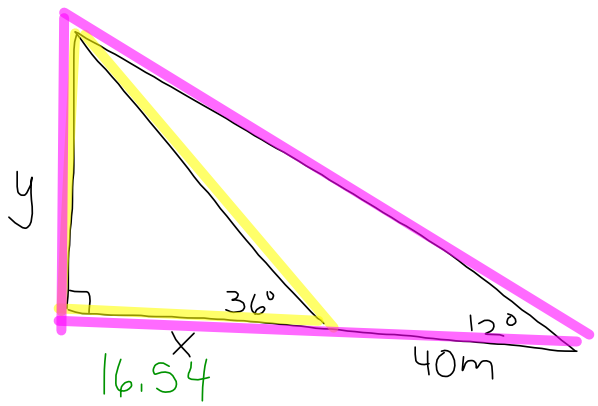
Bell work

Worksheet using your unit circle.



$$\tan 36° = \frac{y}{16.54}$$

$$y \approx 12 \text{ m}$$

$$(x)\tan 36° = \frac{y}{x}(x)$$

$$(x+40)\tan 12° = \frac{y}{x+40}\cancel{(x+40)}$$

$$y = x\tan 36°$$

$$y = (x+40)\tan 12°$$

$$x\tan 36° = (x+40)\tan 12°$$

$$.7265x = (x+40)\cdot .2126$$

$$.7265x = .2126x + 8.5$$

$$-.2126x \quad -.2126x$$

$$.5139x = 8.5$$

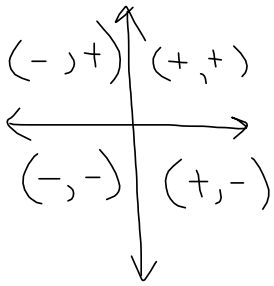
$$x = 16.54 \text{ m}$$

19) $P\left(\frac{3}{5}, \frac{4}{5}\right)$

35) $\tan\theta < 0$ 2 & 4

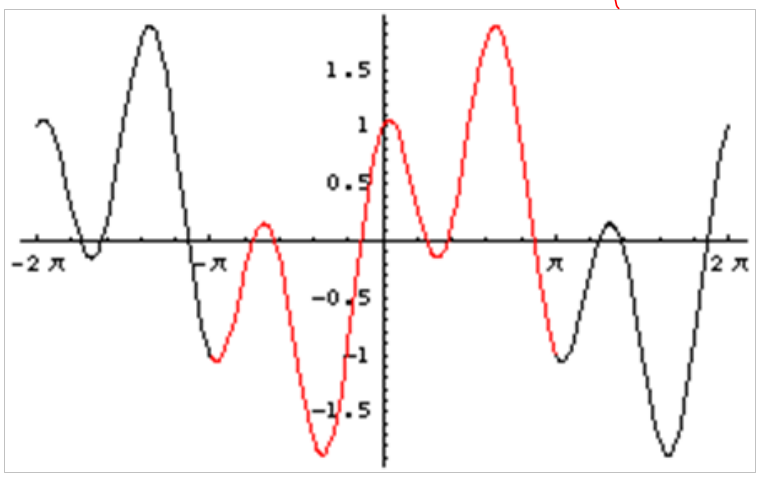
$\cos\theta < 0$ 2 & 3

2

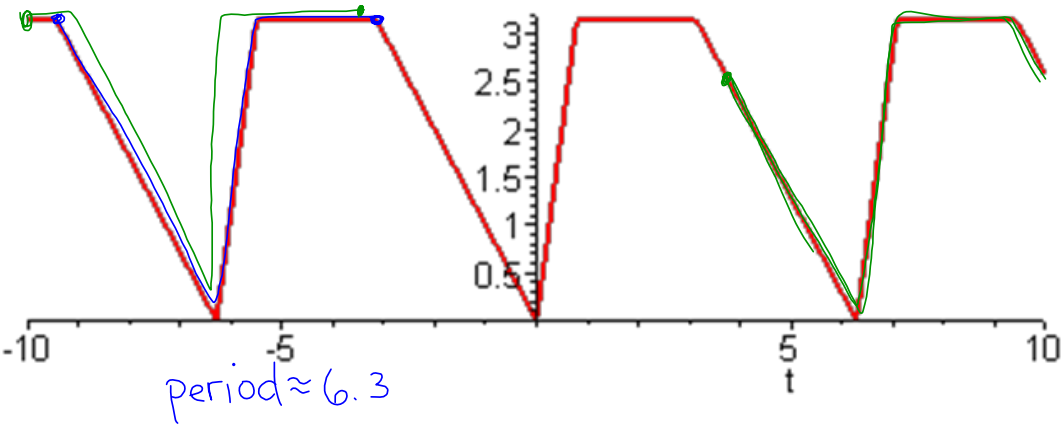


1.

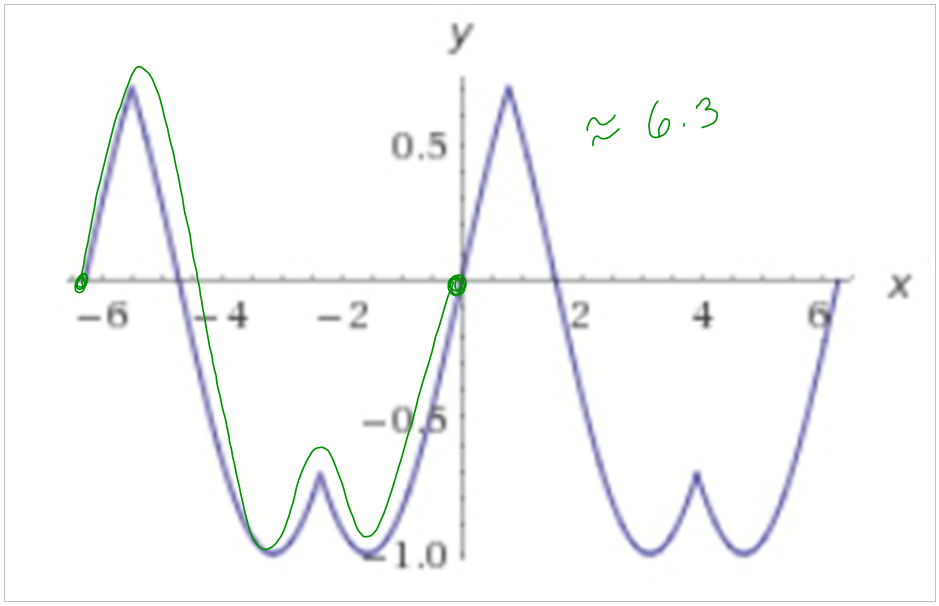
period 2π



2.



3.



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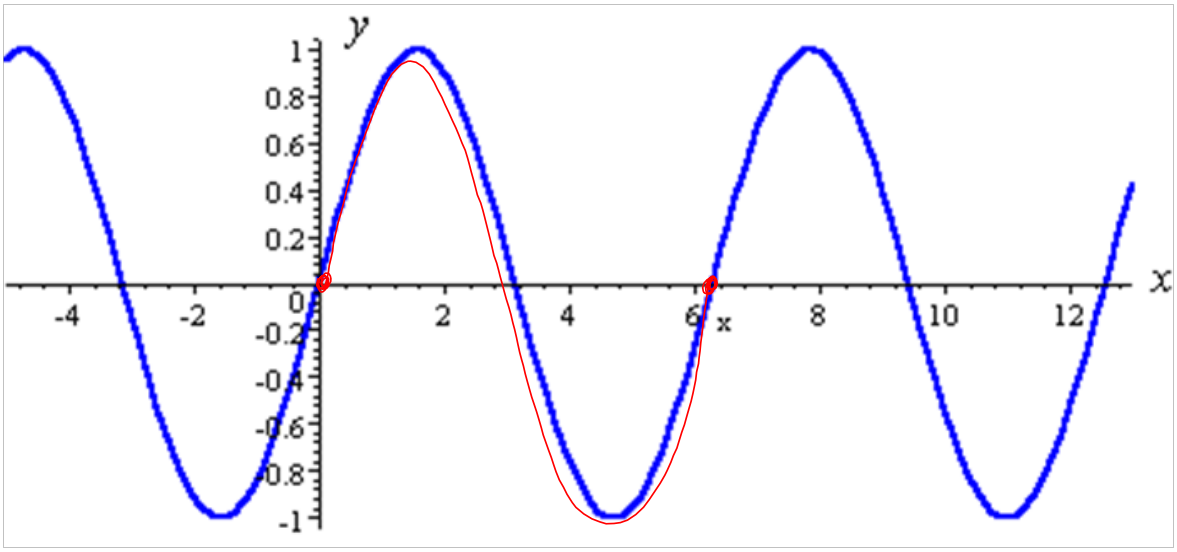
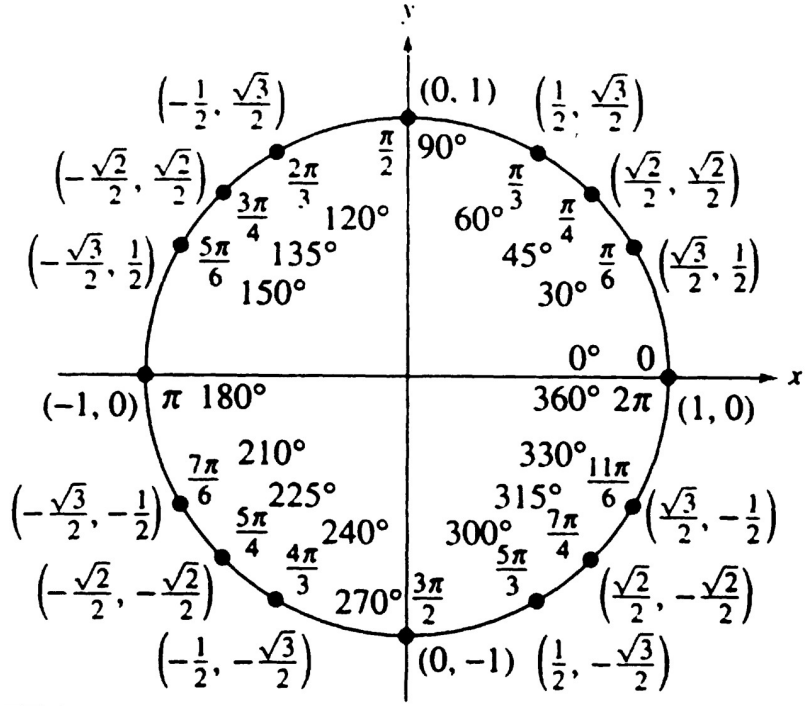
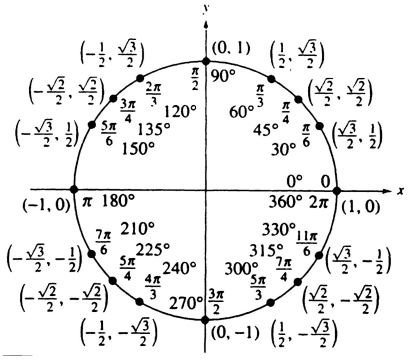


http://demonstrations.wolfram.com/IllustratingSineWithTheUnitCircle/

http://demonstrations.wolfram.com/SineCosineTangentAndTheUnitCircle/


y
x
(0, 1)
$\left(\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$
$\left(\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2}\right)$
$\left(\frac{\sqrt{3}}{2}, \frac{1}{2}\right)$
(1, 0)
$\left(\frac{\sqrt{3}}{2}, -\frac{1}{2}\right)$
$\left(\frac{\sqrt{2}}{2}, -\frac{\sqrt{2}}{2}\right)$
$\left(\frac{1}{2}, -\frac{\sqrt{3}}{2}\right)$
(0, −1)
$\left(-\frac{1}{2}, -\frac{\sqrt{3}}{2}\right)$
$\left(-\frac{\sqrt{2}}{2}, -\frac{\sqrt{2}}{2}\right)$
$\left(-\frac{\sqrt{3}}{2}, -\frac{1}{2}\right)$
(−1, 0)
$\left(-\frac{\sqrt{3}}{2}, \frac{1}{2}\right)$
$\left(-\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2}\right)$
$\left(-\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$
$\frac{\pi}{2}$ 90°
$\frac{\pi}{3}$ 60°
$\frac{\pi}{4}$ 45°
$\frac{\pi}{6}$ 30°
0° 0
360° 2π
330° $\frac{11\pi}{6}$
315° $\frac{7\pi}{4}$
300° $\frac{5\pi}{3}$
$\frac{3\pi}{2}$ 270°
$\frac{4\pi}{3}$ 240°
$\frac{5\pi}{4}$ 225°
$\frac{7\pi}{6}$ 210°
π 180°
$\frac{5\pi}{6}$ 150°
$\frac{3\pi}{4}$ 135°
$\frac{2\pi}{3}$ 120°


y
x
(0, 1)
$\left(\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$
$\left(\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2}\right)$
$\left(\frac{\sqrt{3}}{2}, \frac{1}{2}\right)$
(1, 0)
$\left(-\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$
$\left(-\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2}\right)$
$\left(-\frac{\sqrt{3}}{2}, \frac{1}{2}\right)$
(−1, 0)
$\left(-\frac{\sqrt{3}}{2}, -\frac{1}{2}\right)$
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$\left(-\frac{1}{2}, -\frac{\sqrt{3}}{2}\right)$
(0, −1)
$\left(\frac{1}{2}, -\frac{\sqrt{3}}{2}\right)$
$\left(\frac{\sqrt{2}}{2}, -\frac{\sqrt{2}}{2}\right)$
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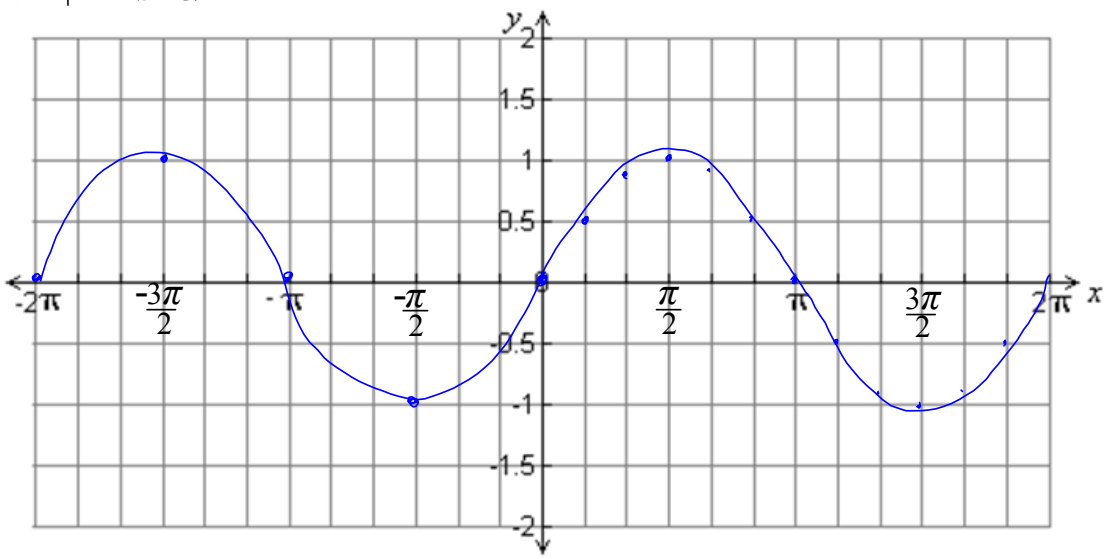
$\frac{5\pi}{6}$ 150°
π 180°
$\frac{7\pi}{6}$ 210°
$\frac{5\pi}{4}$ 225°
$\frac{4\pi}{3}$ 240°
$\frac{3\pi}{2}$ 270°
$\frac{5\pi}{3}$ 300°
$\frac{7\pi}{4}$ 315°
$\frac{11\pi}{6}$ 330°

$$y = \sin\theta$$


y
x
2
1.5
1
0.5
-0.5
-1
-1.5
-2
-2π
$-\frac{3\pi}{2}$
$-\pi$
$-\frac{\pi}{2}$
$\frac{\pi}{2}$
π
$\frac{3\pi}{2}$
2π

Study the graph to answer the following questions:

What is the period? 2π

What is the domain? $(-\infty, \infty)$ $\mathbb{R}$

What is the range? $[-1, 1]$

What is the y-intercept? $(0, 0)$

Where do the x-intercepts occur?

$-2\pi, -\pi, 0, \pi, 2\pi, 3\pi$ $(n\pi, 0)$

n is an integer

What are the maximum values and where do they occur?

$-\frac{3\pi}{2}, \frac{\pi}{2}, \frac{5\pi}{2}$ $\left(\frac{\pi}{2} + 2\pi n, 0\right)$ n is integers

What are the minimum values and where do they occur?

$\left(-\frac{\pi}{2} + 2\pi n, 0\right)$

<u>Notation Note</u>: I've been using $f(\theta) = \sin\theta$ to avoid confusion with various x-values, but you will more commonly see:

$$f(x) = \sin x$$

$$f(t) = \sin t$$

$$f(x) = \sin(x)$$

$$f(t) = \sin(t)$$

It's all the same folks!
Just be sure to label
your axis accordingly!

Make a conjecture!

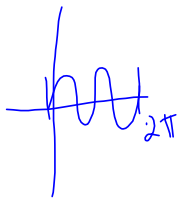
Using your hitherto awesome graphing skills, make a quick guess about the effect the number 2 will have on the graph of each sinusoid.

a. $f(x) = 2\sin x$ amplitude

b. $f(x) = \sin x + 2$ up 2

c. $f(x) = \sin(x - 2)$ right 2 phase shift

d. $f(x) = \sin(2x)$



- https://www.desmos.com/calculator/rcv1racftd
- https://www.desmos.com/calculator/rgpocrfjqz

How does h change the graph?

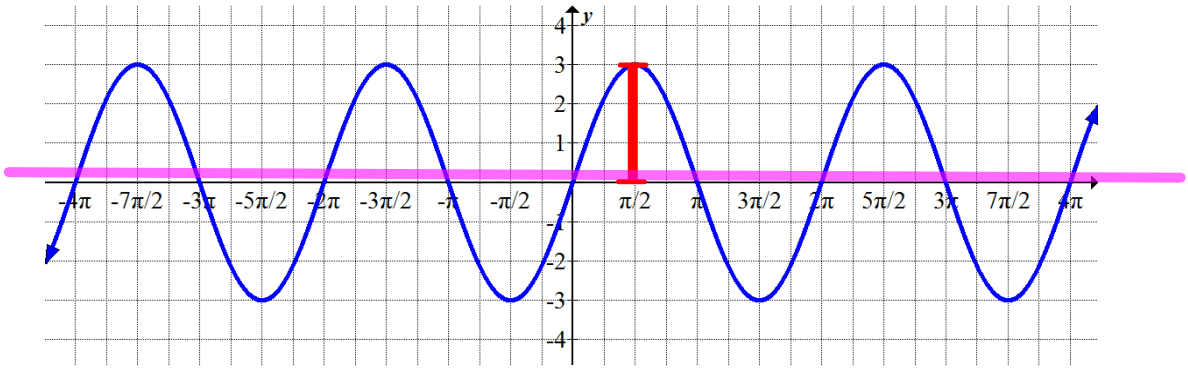
- How does b change the sinusoid?

The <u>Amplitude</u> of the function is |a|.

positive #

distance midline

$$f(x) = 3\sin x$$



Find the period, amplitude, phase shift and vertical translation.

1. $y = 2\sin\theta$

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

2. $y = -3\sin x$

amp: 3
reflect over x-axis
period: 2π

3. $y = 3\sin\theta + 4$

amp: 3
p: 2π
up 4

4. $y = -5\sin x - 7$

amp: 5
reflects over x-axis
p: 2π
down 7

5. $y = \frac{3}{4}\sin(\theta - \pi/2)$

amp: $3/4$
p: 2π
right $\pi/2$

6. $y = 4\sin(x + \pi/6)$

amp: 4
p: 2π
left $\pi/6$

7. $y = \sin 2(\theta + \pi/2) - 6$

amp: 1
p: $\frac{2\pi}{2} = \pi$
Left $\pi/2$
down 6

8. $y = \sin(2\theta + \pi/2) - 6$

amp: 1
p: $\frac{2\pi}{2} = \pi$
Left $\frac{\pi}{4}$

$2\theta + \frac{\pi}{2} = 0$

$\frac{2\theta}{2} = \frac{-\pi}{2 \cdot 2}$ $\theta = -\frac{\pi}{4}$

9. $y = -4\sin 4(\theta - \pi)$

amp: 4
reflect over x-axis
p: $\frac{2\pi}{4} = \frac{\pi}{2}$
Right π

10. $y = -4\sin(4\theta - \pi)$

Right $\frac{\pi}{4}$

$y = a\sin b(\theta - h) + k$ or $y = a\sin(b\theta - h) + k$

$|a|$: amplitude

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

$\frac{1}{P} \Rightarrow$ Frequency

h : the horizontal phase shift

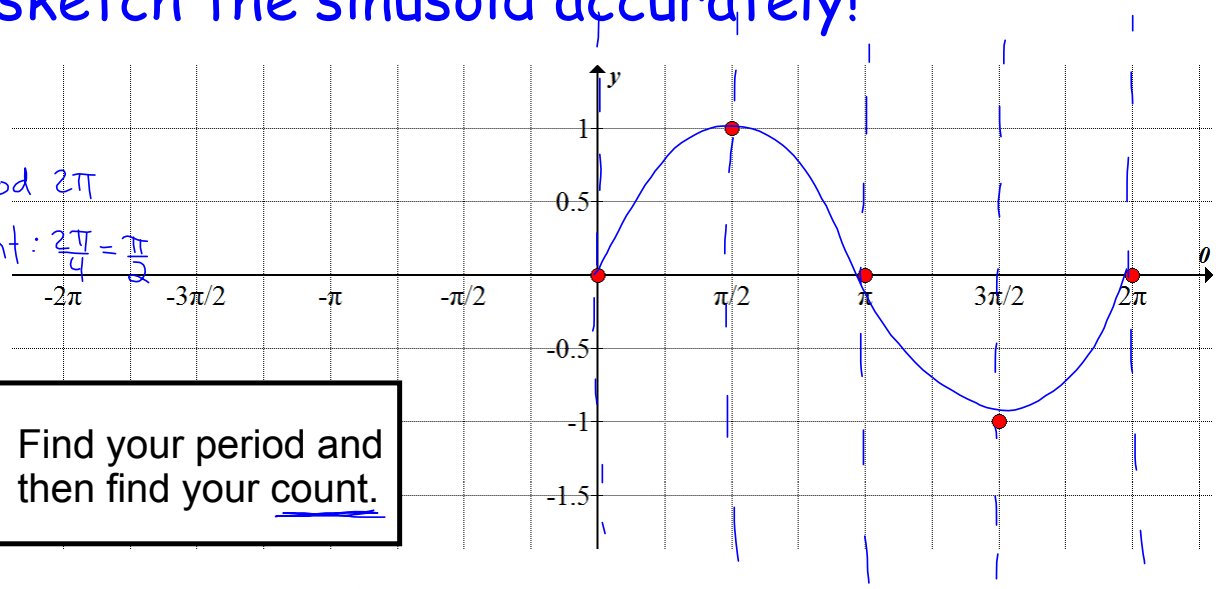
(solve the parentheses for θ)

k : vertical translation

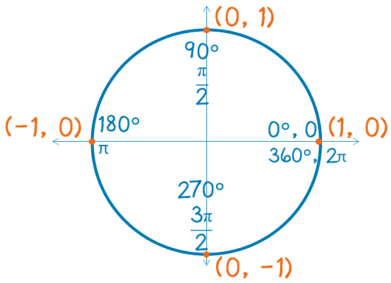
Use this five point pattern to help you sketch the sinusoid accurately!

period 2π

count: $\frac{2\pi}{4} = \frac{\pi}{2}$



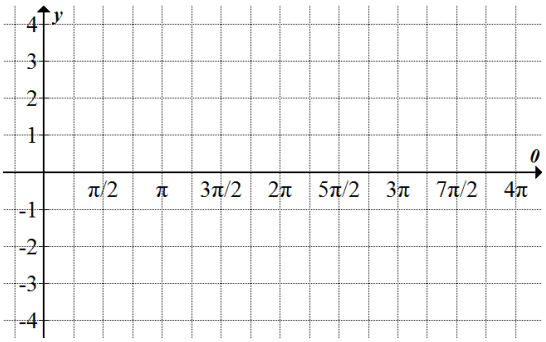
Find your period and then find your count.



The five points come from the intercepts of the unit circle!

Let's try it! Sketch the function (2 periods please).

$$f(x) = 3\sin x$$



amplitude:

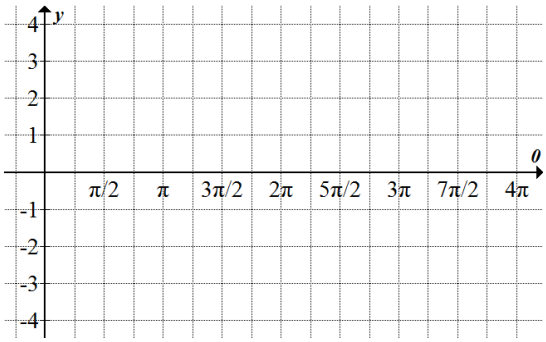
period:

count:

domain:

range:

$$f(x) = -2\sin x$$



amplitude:

period:

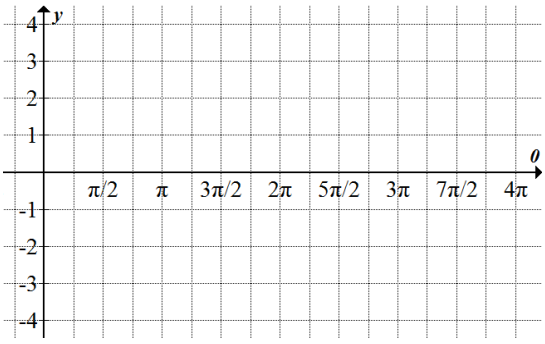
count:

domain:

range:

Sketch the function (Number of periods as appropriate).

$$f(x) = \sin 4x$$



Period:

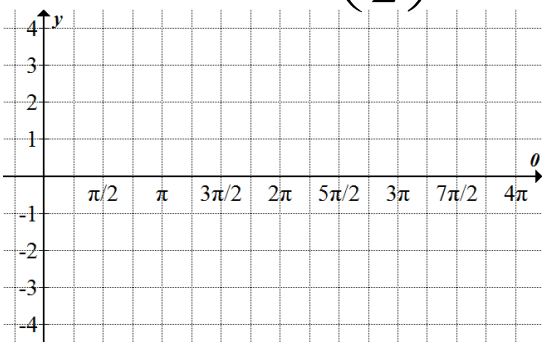
count:

amplitude:

domain:

range:

$$f(x) = \sin\left(\frac{1x}{2}\right)$$ $\sin \frac{1}{2}x$



Period: $\frac{2\pi}{\frac{1}{2}} = 4\pi$

count:

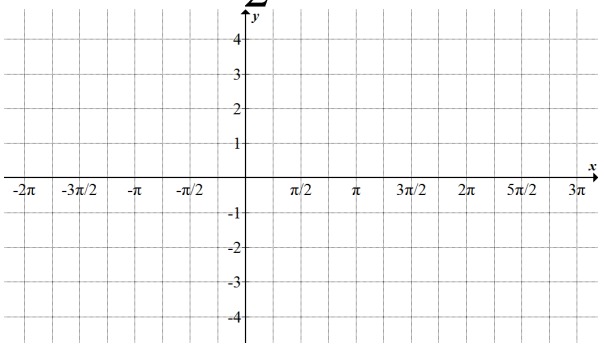
amplitude:

domain:

range:

Can you put it all together?

$$f(x) = \frac{1}{2}\sin 2x$$



amplitude:

period:

count:

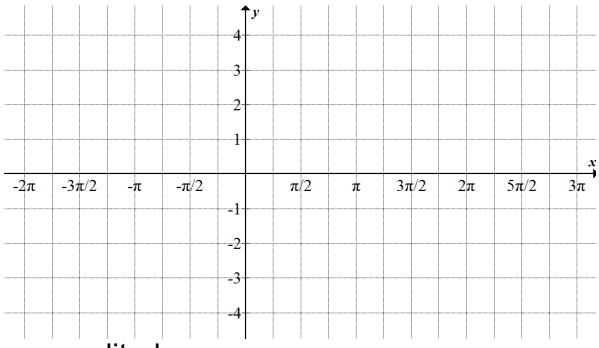
phase shift (L/R):

vertical shift:

domain:

range:

$$g(x) = 2\sin\left(x - \frac{3\pi}{4}\right)$$



amplitude:

period:

count:

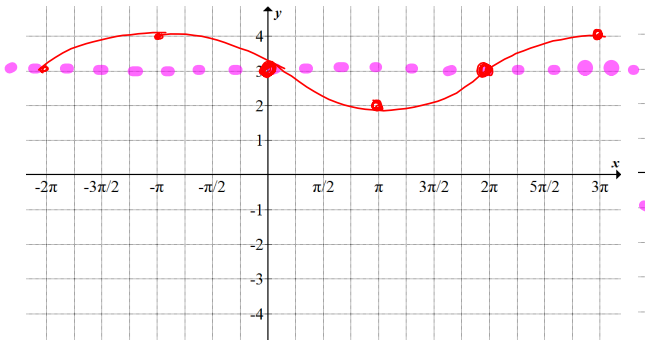
phase shift (L/R):

vertical shift:

domain:

range:

$$h(x) = -\sin\left(\frac{1}{2}x\right) + 3$$



amplitude: 1

period: $\frac{2\pi}{1/2}$ $2\pi \cdot \frac{2}{1} = 4\pi$

count: π

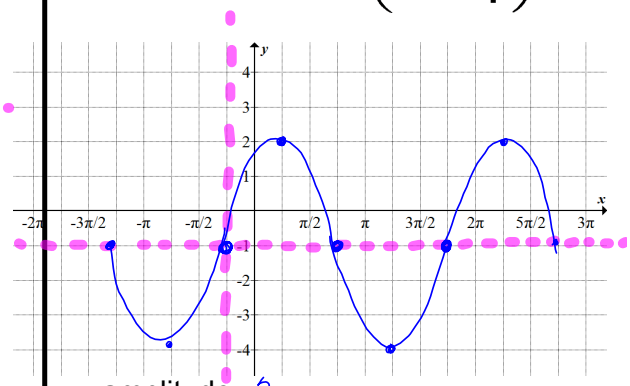
phase shift (L/R): None

vertical shift: up 3

domain: $\mathbb{R}$

range: [2, 4]

$$j(x) = 3\sin\left(x + \frac{\pi}{4}\right) - 1$$



amplitude: 3

period: 2π

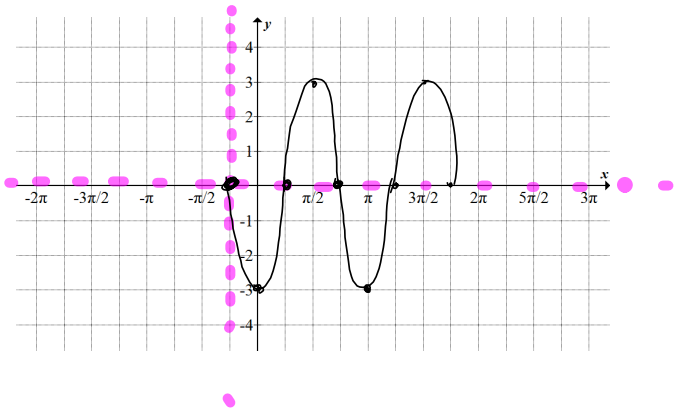
count: $\frac{2\pi}{4} = \frac{\pi}{2}$

phase shift (L/R): Left $\pi/4$

vertical shift: down 1

domain: $\mathbb{R}$

range: [-4, 2]



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

Amp: 3

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

count: $\frac{\pi}{4}$

Left: $\frac{\pi}{4}$