

WRITING TRIGONOMETRIC FUNCTIONS

Section 4.6C

Precalculus PreAP/Dual, Revised ©2017

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TRANSFORMATIONS

A. Equation: $y = A$ trig function $B(x - C) + D$

***B.* A is the amplitude**

1. a : vertically stretches by a factor of a ,
2. $\frac{1}{a}$: Vertically compresses by a factor of $1/a$

***C.* B is the period or frequency**

1. *Period equation:* $\frac{2\pi}{B}$ for sine and cosine, $\frac{\pi}{B}$ for tangent
2. B : horizontally compresses by a factor of $\frac{\pi}{B}$
3. $\frac{1}{B}$: horizontally stretches by a factor of b
4. $-b$: Reflects over the y -axis

***D.* C is the phase shift**

- 1.If there no GCF taken out, divide the coefficient

***E.* D is the vertical shift**

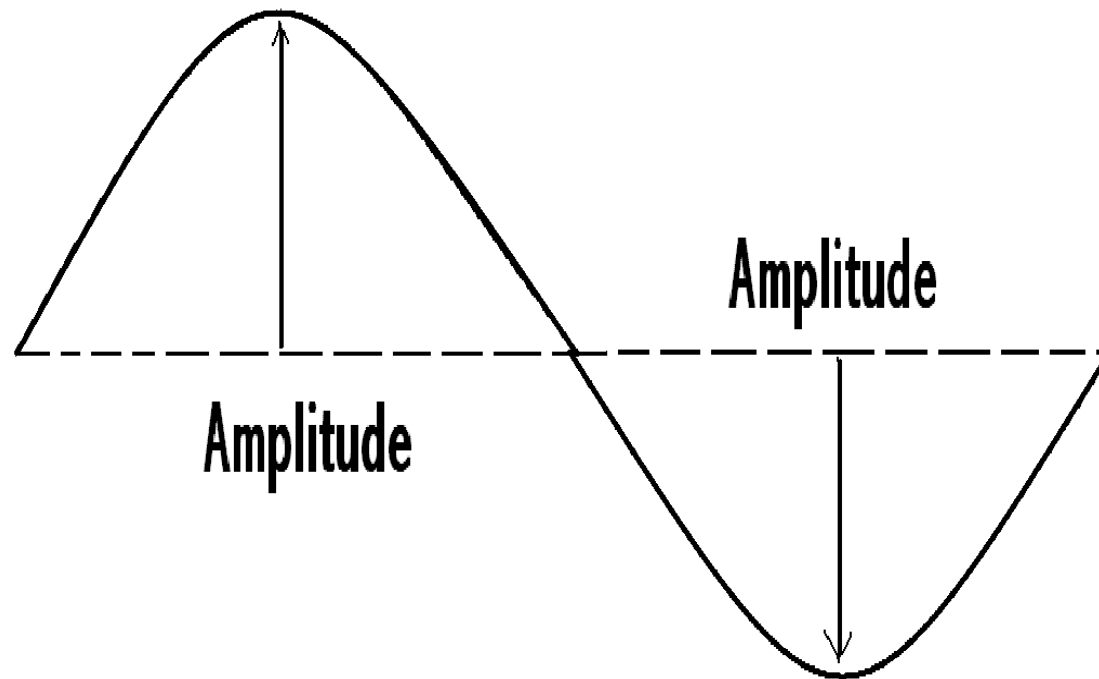
***F.* Frequency is defined as the number of cycles per second**

STEPS

- A. Identify the amplitude (A)**
- B. Identify the period (B)**
 - 1. Find the length of the curve to get the period**
- C. Identify the horizontal shift (C) for sine and cosine and move over the parent function**
- D. Identify the vertical shift (D) by drawing a horizontal line cutting the graph in half**

AMPLITUDE

Amplitude (a) the maximum or minimum vertical distance between the graph and the x -axis. Amplitude is always positive.



PERIOD

The period of a function is the x -interval needed for the function to complete one cycle.

For $b > 0$, the period of $y = A \sin Bx$ or $y = A \cos Bx$ is $\frac{2\pi}{b}$.

If $0 < b < 1$, the graph of the function is stretched horizontally.

EXAMPLE 1

Write an equation using $y = \sin x$ where $a = 2$, period is π , phase shift is right $\frac{\pi}{2}$ and vertical shift is up 1.

$$y = A \sin B \left(x - C \right) + D$$

$$\text{Period} : \frac{2\pi}{B} \quad \text{Amplitude} : 2$$

$$\pi = \frac{2\pi}{B}$$

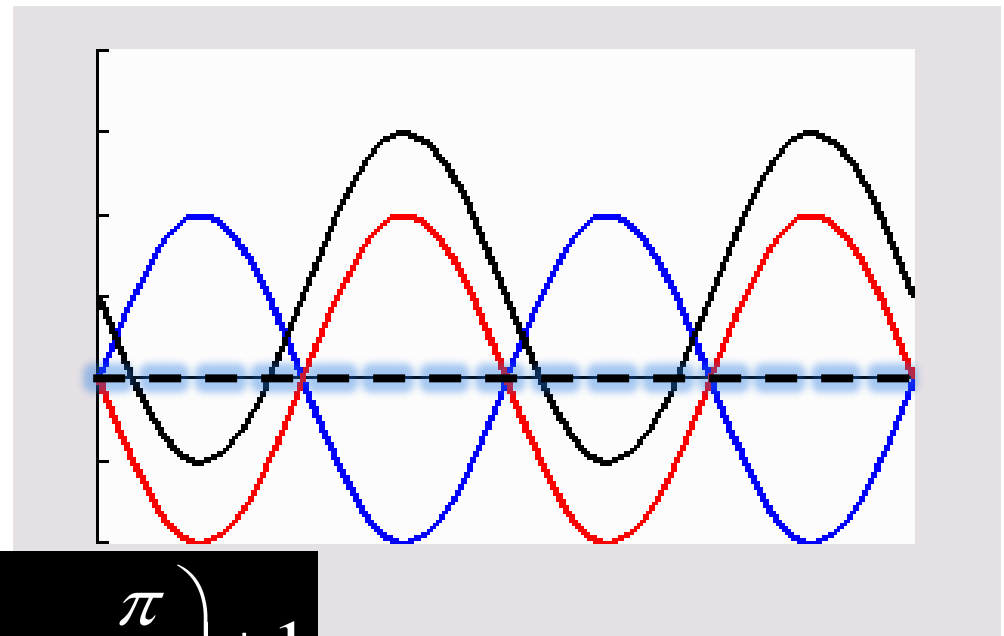
$$B = 2$$

$$C = \frac{\pi}{2}$$

$$B\pi = 2\pi$$

$$D = 1$$

$$y = 2 \sin 2 \left(x - \frac{\pi}{2} \right) + 1$$



EXAMPLE 2

Write an equation using $y = \cos x$ where $a = 3$ reflected across the x -axis, period is 2π , phase shift is $\frac{\pi}{2}$ to the right and vertical shift is down 1.

$$y = -3 \cos \left(x - \frac{\pi}{2} \right) - 1$$

EXAMPLE 3

Write an equation using $y = \tan x$ where $a = 4$, period is $\frac{\pi}{2}$, phase shift is $\frac{\pi}{6}$ to the left.

$$y = 4 \tan 2 \left(x + \frac{\pi}{6} \right)$$

YOUR TURN

Write an equation using $y = \cos x$ where the amplitude is 4, period is $\frac{\pi}{2}$, and phase shift is $\frac{\pi}{24}$ to the left and one unit down

$$y = \frac{1}{2} \cos 4 \left(x + \frac{\pi}{24} \right) - 1$$

BASIC TABLE POINTS

$y = \sin(x)$	
x	y
\mathcal{C}	0
	1
	0
	-1
	0

$y = \cos(x)$	
x	y
\mathcal{C}	1
	0
	-1
	0
	1

$y = \tan(x)$	
x	y
	<i>Und</i>
	-1
\mathcal{C}	0
	1
	<i>Und</i>

BASIC TABLE POINTS

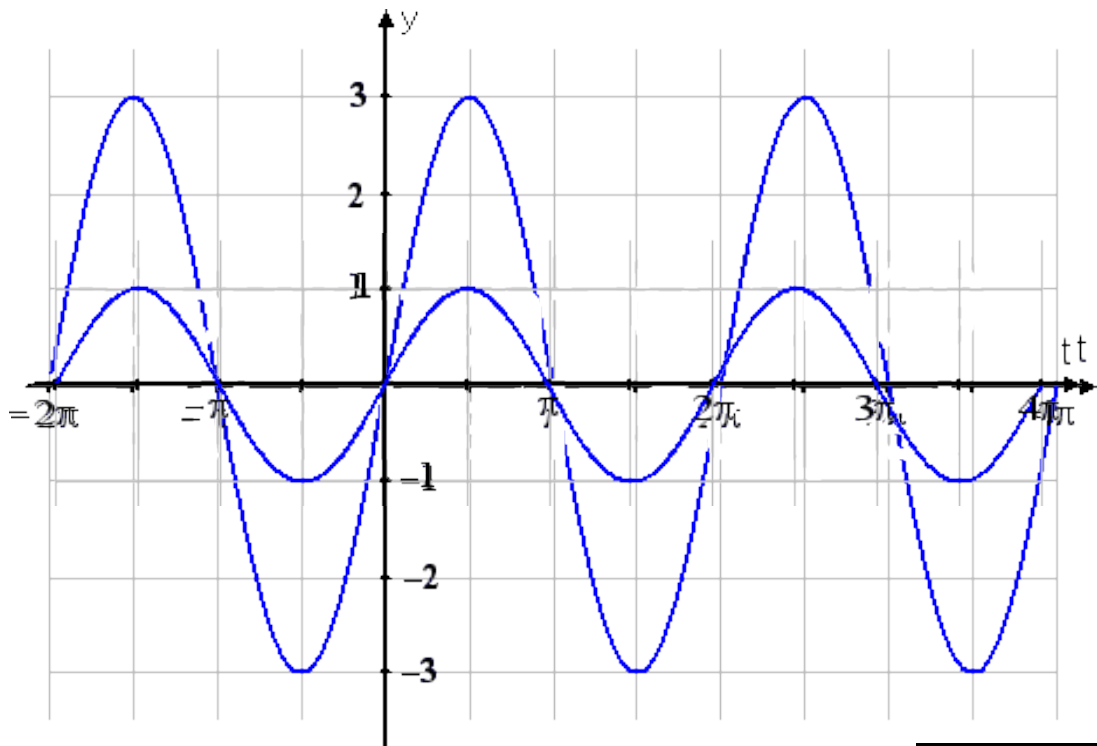
$y = \csc(x)$	
x	y
C	Und
	1
	Und
	-1
	Und

$y = \sec(x)$	
x	y
	Und
C	1
	Und
	-1
	Und

$y = \cot(x)$	
x	y
C	Und
	1
	0
	-1
	Und

EXAMPLE 4

Write the equation of the graph below using a sine function

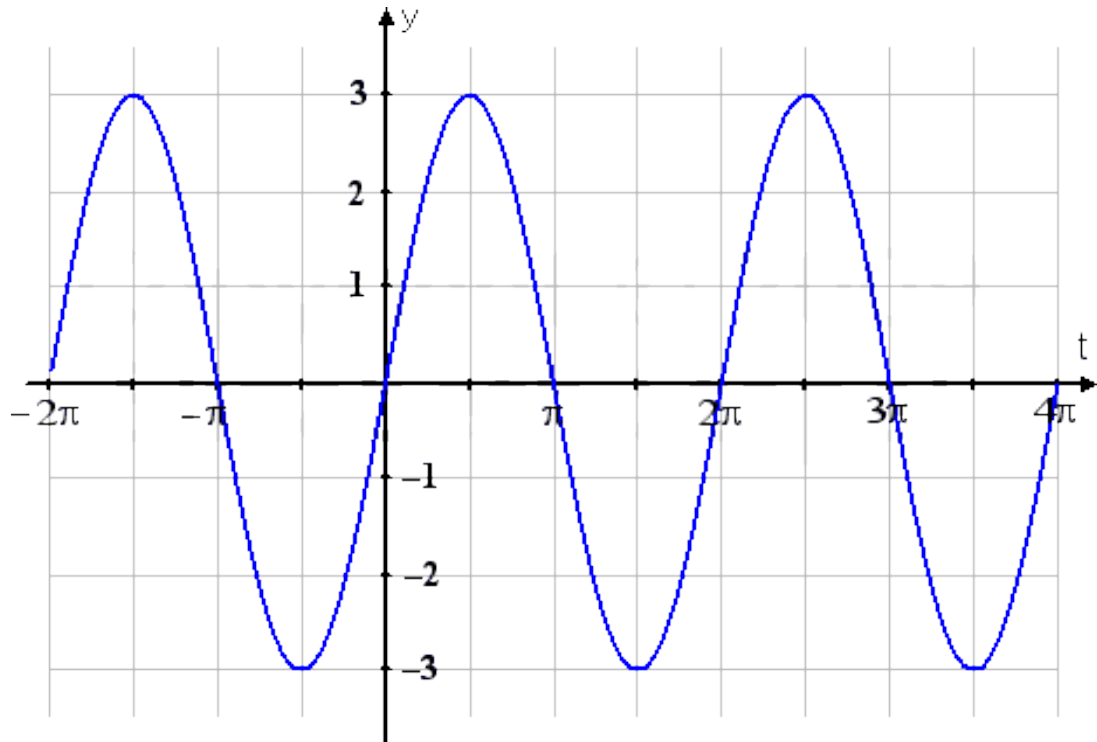


$$y = 3 \sin 1 (x - 0) + 0$$

$$y = 3 \sin x$$

EXAMPLE 4A

Write the equation of the graph below using a cosine function

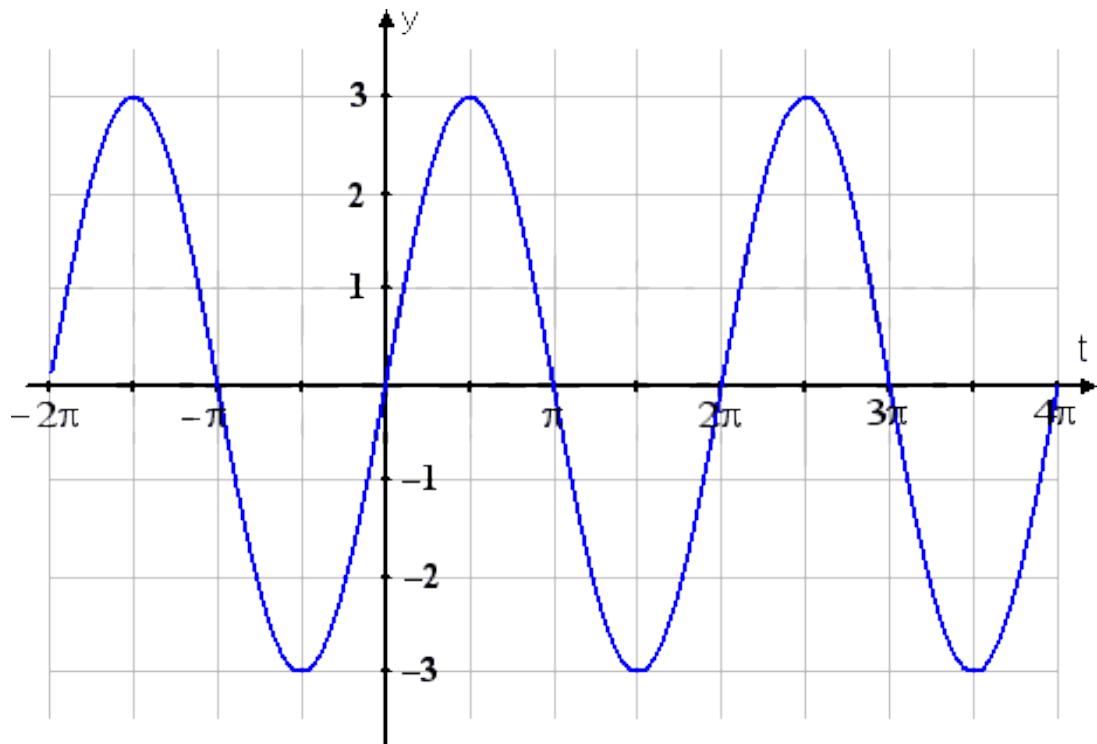


$$y = 3 \cos (x - C) + D$$

EXAMPLE 4A

Write the equation of the graph below using a cosine function

$$y = 3 \cos 1(x - C) + D$$



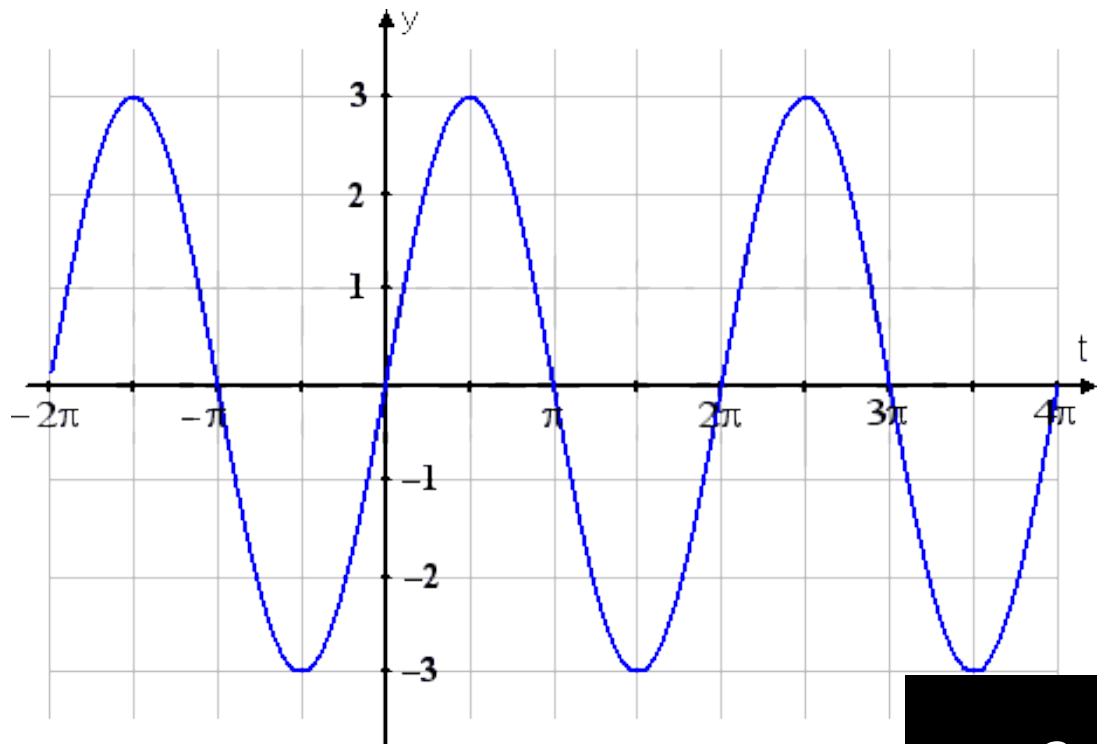
How many complete cycles from $(0, 2\pi)$?

1

EXAMPLE 4A

Write the equation of the graph below using a cosine function

$$y = 3 \cos 1 \left(x - \frac{\pi}{2} \right) + D$$



Where is the phase shift?

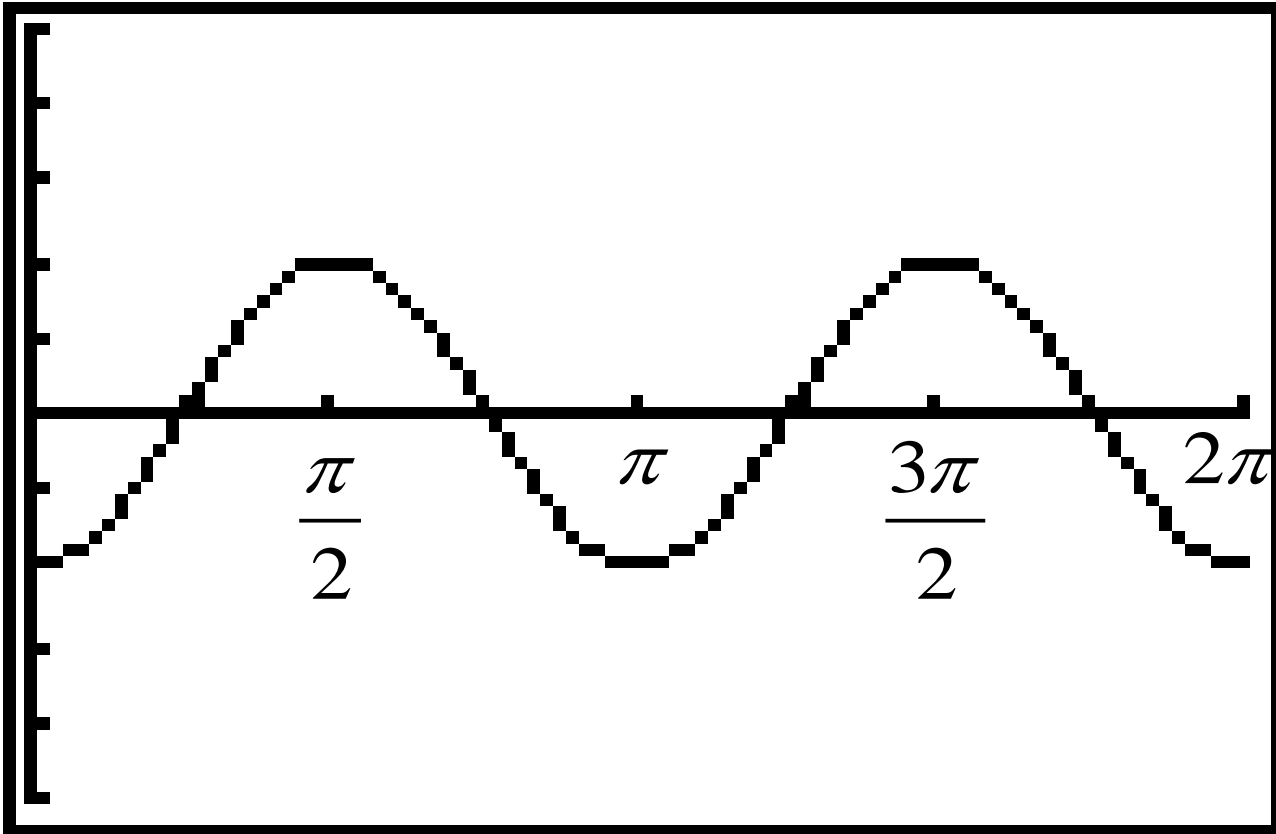
Where is the cosine graph from $(0, 2\pi)$ at?

Right $\frac{\pi}{2}$

$$y = 3 \cos \left(x - \frac{\pi}{2} \right)$$

EXAMPLE 5

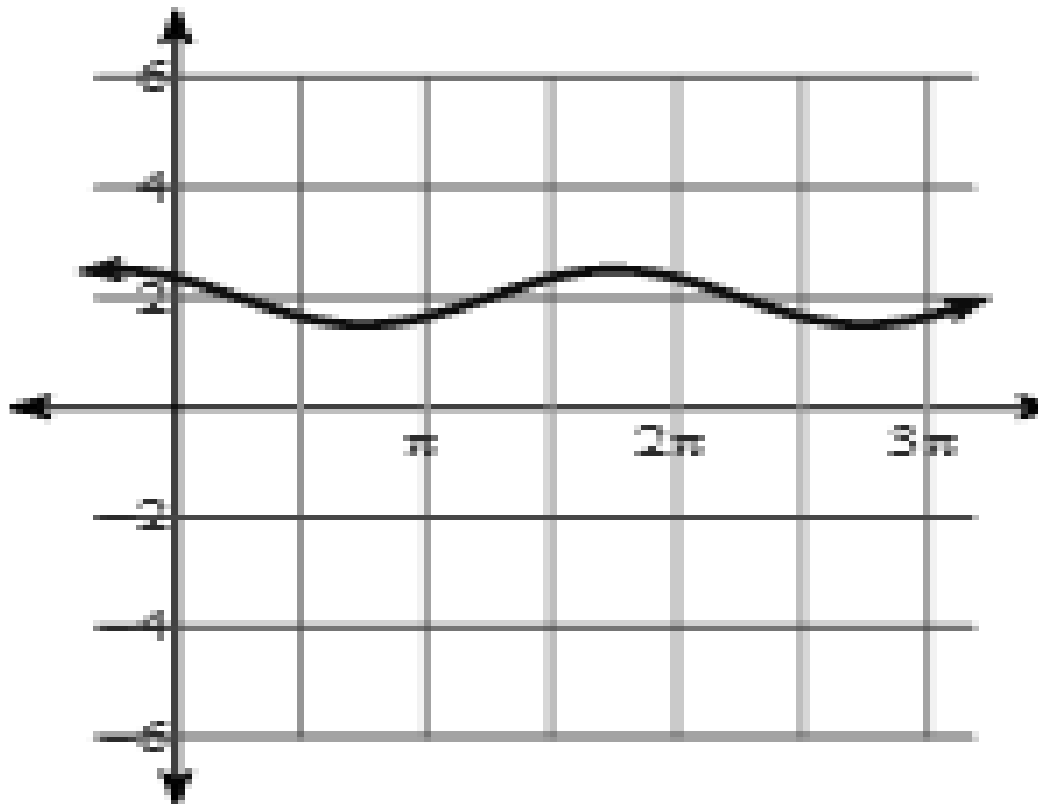
Write the equation of the graph below using a sine and cosine function



$$y = 2 \sin 2 \left(x - \frac{\pi}{4} \right)$$
$$y = 2 \cos 2 \left(x - \frac{\pi}{2} \right)$$

EXAMPLE 6

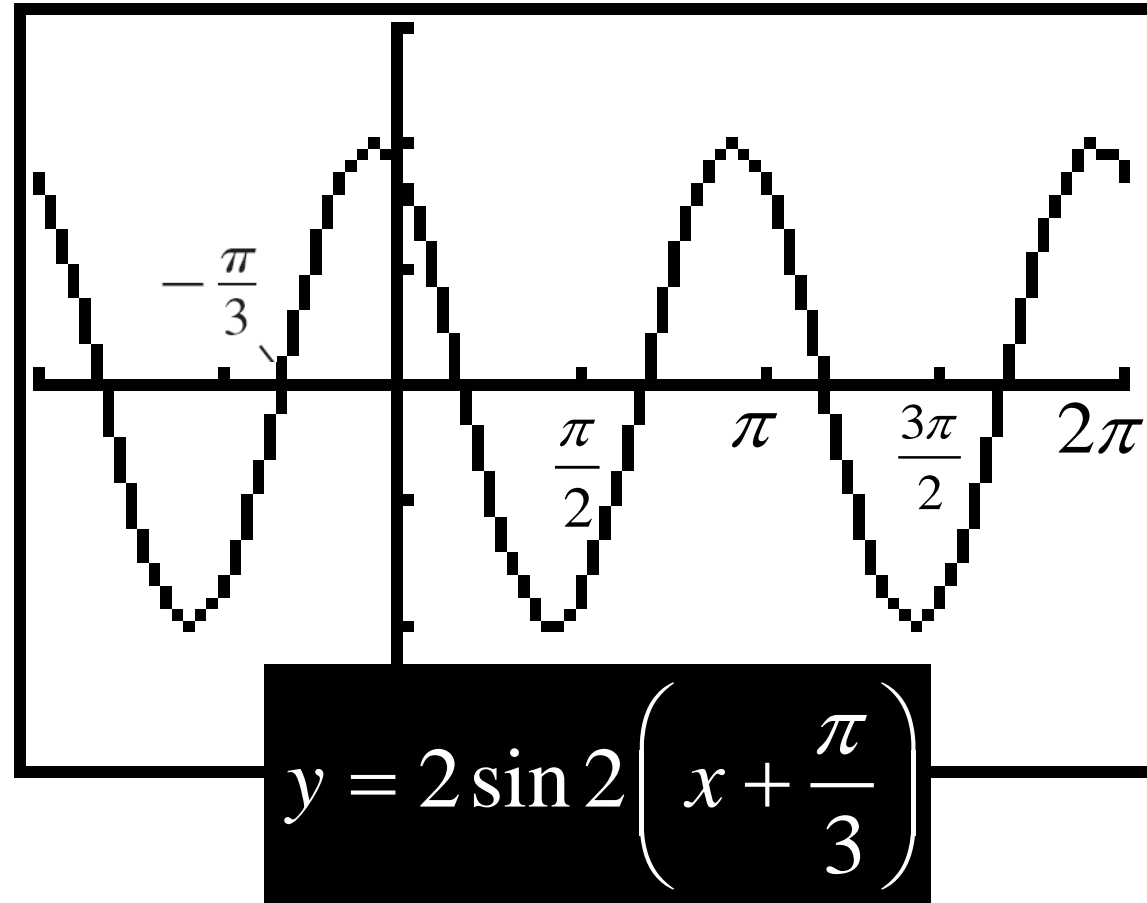
Write the equation of the graph below using a sine and cosine function



$$y = \frac{1}{2} \sin \frac{4}{3} \left(x - \frac{5\pi}{4} \right) + 2$$
$$y = \frac{1}{2} \cos \frac{4}{3} (x) + 2$$

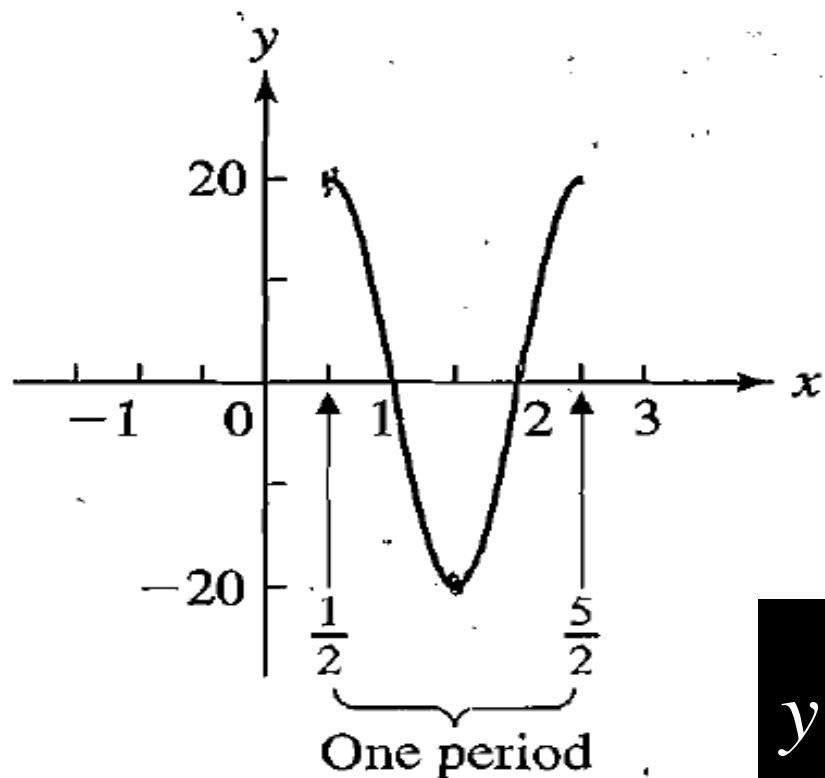
YOUR TURN

Write the equation of the graph below using a sine function



EXAMPLE 7

Write the equation of the graph below using a cosine function



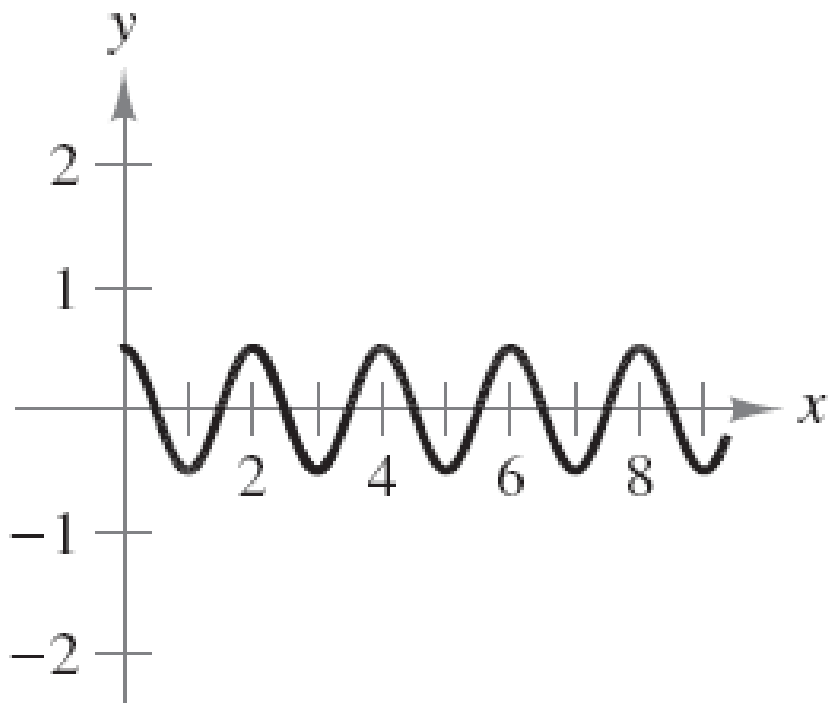
$$y = 20 \cos \pi \left(x - \frac{1}{2} \right) + 0$$

$$B = \frac{2\pi}{2} = \pi$$

$$y = 20 \cos \pi \left(x - \frac{1}{2} \right)$$

EXAMPLE 8

Write the equation of the graph below using a cosine function



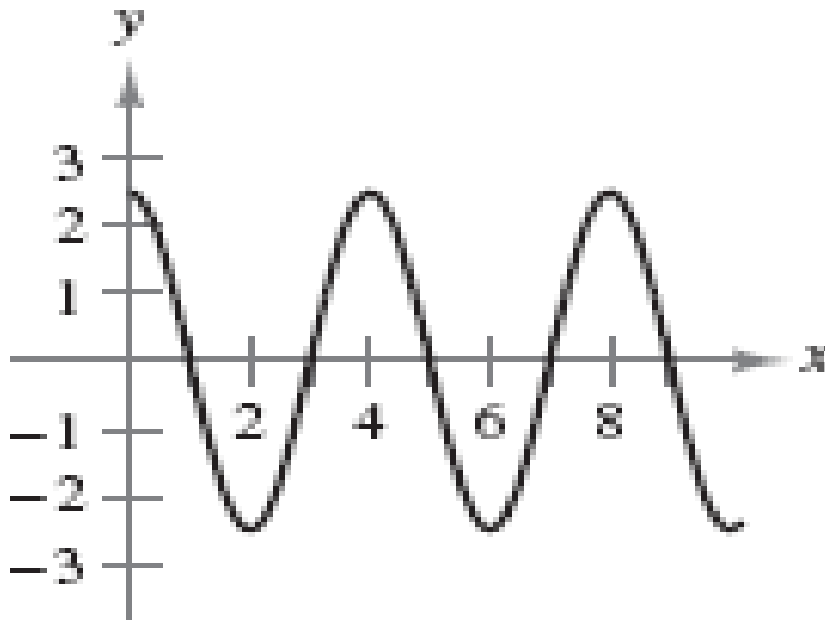
$$y = \frac{1}{2} \cos \pi(x - 0) + 0$$

$$B = \frac{2\pi}{2} = \pi$$

$$y = \frac{1}{2} \cos \pi(x)$$

YOUR TURN

Write the equation of the graph below using a cosine function



$$y = \frac{5}{2} \cos \frac{1}{2} \pi x$$

ASSIGNMENT

Worksheet