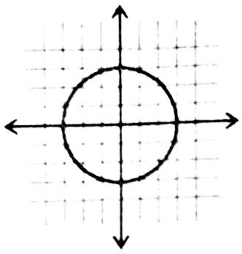
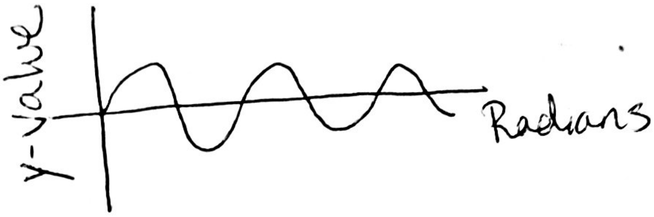
10.1: Graphing Sine

Let's take a look back at the unit circle. When you were asked for the sine of an angle, this meant that you were supposed to find the y coordinate. Let's see what would happen if you were to approach the unit circle from a linear perspective.



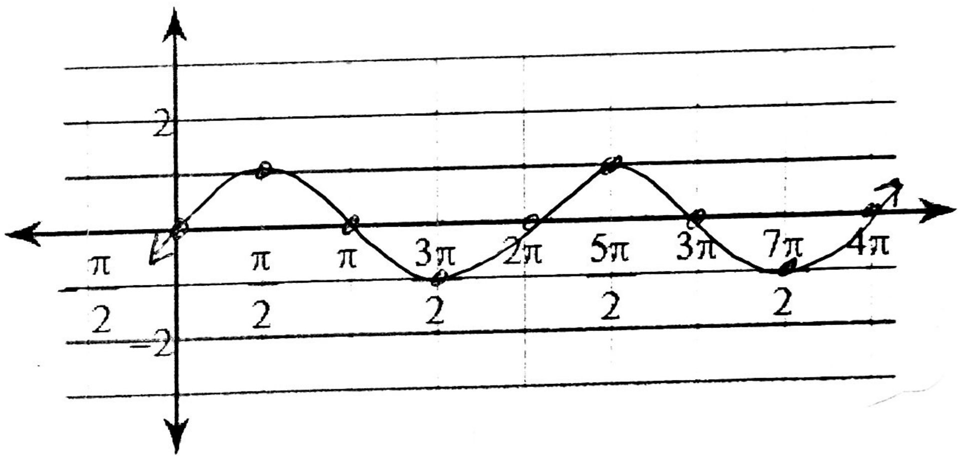


What does the graph of sine represent?

The y-values of the unit circle

You can graph the sine function in radians or degrees. We will be using radians unless degrees are specified. For each and every point along the unit circle, the radian measure of the arc has a corresponding sine value. Use the unit circle to fill out the θ, y chart and graph it below

θ	y
0	0
$\frac{\pi}{2}$	1
π	0
$\frac{3\pi}{2}$	-1
2π	0
$\frac{5\pi}{2}$	1
3π	0
$\frac{7\pi}{2}$	-1
4π	0



What patterns do you notice about the graph of sine?

Snake shape - repeated pattern
Stays between 1 & -1

If you wanted to graph a sine function quickly, what would you do?

0, 1, 0, -1 . . .

How many radians was one complete sine cycle? Why is that?

2π, that's a full rotation of a circle

What is the domain and range of $y = \sin\theta$? What makes the range the way that it is? (connect it back to the unit circle)

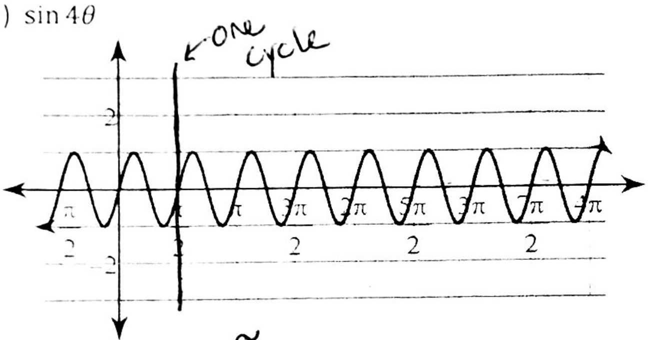
D: $(-\infty, \infty)$
R: $[-1, 1]$ - radius of unit circle is 1

$$y = a(\sin b\theta)$$

Term	Definition
Period $\left(\frac{2\pi}{b}\right)$	How many radians it takes to complete one cycle
Frequency (b)	How many cycles there are between 0 & 2π
Midline	Line halfway between max & min
Amplitude (a)	Distance from midline to max/min

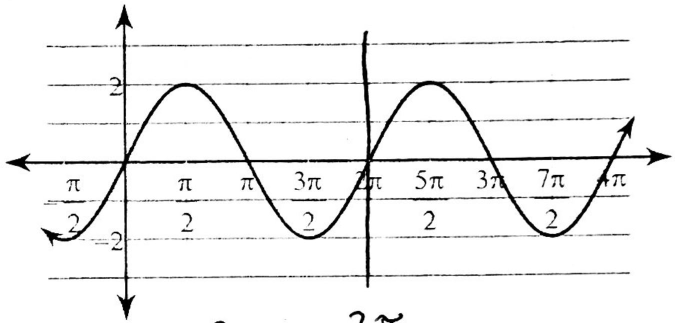
1) Find the period and amplitude of each sine function.

a) $\sin 4\theta$



$a = 1$ $\quad p = \frac{\pi}{2}$

b) $2\sin\theta$



$a = 2$ $\quad p = 2\pi$

c) $\sin 3\theta$

$a = 1$ $\quad p = \frac{2\pi}{3}$

$b = 3$

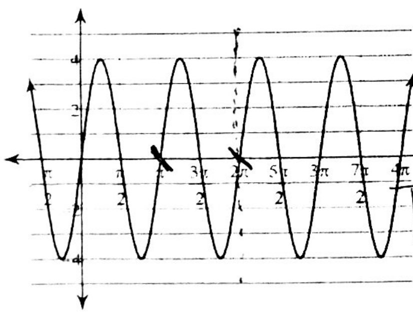
d) $5\sin 6\theta$

$a = 5$ $\quad p = \frac{2\pi}{6} = \frac{\pi}{3}$

$b = 6$

2) Write the equation of each sine curve.

a)



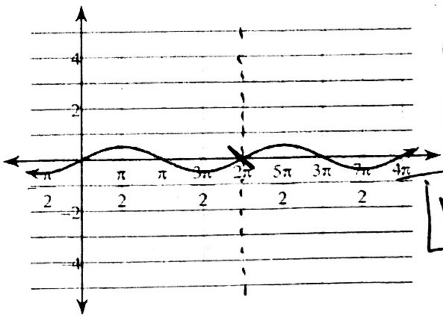
$a = 4$

$b = 2$

(2 cycles by 2π)

$\boxed{y = 4\sin 2\theta}$

b)

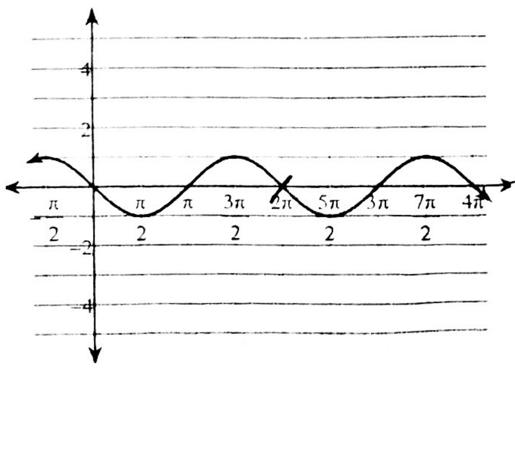


$a = \frac{1}{2}$

$b = 1$

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

c)



$a = -1$

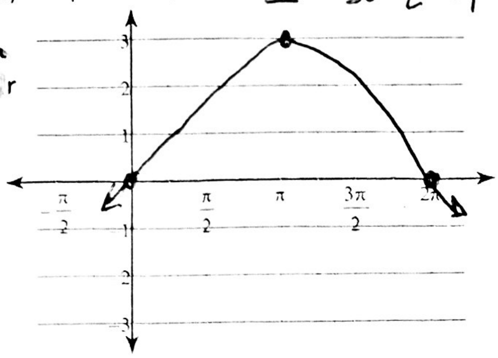
$b = 1$

$\boxed{y = -\sin\theta}$

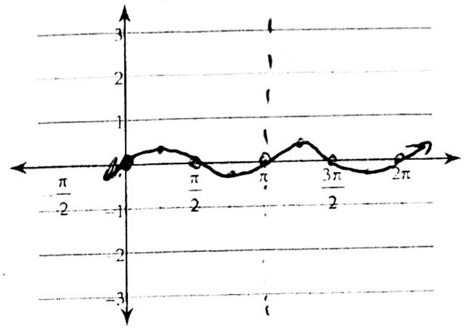
Cycle: 0 - max - 0 - min - 0

3) Sketch one cycle for each sine curve. Then write an equation for the function.

a) Amplitude 3, Period 4π so $\frac{1}{2}$ cycle at 2π



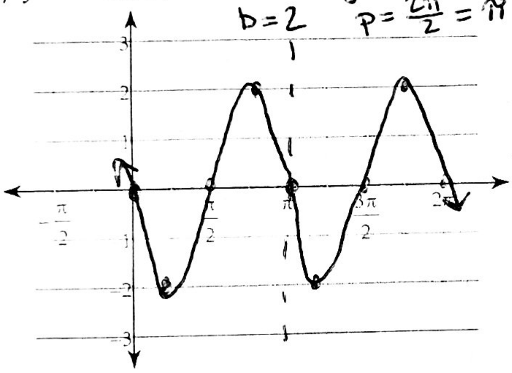
b) Amplitude $\frac{1}{3}$, Period: π



c) $y = -\sin 2\theta$

$a = -1$ (go down)

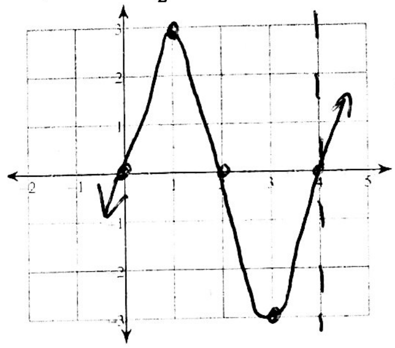
$b = 2 \quad p = \frac{2\pi}{2} = \pi$



d) $y = 3\sin\frac{\pi}{2}\theta$

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

$p = \frac{2\pi}{\frac{\pi}{2}} = 2\pi \cdot \frac{2}{\pi} = 4$



See if you can fill out the following diagram:

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

Reflection over x-axis (a<0)

Vertical stretch/compress (amplitude)

Horizontal stretch/compress (phase shift)

Horizontal Shift (phase shift)

Vertical Shift (midline)

4) Write a function given the following transformations.

a) The sine function that has been translated 2 units down and 5 units to the left, $\boxed{a<0}$ negative

$y = -\sin(\theta + 5) - 2$

b) The sine function that has an amplitude of 5, has a period of π, has been translated π units up and 3 units to the right, $\boxed{a>0}$ positive

$p = \pi \quad b = 2$

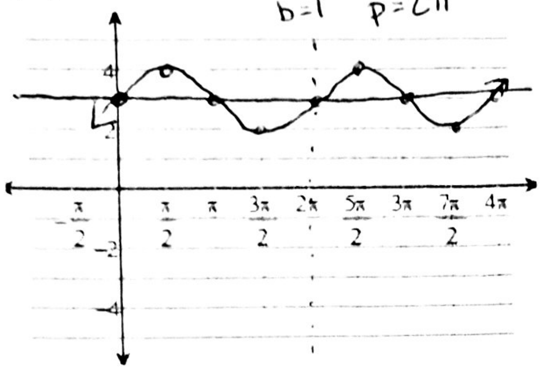
$\left(\frac{2\pi}{\pi} = 2\right)$

$y = 5\sin 2(\theta - 3) + \pi$

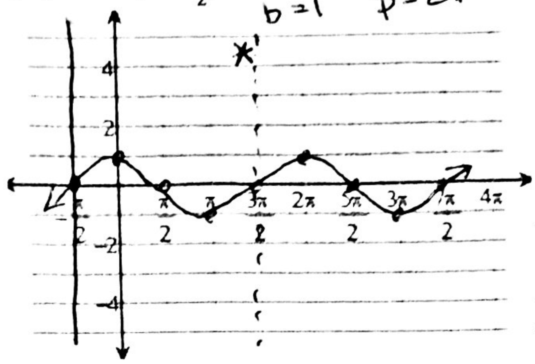
Draw new axes to represent horizontal/vertical shifts

5) Graph the following sine functions.

a) $y = \sin x + 3$ $a=1$ $b=1$ $p=2\pi$

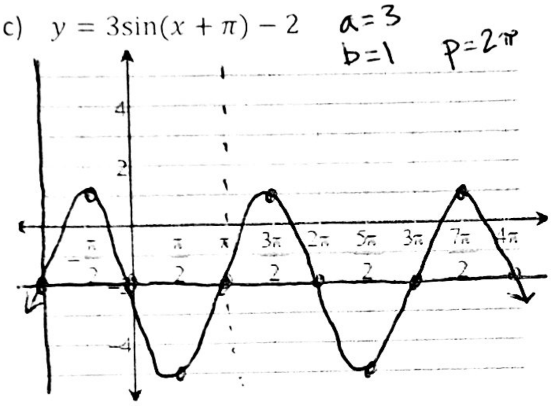


b) $y = \sin(x + \frac{\pi}{2})$ $a=1$ $b=1$ * $p=2\pi$

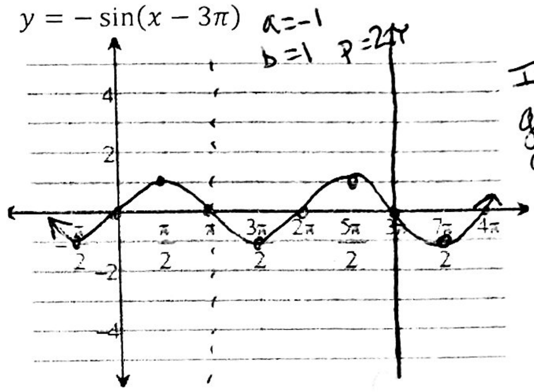


* Period is 2π, but since graph was shifted, end of period is also shifted

c) $y = 3\sin(x + \pi) - 2$ $a=3$ $b=1$ $p=2\pi$

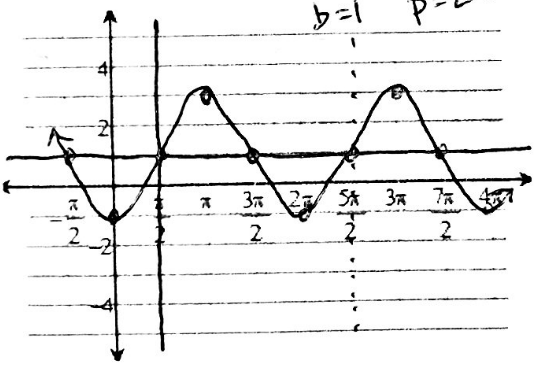


d) $y = -\sin(x - 3\pi)$ $a=-1$ $b=1$ $p=2\pi$

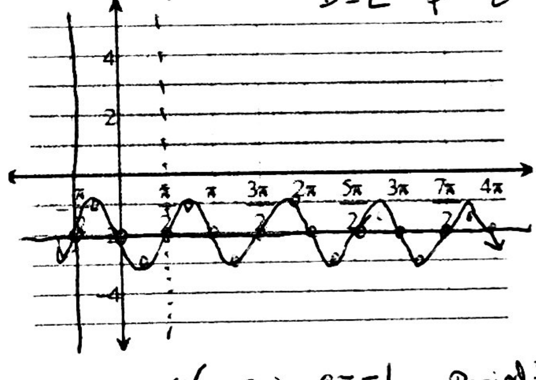


If you can't go forward, go backwards

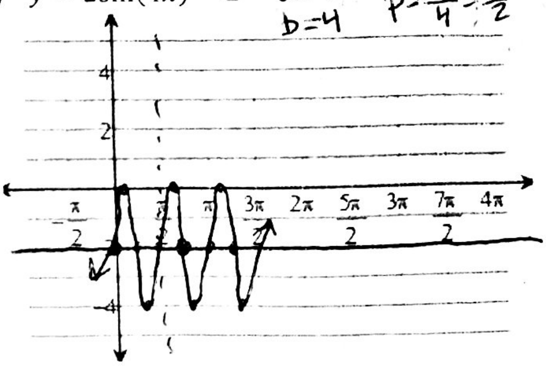
e) $y = 2\sin\left(x - \frac{\pi}{2}\right) + 1$ $a=2$ $b=1$ $p=2\pi$



f) $y = \sin(2(x + \frac{\pi}{2})) - 2$ $a=1$ $b=2$ $p=\frac{2\pi}{2}=\pi$



g) $y = 2\sin(4x) - 2$ $a=2$ $b=4$ $p=\frac{2\pi}{4}=\frac{\pi}{2}$



h) $y = -\sin(2(x - 2\pi))$ $a=-1$ $b=2$ Period $=\pi$