

Objective: Graph sine and cosine using 5 key points

## Graphs of Sine and Cosine

$$y = a \sin(bx - c) + d$$

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$$y = a \sin(bx - c) + d$$

Today we will cover changing  $c$ .

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## Graphs of Sine and Cosine

$$y = a \sin(bx - c) + d$$

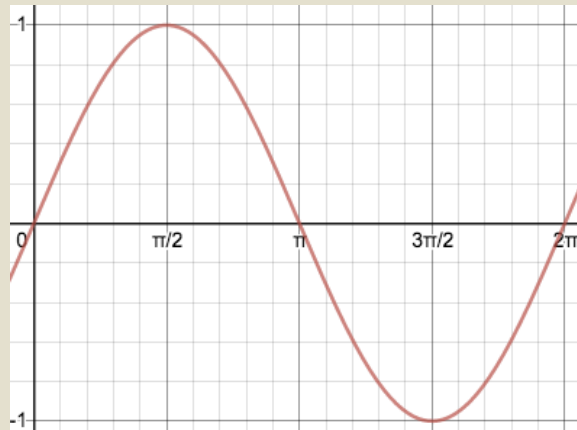
**c** determines the horizontal shift of the function.

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## Changing c

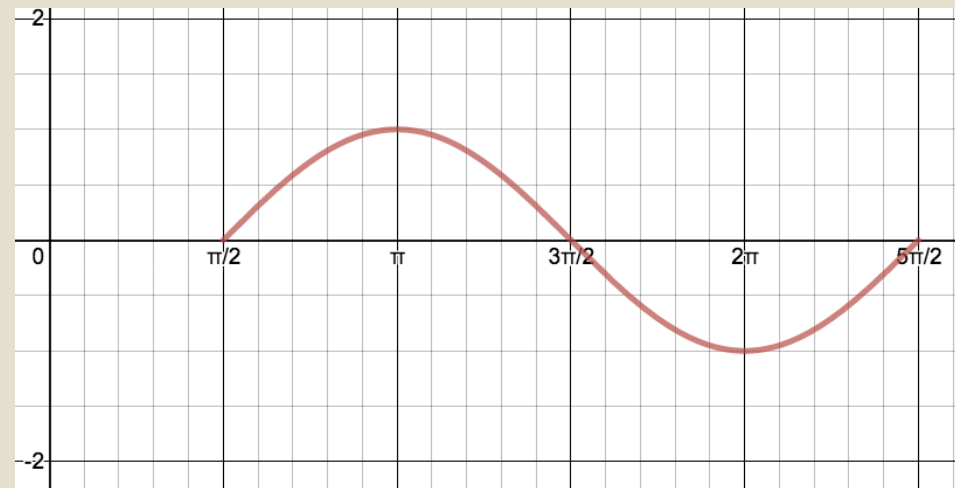
Changing c changes the start position of the cycle.

$y = \sin x$  with no shift



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

Notice the shift right by  $\pi/2$



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## Changing c

Just like all the other functions we have shifted in this class, the left/right shift is the opposite of the sign.

This functions shifts right by  $\pi/2$

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

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$$\text{Sketch } y = \cos\left(x - \frac{\pi}{3}\right)$$

This impacts the location of our 5 key points as well as the start at end points.

The graph starts at  $\pi/3$  and then end at a distance one cycle away from that (which is adding  $2\pi$ )

SO the end point of one cycle is

$$\frac{\pi}{3} + 2\pi = \frac{\pi}{3} + \frac{6\pi}{3} = \frac{7\pi}{3}$$

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

Calculate the key points:

Start at  $\pi/3$ , end at  $7\pi/3$ .

$$\text{Halfway between } \pi/3 \text{ and } 7\pi/3 = \frac{\frac{\pi}{3} + \frac{7\pi}{3}}{2} = \frac{\frac{8\pi}{3}}{2} = \frac{4\pi}{3}$$

$$\text{Halfway between } \pi/3 \text{ and } 4\pi/3 = \frac{\frac{\pi}{3} + \frac{4\pi}{3}}{2} = \frac{\frac{5\pi}{3}}{2} = \frac{5\pi}{6}$$

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Halfway between  $4\pi/3$  and  $7\pi/3$  =

$$\frac{\frac{4\pi}{3} + \frac{7\pi}{3}}{2} = \frac{\frac{11\pi}{3}}{2} = \frac{11\pi}{6}$$

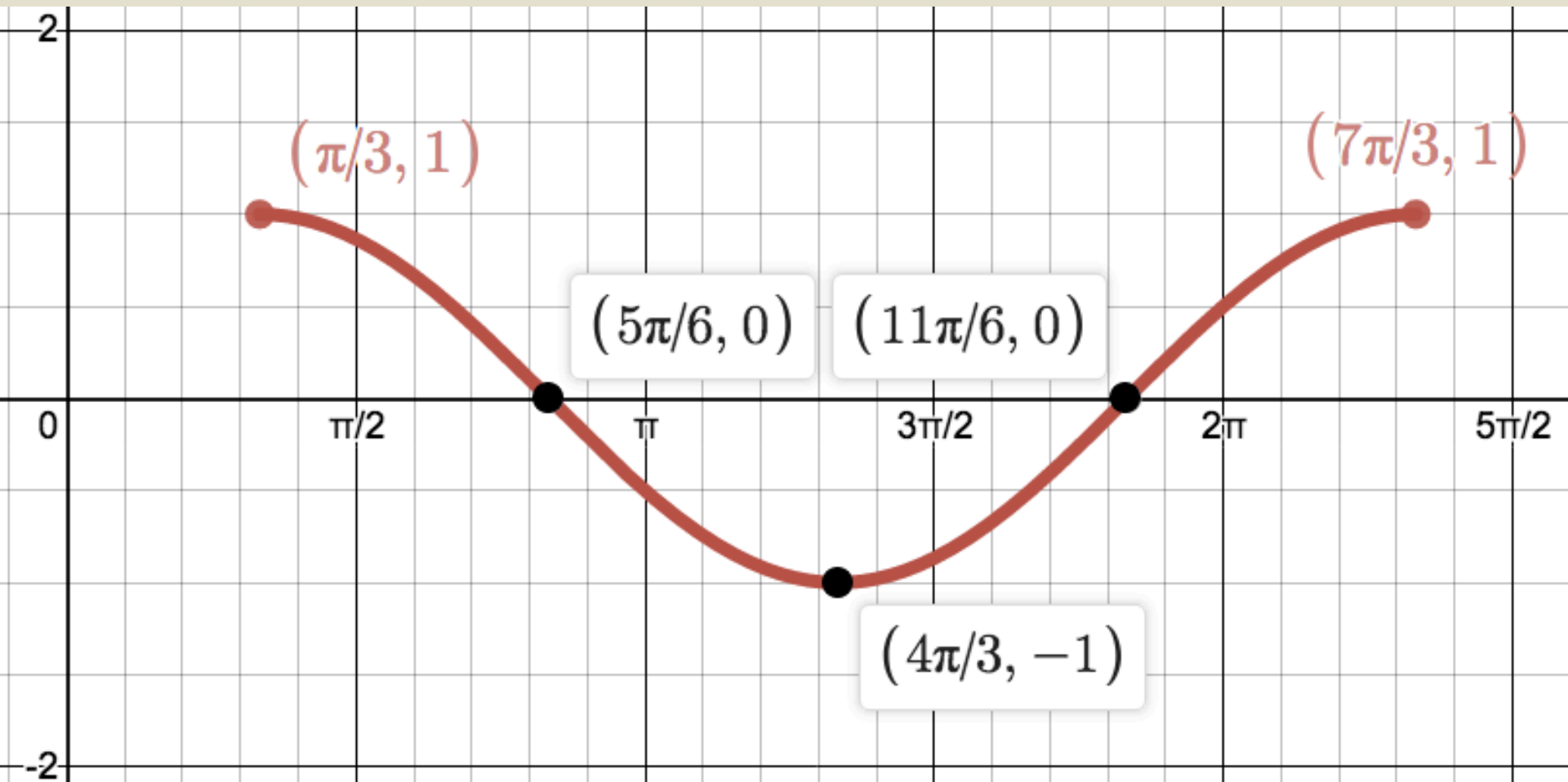
So we have our five key points at:

$$\frac{\pi}{3}, \frac{5\pi}{6}, \frac{4\pi}{3}, \frac{11\pi}{6}, \frac{7\pi}{3}$$



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



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Sketch  $y = \sin(x + \pi)$

The graph starts at  $-\pi$

SO the end point of one cycle is  $-\pi + 2\pi = \pi$

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$$y = \sin(x + \pi)$$

Calculate the key points:

Start at  $-\pi$ , end at  $\pi$ .

$$\text{Halfway between } -\pi \text{ and } \pi = \frac{-\pi + \pi}{2} = \frac{0}{2} = 0$$

$$\text{Halfway between } \pi/3 \text{ and } 4\pi/3 = \frac{-\pi + 0}{2} = -\frac{\pi}{2}$$

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Halfway between pi and zero =

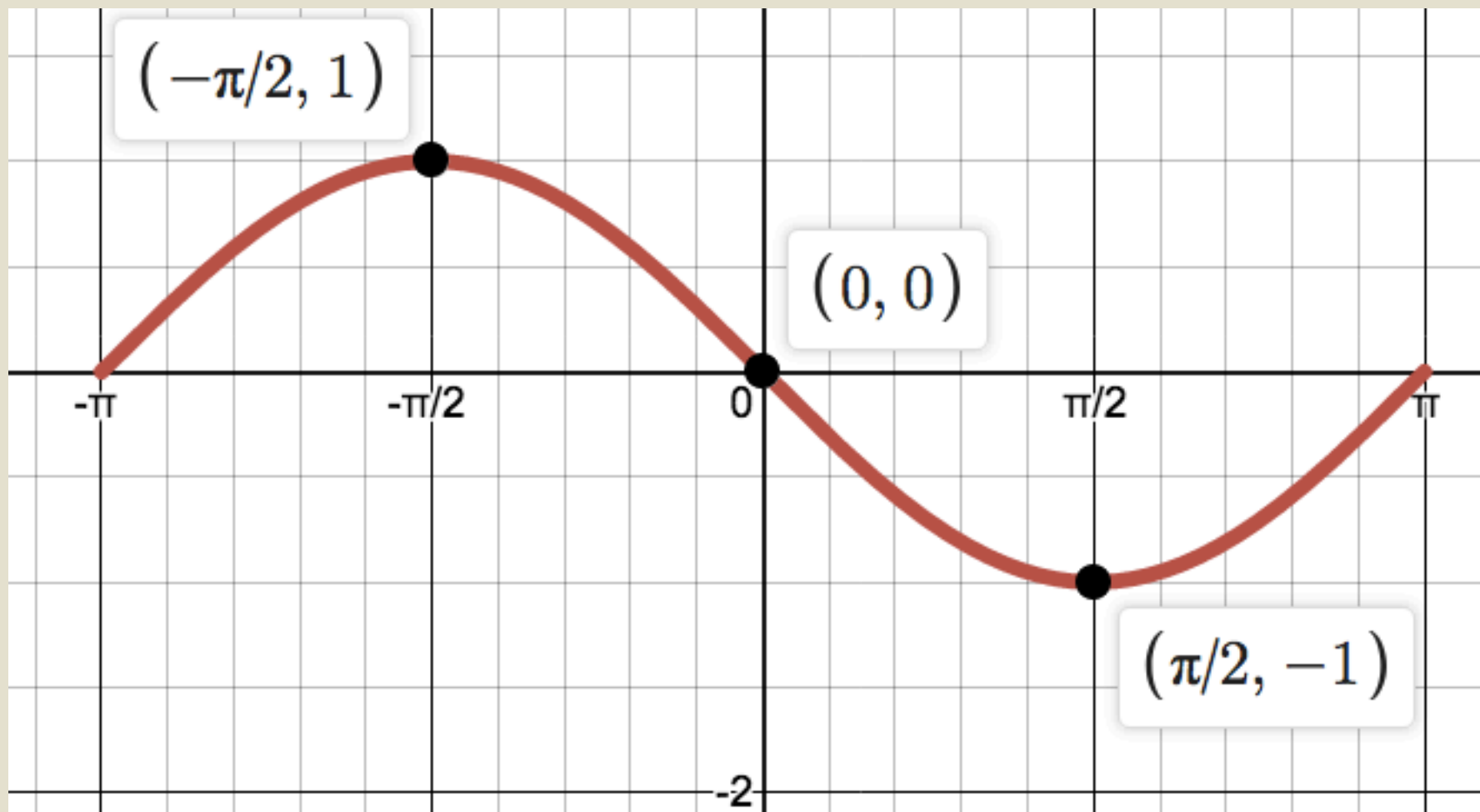
$$\frac{0 + \pi}{2} = \frac{\pi}{2}$$

So we have our five key points at:

$$-\pi, -\frac{\pi}{2}, 0, \frac{\pi}{2}, \pi$$

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$$y = \sin(x + \pi)$$



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Assignment:

Log in to Office 365/Teams

Complete the assignment:

**Graphing Sine and Cosine\_changing c\_ (Week 5, Day 4)**

**SHOW ALL YOUR WORK!**

**NO WORK = NO CREDIT**