Topics: graphs of $a\sin(bx+c)$ and $a\cos(bx+c)$, period, amplitude, and phase shift

Student Learning Outcomes:

1. Students will be able to graph $a\sin(bx+c)$ and $a\cos(bx+c)$.
2. Students will be able to determine a sine and cosine wave given a written description.
3. Students will be able to determine the formula for a sine or cosine wave given the graph of the function.

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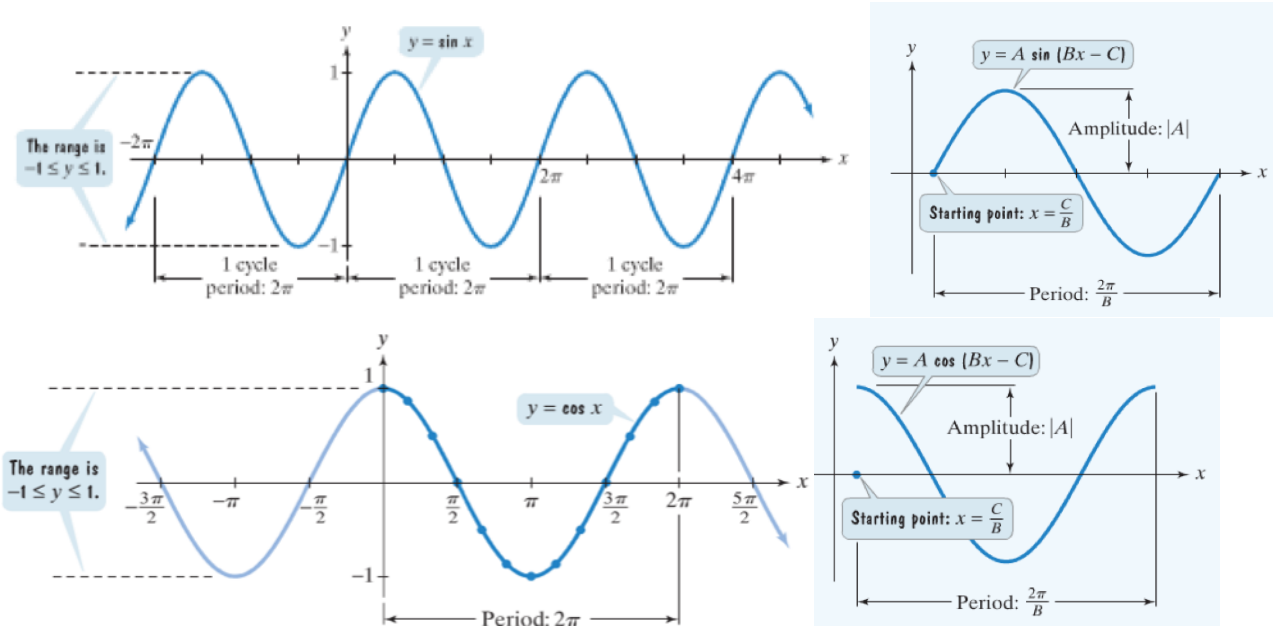
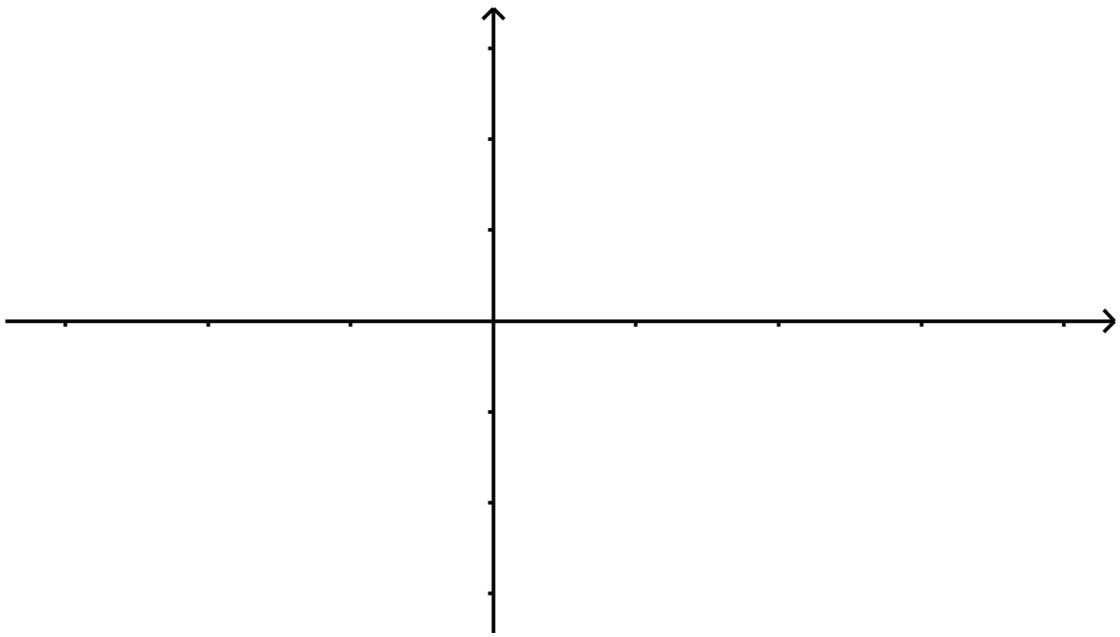
1 Graph $y = \sin(x)$ and $y = \cos(x)$



Recall The period of the sine graph is 2π; the period of the cosine graph is also 2π.

1. (a) Explain how to obtain the graph of $f(x) = -3\sin(x)$ from the graph of $y = \sin(x)$.

   (b) Sketch the graph of the function $f(x) = -3\sin(x)$.



(c) Determine the period and amplitude of the function $f(x) = -3\sin(x)$.

For a function $y = A\sin(Bx + C)$ or $y = A\cos(Bx + C)$, assuming that A and B are both not zero,
$\star$ The *amplitude* is $|A|$.
$\star$ The *period* is $2\pi/|B|$.
$\star$ The *phase shift* is $-C/B$. A negative phase shift is a shift to the left; a positive phase shift is a shift to the right. You can get it from graph transformations if you do the horizontal shift *last*.

How to Graph Sine and Cosine Functions

(a) Find amplitude, period, and phase shift.

(b) Determine the interval of one period on the x-axis. (Set interval $0 \leq Bx + C \leq 2\pi$ and solve.

(c) Divide the interval into fourths to plot "key points".

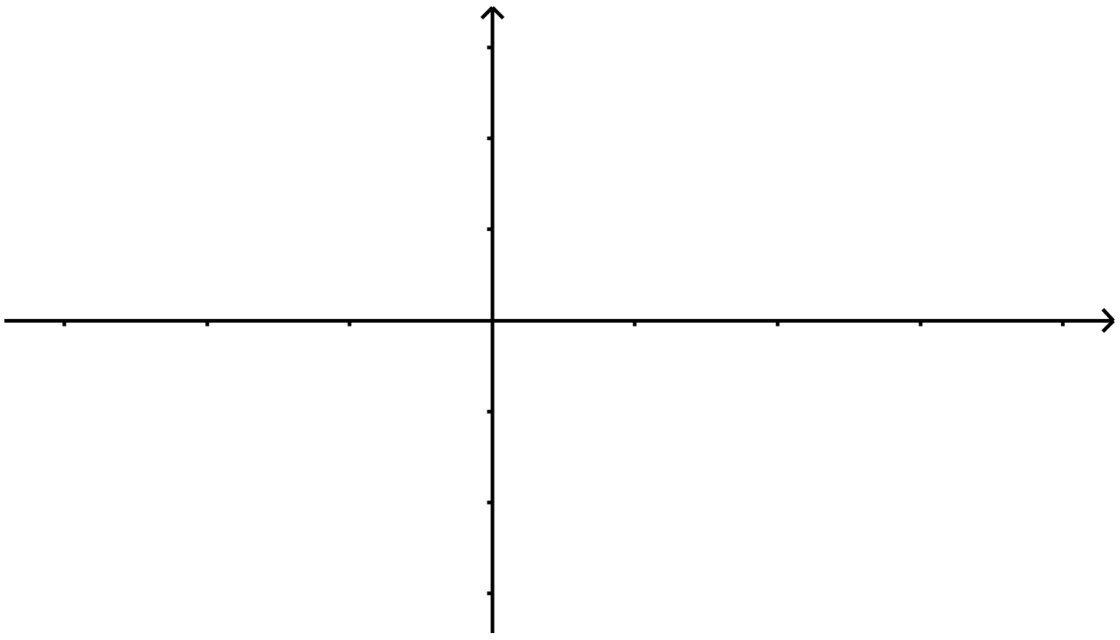
(d) Use rules for function transformation.

2. (a) Explain how to obtain the graph of $f(x) = \sin(x + \pi/6)$ from the graph of $y = \sin(x)$.

(b) Determine the period, amplitude, and phase shift.

(c) Find an interval containing exactly one cycle.

(d) Sketch the graph of $f(x) = \sin(x + \pi/6)$.

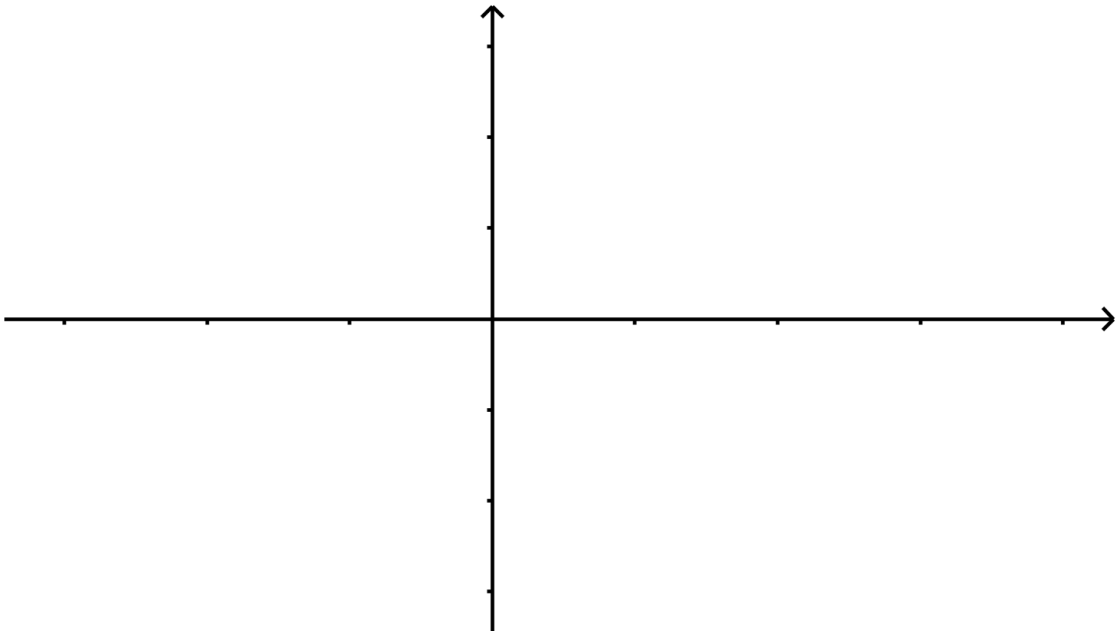


3. (a) Explain how to obtain the graph of $f(x) = 3\cos(2x+\pi/2)$ from the graph of $y = \cos(x)$.

(b) Determine the period, amplitude, and phase shift.

(c) Find an interval containing exactly one cycle.

(d) Sketch the graph of $f(x) = 3\cos(2x + \pi/2)$.



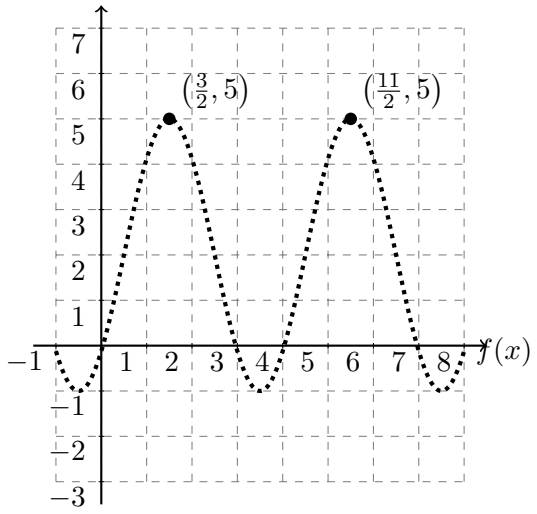
4. Determine the period, amplitude, and phase shift of the function.

   (a) $f(x) = -2\sin(3x - 7)$

   (b) $y = \cos\left(\frac{\pi x}{3} + \pi\right)$

2 Determine a Formula for a Sine or Cosine Wave

5. Express the equation for the sine wave shown below in the form $y = a\sin(bx + c) + d$. Then express the equation for the cosine wave shown below in the form $y = a\cos(bx + c) + d$. In your equation, use $a > 0$, $b > 0$, and the least possible positive real number c.



Student Learning Outcomes Check

1. Are you able to graph $a\sin(bx+c)$ and $a\cos(bx+c)$?
2. Can you determine a sine and cosine wave given a written description?
3. Can you determine the formula for a sine or cosine wave given the graph of the function?

If any of your answers were no, please ask about these topics in class.