

### Unit 3 (4.6) Horizontal Transformations of Trig. Functions

**Warm-up:** Describe the transformation of each function.

1.  $y = \frac{1}{2}x^2$

2.  $y = \sqrt{x+6}$

3.  $y = |x-7| - 9$

4.  $y = (x-2)^2 + 5$

5.  $y = -3|x-1| + 7$

6.  $y = \sqrt{x+5} - 10$

**Objective:** To understand how horizontal dilations and translations affect the graphs of the sine and cosine functions

$$y = A \sin B(\theta - C) + D \quad y = A \cos B(\theta - C) + D$$

**“B” Horizontal Dilation:**

**“C” Horizontal Translation** (phase shift/  
horizontal shift):

Describe the transformation for each of the following:

a.  $y = \sin 3x$

b.  $y = \cos(\theta + 60^\circ)$

c.  $y = \cos \frac{x}{4}$

d.  $y = \sin\left(x - \frac{\pi}{6}\right)$

e.  $y = \cos[2(\theta - 90^\circ)]$

f.  $y = \sin\left[\frac{1}{5}\left(x + \frac{\pi}{4}\right)\right]$

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Write an equation for either the sine or cosine function with the given transformation(s):

a. h.d. of 2

b. h.t. of  $-50^\circ$

c. period of  $45^\circ$  and  
phase shift of  $90^\circ$

d. horizontal shift of  $-\pi$

e. period of  $\frac{\pi}{3}$

f. period of  $12\pi$  and h.t of  $\frac{\pi}{4}$

How to set up the x-axis:

Graph the functions.

1.  $y = \sin 5\theta$

2.  $y = \sin 4x$

3.  $y = \cos \frac{1}{2}\theta$

4.  $y = \cos \frac{1}{3}x$

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5.  $y = \cos(\theta - 30^\circ)$

6.  $y = \sin\left(x + \frac{\pi}{2}\right)$

7.  $y = \cos(\theta + 135^\circ)$

8.  $y = \sin\left(x - \frac{3\pi}{4}\right)$

9.  $y = \sin\frac{1}{4}\left(x + \frac{\pi}{3}\right)$

10.  $y = \sin 3x$

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11.  $y = \cos(\theta + 60^\circ)$

12.  $y = \cos \frac{x}{4}$

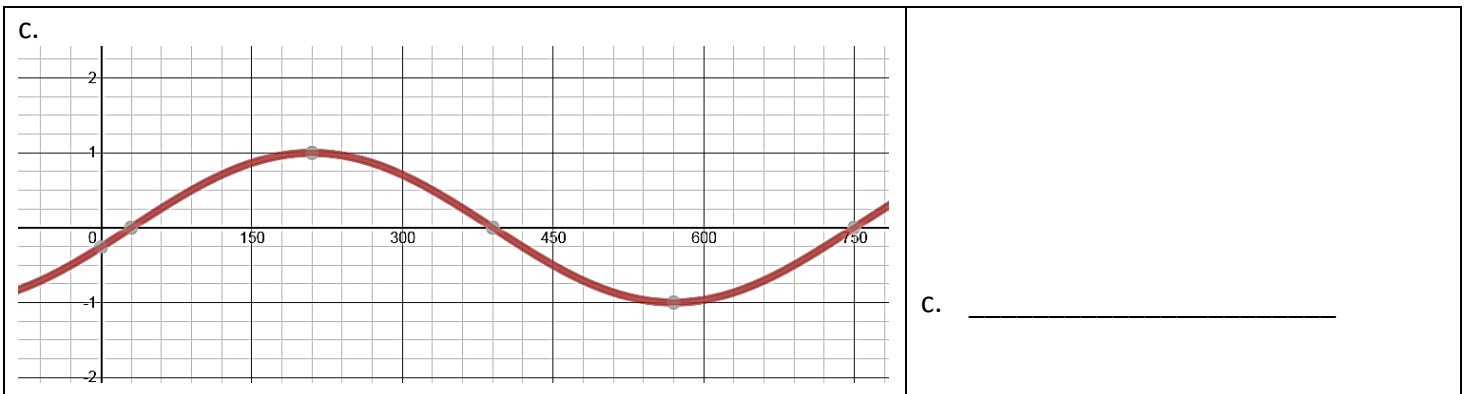
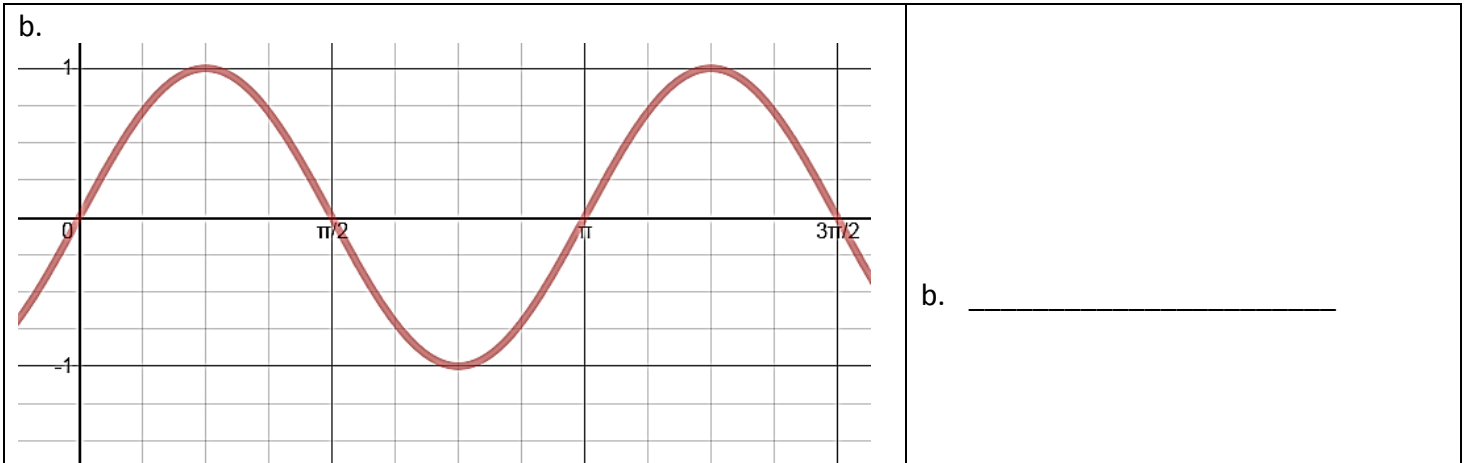
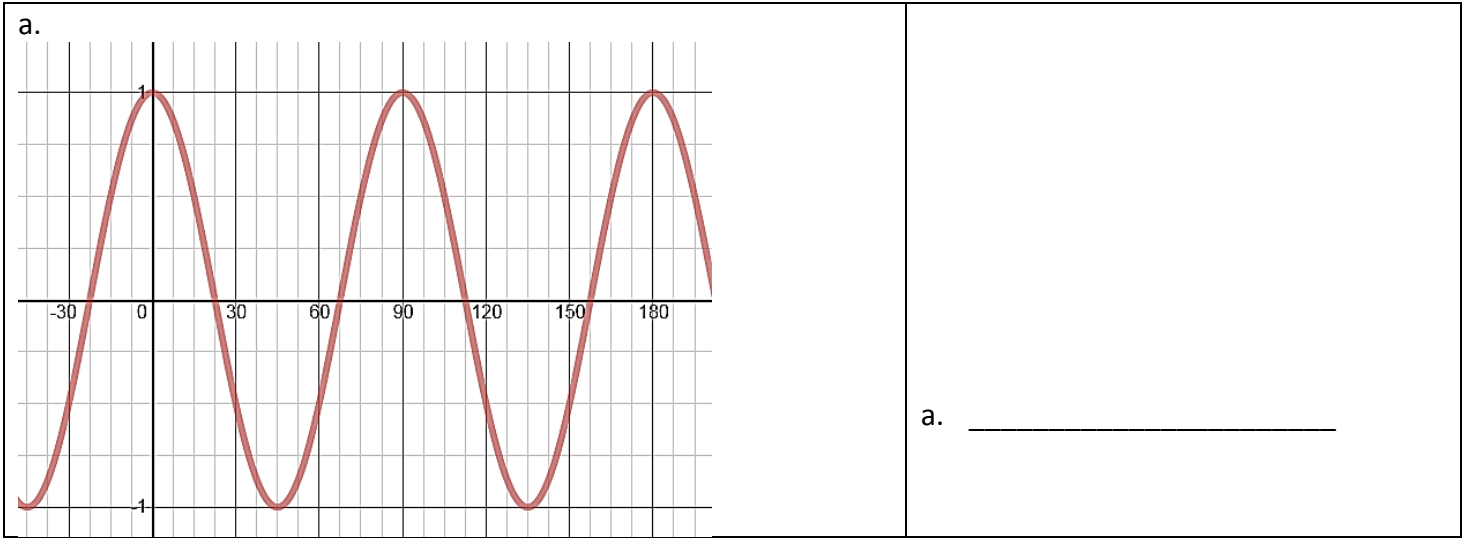
13.  $y = \sin\left(x - \frac{\pi}{6}\right)$

14.  $y = \cos 2(\theta - 90^\circ)$

15. Sketch 2 cycles of  $y = \sin\left[\frac{1}{5}\left(x + \frac{\pi}{4}\right)\right]$

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16. Write the equations for the given graphs



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Extra Practice:

Describe the transformation of each function.

1.  $y = \sin 2\theta$

2.  $y = \cos \frac{1}{2} \left( x - \frac{\pi}{3} \right)$

3.  $y = \sin 3 \left( x + \frac{\pi}{4} \right)$

4. Graph one cycle of question #1.

5. Graph one cycle of question #3.

6. Graph two cycles of question #2.

Write an equation for each of the following set of transformations.

7. The sine function with a horizontal dilation of 4 and a horizontal translation of  $-60^\circ$ .

8. The cosine function with a horizontal dilation of  $\frac{1}{3}$  and a horizontal translation of  $\pi$ .