

### U6D6 MCR3UI Warm Up:

1) If the amplitude is 2.5, the sinusoidal axis is  $y = 8$ , period is  $225^\circ$  and the phase shift is  $45^\circ$  to the left, determine the equation of the cosine function.

2) Given the equation  $y = 2\sin(5(x - 90^\circ)) - 3$ , identify:

Amplitude:                  Period:                  Key points, every:                  Phase Shift:

Sinusoidal Axis:                  Max value:                  Min value:

Domain:                  Range:

### U6D6 MCR 3UI

### Combined Transformations of Sinusoidal Functions

**Method 1:** You can graph transformations of sinusoidal functions the same as transformations of other functions.

- First graph reflections in the x-axis and vertical stretches/compressions.
- Next, graph horizontal stretches/compressions.
- Finally, graph vertical and horizontal translations.

OR

#### **Method 2:** Recommended Method

Given:  $y = \sin(x - d) + c$  or  $y = \cos(x - d) + c$

You can identify the amplitude, period, sinusoidal axis and phase shift.

Determine the maximum and minimum values by calculating:

$$\max = c + a \text{ and } \min = c - a$$

First we will graph  $y = \sin(x - d) + c$  or  $y = \cos(x - d) + c$  with no phase shift:

- Graph the sinusoidal axis
- Plot the sine intercepts (at  $0^\circ$ , period/2, period for sine function)
- Plot the maximum and minimum points
- Join the curve
- Now graph the phase shift.

The method for graphing cosine is similar.

**Example 1:** Sketch the graph of  $y = 4 \cos(x - 30^\circ) + 2$

Amplitude:

Sinusoidal Axis:

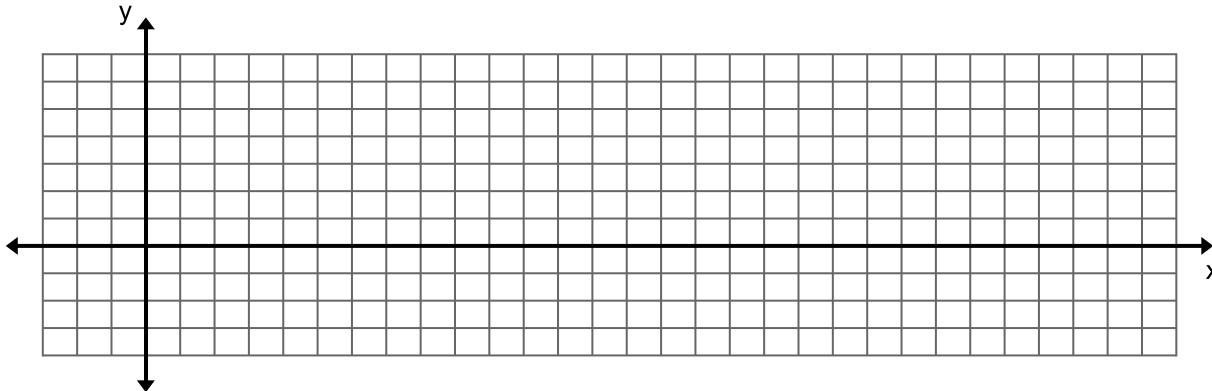
Period:

Phase Shift:

Maximum:

Minimum:

For Method 2, no chart is necessary (use key information such as amp, axis, period, etc.)



For Method 1 (Using transformations on five key points) a chart is helpful.

$y = \cos x$	(0°, 1)	(90°, 0)	(180°, -1)	(270°, 0)	(360°, 1)
$y = 4\cos x$					
$y = 4\cos(x - 30^\circ) + 2$					

**Example 2:** Sketch the graph of  $y = 3 \cos \frac{2}{3}x - 1$

Amplitude:

Sinusoidal Axis:

Period:

Phase Shift:

Maximum:

Minimum:

Method 2 (using key information such as amp, axis, period, etc.)

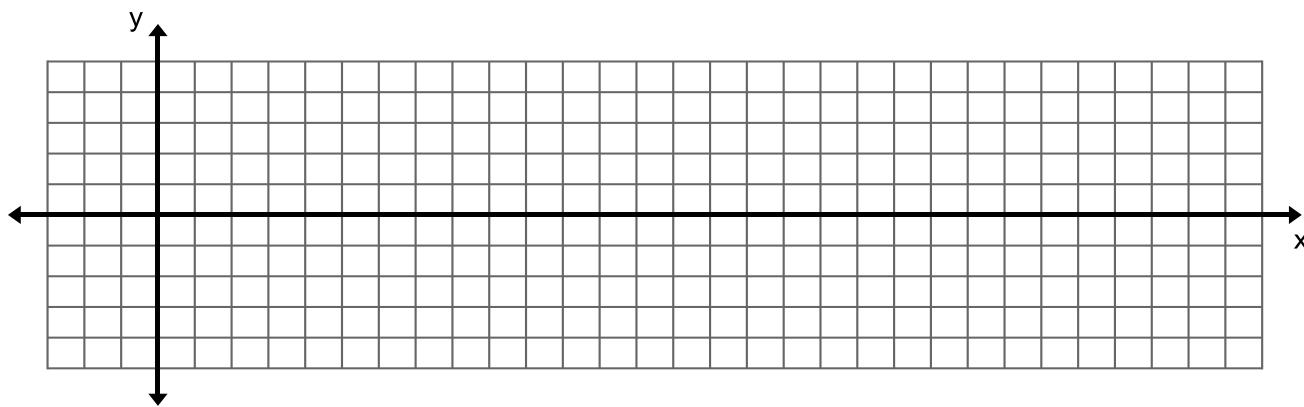


Chart for Method 1: Method 1 is NOT Recommended.

$y = \cos x$	(0°, )	(90°, )	(180°, )	(270°, )	(360°, )
$y = 3\cos x$					
$y = 3\cos \frac{2}{3}x$					
$y = 3\cos \frac{2}{3}x - 1$					

**Example 3:** Sketch the graph of  $y = -\sin(2x + 60^\circ) + 4$

**HINT:** Remember to factor first (if necessary)!

Amplitude:

Sinusoidal Axis:

Period:

Phase Shift:

Maximum:

Minimum:

*Method 2 (using key information such as amp, axis, period, etc.)*

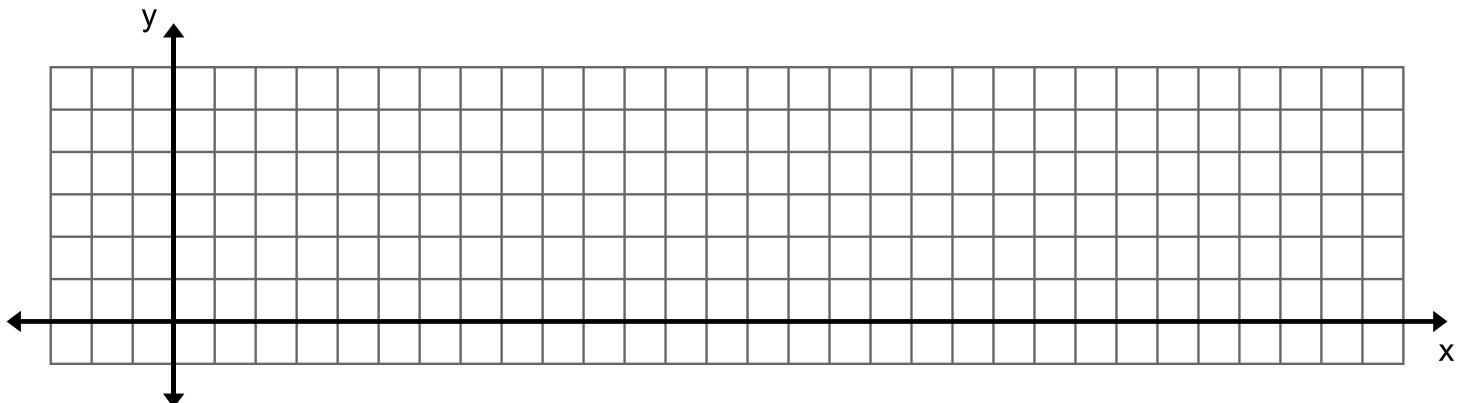
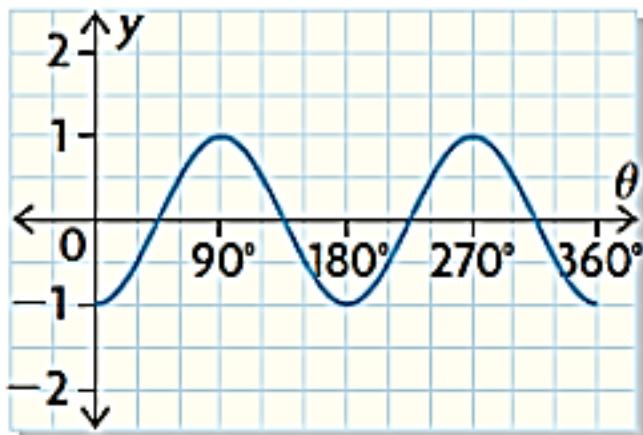


Chart for *Method 1*:

$y = \sin x$	( $0^\circ$ , )	( $90^\circ$ , )	( $180^\circ$ , )	( $270^\circ$ , )	( $360^\circ$ , )

**Example 4:** Write one equation for the following using  $y = \sin x$  as the base function and one using  $y = \cos x$ .



U6D6 Practice: Page 387 #5cd, 7bcd, 8d, 9 (P is  $360^\circ$ ,  $180^\circ$ ,  $720^\circ$ , and  $90^\circ$  respectively and H is  $180^\circ$  and  $90^\circ$  respectively) #11b ( $\pi = 180^\circ$ ,  $2\pi = 360^\circ$ ,  $3\pi = 540^\circ$ )