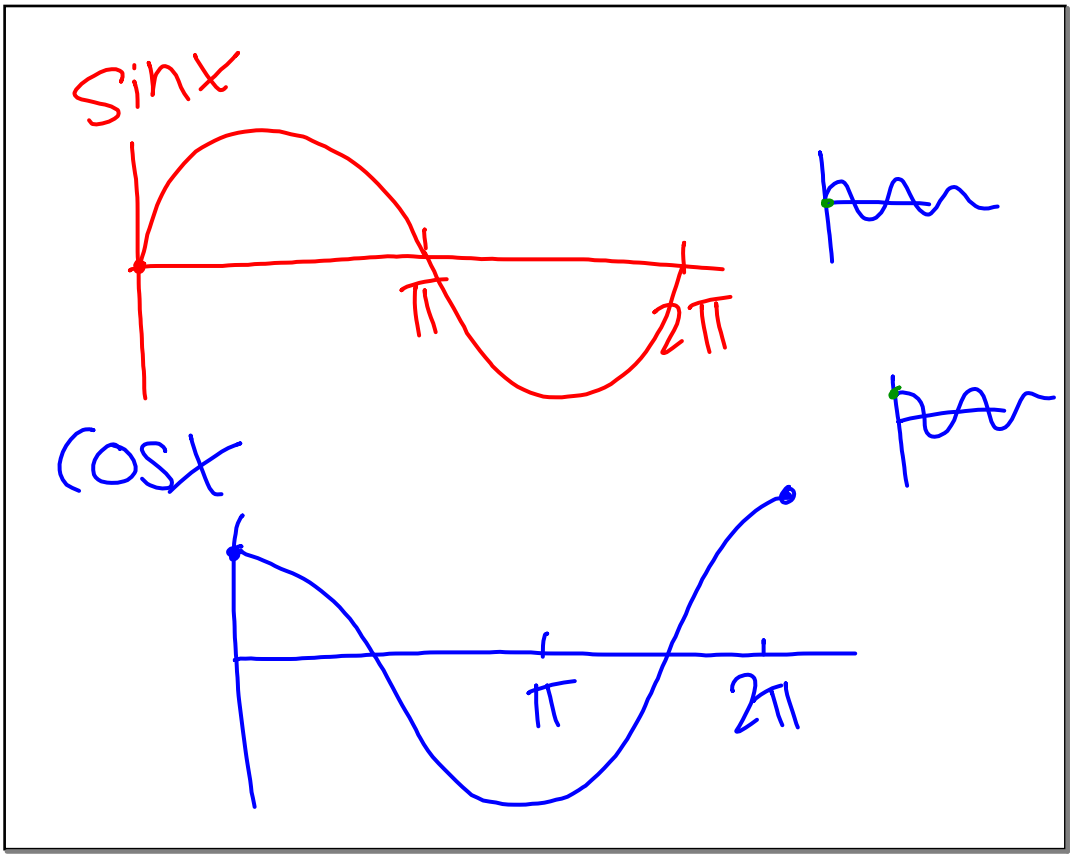


9-4 Graphing Sine and Cosine Functions

Objectives:

- I can graph basic sine and cosine functions
- I can use transformations to graph sine and cosine functions
- I can identify characteristics such as amplitude, period, and frequency

Sinusoid: Word to describe a sine or cosine graph

$$f(x) = a\sin(b(x-h)) + k$$ midline

a: Amplitude (V.S)

b: Period Finder

Period: $\frac{2\pi}{|b|}$

h: Phase Shift (R or L) x-slide

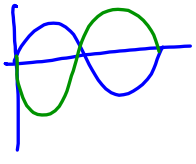
k: Vertical Shift (U or D)

amplitude is half the difference between the max and min on a sine or cosine graph (a vertical stretch or shrink) (the height of one mountain or valley from the midline)

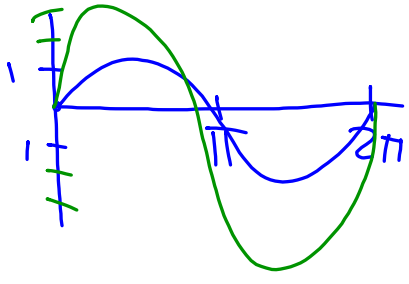
what does it mean if the "a" is negative??

reflection

$y = a \sin x$

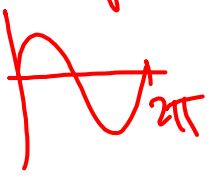


$y = 3\sin x$



Period: how long to make 1 shape

what is the length of the parent period?



$$y = a \sin (bx)$$

multiplied

to find the new period: parent period divided by "b"

$$\frac{2\pi}{|b|}$$

$a \sin(-2x)$

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

Frequency: the reciprocal of the period - it's the number of cycles the wave completes in 1 unit interval

2π

what is the frequency of the parent wave?

$$y = a \sin (bx)$$

to find the frequency: "b" divided by 2π

$\frac{b}{2\pi}$ or $\frac{1}{\text{period}}$

What is the period?

$y = \sin x$ P: $\frac{2\pi}{1} = 2\pi$

$y = -2\sin\left(\frac{x}{3}\right)$ $\times \frac{1}{3}$ P: $\frac{2\pi}{\frac{1}{3}} = 2\pi \cdot \frac{3}{1} = 6\pi$

$y = 3\sin(-2x)$ P: $\frac{2\pi}{2} = \pi$

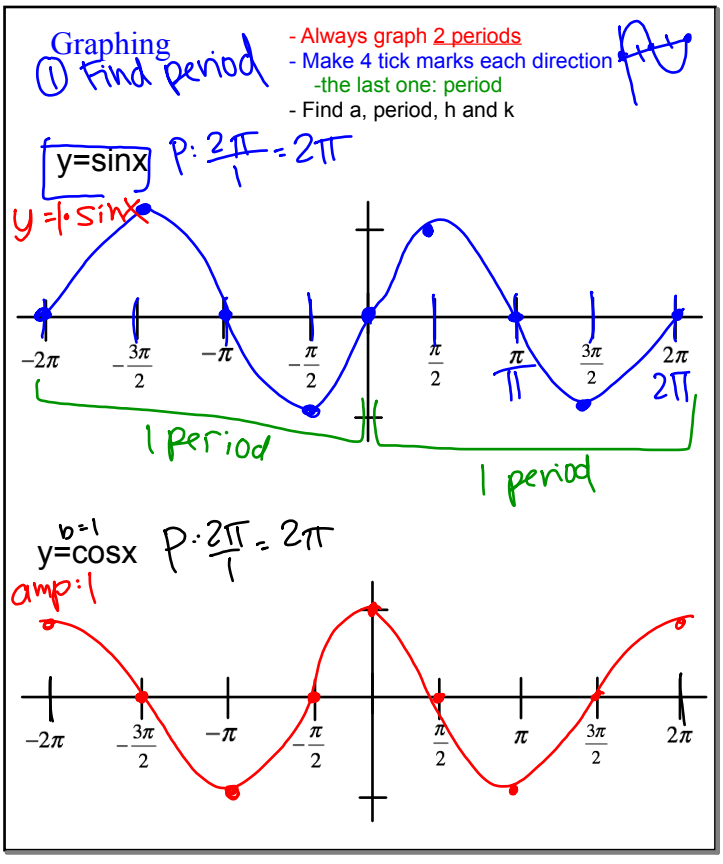
$\frac{2\pi}{|b|}$ → mult. by x

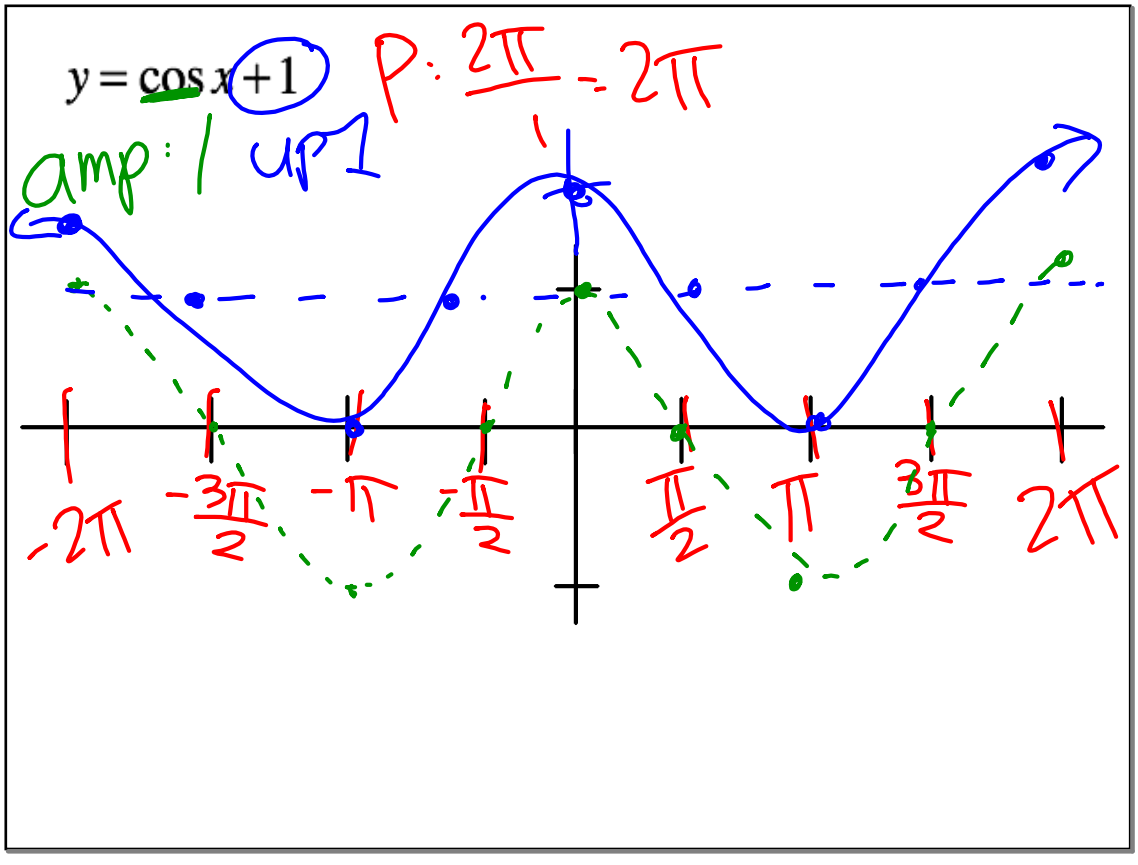
$y = 3\cos(\pi x)$

P: $\frac{2\pi}{\pi} = 2$

Phase Shift - is used to describe moves left and right

Vertical Shift - is used to describe moves up and down


Graphing
① Find period
- Always graph 2 periods
- Make 4 tick marks each direction
-the last one: period
- Find a, period, h and k
y=sinx
P: 2π/1 = 2π
y = 1·sinx
−2π
−3π/2
−π
−π/2
π/2
π
3π/2
2π
1 period
1 period
b=1
y=cosx
P: 2π/1 = 2π
amp: 1
−2π
−3π/2
−π
−π/2
π/2
π
3π/2
2π

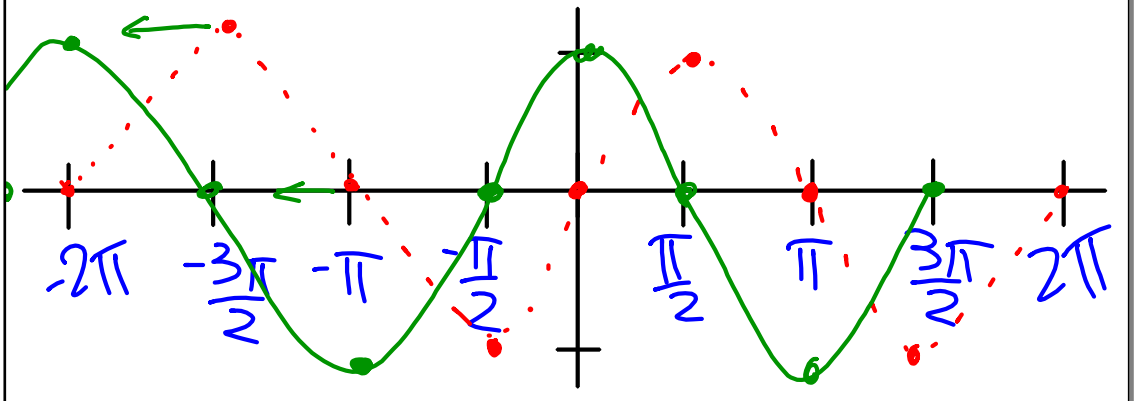

y = cos x + 1
P: 2π/1 = 2π
amp: 1
up 1
−2π
−3π/2
−π
−π/2
π/2
π
3π/2
2π

$y = \sin\left(1 \cdot x + \frac{\pi}{2}\right)$

P: $\frac{2\pi}{1} = 2\pi$

amp: 1

left $\pi/2$



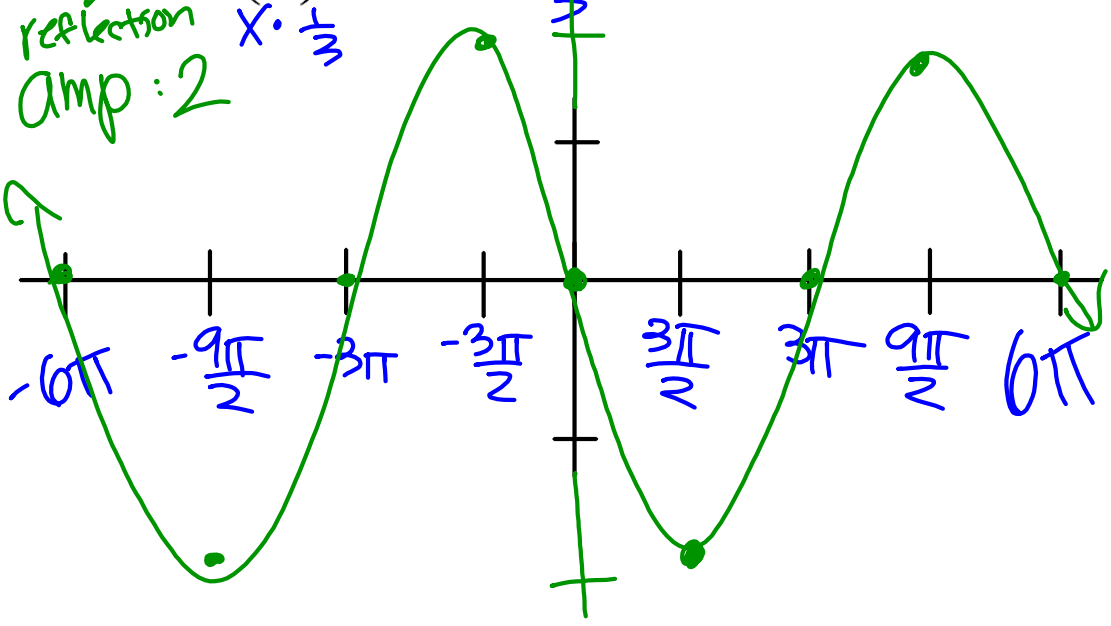
$y = -2\sin\left(\frac{x}{3}\right)$

P: $\frac{2\pi}{\frac{1}{3}} = 2\pi \cdot \frac{3}{1} = 6\pi$

reflection

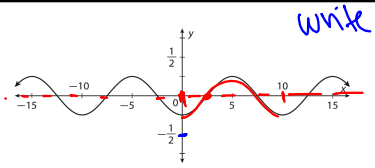
$\times \frac{1}{3}$

amp: 2



Ⓑ

write the function



Because the graph's y-intercept is negative, the graph is a[sine/cosine]function reflected across the x-axis.
Since the maximum and minimum in the graph are ____ and ____, respectively, the graph will be ____ vertical [stretch/compression] of the graph of the parent cosine function by a factor of ____.
The period of the function is ____.
Use the equation $2\pi b =$ ____ to find a positive value for b.
$2\pi b =$ ____
$b =$ ____ $=$ ____
$\frac{1}{b} =$ ____
An equation for the graph is $y =$ ____ cos ____ x.

$y = \frac{1}{4}\cos\frac{\pi}{5}x$

$P: \frac{2\pi}{b}$

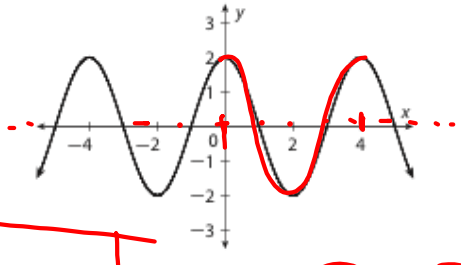
$b \cdot 10 = \frac{2\pi}{b} \cdot b$

$\frac{10b}{10} = \frac{2\pi}{10}$

$b = \frac{\pi}{5}$

Write an equation for the graph.

10.



$y = 2\cos\frac{\pi}{2}x$

$P: \frac{2\pi}{b}$

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

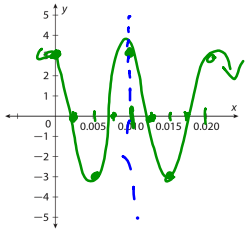
$\frac{4b}{4} = \frac{2\pi}{4}$

Ⓑ **Physics** Use a cosine function to graph a sound wave with a period of 0.010 second and an amplitude of 3 pascals. Note that the recording of the sound wave started when the wave was at its maximum height.

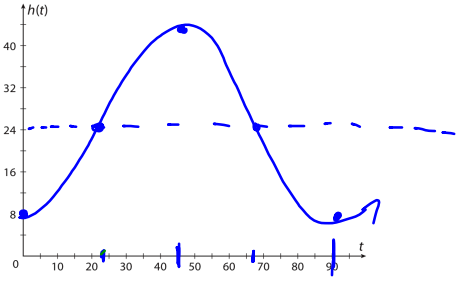
Graph the function.

$$\text{frequency} = \frac{1}{\text{period}} = \frac{1}{.01} = 100 \text{ Hz}$$

The frequency represents the number cycles of the sound wave every _____. The amplitude represents the maximum change in _____. The period represents the amount of time it takes for the sound wave to [end/repeat].



7. Amusement Parks The height h in feet of a car on a different Ferris wheel can be modeled by $h(t) = -16\cos\frac{\pi}{45}t + 24$, where t is the time in seconds. Identify the period, midline, amplitude, and maximum and minimum values of the graph. For one cycle starting from $t = 0$, find all points where the graph intersects its midline and the coordinates of any local maxima and minima. Interpret these points in the context of the problem, and graph one cycle.



$$P = \frac{2\pi}{\frac{\pi}{45}} = \frac{2\pi}{1} \cdot \frac{45}{\pi} = 90$$