

Objective: Graph sine and cosine using 5 key points

Graphs of Sine and Cosine

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

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Today we will cover changing b .

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Graphs of Sine and Cosine

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

b determines the period, or cycle, of the function.

This means it can stretch or shrink the graph in the horizontal direction.

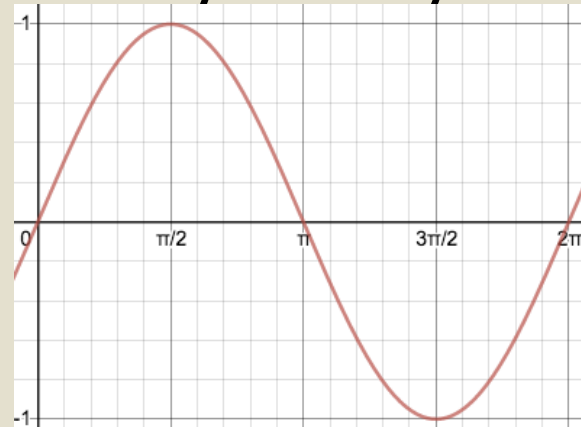
$$period = \frac{2\pi}{b}$$

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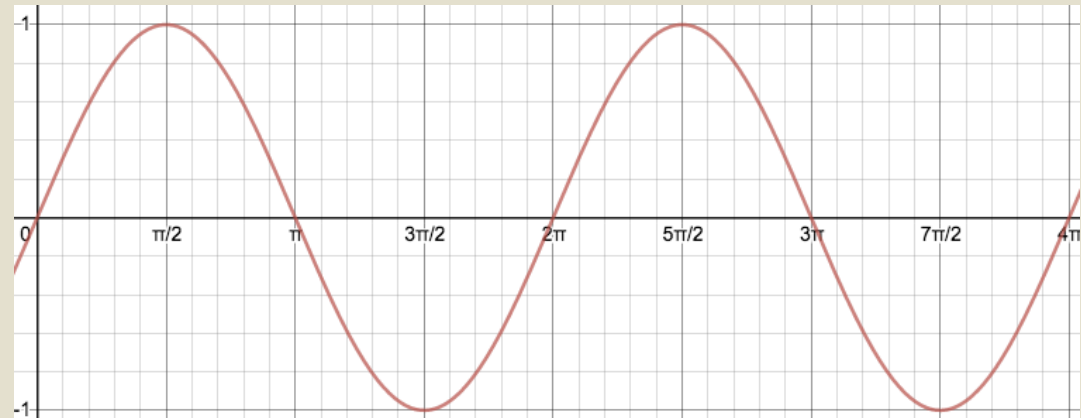
Changing b

One period is the amount to go through all of the values once.

One cycle of $y = \sin x$



Two cycles of $y = \sin x$



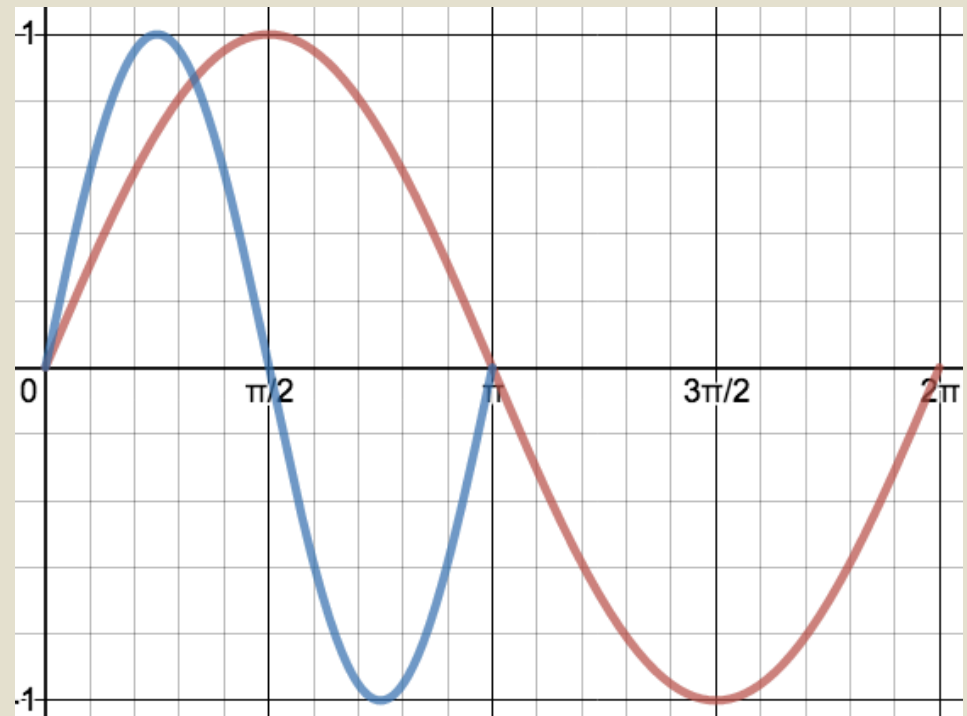
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Changing b

One period is the amount to go through all of the values once.

Changing b will determine how long it takes to get through one cycle.

The blue graph does one full cycle in π instead of 2π .



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We always use b to calculate the period.

Let's sketch $y = \sin \frac{x}{2}$

b is whatever number is multiplied with the x. So here it is $\frac{1}{2}$.

Plug b in to the period formula: $period = \frac{2\pi}{\frac{1}{2}} = 4\pi$

So our graph completes one full cycle in a distance of 4π .

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$$y = \sin \frac{x}{2} \quad \text{period} = 4\pi$$

This impacts the location of our 5 key points.

The graph starts at zero still, but now ends at 4π instead of 2π . So we need to calculate the other 3 points.

Since they are evenly spaced, we can just divide by two to get the middle, then divide each of those spaces in two.

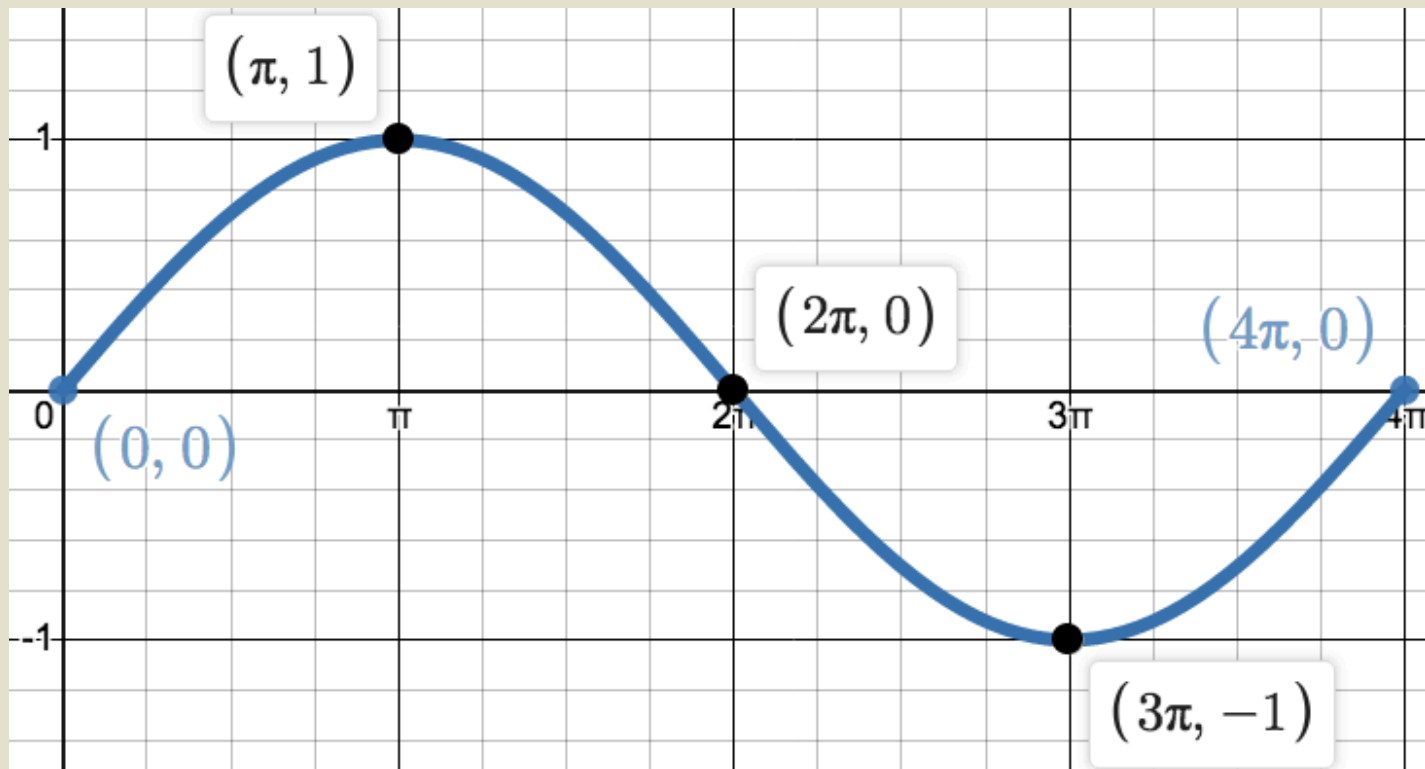
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Another way to think about it:

Halfway between zero and 4π is 2π .

Halfway between zero and 2π is π .

Halfway between 2π and 4π is 3π .



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Sketch $y = \cos 3\pi x$

b is 3π because that is what is multiplied with the x.

$$\text{period} = \frac{2\pi}{3\pi} = \frac{2}{3}$$

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$$y = \cos 3\pi x$$

$$\text{period} = \frac{2}{3}$$

Calculate the key points:
Start at zero, end at $2/3$.

$$\text{Halfway between zero and } 2/3 = \frac{0 + \frac{2}{3}}{2} = \frac{\frac{2}{3}}{2} = \frac{1}{3}$$

$$\text{Halfway between zero and } 1/3 = \frac{0 + \frac{1}{3}}{2} = \frac{\frac{1}{3}}{2} = \frac{1}{6}$$

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$$y = \cos 3\pi x$$

$$\text{period} = \frac{2}{3}$$

Halfway between $1/3$ and $2/3$ =

$$\frac{\frac{1}{3} + \frac{2}{3}}{2} = \frac{\frac{3}{3}}{2} = \frac{1}{2}$$

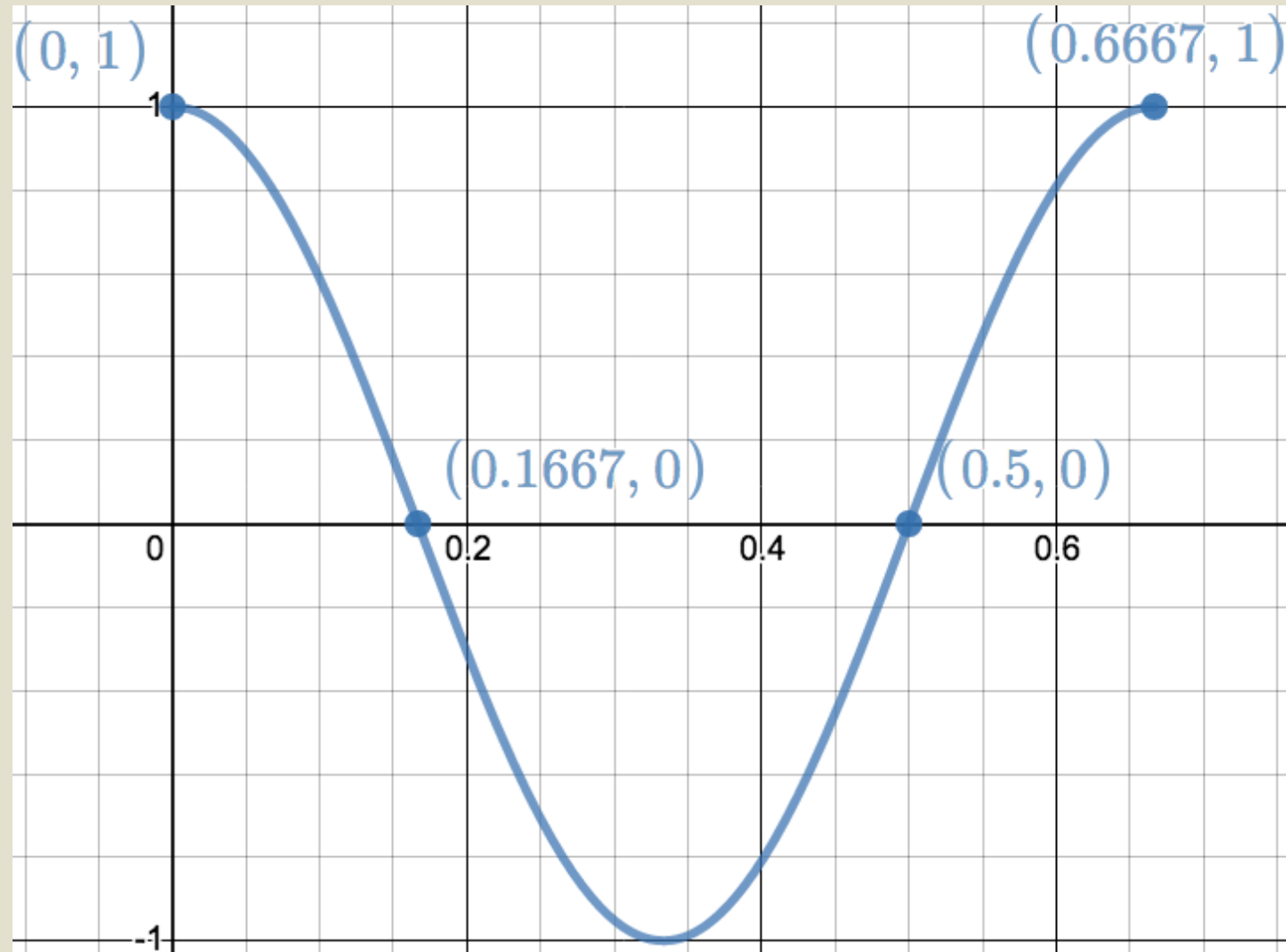
So we have our five key points at:

$$0, \frac{1}{6}, \frac{1}{3}, \frac{1}{2}, \frac{2}{3}$$

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(the computer calculated the fraction into a decimal)

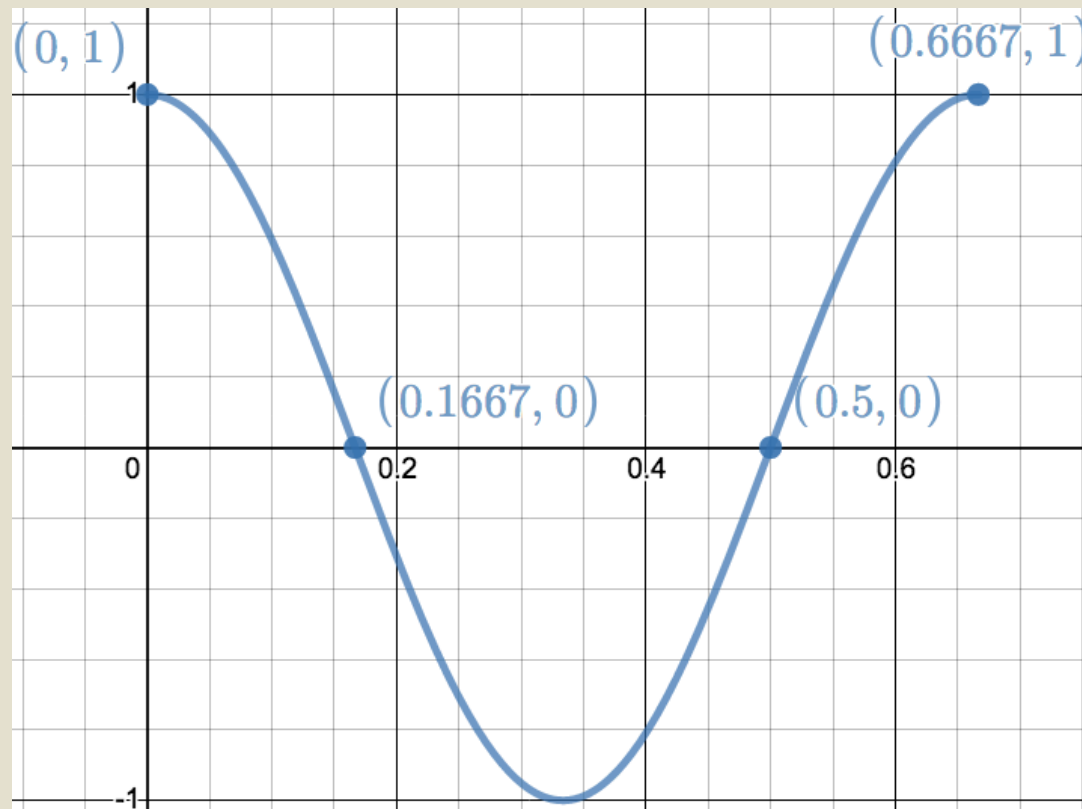
$$y = \cos 3\pi x$$



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Also notice that the cycle does not need to end up being in terms of pi. Sometimes the pi will cancel out. This is okay. It is just a number anyway ($\pi = 3.1415926\dots$)

$$y = \cos 3\pi x$$



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Assignment:

Log in to Office 365/Teams

Complete the assignment:

Graphing Sine and Cosine_changing b_ (Week 5, Day 3)

SHOW ALL YOUR WORK!

NO WORK = NO CREDIT