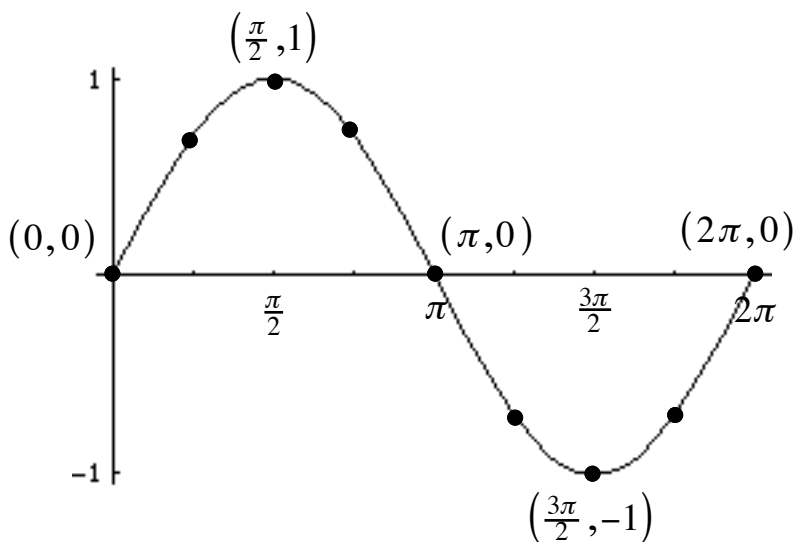


§7.4 Graphs of Sine and Cosine Functions

Graph of $y = \sin x$

x	0	$\frac{\pi}{4}$	$\frac{\pi}{2}$	$\frac{3\pi}{4}$	π	$\frac{5\pi}{4}$	$\frac{3\pi}{2}$	$\frac{7\pi}{4}$	2π
y = sin x									



- since the domain of $y = \sin x$ is all real numbers, the graph repeats infinitely to the left and the right

- one period (or cycle) of the graph is on $[0, 2\pi]$

Graphing trigonometric functions on TI calculator

MODE all choices on left should be highlighted, radians

WINDOW	xmin	-2π (endpoint left)
	xmax	2π (endpoint right)
	xscl	$\pi/2$ (tick marks)
	ymin	-2 (Amplitude low)
	ymax	2 (Amplitude high)
	yscl	1 (ignore)

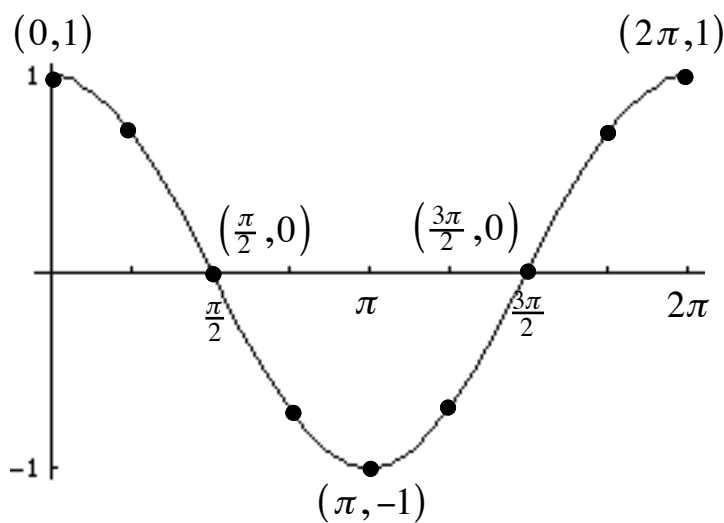
Example: Graph $y = \sin x$ on your calculator. Draw the axes and label properly.

Example: Sketch the graph of $y = 2 \sin x$ on the interval $[-\pi, 4\pi]$. Remember key points.



Graph of $y = \cos x$

x	0	$\frac{\pi}{4}$	$\frac{\pi}{2}$	$\frac{3\pi}{4}$	π	$\frac{5\pi}{4}$	$\frac{3\pi}{2}$	$\frac{7\pi}{4}$	2π
y = cos x									



- since the domain of $y = \cos x$ is all real numbers, the graph repeats infinitely to the left and the right

- one period (or cycle) of the graph is on $[0, 2\pi]$

Amplitude

Compare the graph $y = \sin x$ to each of the following: (Vertical Shrinking and Stretching)

Ex 1. $y = 2 \sin x$

2. $y = -3 \sin x$

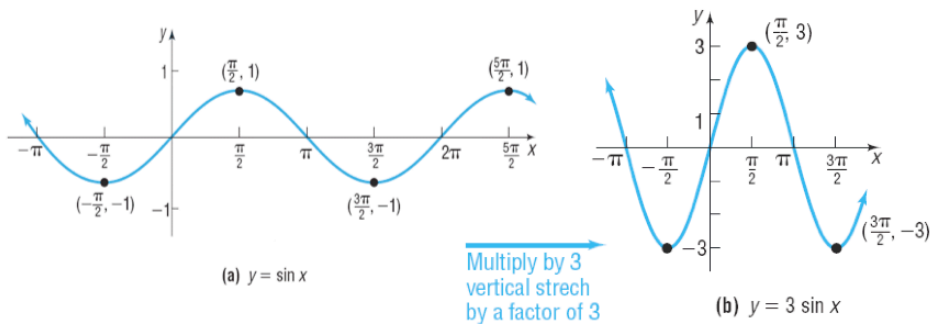
3. $y = \frac{1}{2} \sin x$

Period

EXAMPLE

Graphing Functions of the Form $y = A \sin(\omega x)$ Using Transformations

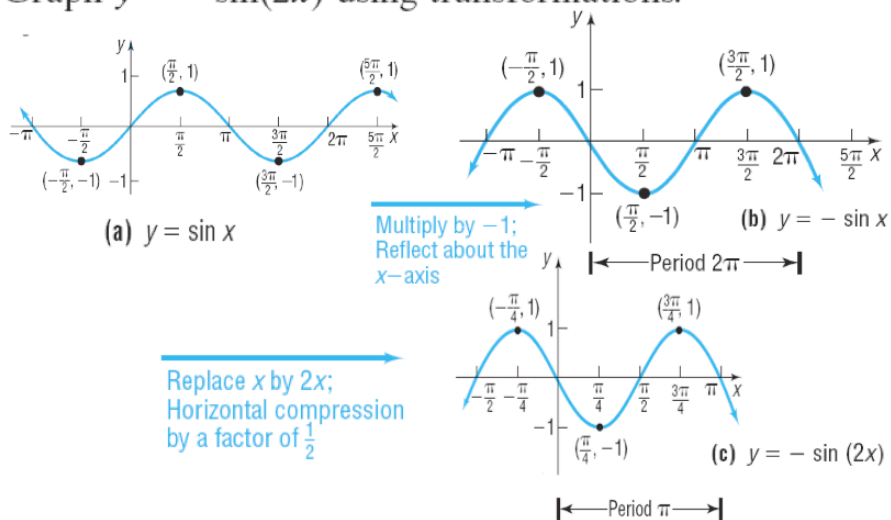
Graph $y = 3 \sin x$ using transformations.



EXAMPLE

Graphing Functions of the Form $y = A \sin(\omega x)$ Using Transformations

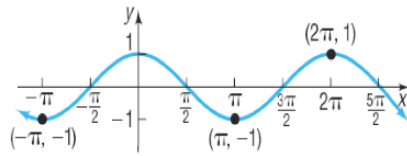
Graph $y = -\sin(2x)$ using transformations.



EXAMPLE

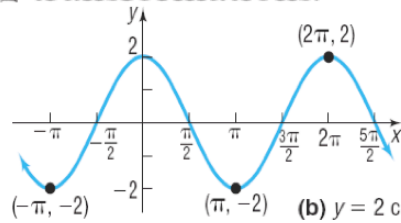
Graphing Functions of the Form $y = A \cos(\omega x)$ Using Transformations

Graph $y = 2 \cos(3x)$ using transformations.



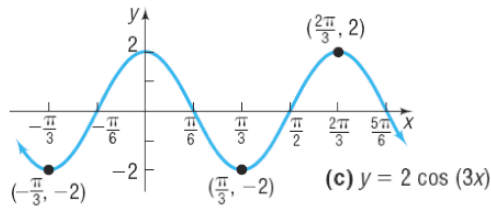
(a) $y = \cos x$

Multiply by 2;
Vertical stretch
by a factor of 2



(b) $y = 2 \cos x$

Replace x by $3x$;
Horizontal
compression
by a factor of $\frac{1}{3}$



(c) $y = 2 \cos(3x)$

Formulas for General Form $y = a \sin(bx - c) + d$
and $y = a \cos(bx - c) + d$

amplitude = $|a|$

period (of sine and cosine) = $\frac{2\pi}{b}$

tick marks = $\frac{\text{period}}{4}$

endpoints Solve: $bx - c = 0$ $bx - c = 2\pi$

vertical shift = d

Example: Horizontal Translation

Sketch the graph of $y = \frac{1}{2} \sin\left(x - \frac{\pi}{3}\right)$

Example: Horizontal Translation

Sketch the graph of $y = -3 \cos(2\pi x + 4\pi)$

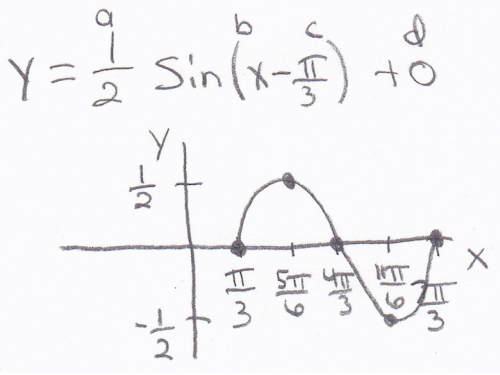
Example: Vertical Translation

Sketch the graph of $y = 2 + 3 \cos(2x)$

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

(Remember APTEV)

Formulas for General Form $y = a \sin(bx - c) + d$ and $y = a \cos(bx - c) + d$

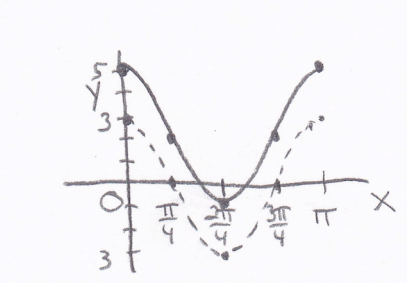
<p>amplitude = $a = \left \frac{1}{2}\right = \frac{1}{2}$</p>	<p>tick mark calculations:</p> <p>(1) $\frac{\pi}{3}$ (2) $\frac{\pi}{3} + \frac{\pi}{2} = \frac{5\pi}{6}$</p>
<p>period (of sine and cosine) =</p> <p>$\frac{2\pi}{b} = \frac{2\pi}{1} = 2\pi$</p>	<p>(3) $\frac{5\pi}{6} + \frac{\pi}{2} = \frac{8\pi}{6} = \frac{4\pi}{3}$</p> <p>(4) $\frac{4\pi}{3} + \frac{\pi}{2} = \frac{11\pi}{6}$</p>
<p>tick marks = $\frac{\text{period}}{4} = \frac{2\pi}{4} = \frac{\pi}{2}$</p>	<p>(5) $\frac{11\pi}{6} + \frac{\pi}{2} = \frac{7\pi}{3}$</p>
<p>endpoints Solve:</p> <p>$bx - c = 0$ $bx - c = 2\pi$</p> <p>$x - \frac{\pi}{3} = 0$ $x - \frac{\pi}{3} = 2\pi$</p> <p>$x = \frac{\pi}{3}$ $x = \frac{\pi}{3} + \frac{6\pi}{3} = \frac{7\pi}{3}$</p> <p>(starts) (ends)</p>	 <p>$y = \frac{1}{2} \sin\left(x - \frac{\pi}{3}\right) + 0$</p>

vertical shift = $d = \text{none}$

Example: $y = 3\cos(2x) + 2$

(Remember APTEV)

Formulas for General Form $y = a\sin(bx - c) + d$ and $y = a\cos(bx - c) + d$

<p>amplitude = $a = 3 = 3$</p> <hr/> <p>period (of sine and cosine) =</p> $\frac{2\pi}{b} = \frac{2\pi}{2} = \pi$ <hr/> <p>tick marks = $\frac{\text{period}}{4} = \frac{\pi}{4}$</p>	<p>tick mark calculations:</p> <p>(1) 0</p> <p>(2) $0 + \frac{\pi}{4} = \frac{\pi}{4}$</p> <p>(3) $\frac{\pi}{4} + \frac{\pi}{4} = \frac{\pi}{2}$ (4)</p> <p>$\frac{\pi}{2} + \frac{\pi}{4} = \frac{3\pi}{4}$</p> <p>(5) $\frac{3\pi}{4} + \frac{\pi}{4} = \frac{4\pi}{4} = \pi$</p>
<p>endpoints Solve:</p> <p>$bx - c = 0$ $bx - c = 2\pi$</p> <p>$2x - 0 = 0$ $2x - 0 = 2\pi$</p> <p>$x = 0$ $x = \pi$</p> <p>(starts) (ends)</p>	<p>$y = 3\cos(2x - 0) + 2$</p> 

vertical shift = $d = 2$

Example : $y = -3\cos(2\pi x + 4\pi)$

(Remember APTEV)

Formulas for General Form $y = a\sin(bx - c) + d$ and $y = a\cos(bx - c) + d$

<p>amplitude = $a = -3 = 3$</p> <hr/> <p>period (of sine and cosine) =</p> $\frac{2\pi}{b} = \frac{2\pi}{2\pi} = 1$ <hr/> <p>tick marks = $\frac{\text{period}}{4} = \frac{1}{4}$</p>	<p>tick mark calculations:</p> <p>(1) -2 (2) $-2 + \frac{1}{4} = \frac{-7}{4}$</p> <p>(3) $\frac{-7}{4} + \frac{1}{4} = \frac{-6}{4} = \frac{-3}{2}$</p> <p>(4) $\frac{-3}{2} + \frac{1}{4} = \frac{-5}{4}$</p> <p>(5) $\frac{-5}{4} + \frac{1}{4} = -1$</p>
<p>endpoints Solve:</p> <p>$bx - c = 0$ $bx - c = 2\pi$</p> <p>$2\pi x + 4\pi = 0$ $2\pi x + 4\pi = 2\pi$</p> <p>$2\pi x = -4\pi$ $2\pi x = -2\pi$</p> <p>$x = -2$ $x = -1$</p> <p>(starts) (ends)</p>	

vertical shift = $d = \text{none}$