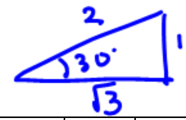
5.1a Graphing Sine and Cosine Functions

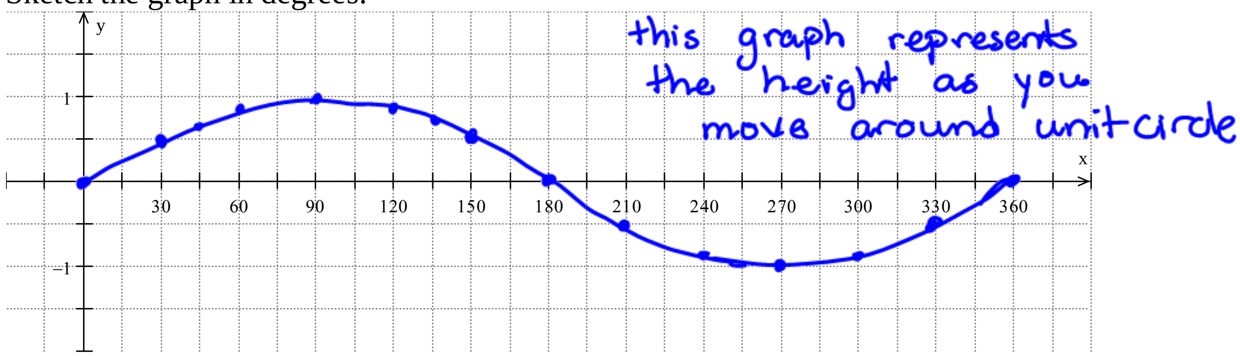
$\sin\Theta = y\text{-coord}$

Complete the table:

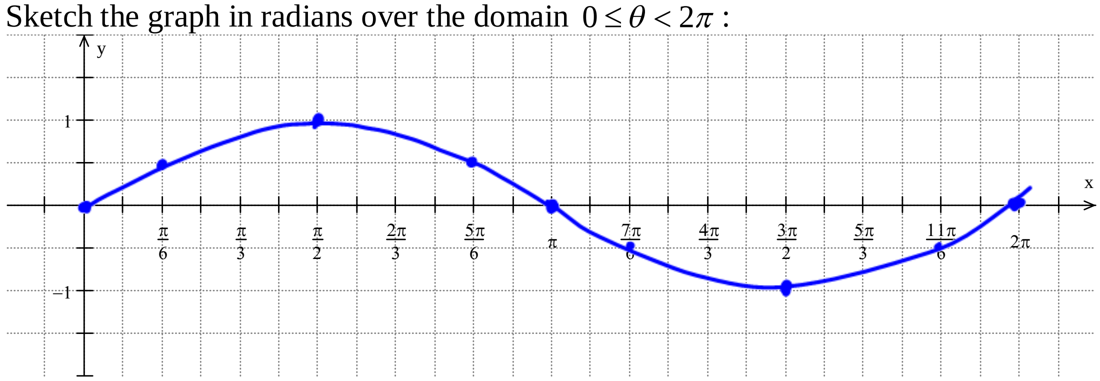


Θ	degrees	0°	30°	45°	60°	90°	120°	135°	150°	180°	210°	225°	240°	270°	300°	315°	330°	360°
	radians	0	$\frac{\pi}{6}$	$\frac{\pi}{4}$	$\frac{\pi}{3}$	$\frac{\pi}{2}$	$\frac{2\pi}{3}$	$\frac{3\pi}{4}$	$\frac{5\pi}{6}$	π	$\frac{7\pi}{6}$	$\frac{5\pi}{4}$	$\frac{4\pi}{3}$	$\frac{3\pi}{2}$	$\frac{5\pi}{3}$	$\frac{7\pi}{4}$	$\frac{11\pi}{6}$	2π
sin Θ exact		0	$\frac{1}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{3}}{2}$	1	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{1}{2}$	0	$-\frac{1}{2}$	$-\frac{\sqrt{2}}{2}$	$-\frac{\sqrt{3}}{2}$	-1	$-\frac{\sqrt{3}}{2}$	$-\frac{\sqrt{2}}{2}$	$-\frac{1}{2}$	0
sin Θ decimal		0	0.5	0.7	0.86	1	0.86	0.7	0.5	0	-.5	-.7	-.86	-1	-.86	-.7	-.5	0

Sketch the graph in degrees:

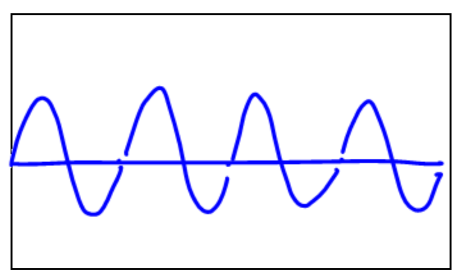


Sketch the graph in radians over the domain $0 \le \theta < 2\pi$:



Sinusoidal curve:
- a curve that oscillates repeatedly up and down from a central line or axis

Sketch the function: $y = \sin\theta$, but extend the domain to $0 \le \theta < 8\pi$



Observations about the graph of sine:

The curve is sinusoidal and periodic.

The domain is $\mathbb{R}$

The range is $-1 \le \Theta \le 1$, with a minimum value of -1 and a maximum value of 1.

The period is 2π and the amplitude is 1.

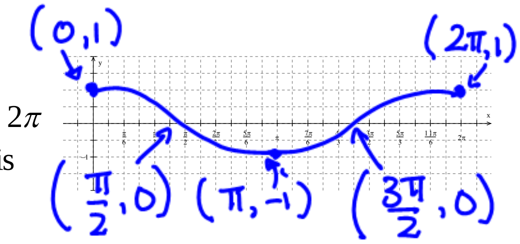
Amplitude is the maximum vertical distance the graph of a sinusoidal function varies above or below the horizontal central axis.

The y-intercept is 0.

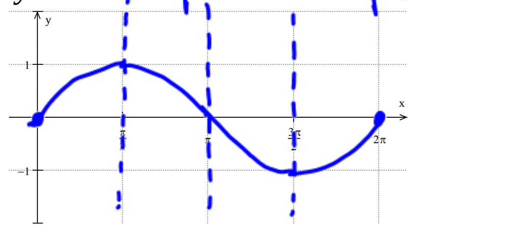
The first Θ-intercept is at π and repeats every π.

$x\text{-int} = \pi + n\pi$ or $x\text{-int} = n\pi$ ← because first $x\text{-int} = 0$

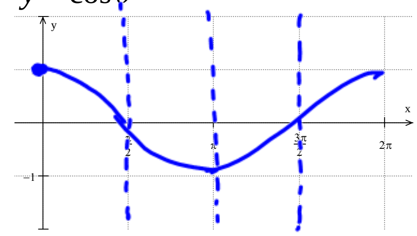
Using technology, sketch the function: $y = \cos\theta$ over the domain: $0 \le \theta < 2\pi$
In what ways is this curve different from that of $y = \sin\theta$? In what ways is
It similar?



$y = \sin\theta$, quarter period



$y = \cos\theta$



The graphs of $y = \sin\theta$ and $y = \cos\theta$ are periodic functions that repeat over a specific period. The shape of the graph is a sinusoidal curve.

Properties that the graphs share:

- Maximum value
- Minimum value
- Amplitude
- Domain
- Range
- Period

Ways in which these graphs differ:

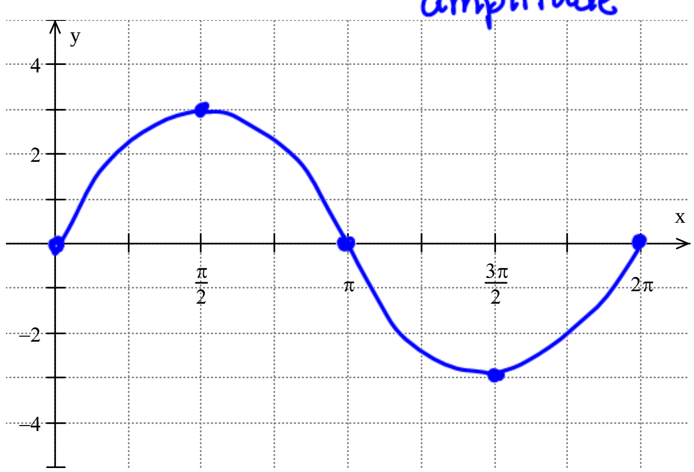
- y-intercept
- θ-intercepts.

<u>Amplitude of a Sinusoidal Function</u>

$y = \sin x$ is related to $y = a\sin x$ in the same way that $y = f(x)$ is related to $y = af(x)$.

Sketch the graph of the function $y = 3\sin x$

amplitude



a coefficient of 3 causes a vertical expansion by a factor of 3.

Sketch the graph of the function $y = 4\cos x$

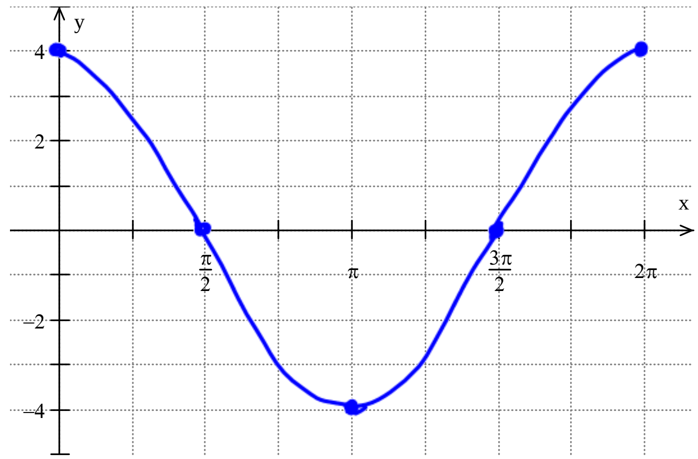
This is transformed by a vertical stretched by a factor of 4.

Maximum: 4 Minimum: -4

Amplitude: 4

Domain: $x = \mathbb{R}$

Range: $[-4, 4]$



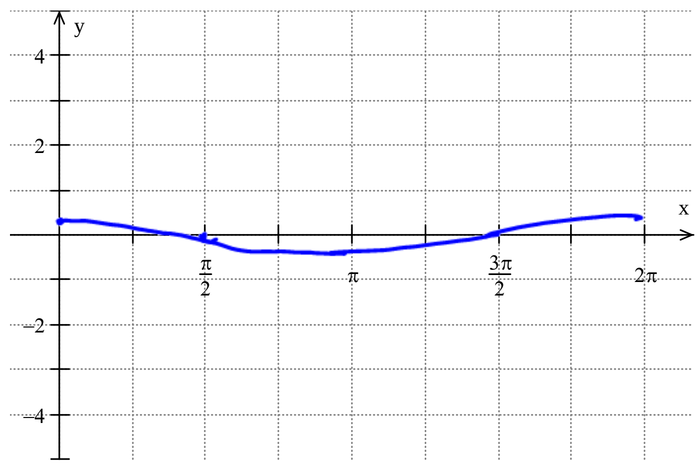
Sketch the graph of the function $y = .25\cos x$

This is transformed by a vertical compressed by a factor of .25.

Amplitude: .25

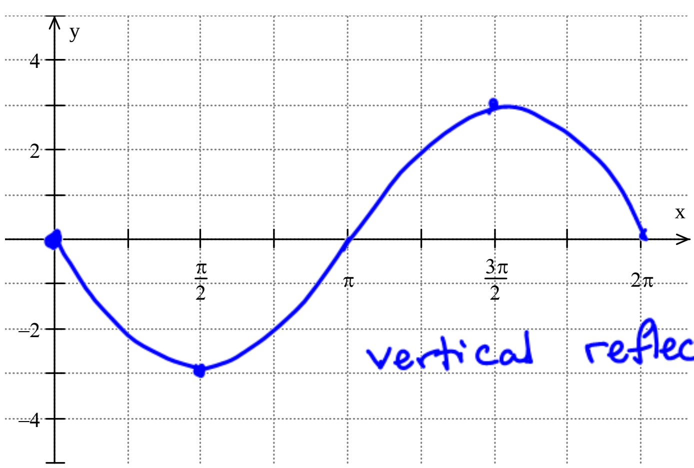
Domain: $x = \mathbb{R}$

Range: $[-.25, .25]$



Consider the function: $y = -.25\cos x$. What happens if $a < 0$ for the function $y = a\cos x$?
negative coefficient causes a flip/reflection

Sketch the function $y = -3\sin x$:



vertical reflection!

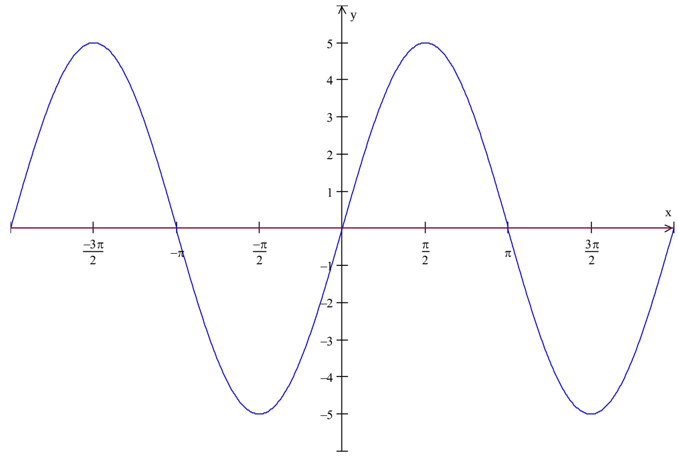
The coefficient, a, in the function $y = a\sin x$ or $y = a\cos x$ results in a vertical stretch by a factor of a.

In a sinusoidal curve, this changes the amplitude

If $a < 0$, then the graph will also be vertically reflected.

The amplitude of a function can be determine by looking at the graph of the function:

Consider $y = 5\sin x$



Determine the maximum and minimum values for *y*. max = 5

min = -5

What is the total distance between the maximum and the minimum?

10

How is this related to the amplitude?

$$\frac{\text{total distance}}{2} = \text{amplitude}$$

Amplitude can be determine using a formula:

$$\text{amplitude} = \frac{\text{max value of } y - \text{min value}}{2}$$

p233 #1, 2, 3, 14, 15

p233 # 4, 6, 7, 11