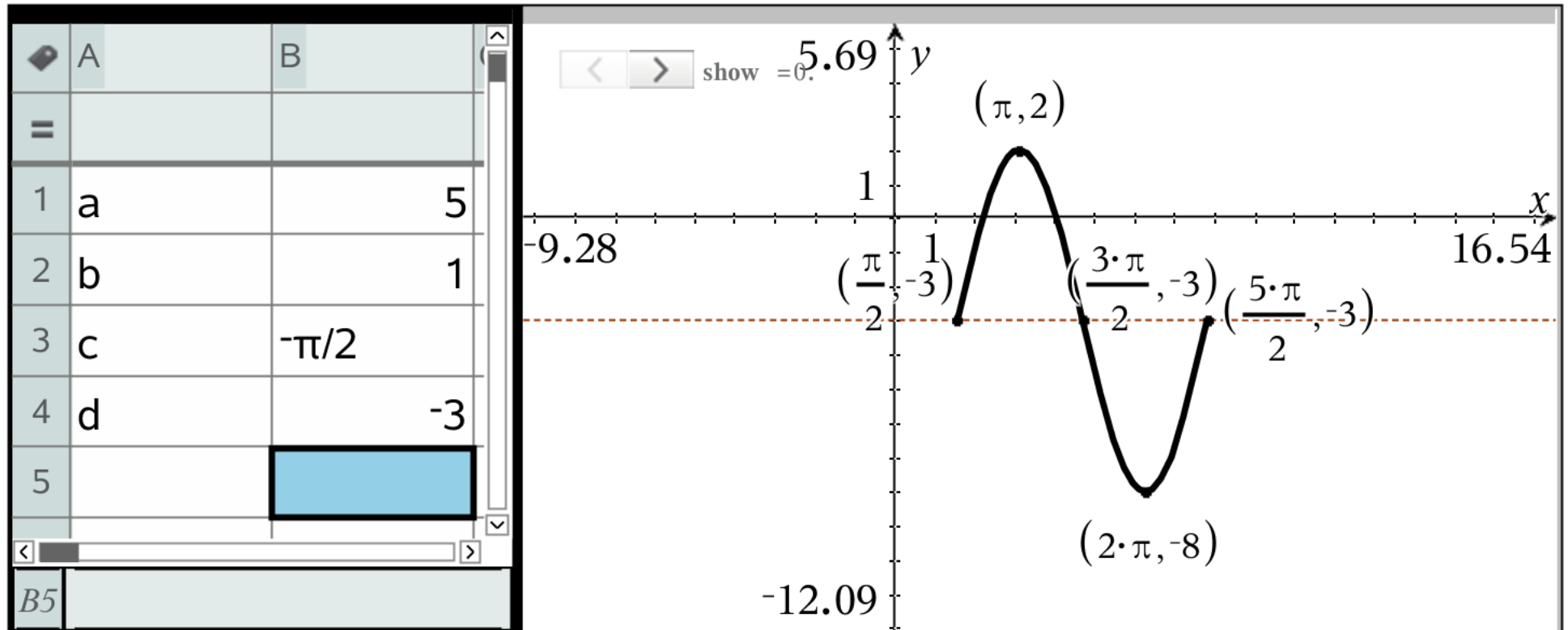
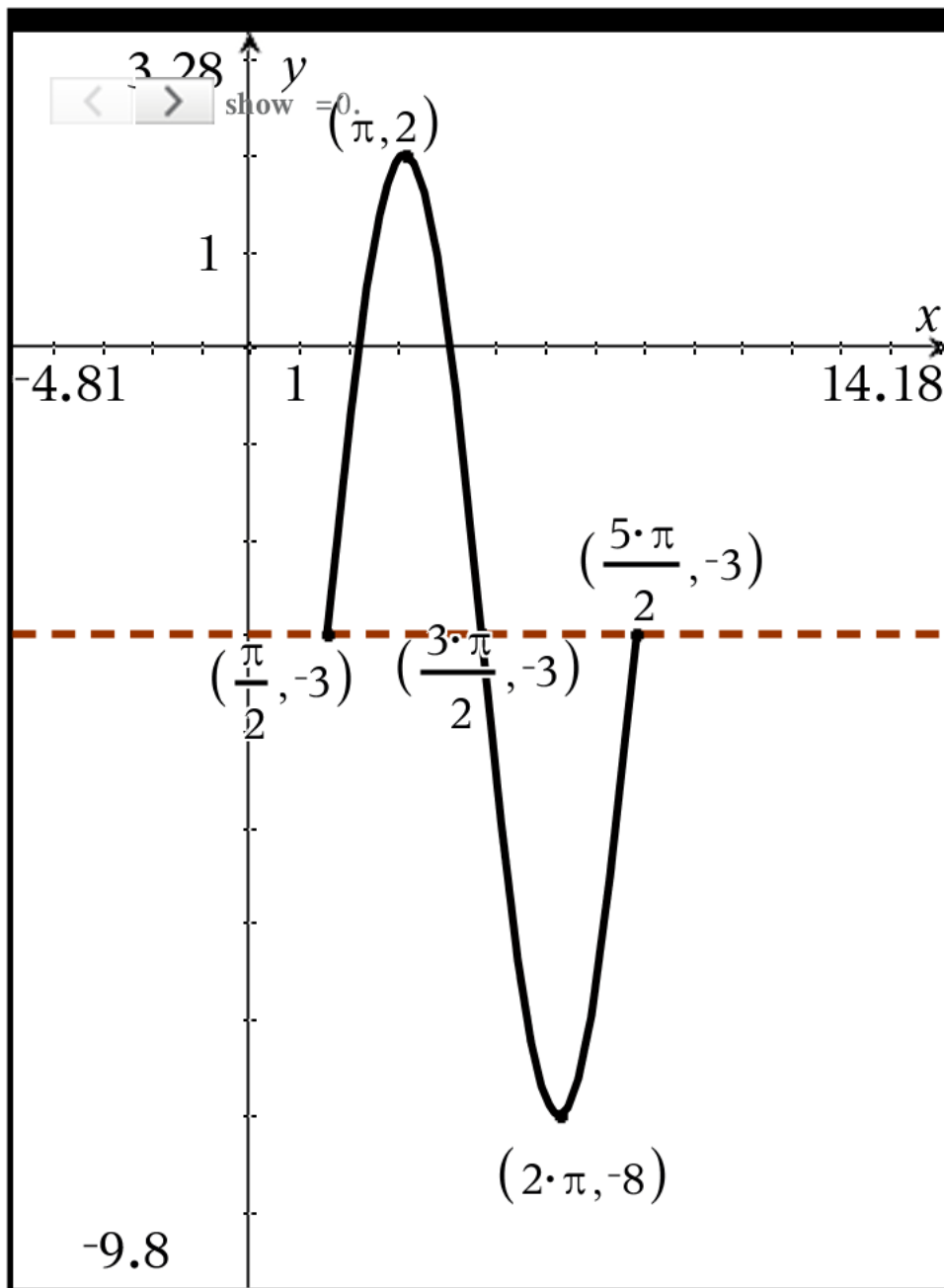


First Transformation



$$y = 5 \sin\left(x - \frac{\pi}{2}\right) - 3 \quad \text{has midline } y = -3$$



$$y = 5 \sin(x - \frac{\pi}{2}) + -3$$

PHASE SHIFT  $\frac{\pi}{2}$  radians to right

Period length =  $2 \cdot \pi$

One of the Periods  $[\frac{\pi}{2}, \frac{5 \cdot \pi}{2})$

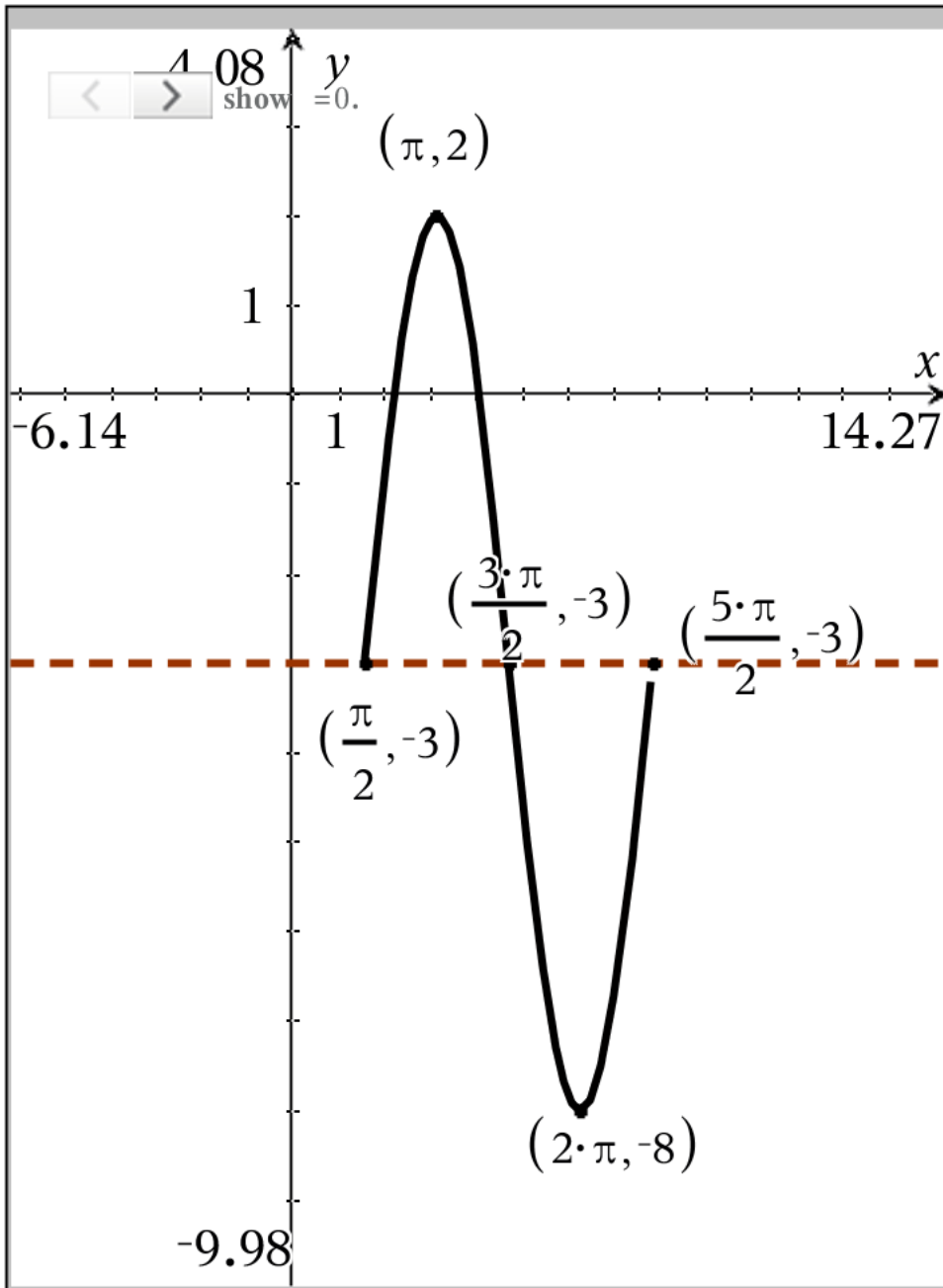
Other Periods

$$[\frac{-7 \cdot \pi}{2}, \frac{-3 \cdot \pi}{2})$$

$$[\frac{-3 \cdot \pi}{2}, \frac{\pi}{2})$$

$$[\frac{5 \cdot \pi}{2}, \frac{9 \cdot \pi}{2})$$

$$[\frac{9 \cdot \pi}{2}, \frac{13 \cdot \pi}{2})$$



$$y = 5 \sin\left(x - \frac{\pi}{2}\right) - 3$$

vertical stretch

NO HORIZONTAL STRETCH or COMPRESS

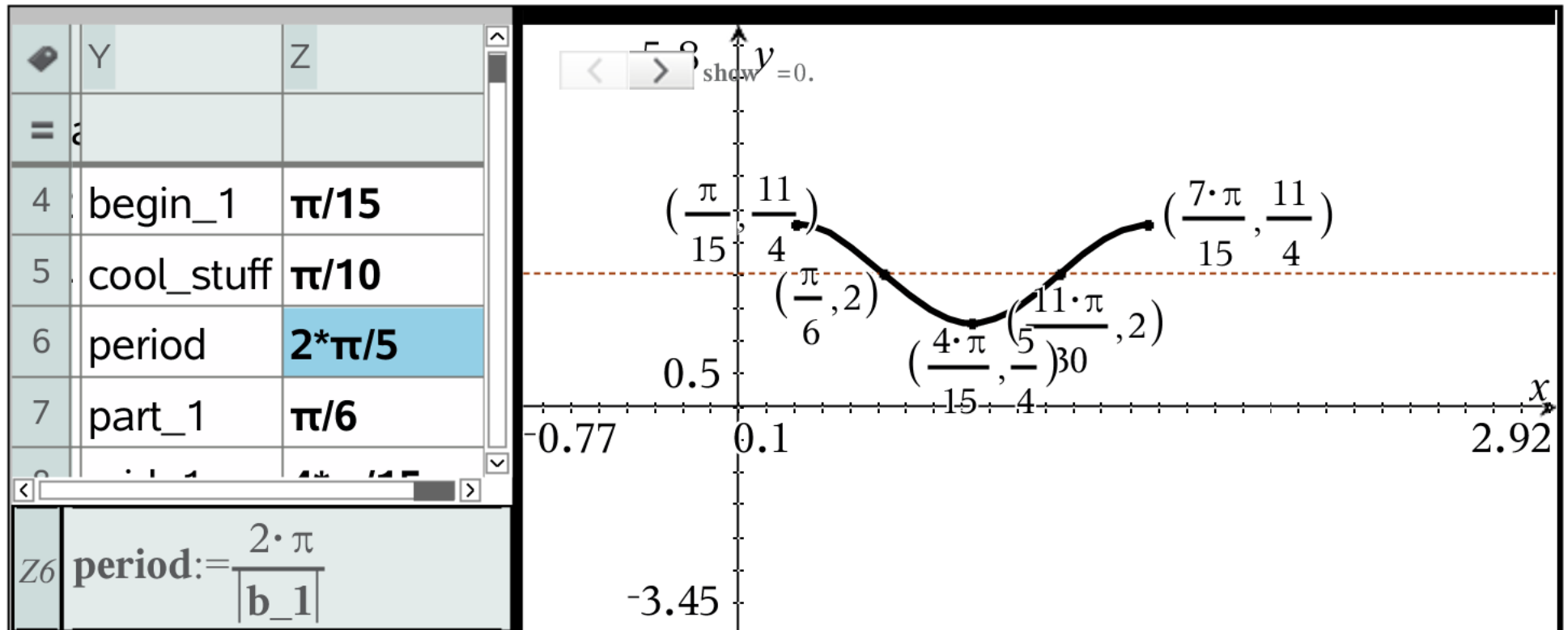
PHASE SHIFT RIGHT

period  $2\pi$

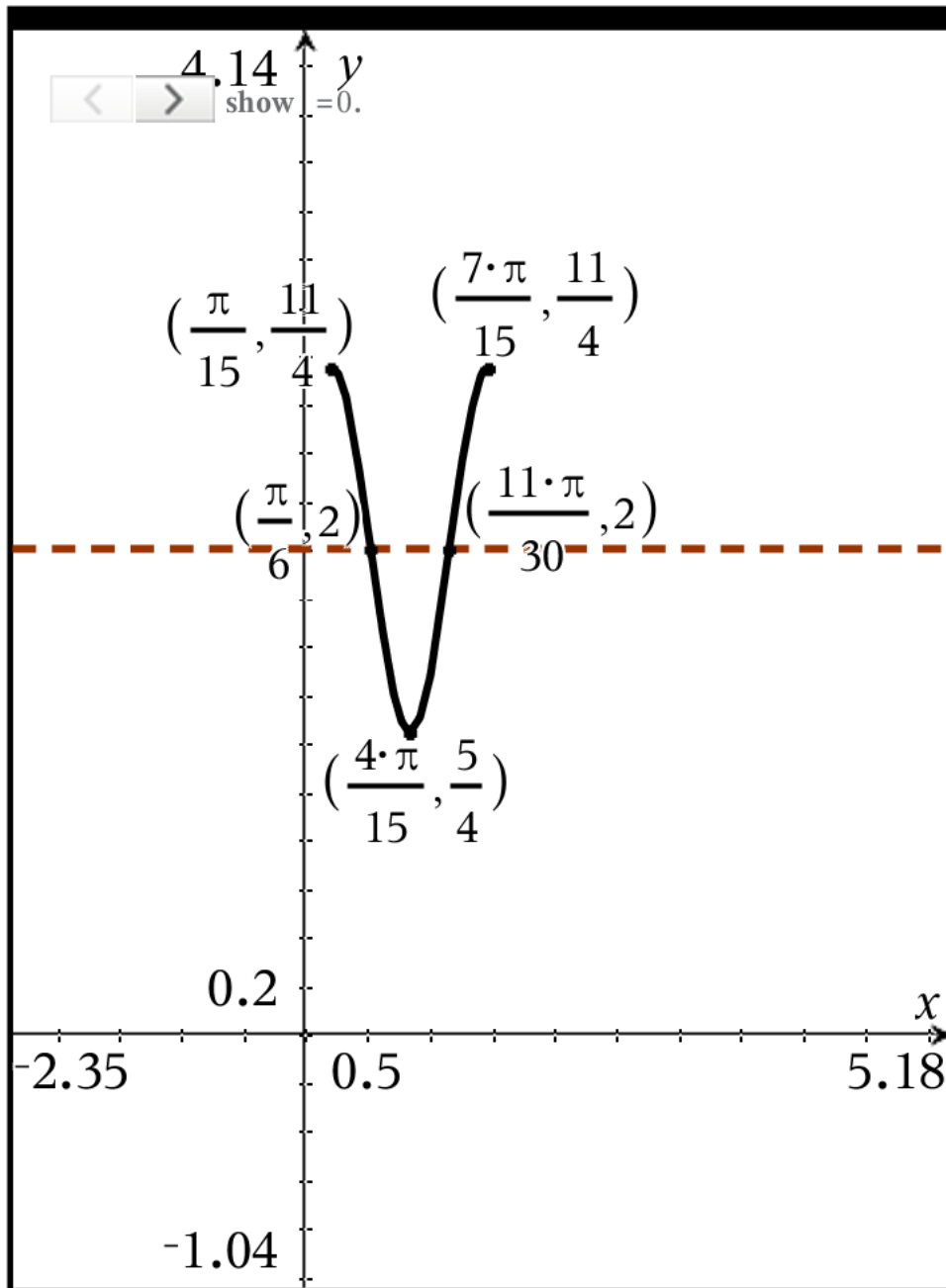
$\frac{\pi}{2}$  right

midline  $y = -3$  amplitude = 5

Second Transformation



$$y = \frac{3}{4} \cos\left(\frac{\pi}{3} - 5 \cdot x\right) + 2 \quad \text{has midline } y = 2$$



$$y = \frac{3}{4} \cos\left(\frac{\pi}{3} - 5x\right) + 2$$

PHASE SHIFT  $\frac{\pi}{15}$  radians to right

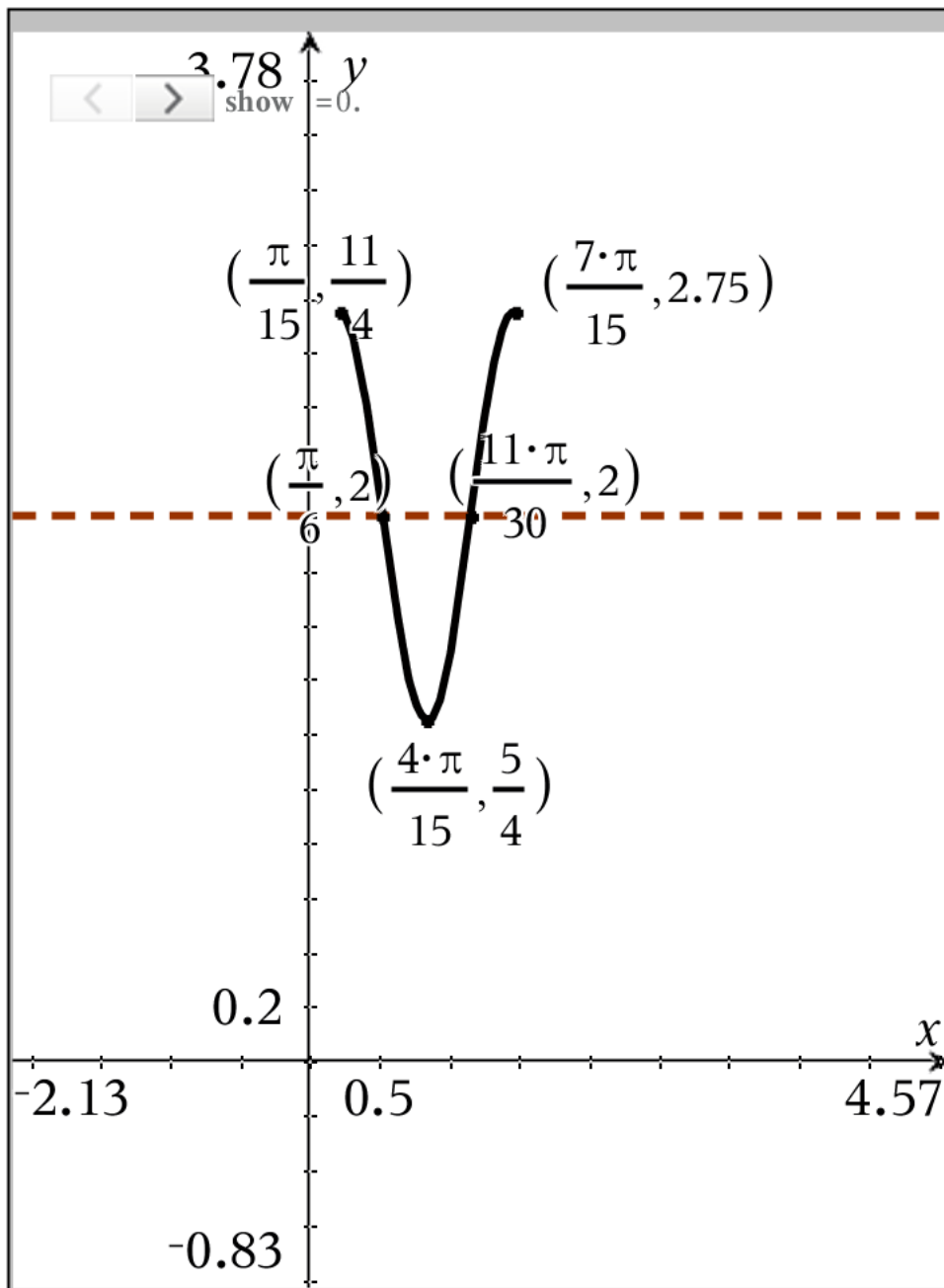
$$\text{Period length} = \frac{2\pi}{5}$$

One of the Periods  $\left[\frac{\pi}{15}, \frac{7\pi}{15}\right)$

Other Periods

$$\left[\frac{-11\pi}{15}, \frac{-\pi}{3}\right) \left[\frac{-\pi}{3}, \frac{\pi}{15}\right)$$

$$\left[\frac{7\pi}{15}, \frac{13\pi}{15}\right) \left[\frac{13\pi}{15}, \frac{19\pi}{15}\right)$$



$$y = \frac{3}{4} \cos\left(\frac{\pi}{3} - 5x\right) + 2$$

*vertical compression* *horizontal compression*

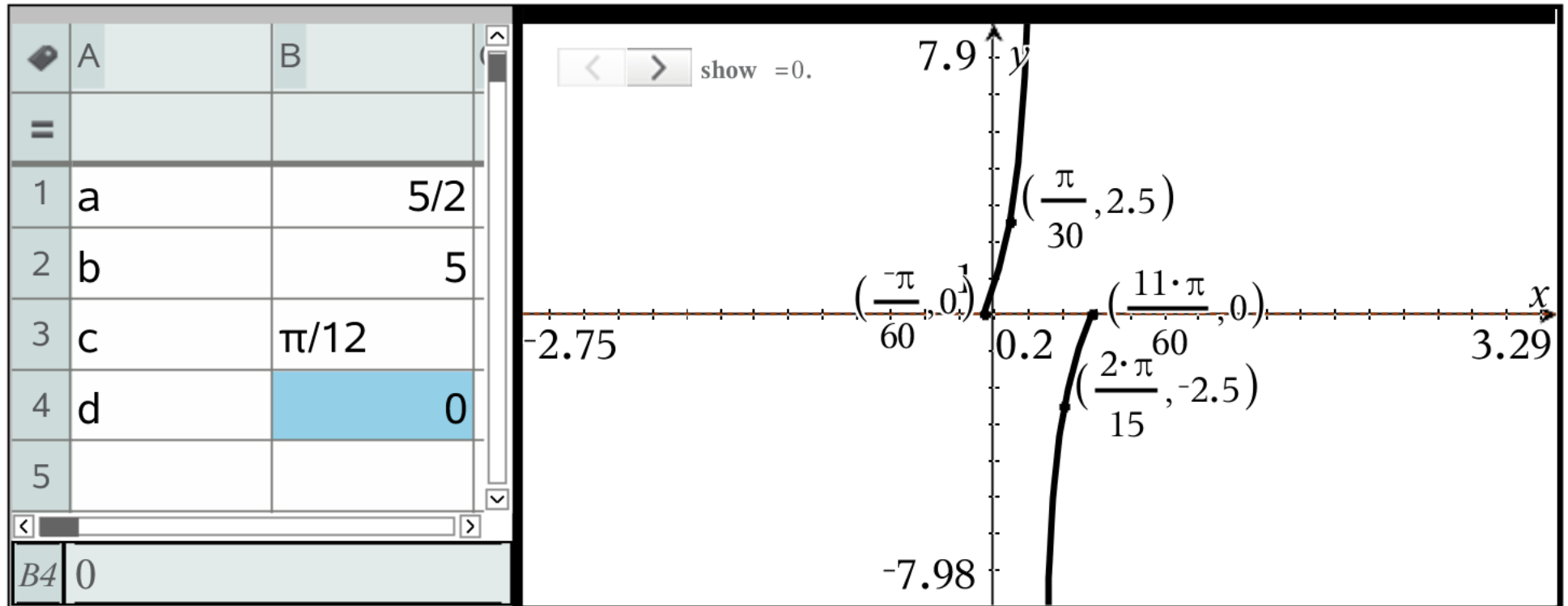
*horizontal reflection*

**PHASE SHIFT RIGHT**

period  $\frac{2\pi}{5}$   $\frac{\pi}{15}$  right

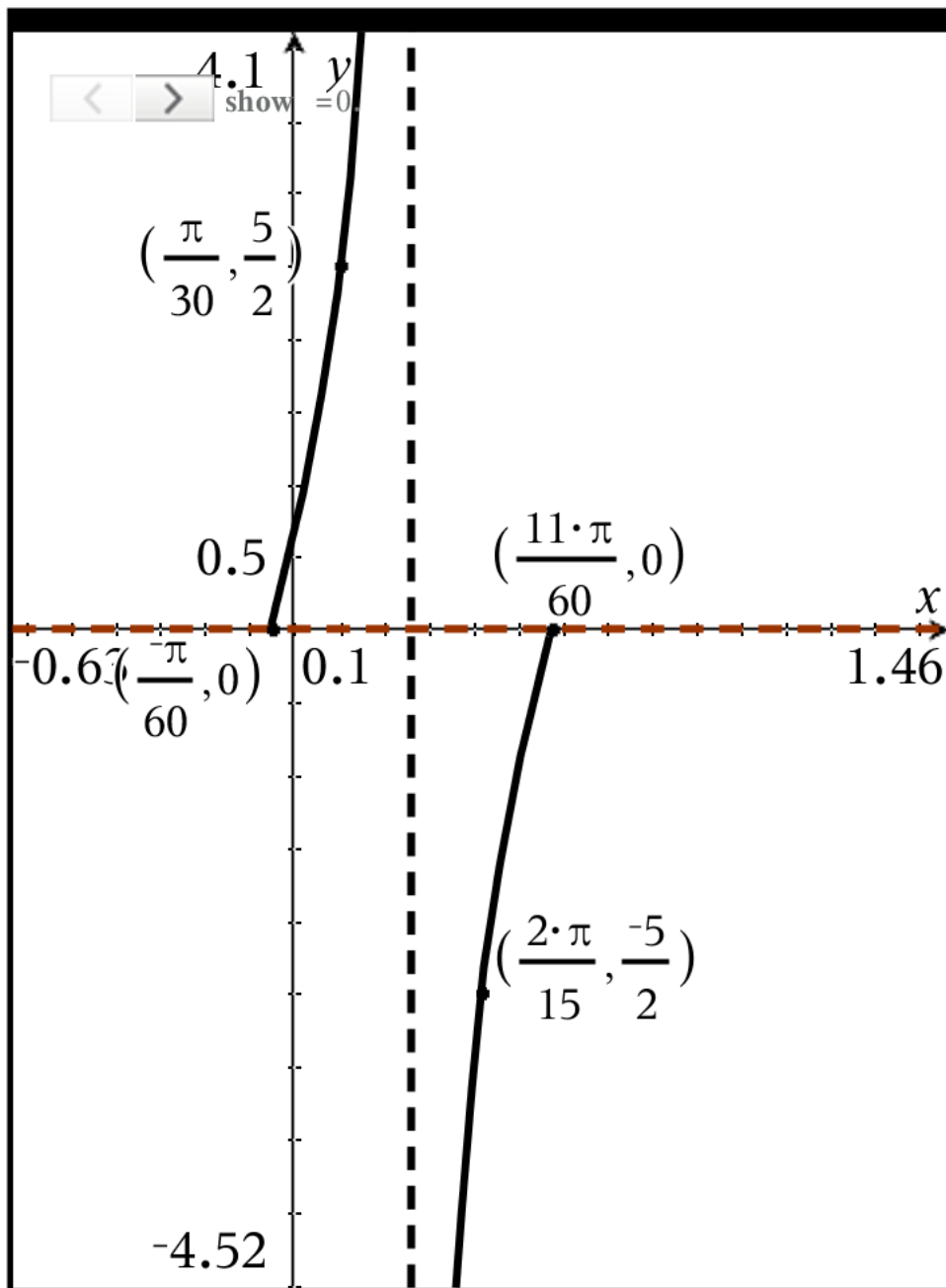
midline  $y = 2$  amplitude =  $\frac{3}{4}$

Third Transformation



$$y = \frac{5}{2} \tan\left(5 \cdot x + \frac{\pi}{12}\right) + 0 \text{ has an asymptote at } x = \frac{\pi}{12}$$

$$\text{has a second asymptote at } x = \frac{17 \cdot \pi}{60}$$



$$y = \frac{5}{2} \tan\left(5x + \frac{\pi}{12}\right) + 0$$

PHASE SHIFT  $\frac{\pi}{60}$  radians to left

Period length =  $\frac{\pi}{5}$  Midline  $y = 0$

One of the Periods  $\left[\frac{-\pi}{60}, \frac{11\pi}{60}\right)$  Asymptote  $x = \frac{\pi}{12}$

Other Periods

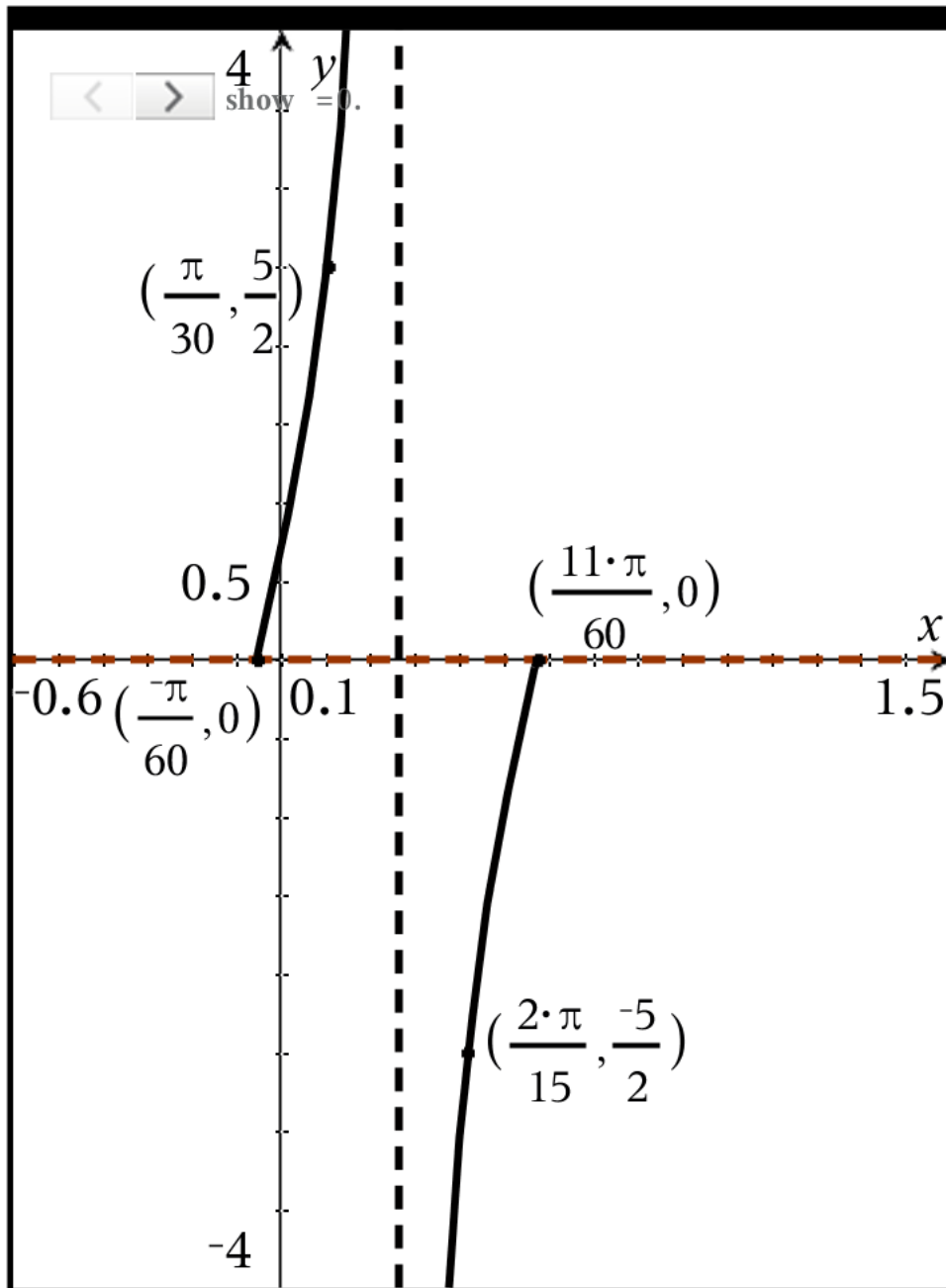
$\left[\frac{-5\pi}{12}, \frac{-13\pi}{60}\right)$  Asymptote  $x = \frac{-19\pi}{60}$

$\left[\frac{-13\pi}{60}, \frac{-\pi}{60}\right)$  Asymptote  $x = \frac{-7\pi}{60}$

$\left[\frac{11\pi}{60}, \frac{23\pi}{60}\right)$  Asymptote  $x = \frac{17\pi}{60}$

$\left[\frac{23\pi}{60}, \frac{7\pi}{12}\right)$  Asymptote  $x = \frac{29\pi}{60}$





$$y = \frac{5}{2} \tan\left(5x + \frac{\pi}{12}\right) + 0$$

vertical stretch

horizontal compression

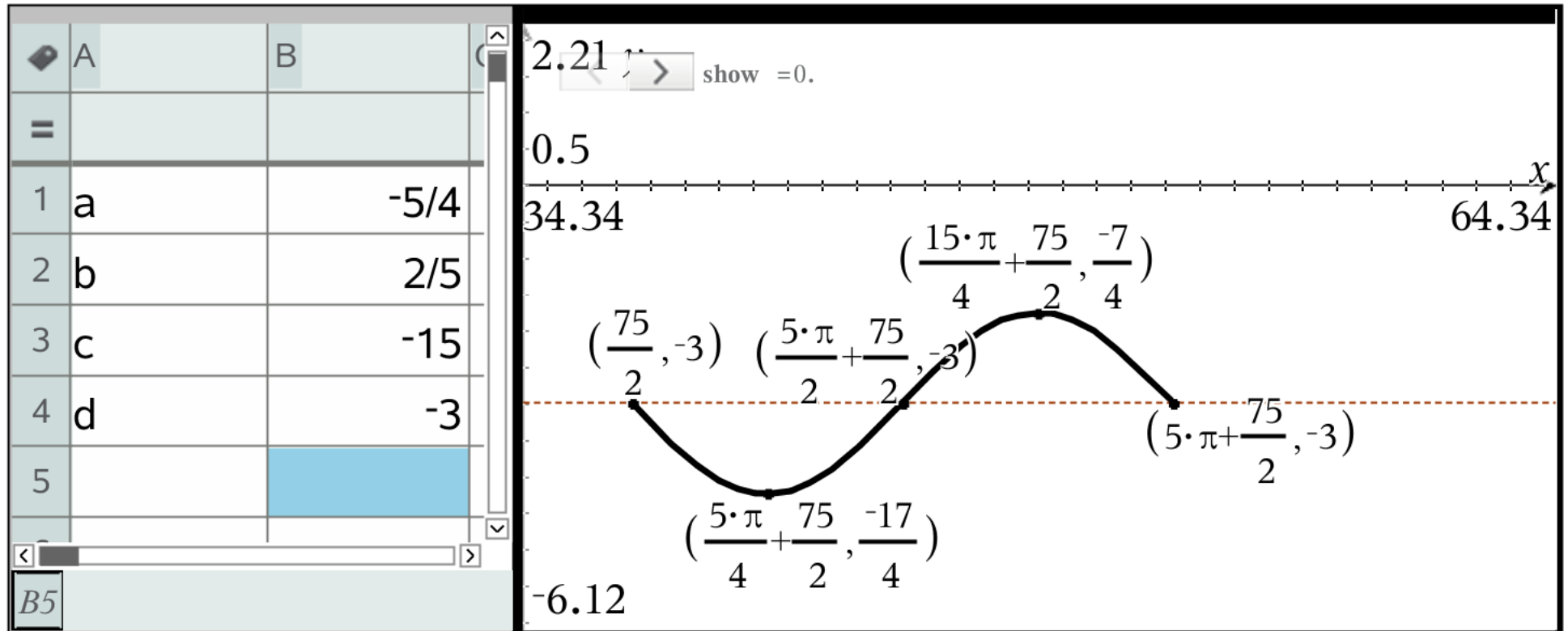
PHASE SHIFT LEFT

period  $\frac{\pi}{5}$   $\frac{\pi}{60}$  left

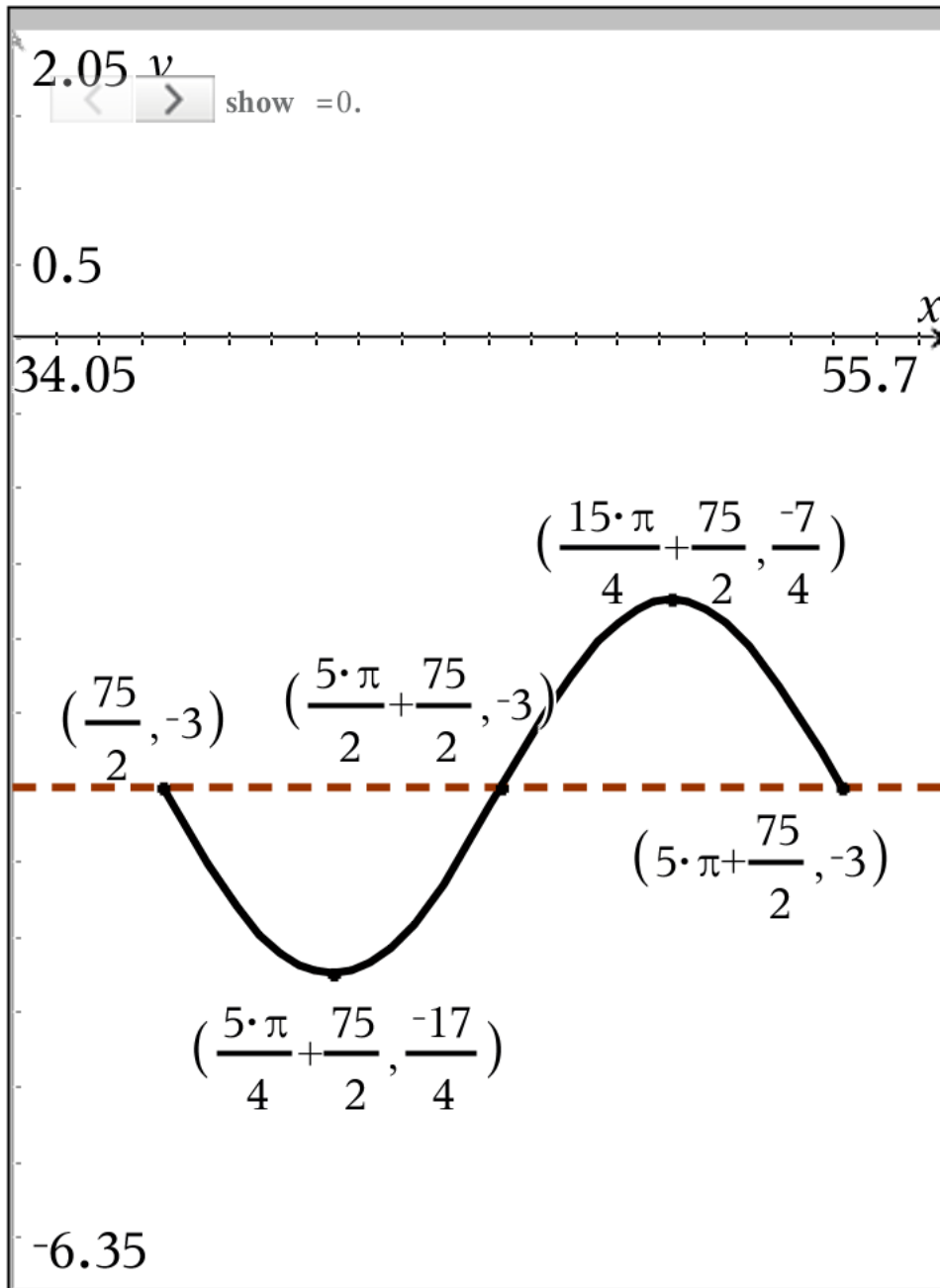
midline  $y = 0$  amplitude =  $\frac{5}{2}$

Asymptote  $x = \frac{\pi}{12}$

Fourth Transformation



$$y = \frac{-5}{4} \sin\left(\frac{2 \cdot x}{5} - 15\right) + -3$$



$$y = \frac{-5}{4} \sin\left(\frac{2 \cdot x}{5} - 15\right) + 3$$

PHASE SHIFT  $\frac{75}{2}$  radians to right

Period length =  $5 \cdot \pi$

One of the Periods

$$\left[\frac{75}{2}, 5 \cdot \pi + \frac{75}{2}\right)$$

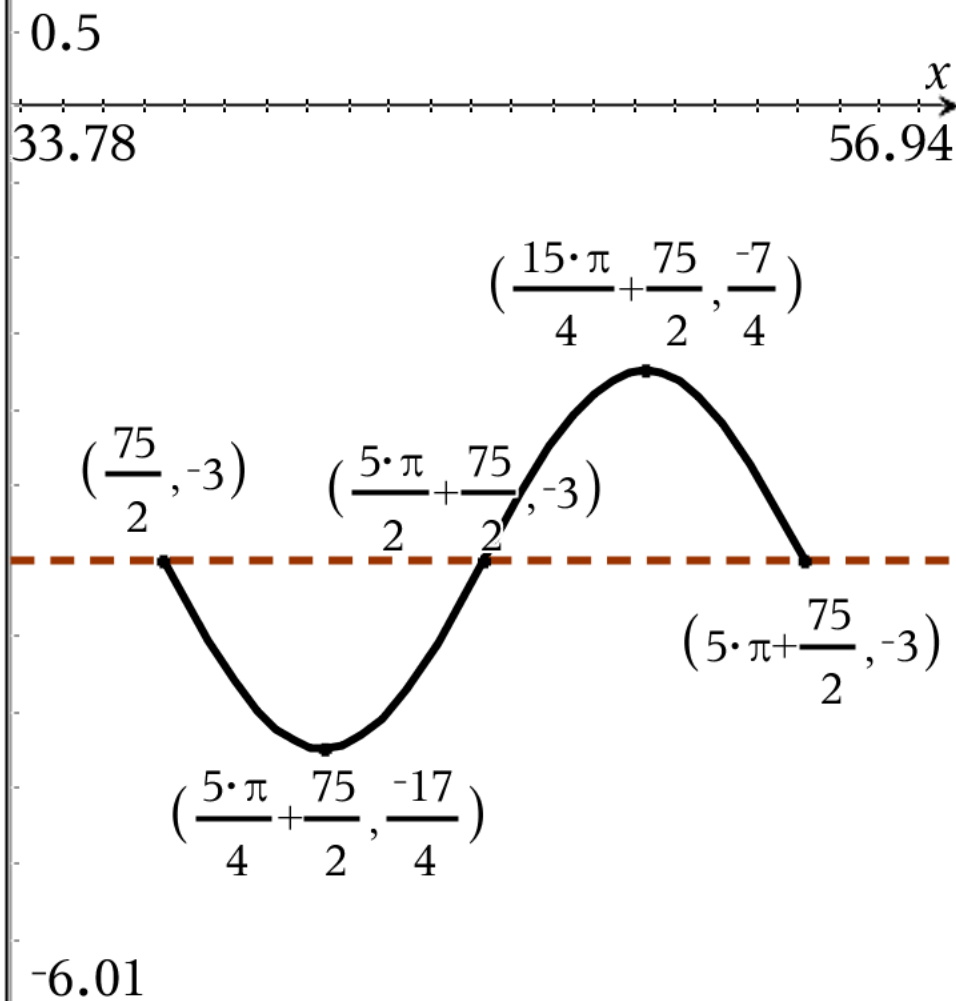
Other Periods

$$\left[\frac{75}{2} - 10 \cdot \pi, \frac{75}{2} - 5 \cdot \pi\right)$$

$$\left[\frac{75}{2} - 5 \cdot \pi, \frac{75}{2}\right) \quad \left[5 \cdot \pi + \frac{75}{2}, 10 \cdot \pi + \frac{75}{2}\right)$$

$$\left[10 \cdot \pi + \frac{75}{2}, 15 \cdot \pi + \frac{75}{2}\right)$$

2.39  $v$   =0.



$$y = \frac{-5}{4} \sin\left(\frac{2 \cdot x}{5} - 15\right) + -3$$

vertical stretch

horizontal stretch

vertical reflection

PHASE SHIFT RIGHT

period  $5\pi$

$\frac{75}{2}$  right

midline  $y = -3$  amplitude =  $\frac{5}{4}$