**Learning Outcomes:** What level of knowledge should you possess by the end of this section?

- Know how to obtain the graph of the tangent and cotangent functions by analyzing the sine and cosine functions.

- Understand the relationships between numbers and their reciprocals, and use this information to graph the trigonometric cofunctions.

- Graph transformed tangent and cotangent functions using key values.

- Graph transformed secant and cosecant functions using cosine and sine functions.

#1) Create a sign diagram for the cotangent function. This is similar to the one you completed for the tangent function in the preclass activity. Underneath the coordinates on the cotangent number line, indicate which points are zeros and which are asymptotes.
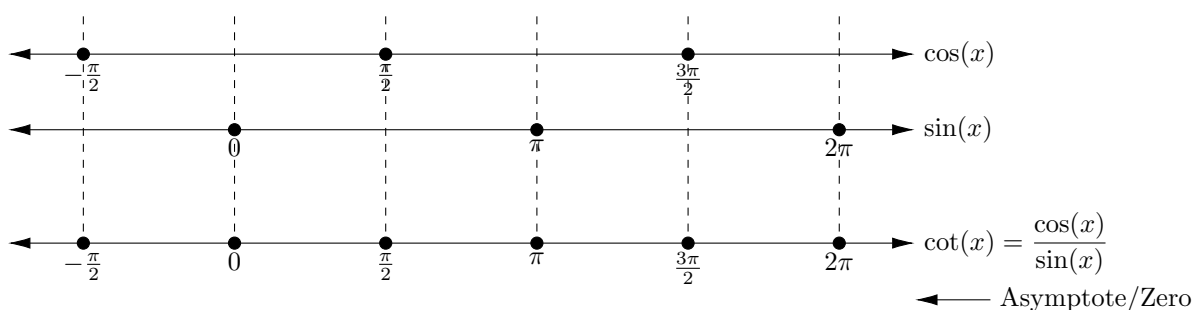
#2) Graph $y = -2\tan\left(2x + \frac{\pi}{2}\right) + 1$.

Step 1: Identify the fundamental period
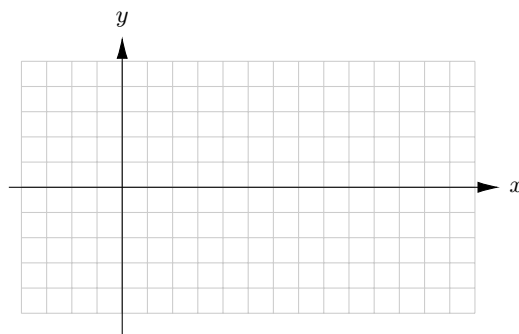
Step 3: Transform the y-coordinates of the key values.

Key Values	1	2	3	4	5
x					
y					

Step 2: Identify the x-coordinates of the key values.

Step 4: Plot the points and sketch the graph.

#3) Graph $y = 3\tan\left(\pi x + \frac{\pi}{2}\right) + 1$. Organize and present your work in an organized manner.

#4) Graph $y = -2\cot\left(x - \frac{4\pi}{3}\right) - 1$. Organize and present your work in an organized manner.

#5) Describe the features of each transformation, or state N/A if there is no transformation of that type.

$$y = -\tan\left(2x + \tfrac{\pi}{2}\right) + 1 \qquad\qquad\qquad y = 2\sec\left(\tfrac{\pi x}{3} + \pi\right) - 2$$

Horizontal shift: Horizontal shift:

Horizontal stretch/compression/flip: Horizontal stretch/compression/flip:

Vertical stretch/compression/flip: Vertical stretch/compression/flip:

Vertical shift: Vertical shift:

**#6)** Given the descriptions of the transformations, determine the equation of the function.

- The tangent function shifted right by $\frac{2\pi}{3}$, horizontally compressed by a factor of 2, vertically flipped and stretched by a factor of 3, and shifted down 2 units.
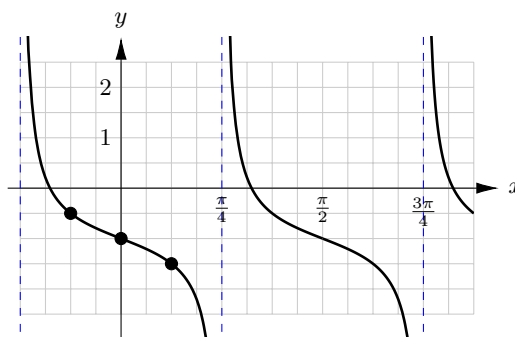
    – Function:

- The cosecant function shifted right by π, horizontally stretched by a factor of 2, vertically stretched by a factor of $\frac{1}{2}$, and shifted up 2 units.

    – Function:

#7) Determine an equation of the function from the graph. The marked points are reference points. (Note: There are multiple equations that give the same graph.)
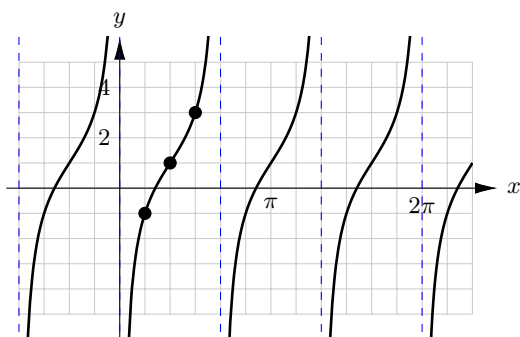
$f(x) =$

$f(x) =$

#8)   Graph $y = 2\sec\left(\pi x - \frac{2\pi}{3}\right) - 1$. Organize and present your work in an organized manner.

#9)   Graph $y = -3\csc\left(2x - \frac{\pi}{2}\right) + 1$. Organize and present your work in an organized manner.

#10) Use your knowledge of transformations to find a way to write the cotangent function as a transformed tangent function. Explain in words the logic you applied to reach your goal.

#11) Write your own graphing problem and then graph it. Try to create a problem that is about the same difficulty as the other graphs in this section.