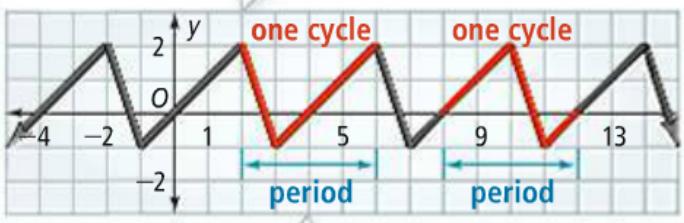
# 13.4 - The Sine Function

A **periodic function** is a function that repeats a pattern of $y$-values (outputs) at regular intervals. One complete pattern is a **cycle**. A cycle may begin at any point on the graph of the function. The **period** of a function is the horizontal length—the distance along the $x$-axis—of one cycle. The $x$-value in a periodic function often represents time.

Begin at any point on the graph. Trace one complete cycle.




The beginning and ending $x$-values of each cycle determine the period of the function.

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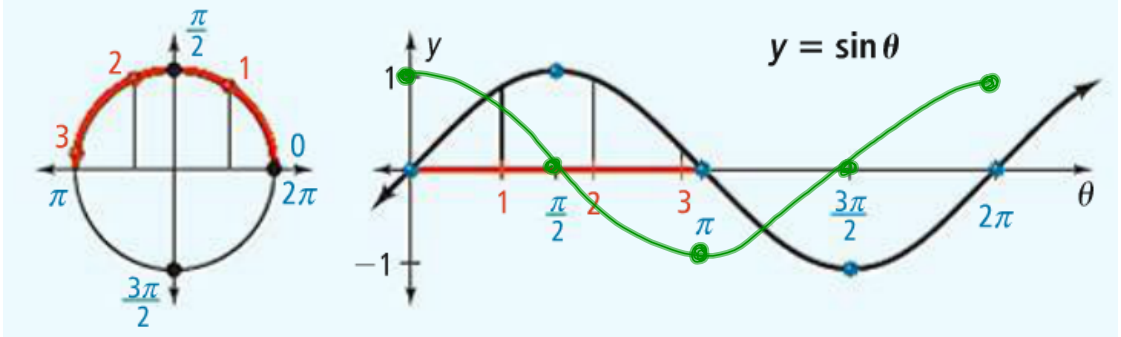
The **sine function**, $y = \sin\theta$, matches the measure $\theta$ of an angle in standard position with the $y$-coordinate of a point on the unit circle. This point is where the terminal side of the angle intersects the unit circle.




**Essential Understanding** As the terminal side of an angle rotates about the origin (beginning at 0), its sine value on the unit circle increases from 0 to 1, decreases from 1 to −1, and then increases back to 0.

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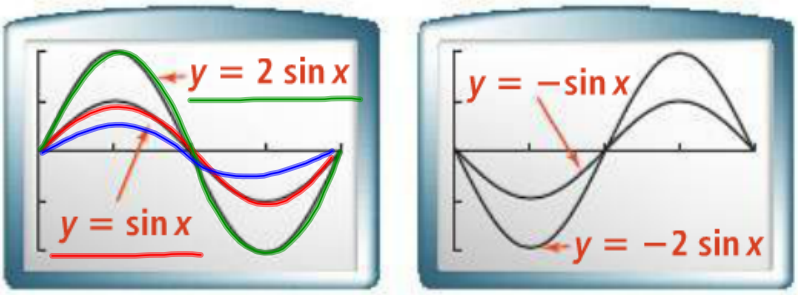
## ***Amplitutde***




**A** What is the amplitude of each sine curve? How does the value of *a* affect the amplitude?

**B** How does a negative value of *a* affect the position of the curve?

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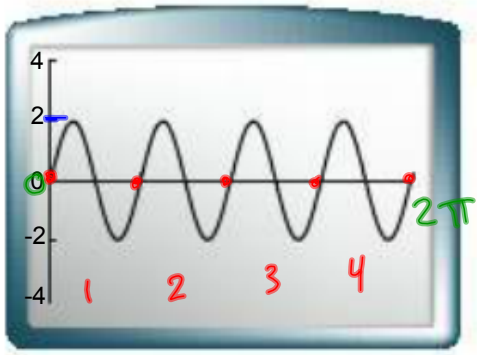
**Ex.1** Determine the number of cycles the sine function has in the intreval 0 to 2pi. Find the amplitude and period as well.

4 cycles

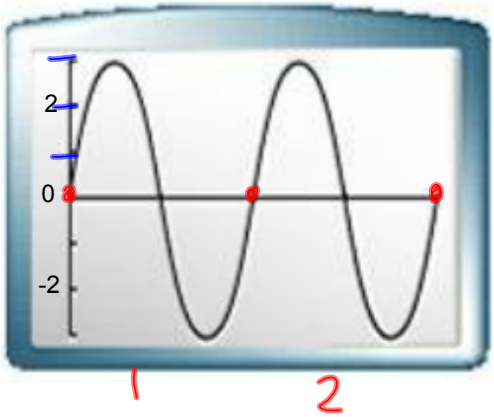
amplitude: 2




**Ex.2** Determine the number of cycles the sine function has in the intreval 0 to 2pi. Find the amplitude and period as well.

2 cycles

a = 3

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take note

## Concept Summary Properties of Sine Functions

Suppose $y = a \sin b\theta$, with $a \neq 0$, $b > 0$, and $\theta$ in radians.

- $|a|$ is the amplitude of the function.
- $b$ is the number of cycles in the interval from 0 to $2\pi$.
- $\frac{2\pi}{b}$ is the period of the function.

You can use five points equally spaced through one cycle to sketch a sine curve. For $a > 0$, this five-point pattern is *zero-max-zero-min-zero*.

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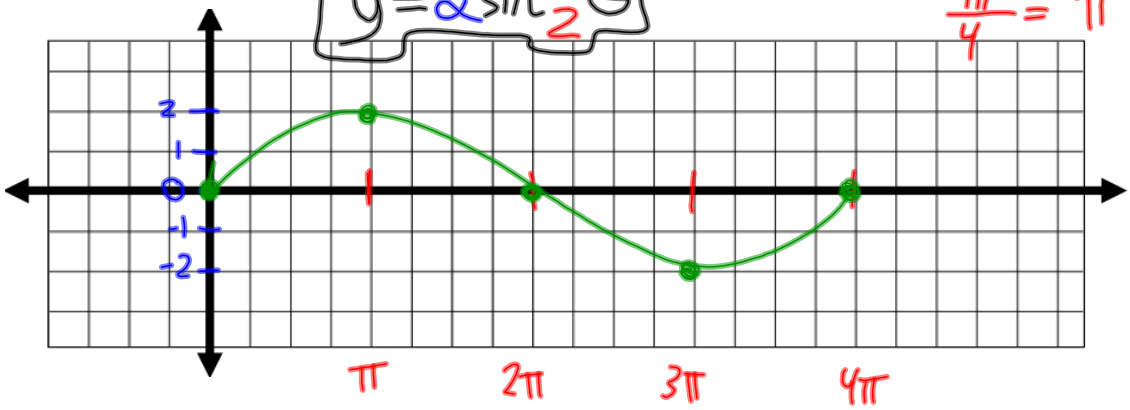
**Ex.3**

**What is the graph of one cycle of a sine curve with amplitude 2, period $4\pi$, midline $y = 0$, and $a > 0$? Using the form $y = a \sin b\theta$, what is an equation for the sine curve?**

$y = 2 \sin \frac{1}{2}\theta$

$\frac{4\pi}{4} = \pi$

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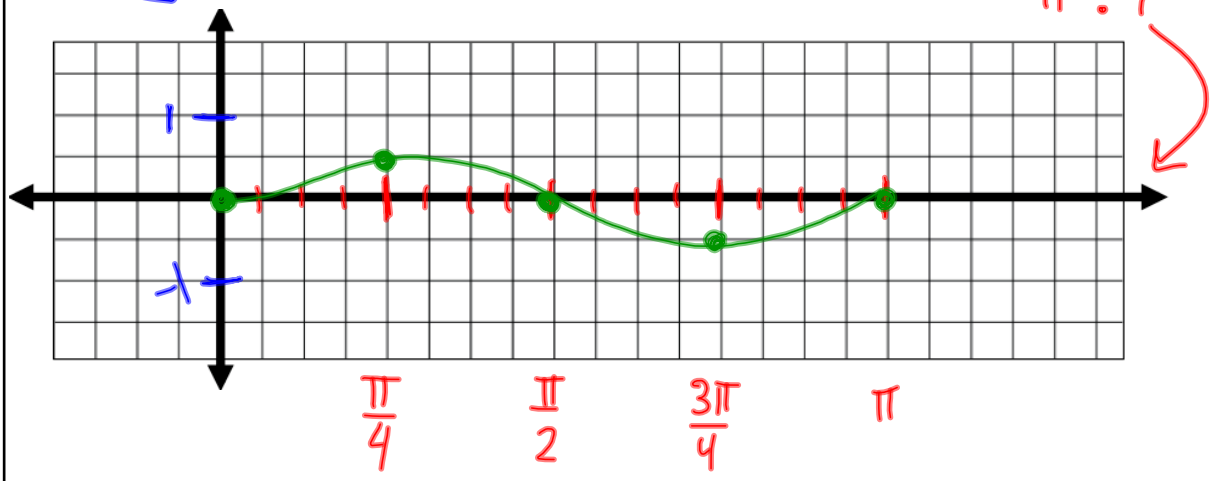
**Ex.4** Sketch one cycle the graph of the sine function.

$y = \frac{1}{2}\sin 2\theta$

$a = \frac{1}{2}$

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

$\pi \div 4$

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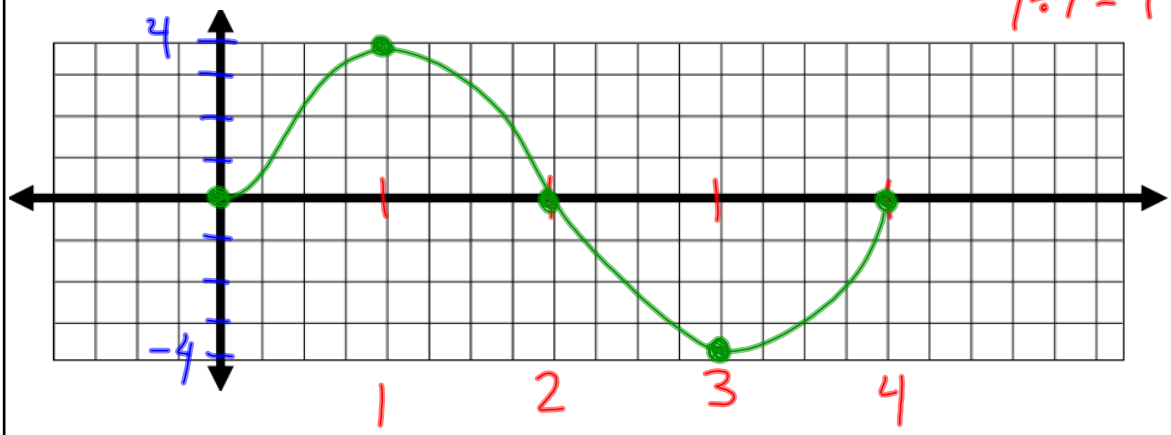
**Ex.5** Sketch one cycle the graph of the sine function.

$y = 4\sin\frac{\pi}{2}\theta$

amp: 4

period: $\frac{2\pi}{b} = \frac{2\pi}{\frac{\pi}{2}} = 4$

$4 \div 4 = 1$

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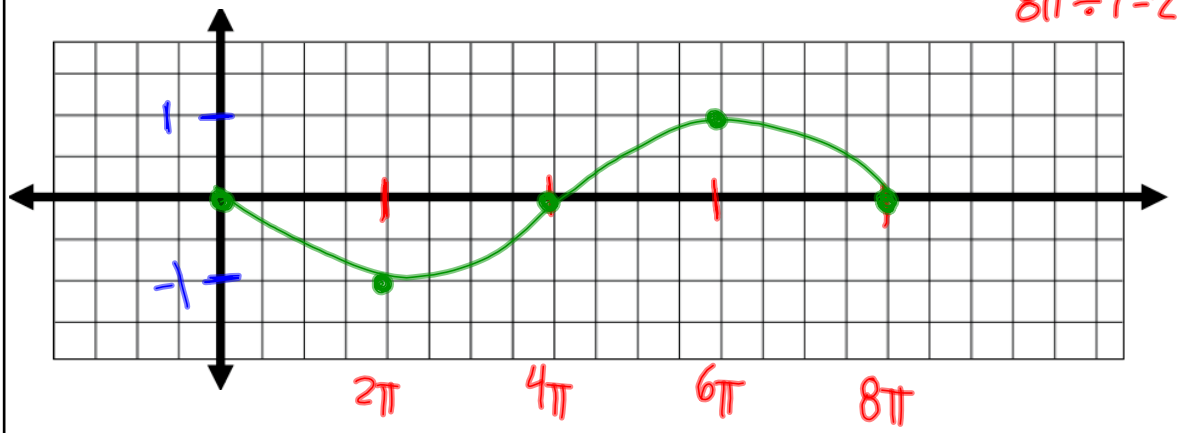
**Ex.6** Sketch one cycle the graph of the sine function.

$y = -\sin 0.25\theta$

$a = 1$ reflects

$P = \frac{2\pi}{b} = \frac{2\pi}{0.25} = 8\pi$

$8\pi \div 4 = 2\pi$

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HOMEWORK:

p.856:

12-14 all, 21 - 36 all

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