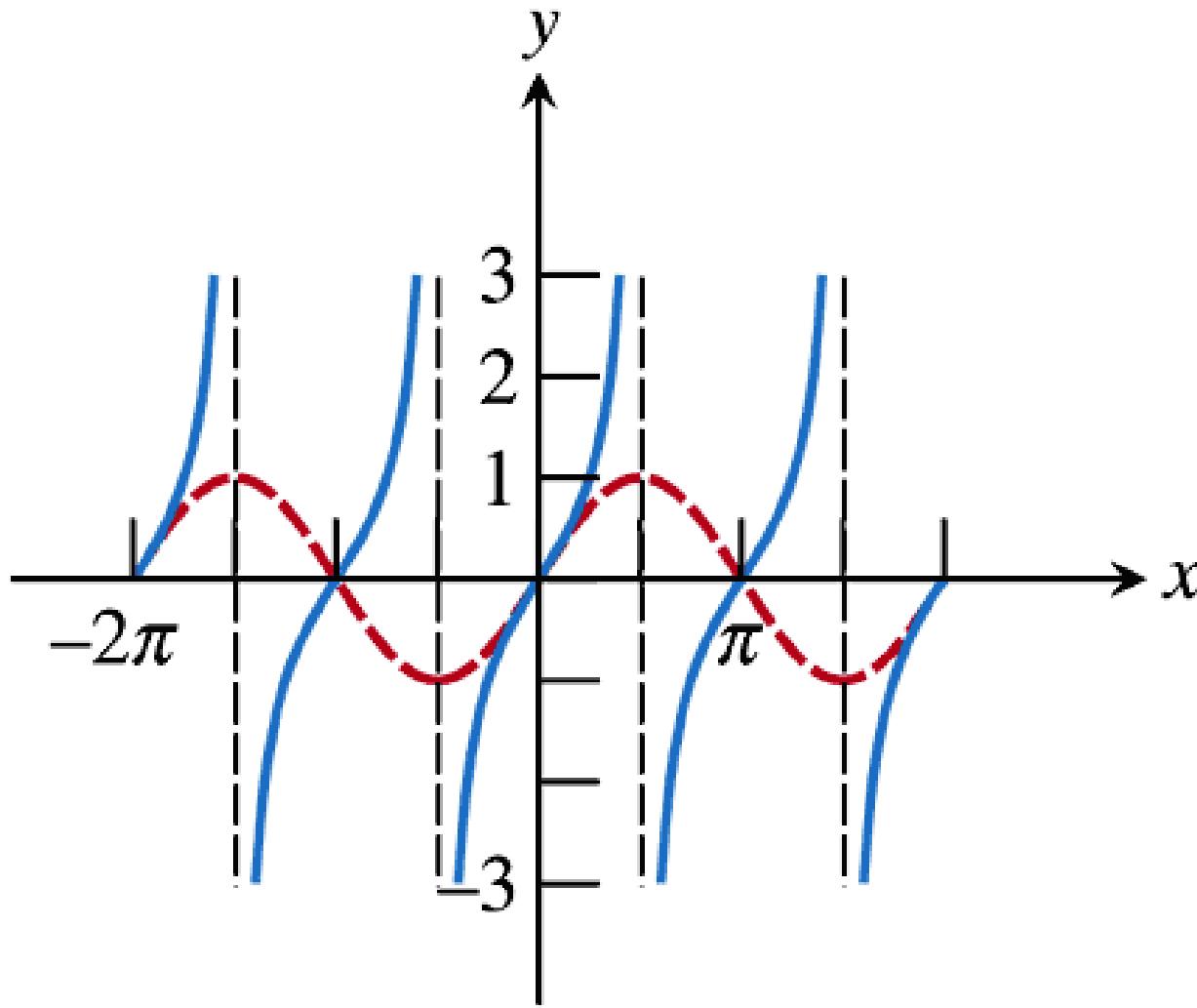
Asymptotes of the Cotangent Function
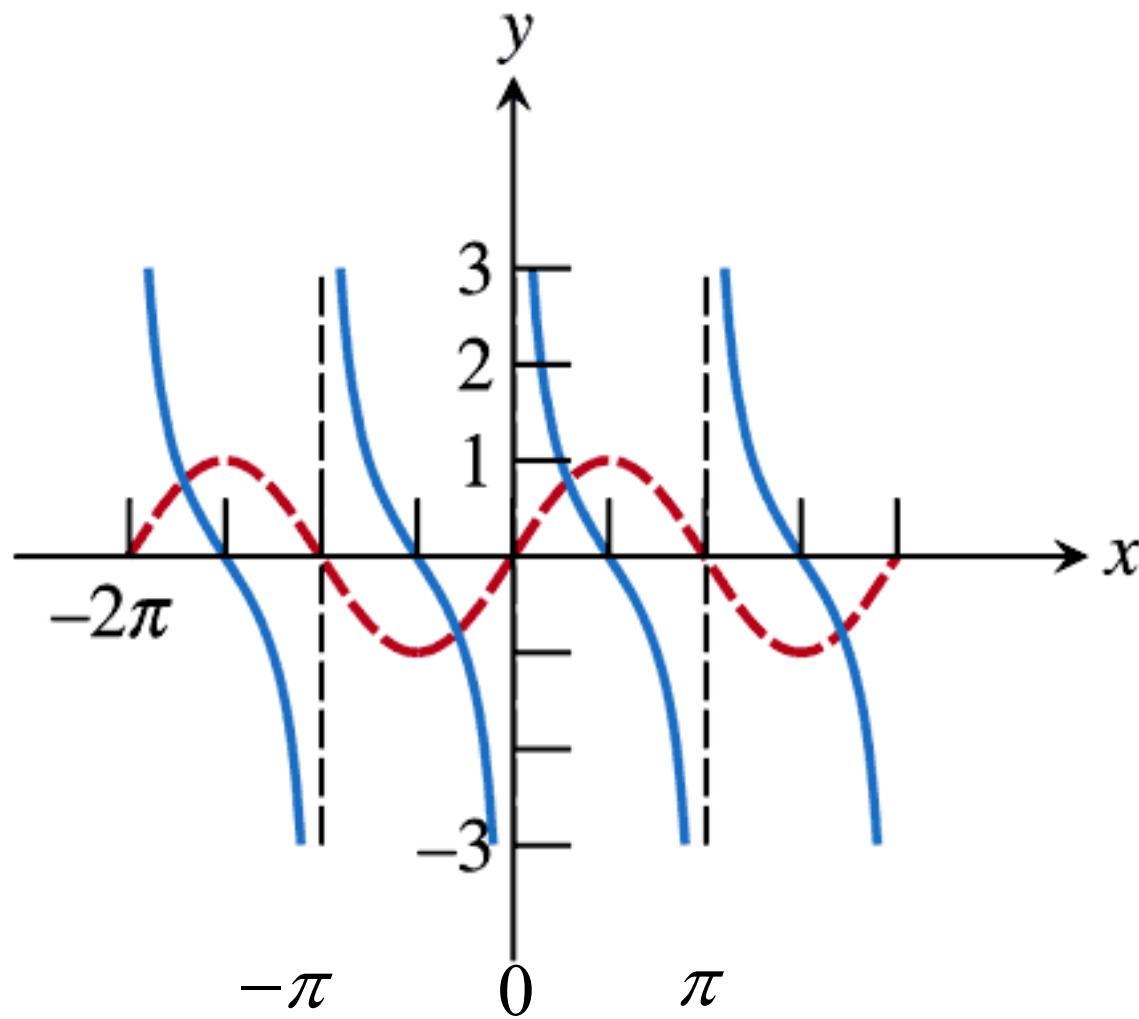
Zeros of the Cotangent Function

$$-\frac{3\pi}{2} \qquad -\frac{\pi}{2} \qquad \frac{\pi}{2} \qquad \frac{3\pi}{2}$$
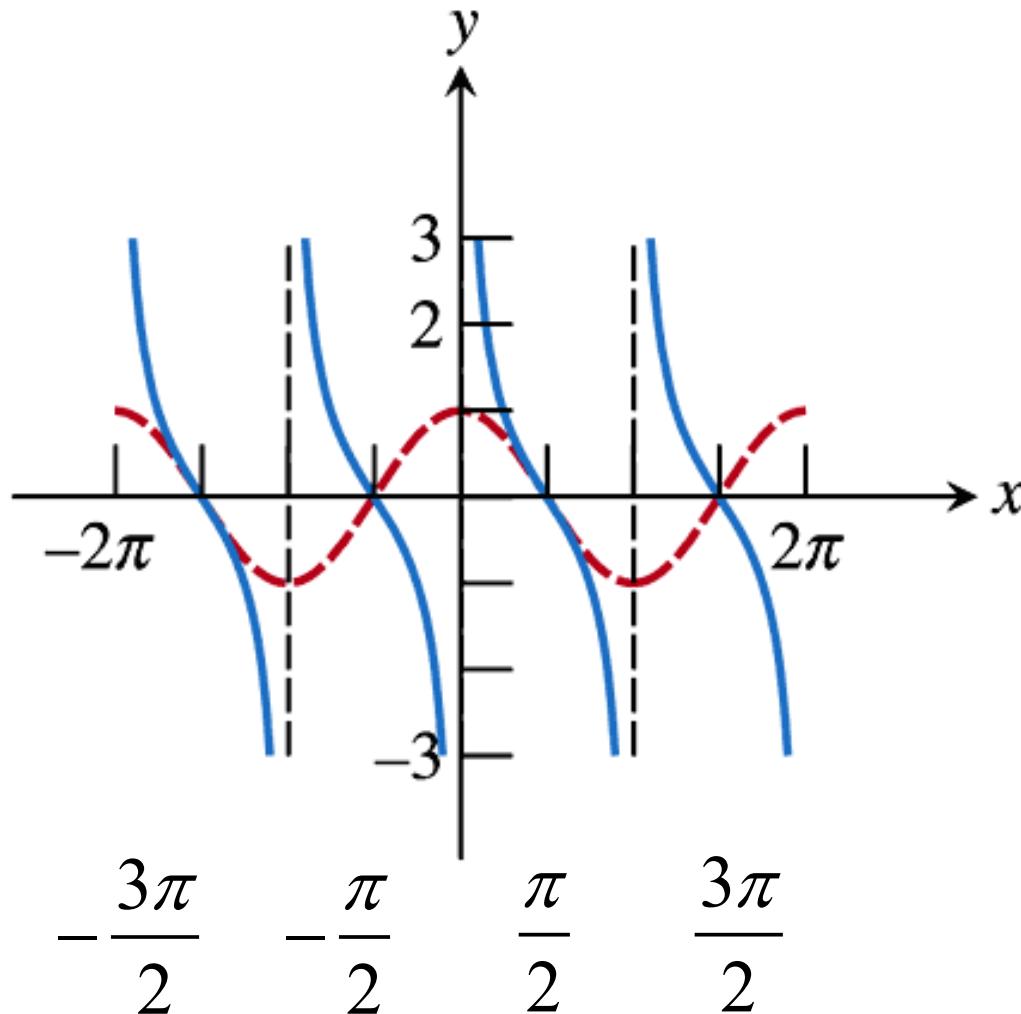
The Secant Function
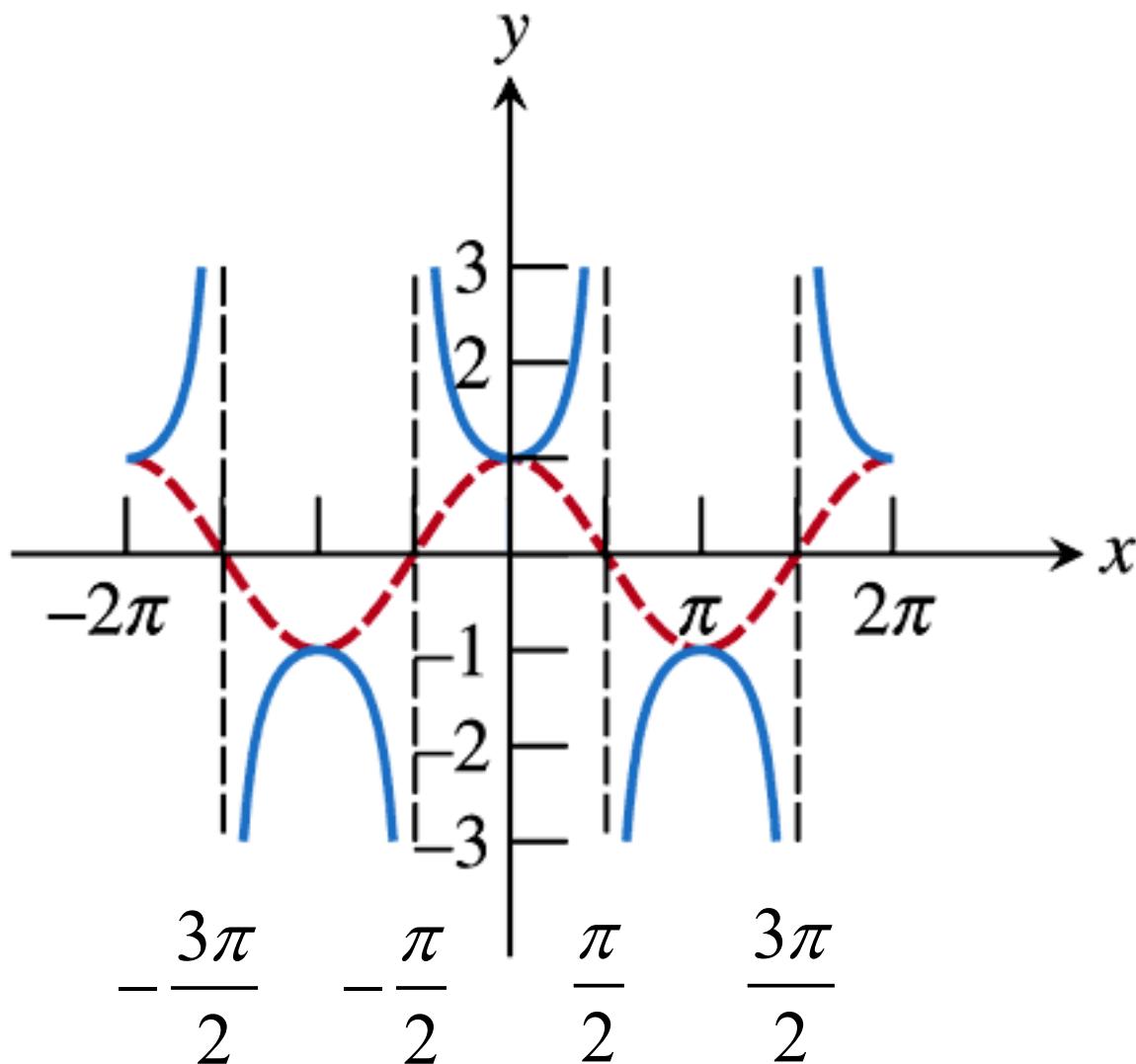
The Cosecant Function
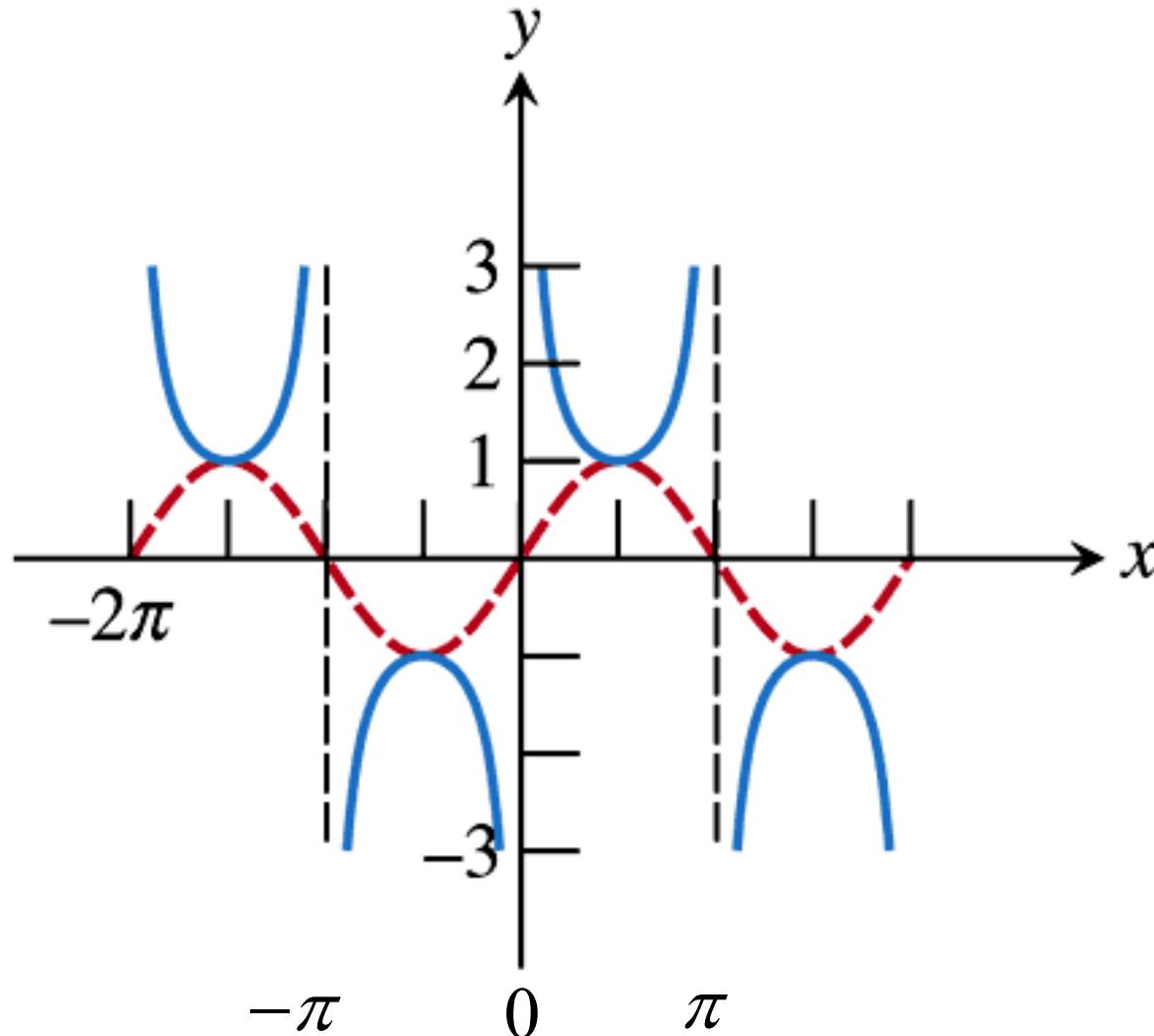
Basic Trigonometry Functions

Summary: Basic Trigonometric Functions

Function	Period	Domain	Range
$\sin x$	2π	All reals	$[-1, 1]$
$\cos x$	2π	All reals	$[-1, 1]$
$\tan x$	π	$x \neq \pi/2 + n\pi$	All reals
$\cot x$	π	$x \neq n\pi$	All reals
$\sec x$	2π	$x \neq \pi/2 + n\pi$	$(-\infty, -1] \cup [1, \infty)$
$\csc x$	2π	$x \neq n\pi$	$(-\infty, -1] \cup [1, \infty)$

Basic Trigonometry Functions

Function	Asymptotes	Zeros	Even/Odd
$\sin x$	None	$n\pi$	Odd
$\cos x$	None	$\pi/2 + n\pi$	Even
$\tan x$	$x = \pi/2 + n\pi$	$n\pi$	Odd
$\cot x$	$x = n\pi$	$\pi/2 + n\pi$	Odd
$\sec x$	$x = \pi/2 + n\pi$	None	Even
$\csc x$	$x = n\pi$	**None**	**Odd**

Example Solving a Trigonometric Equation Graphically

Find the smallest possible number x such that $x^2 = \csc x$.

Example **Solving a Trigonometric Equation Graphically**

Find the smallest possible number x such that $x^2 = \csc x$.

The graphs of $y = x^2$ and $y = \sec x$ are shown. Using the grapher, we find that the smallest positive x-coordinate where the graphs intersect is $x \approx 1.068$

Intersection
X=1.0682235 Y=1.1411015
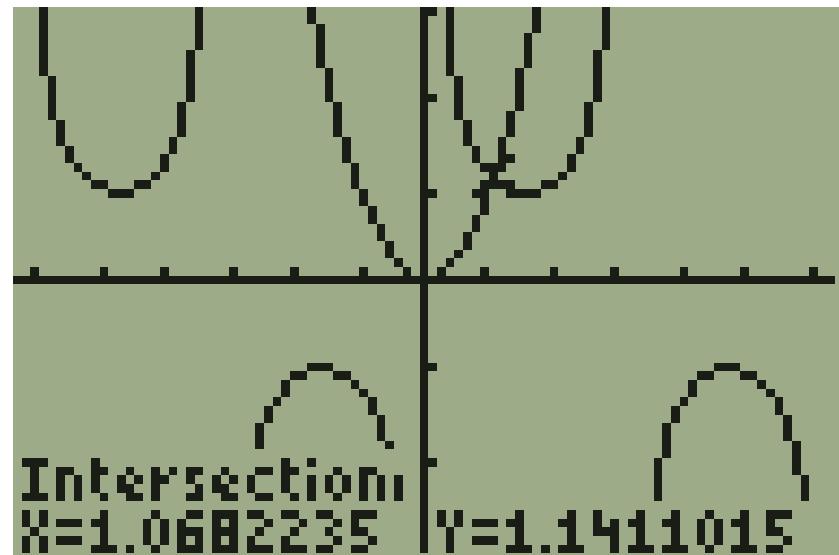
$[-2\pi, 2\pi]$ **by** $[-3, 3]$

Quick Review

State the period of the function.

1. $y = \cos 4x$

2. $y = \sin \dfrac{1}{4} x$

Find the zeros and the vertical asymptotes of the function.

3. $y = \dfrac{x+1}{x-1}$

4. $y = \dfrac{x+1}{(x+2)(x-3)}$

5. Tell whether $y = x^2 + 4$ is odd, even, or neither.

Quick Review Solutions

State the period of the function.

1. $y = \cos 4x$ $\pi/2$

2. $y = \sin \dfrac{1}{4} x$ 8π

Find the zeros and the vertical asymptotes of the function.

3. $y = \dfrac{x+1}{x-1}$ $-1;\ x = 1$

4. $y = \dfrac{x+1}{(x+2)(x-3)}$ $-1;\ x = 3, x = -2$

5. Tell whether $y = x^2 + 4$ is odd, even, or neither.   even