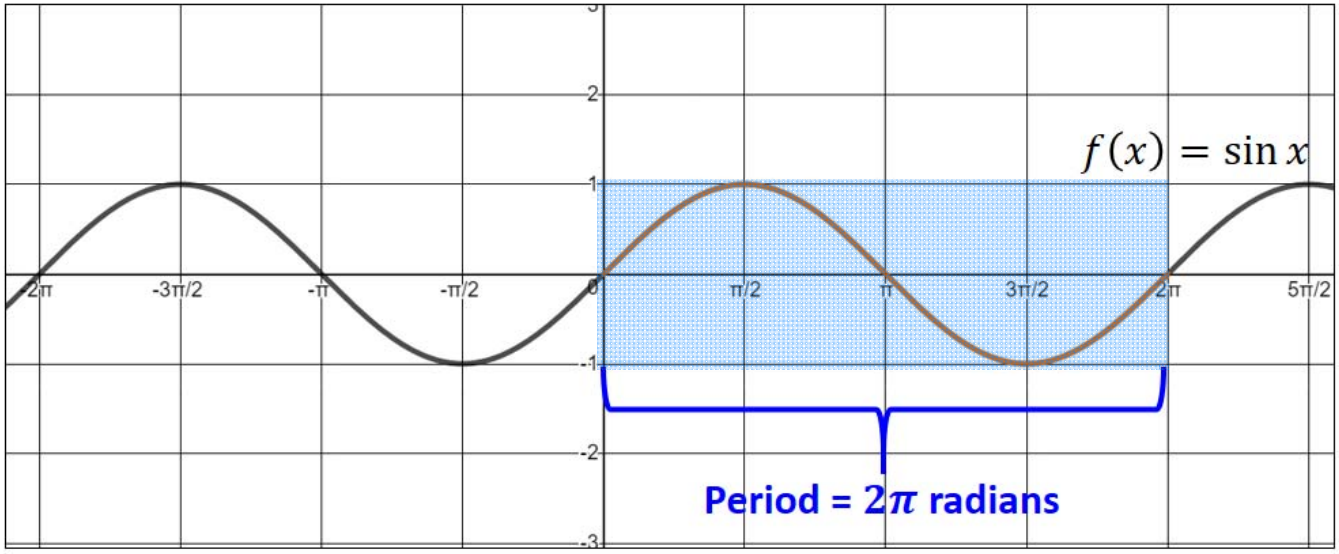
Objective: Graph sine and cosine functions using amplitude, period, and midline.

Concept

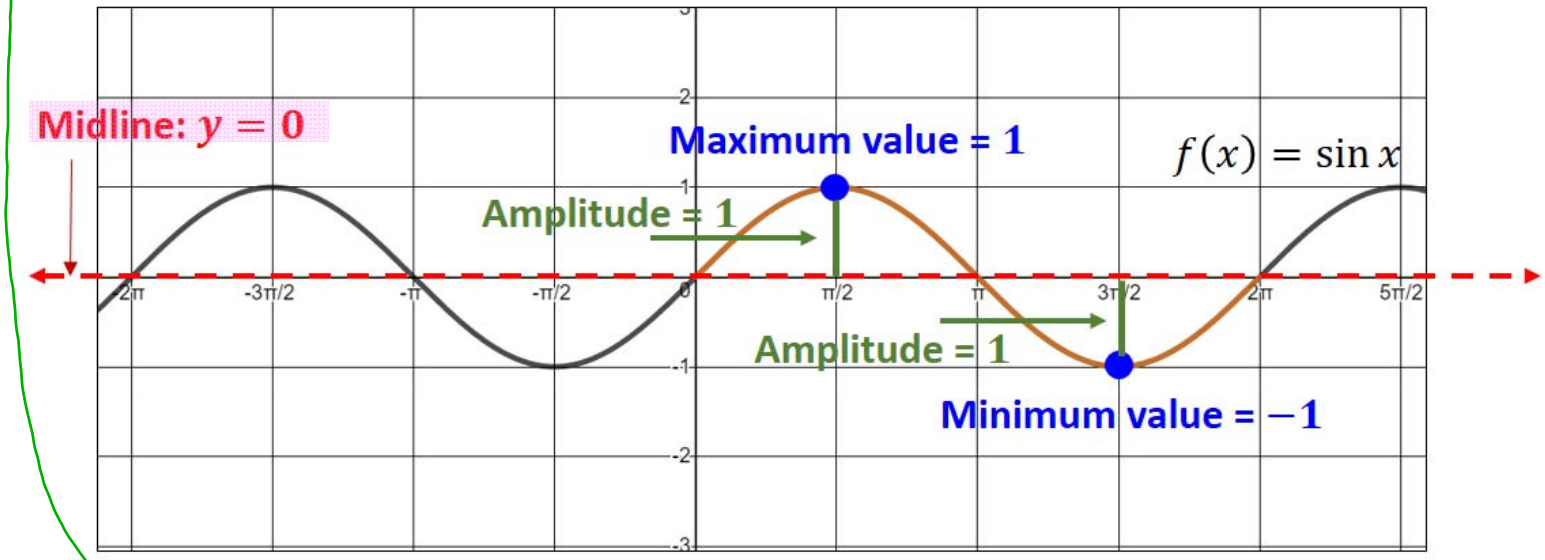
The graph of the **sine function** is a **sine curve**. The orange portion of the graph represents one **period** of the function and is one cycle of the sine curve. The rest of the graph shows how the sine curve repeats indefinitely to the left and right.



Objective: Graph sine and cosine functions using amplitude, period, and midline.

Concept

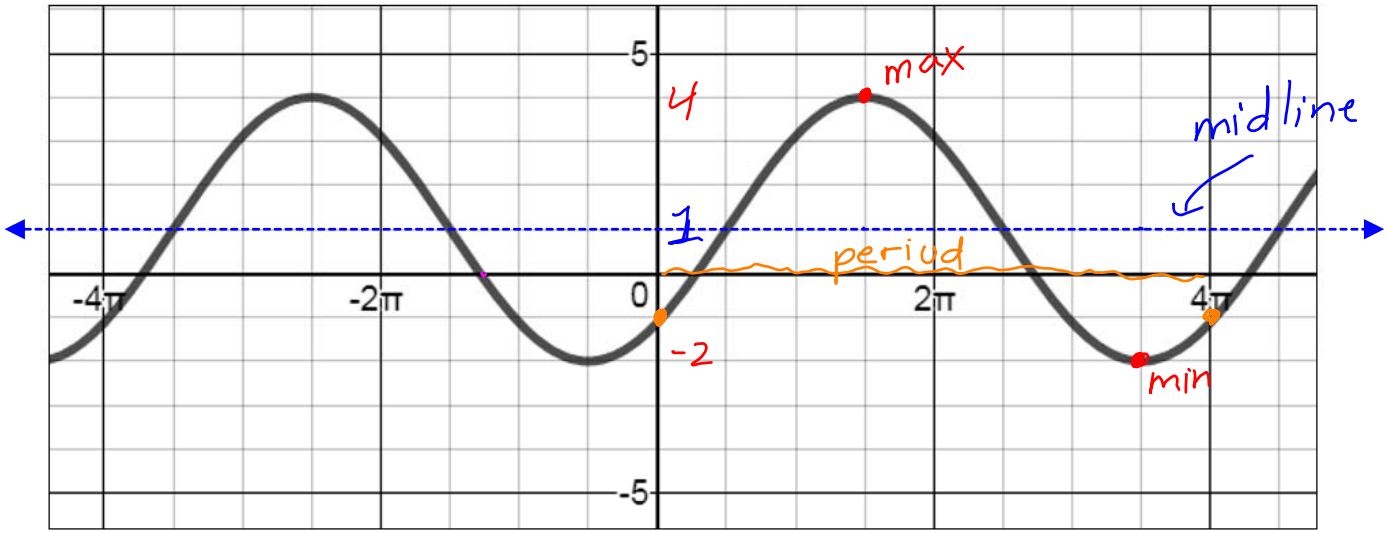
The **amplitude** of the sine function is **half the distance from its maximum to its minimum**. The amplitude is **also the distance from the midline to a maximum or minimum**. The **midline** of the sine function is the **horizontal line halfway between the function's maximum and minimum values**.



$$\text{Amplitude} = \frac{max - min}{2} = \frac{1-(-1)}{2} = \frac{2}{2} = 1$$

Objective: Graph sine and cosine functions using amplitude, period, and midline.

Ex) Shown is the graph of a sine curve. Determine the amplitude, period and midline of the function.



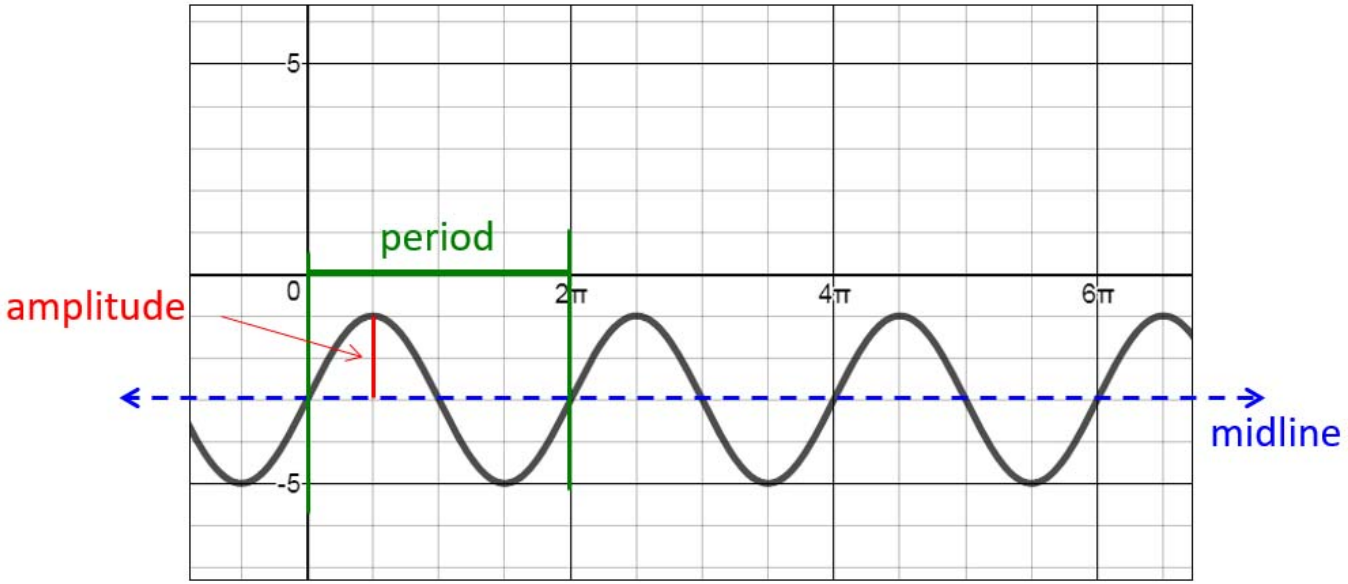
amplitude $= \frac{4-(-2)}{2} = \frac{6}{2} = 3$

midline: $y = 1$

period $= 4\pi$ radians

Objective: Graph sine and cosine functions using amplitude, period, and midline.

Practice) Shown is the graph of a sine function. Determine the amplitude, period and midline of the function.



Amplitude: $\frac{-1-(-5)}{2} = \frac{4}{2} = 2$

Period: 2π

Midline: $y = -3$

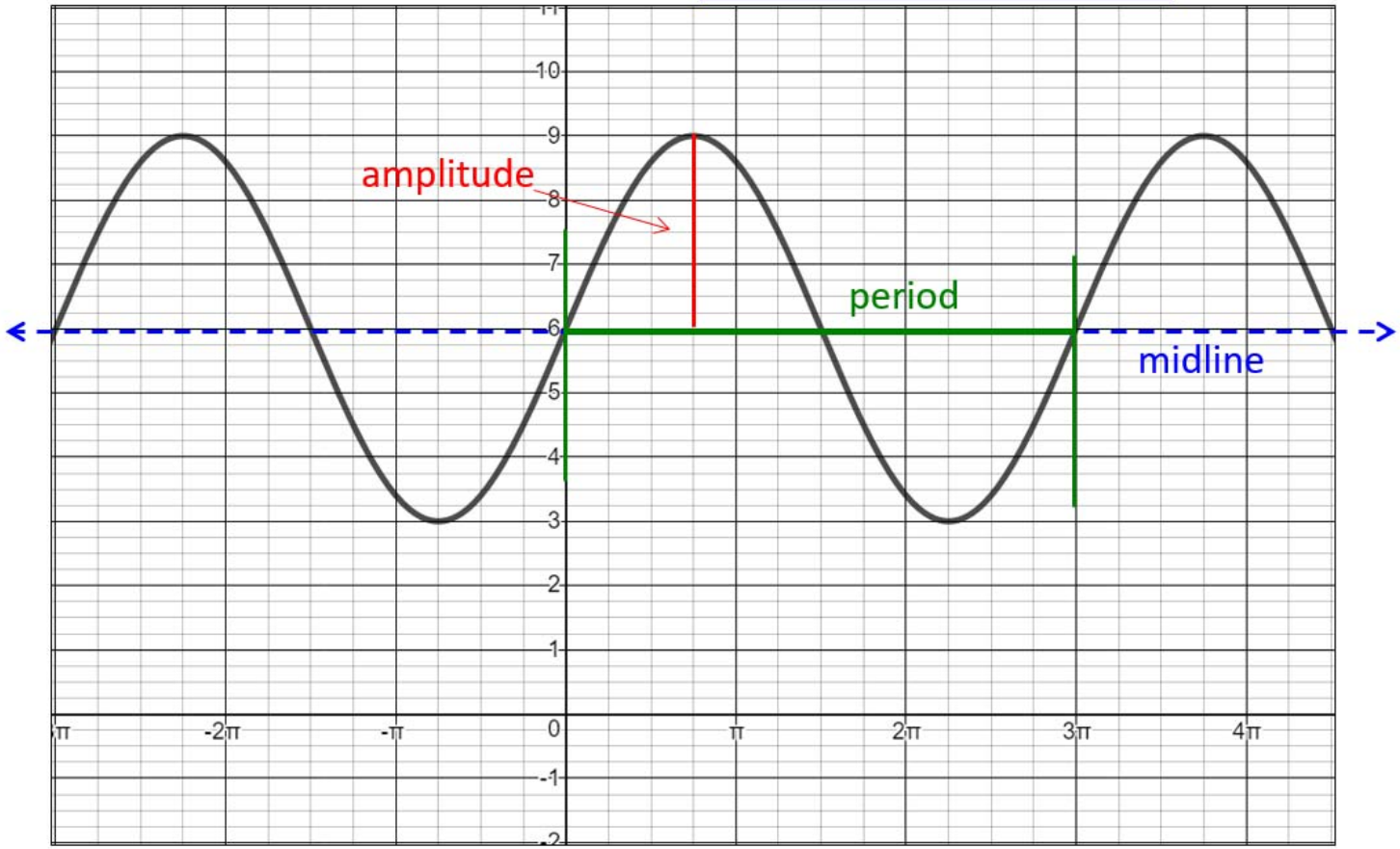
Objective: Graph sine and cosine functions using amplitude, period, and midline.

Practice) Shown is the graph of a sine function. Determine the amplitude, period and midline of the function.

Amplitude: $\frac{9-(3)}{2} = \frac{6}{2} = 3$

Period: 3π

Midline: $y = 6$



Objective: Graph sine and cosine functions using amplitude, period, and midline.

Concept

The transformations you have learned can be applied to the sine and cosine functions as well.

A **horizontal stretch/compression will change the period** to something other than 2π.

A **vertical stretch/compression will change the amplitude** to something other than 1.

A **vertical translation will change the midline** to something other than $y = 0$.

Note: While there can also be reflections across the x-axis and y-axis, these do not change the values of the period or the amplitude or the equation of the midline.

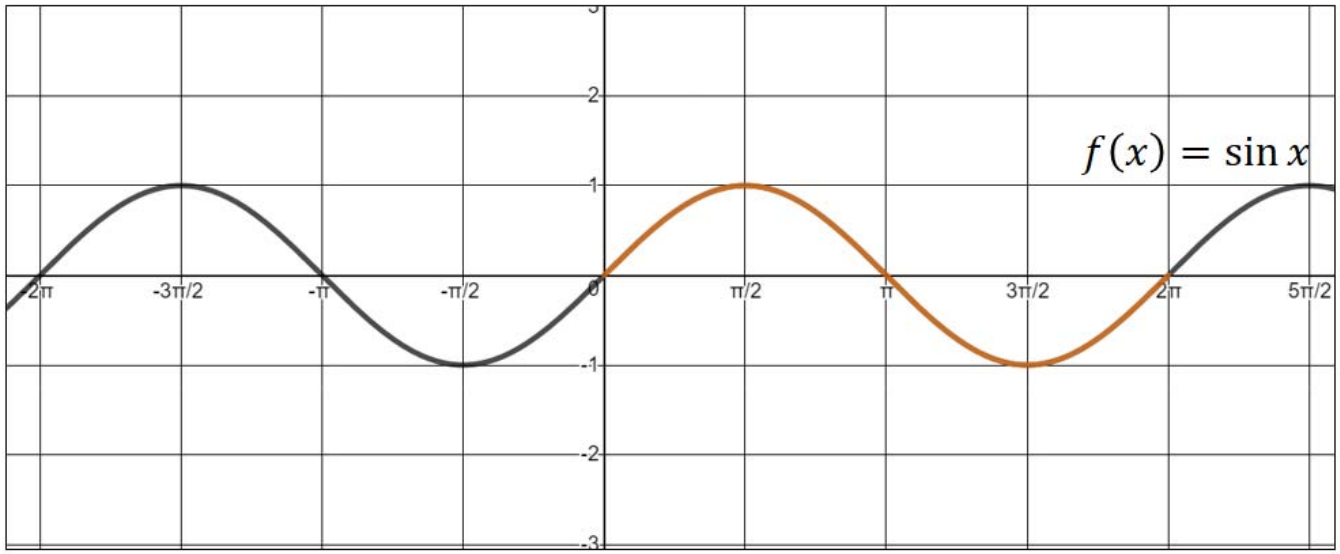
Objective: Graph sine and cosine functions using amplitude, period, and midline.

Concept

One method for graphing sine and cosine functions is **to use the key points that represent the maximums, minimums, and x-intercepts** of the first period of the function and then apply the transformations that change the period, midline, and amplitude.

For $f(x) = \sin x$, identify each point as a maximum, minimum, or intercept.

$(0,0)$	$\left(\frac{\pi}{2}, 1\right)$	$(\pi, 0)$	$\left(\frac{3\pi}{2}, -1\right)$	$(2\pi, 0)$
intercept	maximum	intercept	minimum	intercept

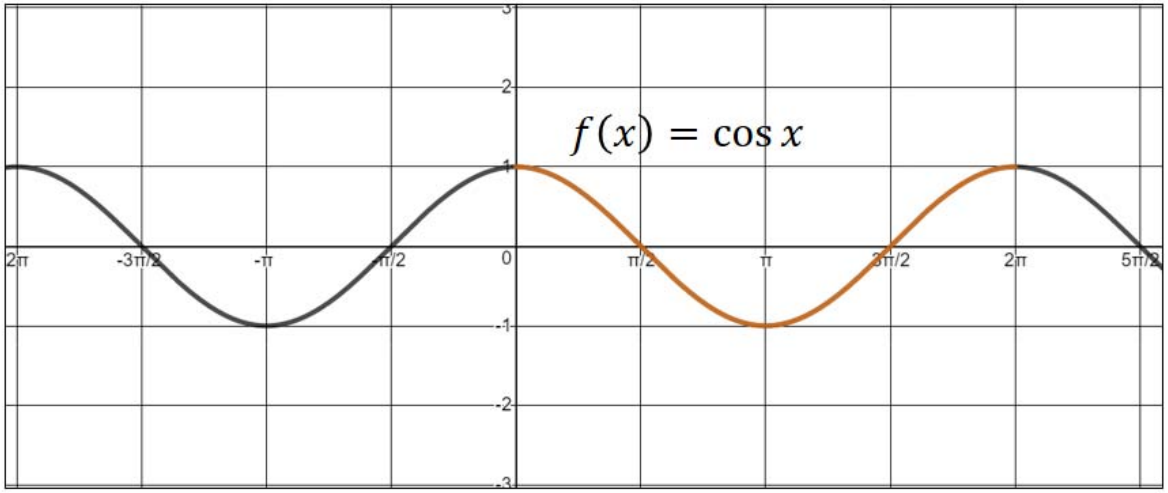


Objective: Graph sine and cosine functions using amplitude, period, and midline.

Concept

For $f(x) = \cos x$, identify each point as a maximum, minimum, or intercept.

$(0,1)$	$\left(\frac{\pi}{2}, 0\right)$	$(\pi, -1)$	$\left(\frac{3\pi}{2}, 0\right)$	$(2\pi, 1)$
maximum	intercept	minimum	intercept	maximum



Objective: Graph sine and cosine functions using amplitude, period, and midline.

Concept

For $g(x) = a \cdot \sin\frac{1}{b}x + k$ **or** $g(x) = a \cdot \cos\frac{1}{b}x + k$

Period of a sine or cosine function: $P = \frac{2\pi}{\left|\frac{1}{b}\right|} = 2\pi \cdot |b|$

Amplitude of a sine or cosine function: $A = |a|$

Midline of a sine or cosine function: $y = k$

To graph a sine or cosine function with the above form:

1. Determine the period, amplitude, and midline.
2. **The scale of $\frac{\pi}{4}$ radians is recommended for the x-axis. If this scale won't work, use the strategy of dividing the period by 4.**
3. Mark the points at the beginning and end of the period. Fill in the middle with the other key points. Extend the cycle as needed to the left and right.
4. Draw a smooth curve.

Objective: Graph sine and cosine functions and determine the key features.

Ex) Find the period, amplitude, and midline. Then graph the function.

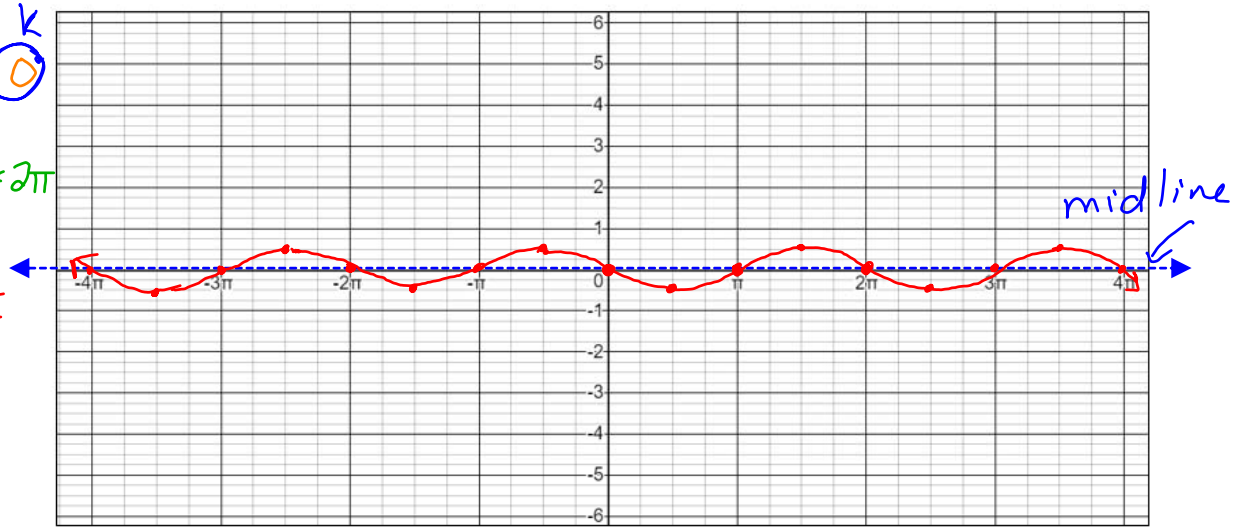
$g(x) = -\frac{1}{2}\sin x$

$g(x) = -\frac{1}{2}\sin(1x) + 0$ (a, b, k)

Period = $\frac{2\pi}{1} = 2\pi \cdot 1 = 2\pi$

Amplitude = $\left|\frac{-1}{2}\right| = \frac{1}{2}$

Midline: $y = 0$



x-axis reflection

Objective: Graph sine and cosine functions and determine the key features.

Ex) Find the period, amplitude, and midline. Then graph the function.

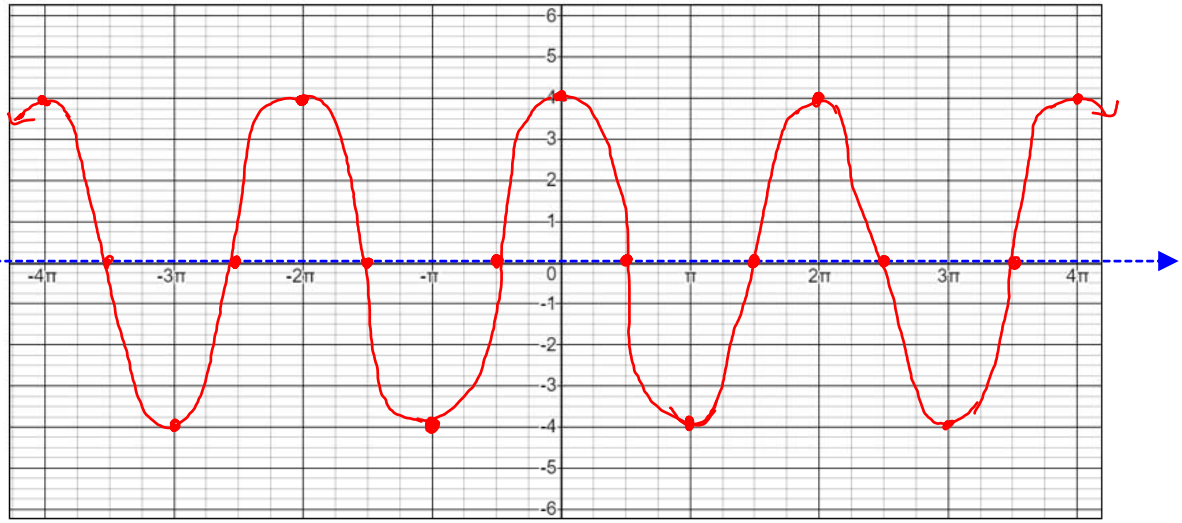
$g(x) = 4\cos x$

$g(x) = 4\cos(1x) + 0$ (a, b, k)

Period = $\frac{2\pi}{1} = 2\pi$

Amplitude = $|4| = 4$

Midline: $y = 0$



Objective: Graph sine and cosine functions and determine the key features.

Ex) Find the period, amplitude, and midline. Then graph the function.

$$g(x) = -\frac{3}{2}\cos x + 4$$

$g(x) = \frac{-3}{2}\cos(1x) + 4$

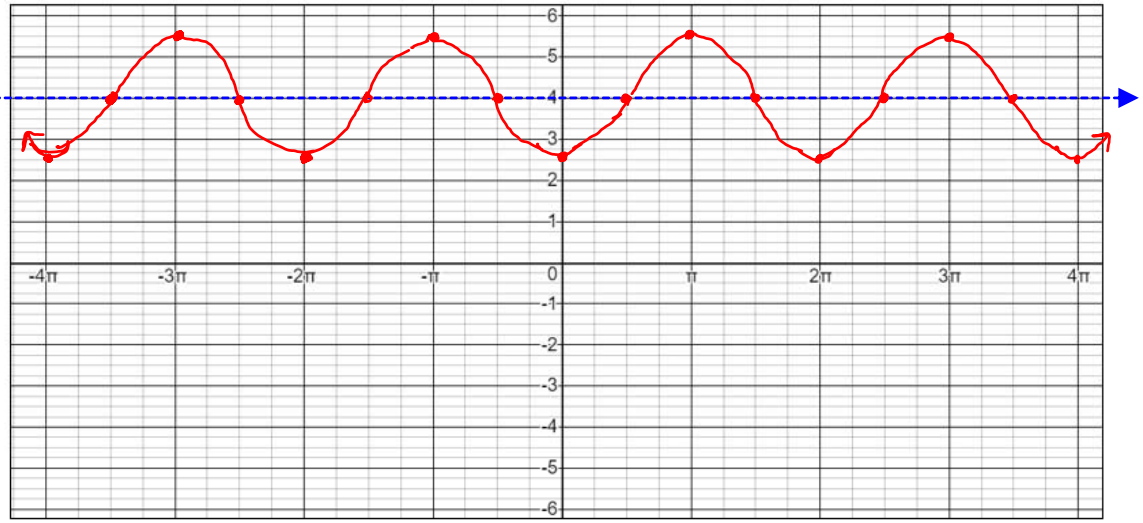
a b k

Period = $\frac{2\pi}{1} = 2\pi$

Amplitude = $\left|\frac{-3}{2}\right| = \frac{3}{2} = 1.5$

Midline: $y = 4$

x-axis refl.



Objective: Graph sine and cosine functions and determine the key features.

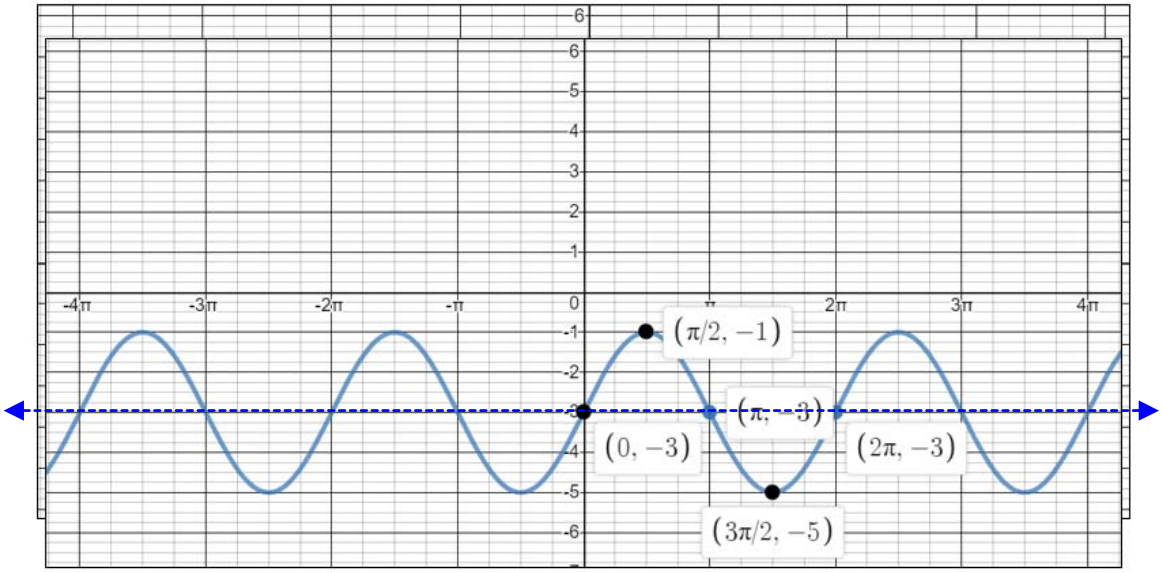
Ex) Find the period, amplitude, and midline. Then graph the function.

$g(x) = 2\sin x - 3$

Period = $\frac{2\pi}{1} = 2\pi$

Amplitude = $|2| = 2$

Midline: $y = -3$



Objective: Graph sine and cosine functions and determine the key features.

Closure

Circle the correct term to complete each statement.

The first positive cycle of the sine function starts at a maximum/minimum/intercept.

The first positive cycle of the cosine function starts at a maximum/minimum/intercept.