Lesson 6-5

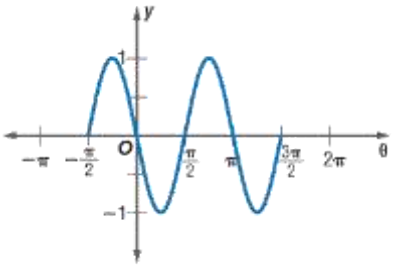
Example 1

State the phase shift for each function. Then graph the function.

a. $y = \sin(2\theta + \pi)$

The phase shift of the function is $-\frac{c}{k}$ or $-\frac{\pi}{2}$.

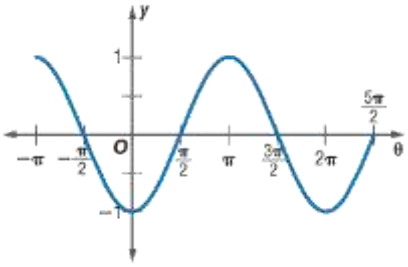
To graph $y = \sin(2\theta + \pi)$, consider the graph of $y = \sin 2\theta$. Graph this function and then shift the graph $-\frac{\pi}{2}$.



b. $y = \cos(\theta - \pi)$

The phase shift of the function is $-\frac{c}{k}$ or $-\frac{-\pi}{1}$, which equals π.

To graph $y = \cos(\theta - \pi)$, consider the graph of $y = \cos\theta$ and then shift the graph π.

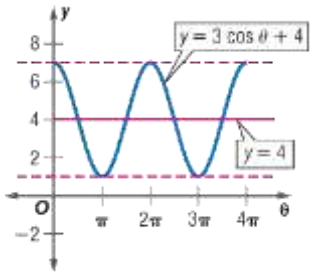


Example 2

State the vertical shift and the equation of the midline for the function $y = 3 \cos \theta + 4$. Then graph the function.

The vertical shift is 4 units upward. The midline is the graph $y = 4$.

To graph the function, draw the midline, the graph of $y = 4$. Since the amplitude of the function is 3, draw dashed lines parallel to the midline which are 3 units above and below the midline. Then draw the cosine curve.



Example 3

State the amplitude, period, phase shift, and vertical shift for $y = 2 \cos 1\frac{\theta}{2} + \pi 2 + 3$.

The amplitude is $|2|$ or 2.

The period is $\frac{2\pi}{\frac{1}{2}}$ or 4π. The phase shift is $-\frac{\pi}{\frac{1}{2}}$ or -2π.

The vertical shift is +3.

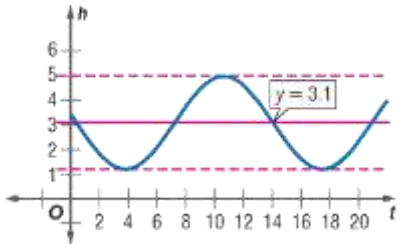
Example 4

TIDES **The equation that models the tides off the coast of a city on the east coast of the United States is given by $h = 3.1 + 1.9 \sin \left(\frac{\pi}{6.8}t - \frac{5.1\pi}{6.8}\right)$, where t represents the number of hours since midnight and h represents the height of the water. Draw a graph that models the cyclic nature of the tide.**

The vertical shift is 3.1. Draw the midline $y = 3.1$. The amplitude is 1.9. Draw dashed lines parallel to and 1.9 units above and below the midline.

The period is $\frac{2\pi}{\frac{\pi}{6.8}}$ or 13.6. Draw the sine curve with a period of 13.6.

Shift the graph $-\frac{\frac{-5.1\pi}{6.8}}{\frac{\pi}{6.8}}$ or 5.1 units.



Example 5

Write an equation of a sine function with amplitude 5, period 3π, phase shift $\frac{\pi}{2}$, and vertical shift 2.

The form of the equation will be $y = A \sin(k\theta + c) + h$. Find the values of A, k, c, and h.

***A*:** $|A| = 5$

$A = 5$ or -5

***k*:** $\frac{2\pi}{k} = 3\pi$ *The period is 3π.*

$k = \frac{2}{3}$

***c*:** $-\frac{c}{k} = \frac{\pi}{2}$ *The phase shift is $\frac{\pi}{2}$.*

$-\frac{c}{\frac{2}{3}} = \frac{\pi}{2}$ *$k = \frac{2}{3}$*

$c = -\frac{\pi}{3}$

***h*:** $h = 2$

Substitute these values into the general equation. The possible equations are

$y = 5 \sin 1\frac{2}{3}\theta - \frac{\pi}{3}2 + 2$ or $y = -5 \sin 1\frac{2}{3}\theta - \frac{\pi}{3}2 + 2$.

Example 6

Graph $y = x + \sin x$.

First graph $y = x$ and $y = \sin x$ on the same axes. Then add the corresponding ordinates of the functions. Finally, sketch the graph.

x	$\sin x$	$x + \sin x$
0	0	0
$\frac{\pi}{2}$	1	$\frac{\pi}{2} + 1 \approx 2.57$
π	0	$\pi \approx 3.14$
$\frac{3\pi}{2}$	-1	$\frac{3\pi}{2} - 1 \approx 3.71$
2π	0	$2\pi \approx 6.28$
$\frac{5\pi}{2}$	1	$\frac{5\pi}{2} + 1 \approx 8.85$
3π	0	$3\pi \approx 9.42$