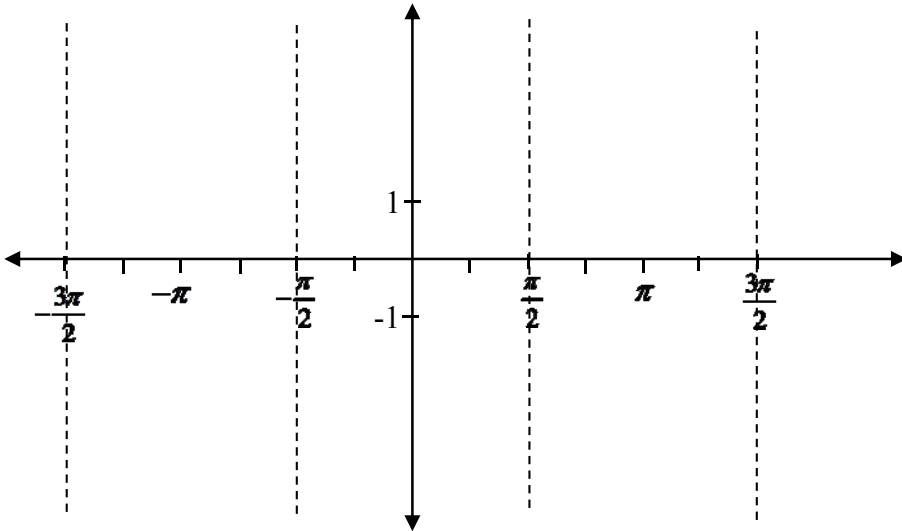


### Section 5.3b Graphs of the Tangent and Cotangent Functions

Recall:  $\tan x = \frac{\sin x}{\cos x}$  so where  $\cos x = 0$ ,  $\tan x$  has an asymptote and where  $\sin x = 0$ ,  $\tan x$  has an  $x$ -intercept.

**Tangent:**  $f(x) = \tan x$



Period:  $\pi$

Vertical Asymptote:  $x = \frac{k\pi}{2}$ ,  $k$  is

an odd integer.

$x$ -intercepts:  $k\pi$ ,  $k$  is an integer.

$y$ -intercept:  $(0, 0)$

Domain:  $x \neq \frac{k\pi}{2}$ ,  $k$  is an odd

integer.

Range:  $(-\infty, \infty)$

**How to graph**  $y = A \tan(Bx - C)$  :

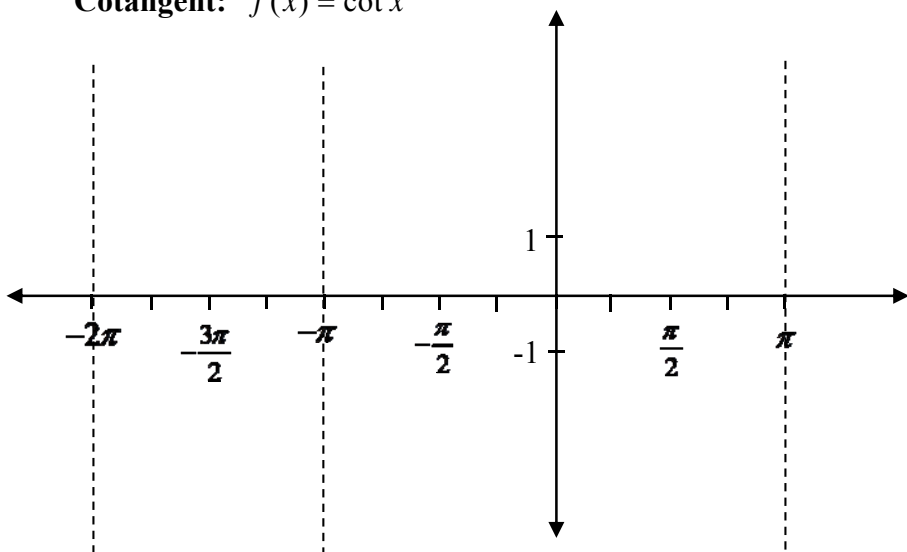
1. The period is given by  $\frac{\pi}{B}$ . Find two consecutive asymptotes by setting  $Bx - C$  equal to  $-\frac{\pi}{2}$  and  $\frac{\pi}{2}$  and then solve for  $x$ .
2. Find an  $x$ -intercept by taking the average of the two points on the  $x$ -axis where consecutive asymptotes pass.
3. Find the points on the graph  $\frac{1}{4}$  and  $\frac{3}{4}$  of the way between the consecutive asymptotes. The  $y$ -coordinates of these points are  $-A$  and  $A$ .

**Example 1:** Describe the transformations of  $f(x) = -\tan(5x) - 3$ . Then find the period and asymptotes.

**Example 2:** Given:  $f(x) = 2 \tan\left(\frac{x}{4}\right)$ . Find the period of the function. Show the two asymptotes of the graph of the function. List one x intercept and the coordinates of two other points.

Recall:  $\cot x = \frac{\cos x}{\sin x}$  so where  $\cos x = 0$ ,  $\cot x$  has an x- intercept and where  $\sin x = 0$ ,  $\cot x$  has an asymptote.

**Cotangent:**  $f(x) = \cot x$



Period:  $\pi$   
 Vertical Asymptote:  $x = k\pi$ ,  $k$  is an integer.  
 x-intercepts:  $\frac{k\pi}{2}$ ,  $k$  is an odd integer.  
 y-intercept: None  
 Domain:  $x = k\pi$ ,  $k$  is an integer.  
 Range:  $(-\infty, \infty)$

**How to graph**  $y = A \cot(Bx - C)$ :

1. The period is given by  $\frac{\pi}{B}$ . Find two consecutive asymptotes by setting  $Bx - C$  equal to 0 and  $\pi$  and then solve for  $x$ .
2. Find an  $x$ -intercept by taking the average of the two points on the  $x$ -axis where consecutive asymptotes pass.
3. Find the points on the graph  $\frac{1}{4}$  and  $\frac{3}{4}$  of the way between the consecutive asymptotes. The  $y$ -coordinates of these points are  $-A$  and  $A$ .

**Example 3:** Graph  $f(x) = 5 \cot(2x)$ . Find the period of the function. Show the two asymptotes of the graph of the function. List one  $x$  intercept and the coordinates of two other points.

**Example 4:** Graph  $f(x) = -2 \cot\left(\frac{\pi}{4}x\right)$ . Find the period of the function. Show the two asymptotes of the graph of the function. List one  $x$  intercept and the coordinates of two other points.

Extra Review for Test 3:

**Example 1:** Graph  $f(x) = 3 \cos(4x)$

**Example 2:** Given the following sine curve and the fact that point A has coordinates  $(6, -3)$ , what is the equation in terms of sine function that produces this graph?

