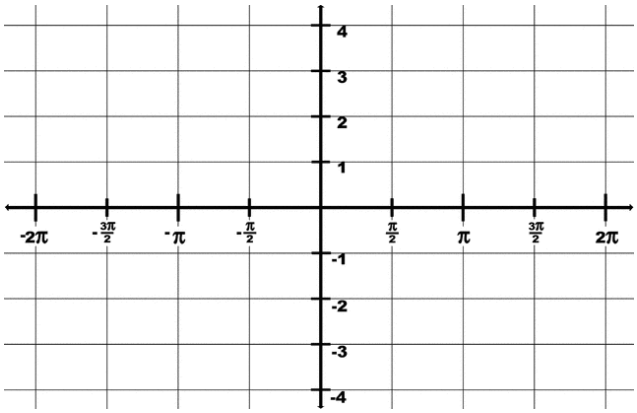
Name: Period: Date:

Math Lab: Explore Transformations of Trig Functions

EXPLORE VERTICAL DISPLACEMENT

1] Graph $y = \sin x\ (red),\ y = \sin x + 3\ (blue),\ y = \sin x - 2\ \ (green)$

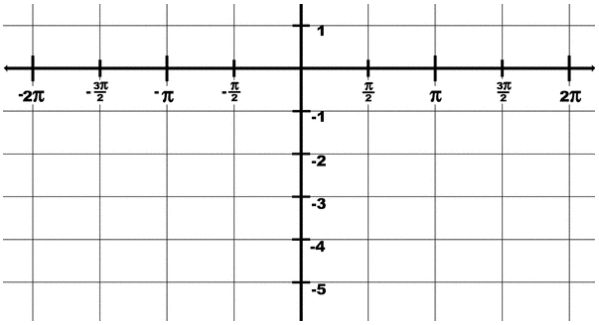


2] Explain what happens to the parent graph when a constant is added to the sine function.

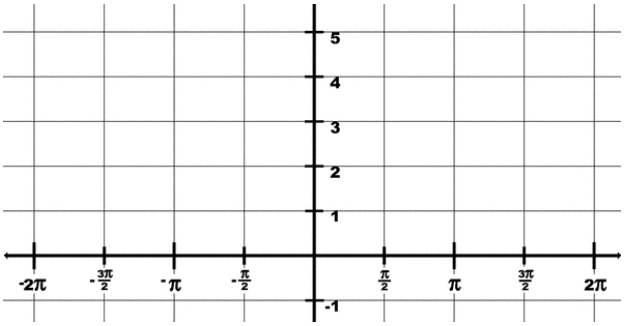
3] Explain what happens to the parent graph when a constant is subtracted from the sine function.

4] In the standard form of the sine function $\boxed{y = a \sin b(x - h) + k}$, what variable represents **vertical displacement**?

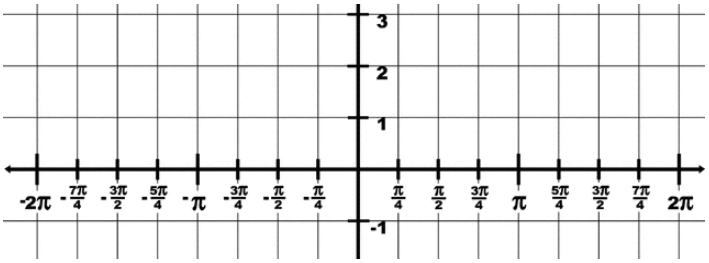
5] Sketch the graph of $y = \csc x - 4$.



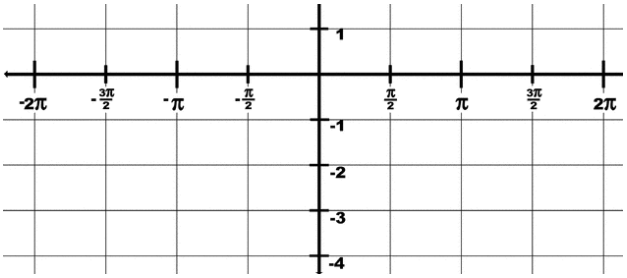
6] Sketch the graph of $y = \sec x + 3$.



7] Sketch the graph of $y = \tan x + 1$.

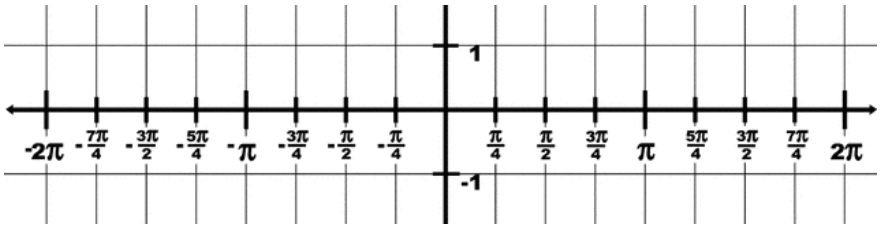


8] Sketch the graph of $y = \cos x - 2$.



EXPLORE PHASE SHIFT

9] Graph $y = \sin x\ (red),\ y = \sin\left(x - \frac{\pi}{4}\right)\ (blue),\ y = \sin\left(x + \frac{\pi}{2}\right)\ (green)$

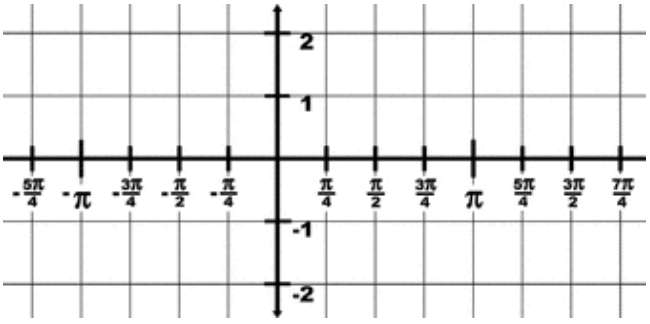


10] Explain what happens to the parent graph when a constant is added to the x in the sine function.

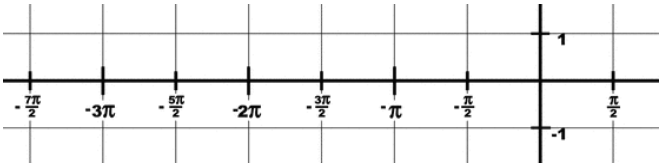
11] Explain what happens to the parent graph when a constant is subtracted from x in the sine function.

12] In the standard form of the sine function $\boxed{y = a\sin b(x - h) + k}$, what variable represents **phase shift**?

13] Sketch the graph of $y = \csc\left(x - \frac{3\pi}{4}\right)$.



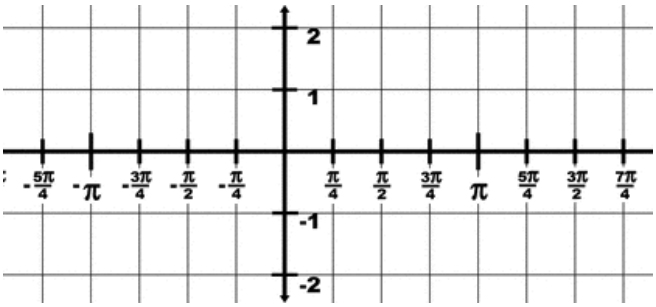
14] Sketch the graph of $y = \cos(x + \pi)$.



What transformation could we add to the sine function to make it have this same graph?

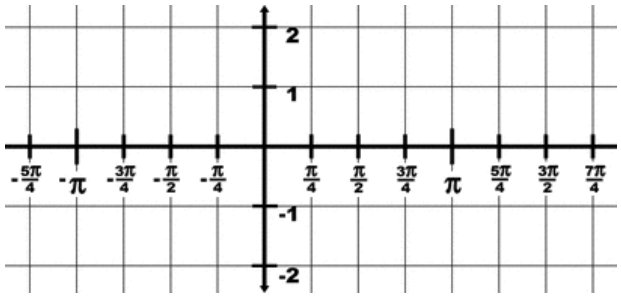
$y = \sin(x \qquad)$

15] Sketch the graph of $y = \cot\left(x + \frac{5\pi}{4}\right)$.



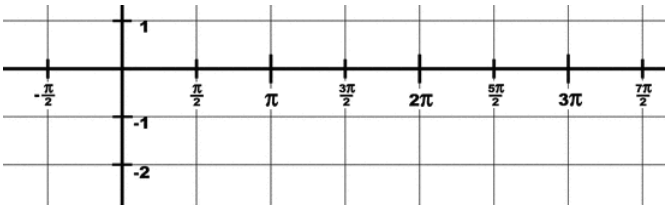
What is another way to write this equation that produces the same graph?

16] Sketch the graph of $y = \tan\left(x - \frac{\pi}{4}\right)$.

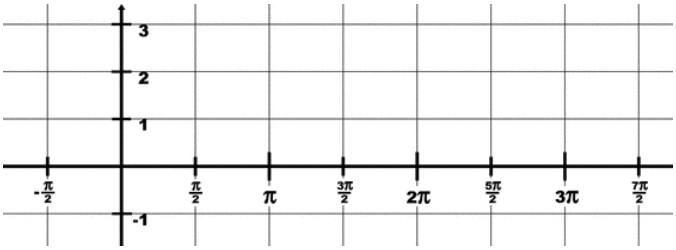


What transformation could we make to this equation to make the graph exactly the same as #15?

17] Sketch the graph of $y = \sin\left(x - \frac{\pi}{2}\right) - 1$.

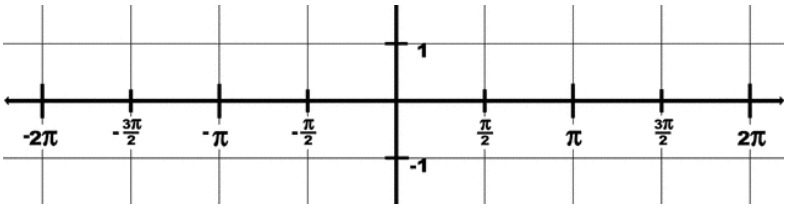


18] Sketch the graph of $y = \cos\left(x + \frac{\pi}{2}\right) + 2$.



EXPLORE REFLECTION

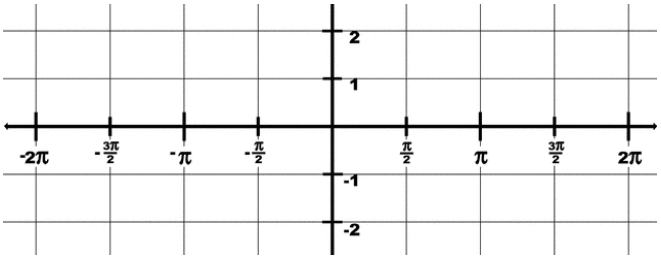
19] Graph $y = \sin x\ (red),\ y = -\sin x\ (blue)$



20] Explain what happens to the graph when the sine function is negative.

21] In the standard form of the sine function $y = a\sin b(x - h) + k$, what variable represents **reflection**?

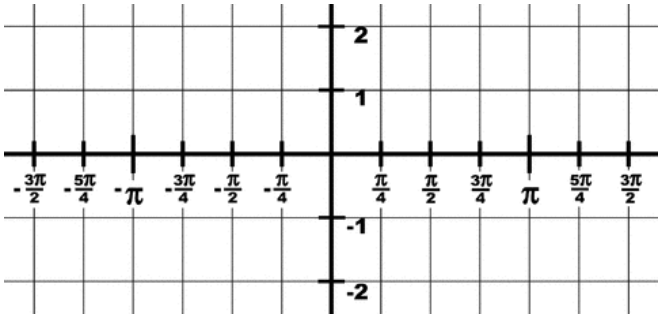
22] Sketch the graph of $y = -\csc x$.



What transformation could we make to the secant function to make it have this same graph?

$y = \sec(x \qquad)$

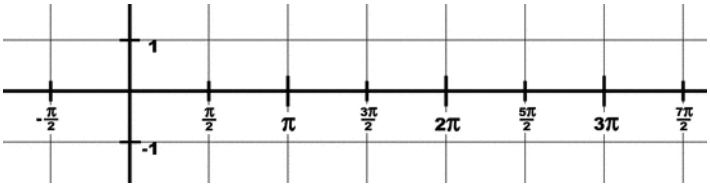
23] Sketch the graph of $y = -\tan x$.



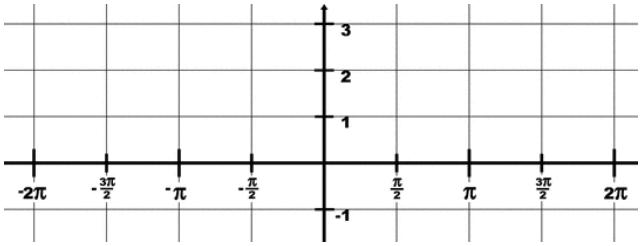
What transformation could we make to the cotangent function to make it have this same graph?

$y = \cot(x \qquad)$

24] Sketch the graph of $y = -\sin\left(x - \frac{\pi}{2}\right)$.



25] Sketch the graph of $y = -\cos x + 2$.



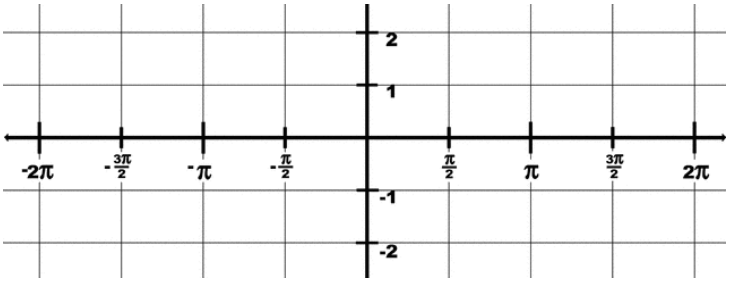
EXPLORE AMPLITUDE

26] Graph each function and calculate its amplitude.

$y = \sin x\ (red)$, amplitude =

$y = 2\sin x\ (blue)$, amplitude =

$y = \frac{1}{2}\sin x\ (green)$ amplitude =



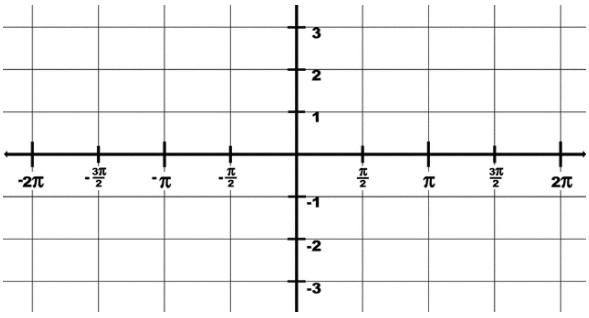
27] Explain what happens to the graph of a sine function when it is multiplied by a constant greater than 1.

28] Explain what happens to the graph of a sine function when it is multiplied by a constant between 0 and 1.

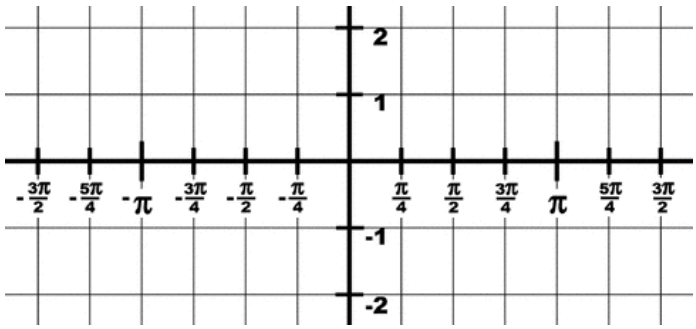
29] In the standard form of the sine function $\boxed{y = a\sin b(x-h)+k}$, what variable represents **amplitude**?

Note that only sine and cosine have an amplitude. However, the a in the function helps us graph the other trig functions by giving the vertical stretch or shrink. For example, since $y = 5\sin x$ has an amplitude of 5, its range is $[-5, 5]$. That means the range of $y = 5\csc x$ must be $(-\infty, -5] \cup [5, \infty)$.

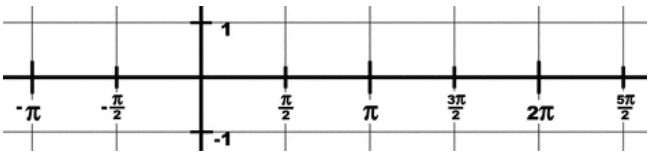
30] Sketch the graph of $y = 2\csc x$.



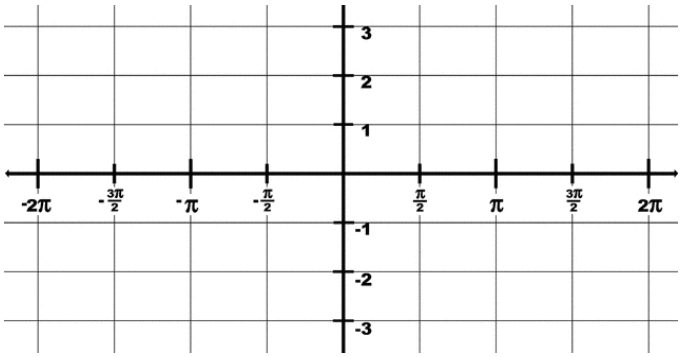
31] Sketch the graph of $y = \frac{1}{2}\tan x$.



32] Sketch the graph of $y = \frac{1}{2}\sin\left(x - \frac{\pi}{2}\right)$.



33] Sketch the graph of $y = -3\cos x$.

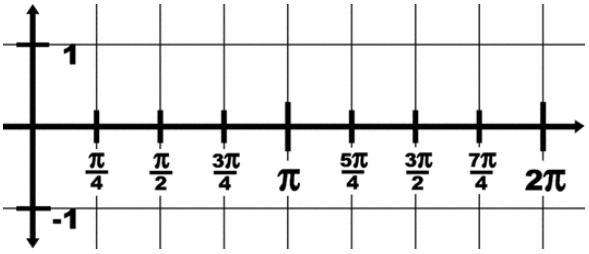


EXPLORE PERIOD

34] Graph each function and calculate its period.

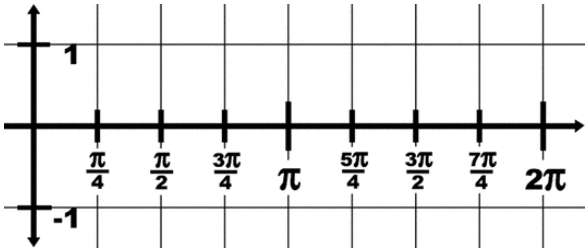
$y = \sin x\ (red)$

period =



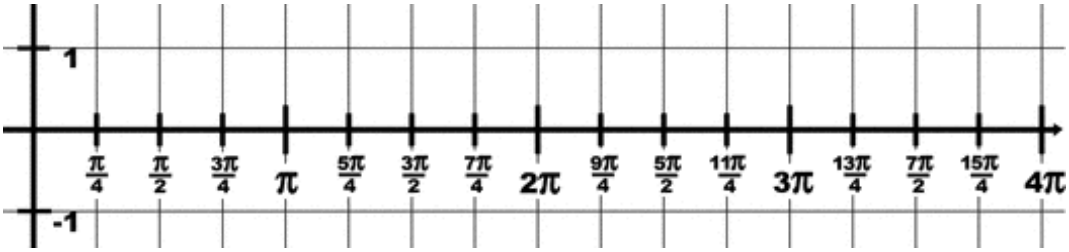
$y = \sin 2x\ (blue)$

period =



$y = \sin\frac{1}{2}x\ (green)$

period =

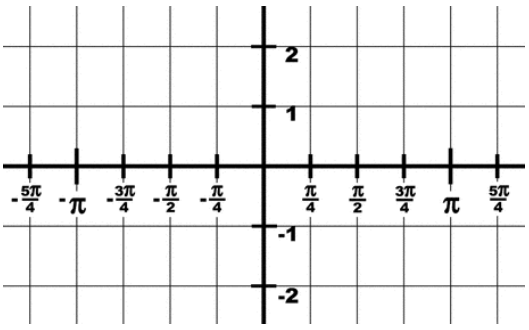


35] Explain what happens to the period of a sine function when the angle is multiplied by a constant greater than 1.

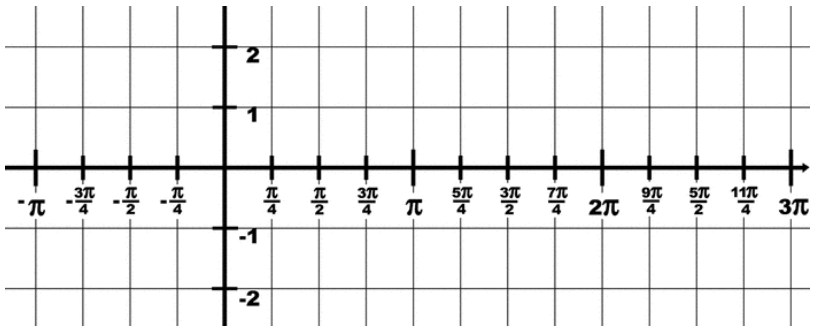
36] Explain what happens to the period of a sine function when the angle is multiplied by a constant between 0 and 1.

37] In the standard form of the sine function $\boxed{y = a\sin b(x - h) + k}$, what variable represents a change in the **period**?

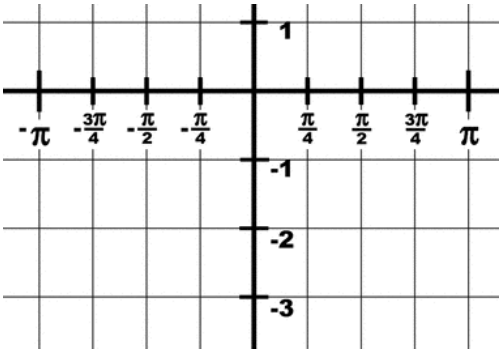
38] Sketch the graph of $y = \sec 2x$.



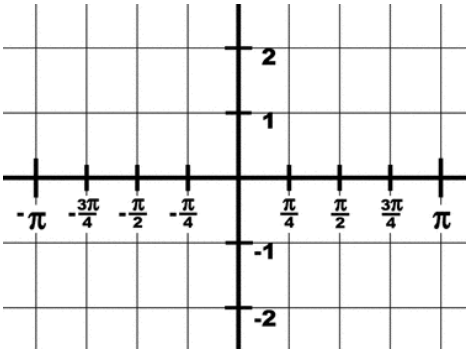
39] Sketch the graph of $y = \tan\frac{1}{2}x$.



40] Sketch the graph of $y = \cos 2x - 2$.



41] Sketch the graph of $y = -\cot 2x$.



PUTTING IT ALL TOGETHER

$$y = a \sin b(x - h) + k$$

Amplitude or vertical stretch/shrink:

Reflection:

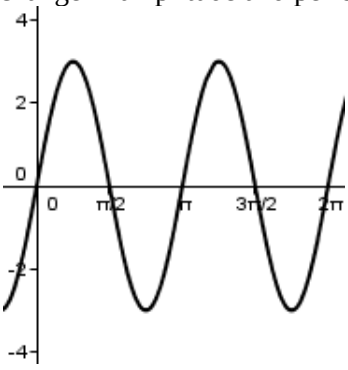
Period for sin, cos, csc, sec:

Period for tan, cot:

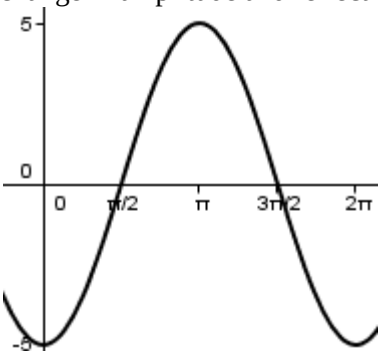
Phase shift:

Vertical displacement:

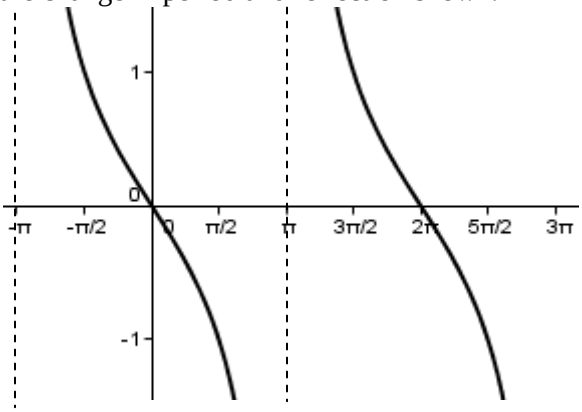
42] Write the equation of the sine function with the change in amplitude and period shown.



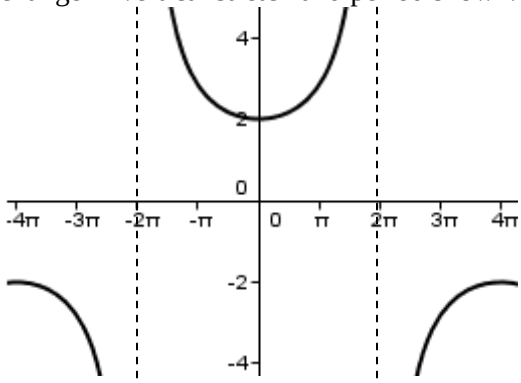
43] Write the equation of the cosine function with the change in amplitude and reflection shown.



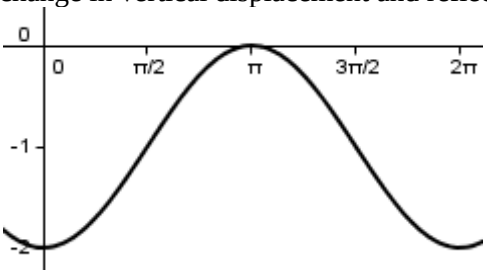
44] Write the equation of the tangent function with the change in period and reflection shown.



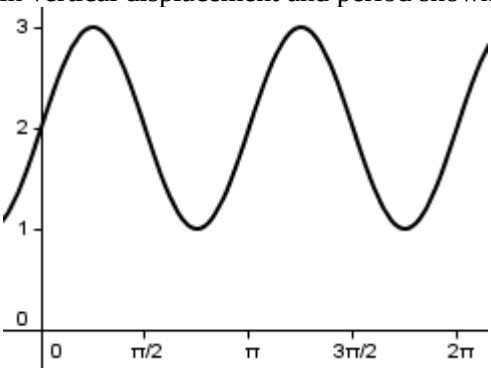
45] Write the equation of the secant function with the change in vertical stretch and period shown.



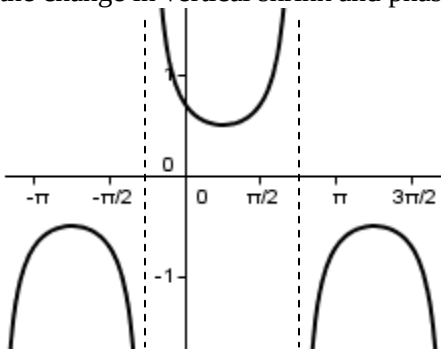
46] Write the equation of the cosine function with the change in vertical displacement and reflection shown.



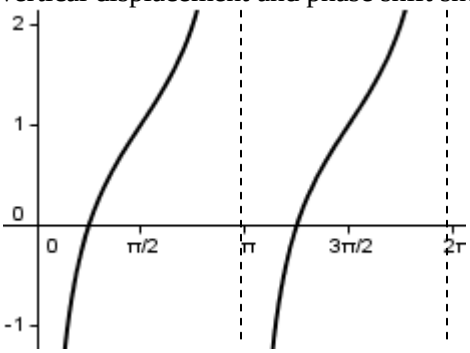
47] Write the equation of the sine function with the change in vertical displacement and period shown.



48] Write the equation of the cosecant function with the change in vertical shrink and phase shift shown.



49] Write the equation of the tangent function with the vertical displacement and phase shift shown in the graph.



50] Write the equation of the tangent function that has been translated down 4 units and left π units.

51] Write the equation of the cosine function with a period of 4π that has been reflected.

52] Write the equation of the sine function with an amplitude of 7 that has been translated $\frac{3\pi}{4}$ units right.

53] Write the equation of the cotangent function that has a vertical stretch of 3 and a period of 4π.

54] Write the equation of the cosecant function with a vertical displacement of 5 units and a reflection.

55] Write the equation of the secant function with a phase shift of $\frac{\pi}{5}$ units left and a vertical shrink of 2.