Warm Up 12/10

Find the period and the amplitude of the following.

1. $2\sin 4\pi$

2. $5\cos\frac{1}{2}\pi$

3. $7\sin 0.6\pi$

4. What does it mean for a function to have a period of 3π?

Lesson 5-3

Trigonometric Graphs III

Objective

Students will…

- Be able to identify and graph the shift of sine and cosine functions.

Standard Equation of Sine and Cosine Curves

Like any other functions, there exists a standard equation of both sine and cosine curves.

Sine Curves: Any equation of a sine curve is written in the form:

$y = a \sin kx$, where a and k are real numbers with $k > 0$

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

Cosine Curves: Any equation of a cosine curve is written in the form:

$y = a \cos kx$, where a and k are real numbers with $k > 0$

$y = a \cos k(x - h) + m$

Period and Amplitude of Sine and Cosine Curves

In our previous lesson we simply used the graph to figure out the period and amplitude of a given sine or cosine curve. However, we may not (more of than not) have a graph to refer to. In fact, how would we find the period if we were asked to graph a given sine or cosine curve? Of course, we can use the x-y table to graph the curve first, but this isn't always practical.

Fortunately, finding the period and the amplitude of a sine or cosine curve can be found algebraically from their equation.

For sine and cosine curves: $y = a \sin kx$ and $y = a \cos kx$,

Period = $\frac{2\pi}{k}$ **Amplitude** = $|a|$

Horizontal and Vertical Shift

Recall from chapter 2 about the shift of parabolas. The standard equation of a parabola is $y = x^2$. Now, consider…

Ex.

	$y = x^2$	$y = (x-4)^2 - 9$
Vertex:	(0,0)	(4, -9)
Shift:		right 4, down 9

Horizontal and Vertical Shift

Believe it or not, trig functions (along with many other functions) take the similar format when it comes to their shifts.

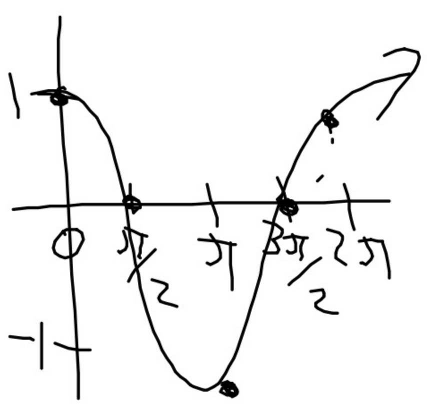
Ex.

	$y = 1\cos x$	$k=1$ $y = 1\cos(x - \frac{\pi}{2}) + 1$
Period:	2π	2π
Amplitude:	1	1
Shift:		right $\pi/2$, up 1
Start/End Point:	X-axis: $0 \to 2\pi$ y-axis: $-1 \to 1$ mid = 0	X-axis: $\pi/2 \to \frac{5\pi}{2}$ y-axis: $0 \to 2$ mid = 1

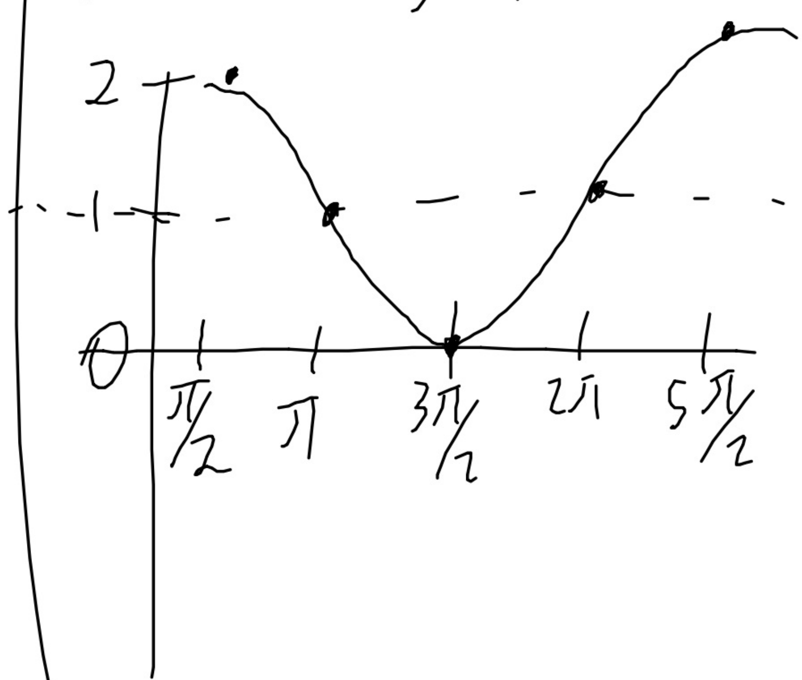
Examples

Let's graph the two and compare. $y = \cos x$, $y = \cos\left(x - \frac{\pi}{2}\right) + 1$

$y = \cos x$



$y = \cos(x - \pi/2) + 1$



Example

Believe it or not, trig functions (along with many other functions) take the similar format when it comes to their shifts.

$3\sin(2x - 2\pi/4)$

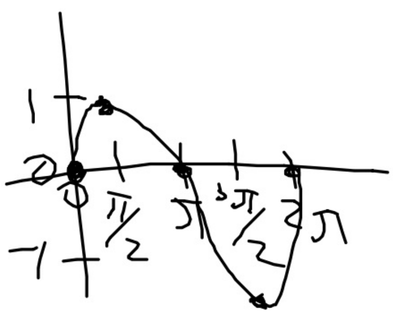
Ex.

	$y = \sin x$	$y = 3\sin \overset{k}{2}(x - \frac{\pi}{4})$
Period:	2π	$2\pi/k = \frac{2\pi}{2} = \pi$
Amplitude:	1	3
Shift:		right $\pi/4$
Start/End Point:	X-axis: $0 \to 2\pi$ y-axis: $-1 \to 1$ mid $= 0$	X-axis: From: $0 \to \pi$ w/shift: $\pi/4 \to 5\pi/4$ y-axis: $-3 \to 3$ mid $= 0$

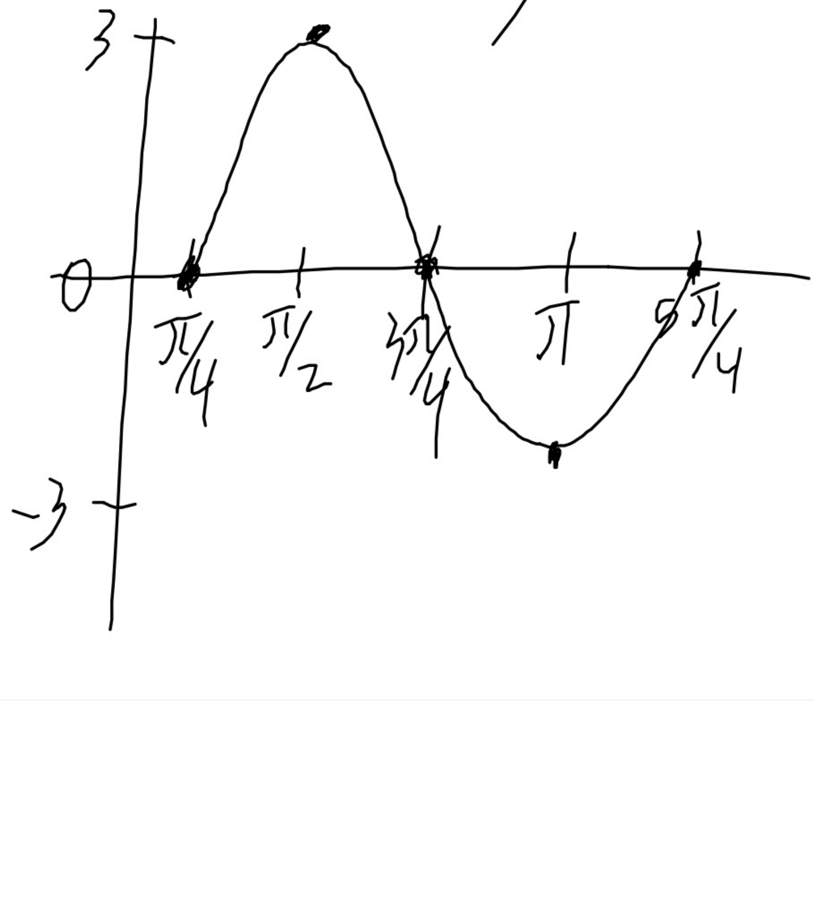
Examples

Let's graph the two and compare. $y = \sin x$, $y = 3\sin 2\left(x - \frac{\pi}{4}\right)$

$y = \sin x$



$y = 3\sin 2(x - \pi/4)$



Guidelines to Graphing

1. Identify whether it is a sine or a cosine function.

2. Find the period and the amplitude.

   $2\pi/k$ $|a|$

3. Find the phase shift of the functions.

   (left/right, up/down)

4. Identify the starting points and the endpoints of the shifted graph.

   middle

5. Graph

Examples

Graph the following (pg. 429)

1. $f(x) = 1 + \cos x$

Examples

Graph the following (pg. 429)

$= 5\cos 3\left(x - \frac{\pi}{12}\right)$

33. $y = 5\cos(3x - \frac{\pi}{4})$ $\frac{1}{3}$

Period: $\frac{2\pi}{3}$

Shift: right $\frac{\pi}{12}$

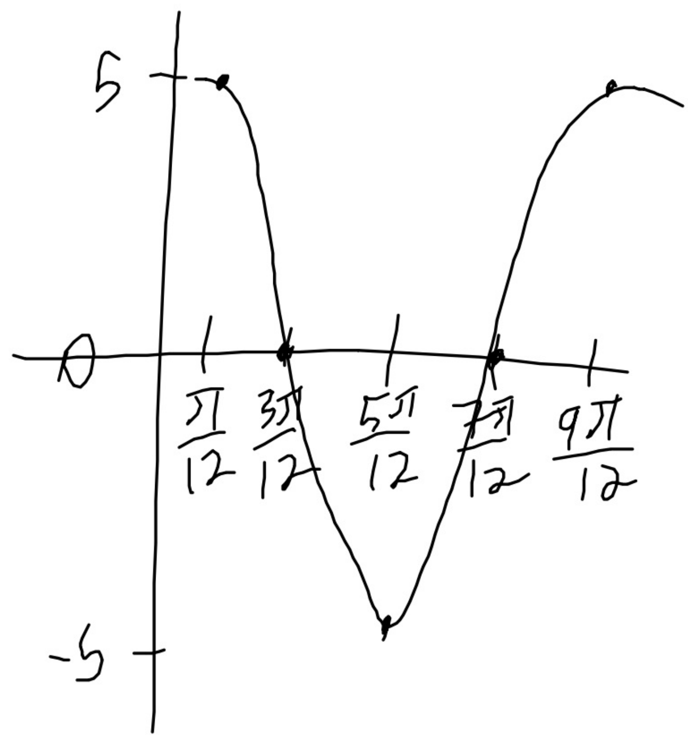
Amp: 5

Start/End:

X-axis: $\frac{\pi}{12} \to \frac{9\pi}{12}$

y-axis: $-5 \to 5$

mid $= 0$



Homework 12/10

TB pg. 429 #1, 11, 19, 27, 33, 36

(**<u>Be sure to graph!)</u>**