# Chapter 4 Trigonometry

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| Course/Section<br>Lesson Number<br>Date |

## Section 4.6 Graphs of Other Trigonometric Functions

**Section Objectives:** Students will know how to sketch the graphs of trigonometric functions.

**I. Graph of the Tangent Function** (pp. 332−333) Pace: 10 minutes

- State that the tangent function is odd and periodic with period $\pi$.

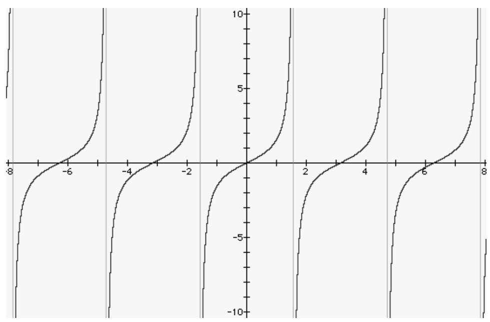
- State that functions that are fractions can have vertical asymptotes at points at which the denominator is zero and the numerator is not. Therefore, because $\tan x = \sin x / \cos x$, the graph of $y = \tan x$ will have vertical asymptotes at $\pi/2 + \pi n$, where $n$ is an integer.

- State that the key points of the graph of the tangent function are the asymptotes at the ends of the period and the intercept in the middle.

**Example 1.** Graph the following functions.

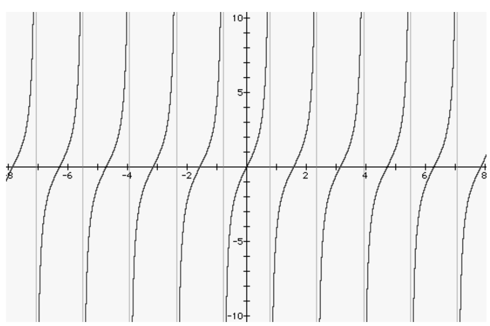
**a)** $y = \tan x$

Asymptotes at $x = \pm\pi/2$ and intercept at (0, 0).

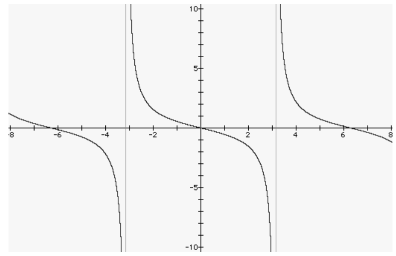


**b)** $y = 2\tan 2x$

Asymptotes at $x = \pm\pi/4$ and intercept at (0, 0).



**c)** $y = -\tan(x/2)$
Asymptotes at $x = \pm\pi$ and intercept at (0, 0).

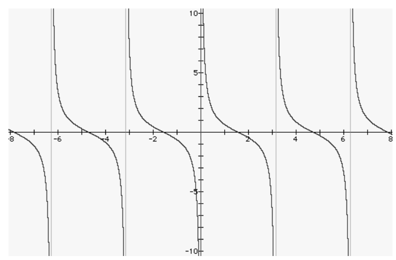


**II. Graph of the Cotangent Function** (p. 334) Pace: 5 minutes

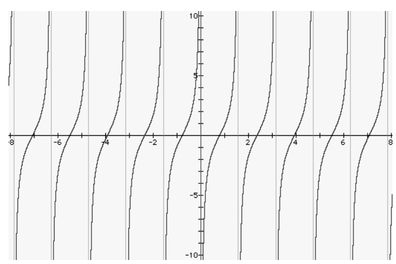
- State that, similar to the tangent function, the cotangent function is odd, periodic with period $\pi$, and has asymptotes at $x = \pi n$.

**Example 2.** Graph the following functions.

**a)** $y = \cot x$
Asymptotes at $x = 0$ and $x = \pi$, and intercept at $(\pi/2, 0)$.

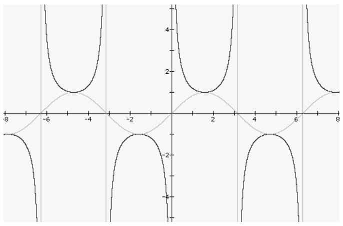


**b)** $y = -2\cot 2x$
Asymptotes at $x = 0$ and $x = \pi/2$, and intercept at $(\pi/4, 0)$.

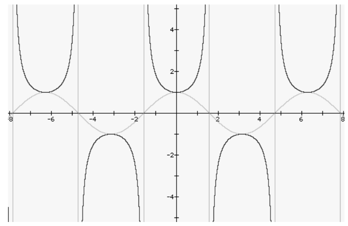


**III. Graphs of the Reciprocal Functions** (pp. 335−336)  Pace: 10 minutes

- Remind students that the sine and cosecant functions are reciprocals, as are the cosine and secant functions. State that this implies that where the sine is zero, the cosecant has a vertical asymptote; where sine has a relative maximum, the cosecant has a relative minimum; and where the sine has a relative minimum, the cosecant has a relative maximum. Similarly for the cosine and secant. The graphs are sketched below.



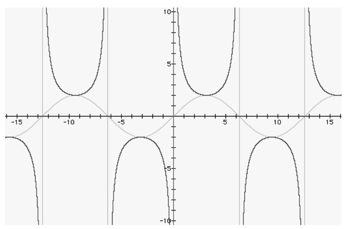
$y = \csc x$



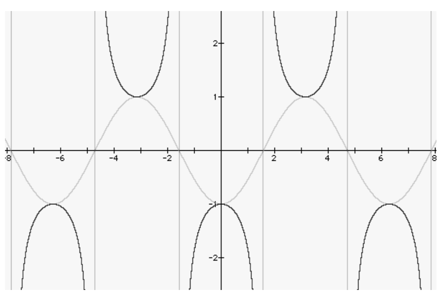
$y = \sec x$

**Example 3.** Graph the following functions.

**a)** $y = 2\csc (x/2)$



**b)** $y = \sec (x + \pi)$



**IV. Damped Trigonometric Graphs** (pp. 337−338) Pace: 5 minutes

- State that some functions, when multiplied by a sine or cosine function, become **damping factors**.

**Example 4.** Sketch the graph of $y = (x^2 + 1)^{-1}\sin x$
First graph both $y = +(x + 1)^{-1}$ and $y = -(x + 1)^{-1}$ and then graph $y = \sin x$ between them.