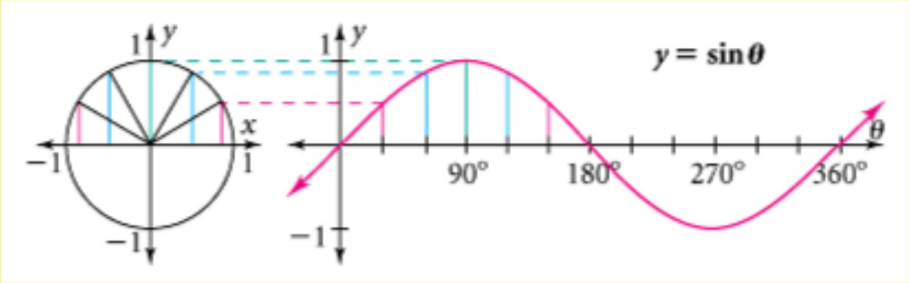
13.4 The Sine Function

Sine Function $y = \sin\theta$, matches the measure of θ of an angle in standard position with the y-coordinate of a point on the unit circle.



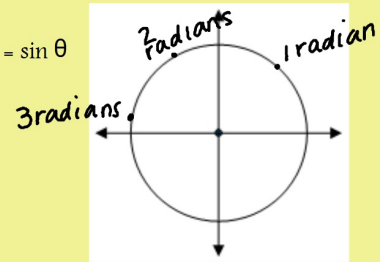
Use the graph to find the value of $y = \sin\theta$ for each value of θ.

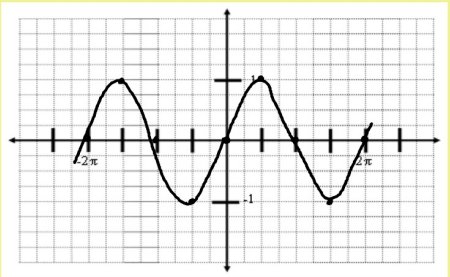
60° $\frac{\sqrt{3}}{2}$ 270° -1 210° $-\frac{1}{2}$

An angle θ can be expressed in degrees or radians. In this book, when no unit is mentioned, you should use RADIANS.

Graph the sine function in radians. In the unit circle you can show radian measures along the circle as lengths of arcs.

Graph $y = \sin\theta$





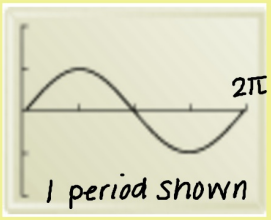
The sine function reaches it maximum value of 1 at $\pi/2$

The sine function crosses the x-axis at π, so $\sin\pi = 0$

What is the amplitude of the sine function? 1

What is the period in degrees and in radians? $p = 360° = 2\pi$

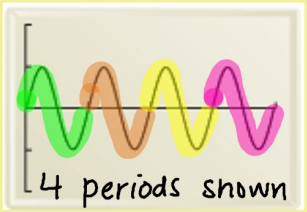
The graph of the sine function is called the sine curve. By varying the period, you get different sine curves. Find the period of each sine curve below For each graph the θ-axis shows values from 0 to 2π



$p = 2\pi$

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

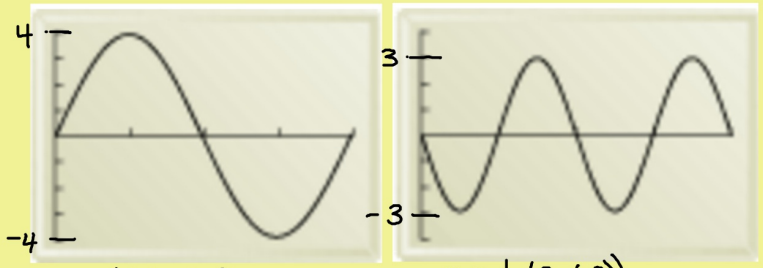
$p = \frac{2\pi}{3}$



$\text{period} = \frac{2\pi}{4}$

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

Find the amplitude of each sine curve. Each interval on the y-axis represents one unit.



$a = \frac{1}{2}(4-(-4))$

$a = \frac{1}{2}(8)$

$a = 4$

$a = \frac{1}{2}(3-(-3))$

$a = \frac{1}{2} \cdot 6$

$a = 3$

Properties of Sine Function

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

- $|a|$ is the amplitude of the funciton
- b is the number of cycles in the interval from 0 to 2π
- $\frac{2\pi}{b}$ 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*

For a < 0, this five-point pattern is *zero-min-zero-max-zero*

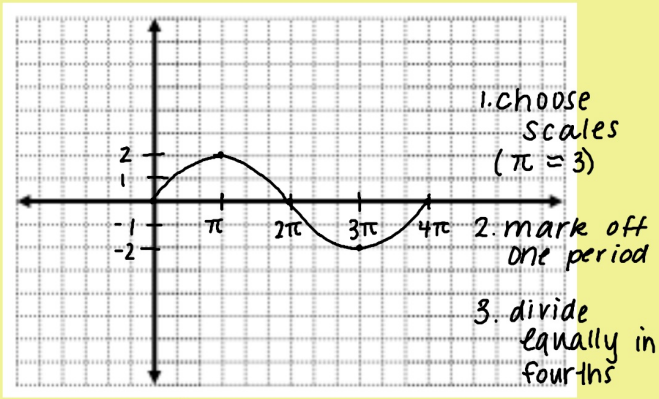
Sketch one cycle of a sine curve with amplitude 2 and period 4π. Then write the equation.

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

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

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

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



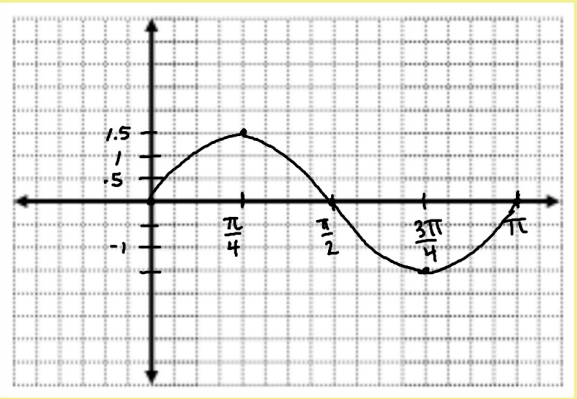
$y = 2\sin\frac{1}{2}\theta$

Sketch one cycle of $y = 1.5\sin 2\theta$

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

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

$\pi = \text{period}$

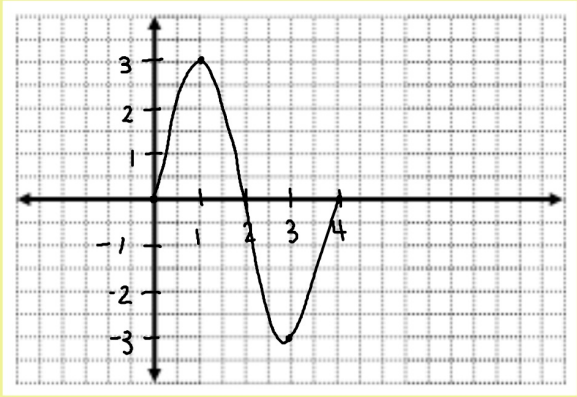


Sketch one cycle of $y = 3\sin\frac{\pi}{2}\theta$

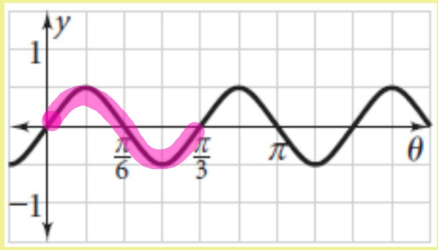
$\frac{2\pi}{b}$ = period

$\frac{2\pi}{\frac{\pi}{2}} = 2\pi \cdot \frac{2}{\pi}$

4 = period



Find the period and amplitude of the following sine curve. Then write the equation for the curve.



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

amplitude = $\frac{1}{2}\left(\frac{1}{2} - \left(-\frac{1}{2}\right)\right)$

= $\frac{1}{2}$

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

$\frac{\pi}{3} = \frac{2\pi}{b}$ $\quad b\pi = 6\pi$

$b = 6$

$y = \frac{1}{2}\sin 6\theta$

homework

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