

U6D6_T_Transformations combined Trig

Monday, May 13, 2019 8:17 PM



U6D6_T_Tr
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U6D6 MCR3UI Warm Up:

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

$$a = 2.5 \quad c = 8 \quad \text{period} = \frac{360^\circ}{225^\circ} \quad d = -45^\circ$$

$$\textcircled{a} \frac{5}{2}$$

$$= \frac{72}{45} \\ = \frac{8}{5}$$

$$y = a \cos k(x-d)+c$$

$$y = 2.5 \cos 1.6(x+45^\circ) + 8$$

$$\textcircled{b} 1.6$$

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

$$\text{Amplitude: } 2$$

$$\text{Period: } \frac{360^\circ}{5} \\ = 72^\circ$$

$$\text{Key points, every: } \frac{72^\circ}{4} \\ = 18^\circ \quad \text{Phase Shift: Right } 90^\circ$$

$$\text{Sinusoidal Axis: } y = -3 \quad \text{Max value: } -3 + 2 \\ = -1 \quad \text{Min value: } -3 - 2 \\ = -5$$

$$\text{Domain: } \{x | x \in \mathbb{R}\} \quad \text{Range: } \{y | y \in \mathbb{R}, -5 \leq y \leq -1\}$$

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

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

Determine the maximum and minimum values by calculating:

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

First we will graph $y = a\sin(x - d) + c$ or

$$y = a\cos(x - d) + c \text{ with } \underline{\text{no}} \text{ phase shift:}$$

- Graph the sinusoidal axis
- Plot the sine intercepts (at 0° , $\text{period}/2$, 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.

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$$y = 4 \cos x + 2$$

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

Amplitude: 4

Sinusoidal Axis: $y = 2$

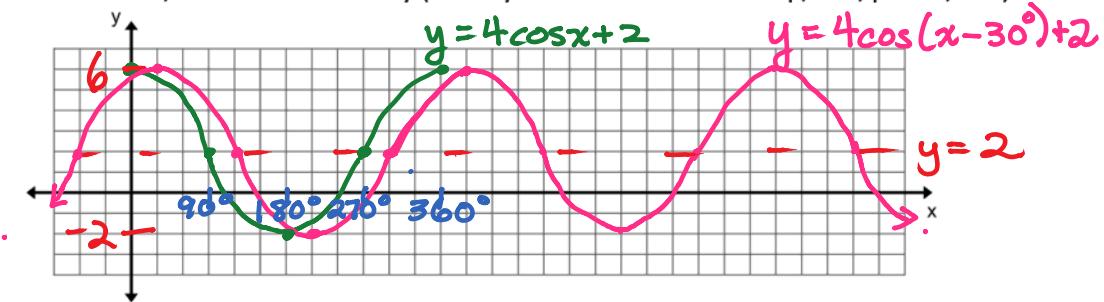
Period: 360°

Phase Shift: Right 30°

$$\text{Maximum: } \frac{2+4}{2} = 6$$

$$\text{Minimum: } \frac{2-4}{2} = -2$$

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. I do NOT recommend Method 1.

$y = \cos x$	$(0^\circ, 1)$	$(90^\circ, 0)$	$(180^\circ, -1)$	$(270^\circ, 0)$	$(360^\circ, 1)$
$y = 4 \cos x$	$(0^\circ, 4)$	$(90^\circ, 0)$	$(180^\circ, -4)$	$(270^\circ, 0)$	$(360^\circ, 4)$
$y = 4 \cos(x - 30^\circ) + 2$	$(30^\circ, 6)$	$(120^\circ, 2)$	$(210^\circ, -2)$	$(300^\circ, 2)$	$(390^\circ, 6)$

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

Amplitude: 3

Sinusoidal Axis: $y = -1$

$$\rightarrow 360^\circ \div \frac{2}{3}$$

$$= 360^\circ \times \frac{3}{2}$$

$$= 540^\circ$$

Phase Shift:

Maximum: $-1 + 3$

$$= 2$$

Minimum: $-1 - 3$

$$= -4$$

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

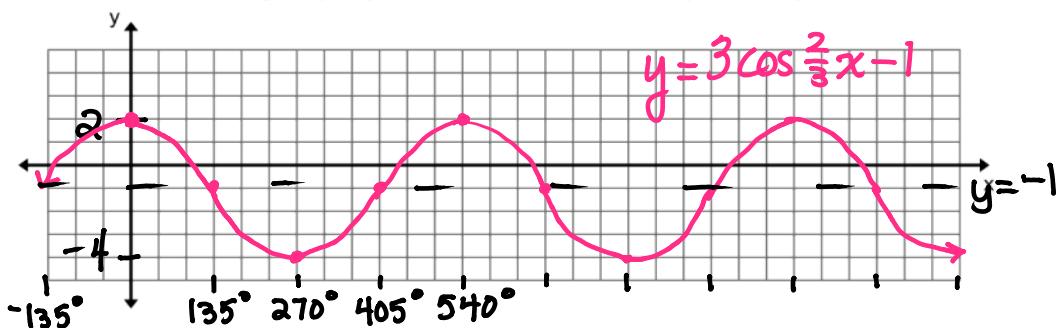


Chart for Method 1: only for students using method 1.

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

~~b~~

Example 3: Sketch the graph of $y = -\sin(2x + 60^\circ) + 4$
HINT: Remember to factor first (if necessary)! $y = -\sin 2(x+30^\circ)+4$

Amplitude: 1 Sinusoidal Axis: $y = 4$ Period: $\frac{360^\circ}{2} = 180^\circ$

Phase Shift: Left 30° Maximum: $\frac{4+1}{5} = 5$ Minimum: $\frac{4-1}{3} = 3$

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

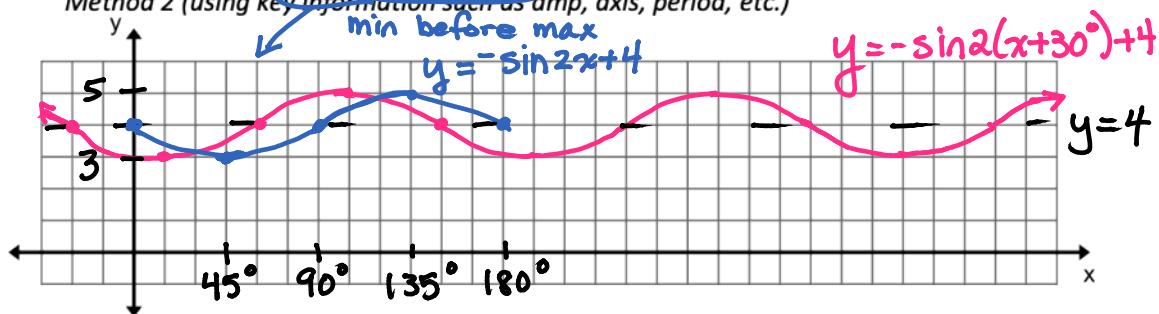
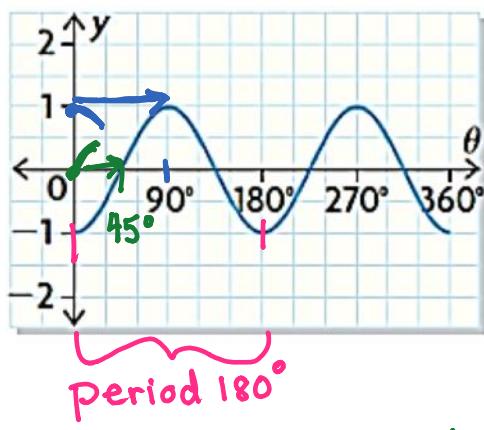


Chart for Method 1:

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

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



$$\text{amplitude} = 1 \quad k = \frac{360^\circ}{180^\circ} = 2 \quad c = 0$$

Graph begins at minimum.

$$y = -\cos 2x$$

OR $y = \cos 2(x - 90^\circ)$

$$y = \sin 2(x - 45^\circ)$$

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

$$\frac{\pi}{4} = \frac{180^\circ}{4} = 45^\circ$$