

Section 4.5

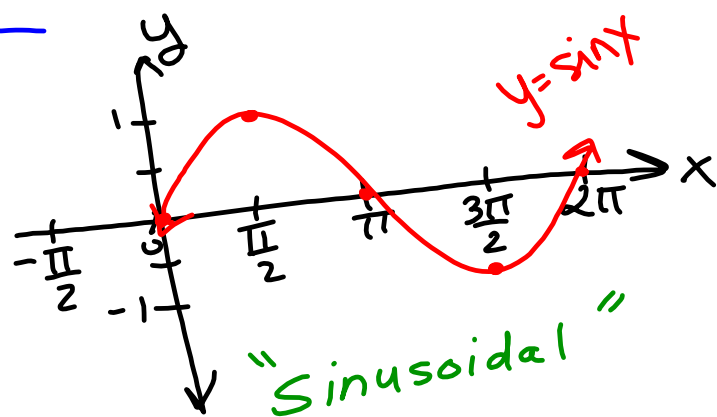
Graphs of Sine and Cosine Functions

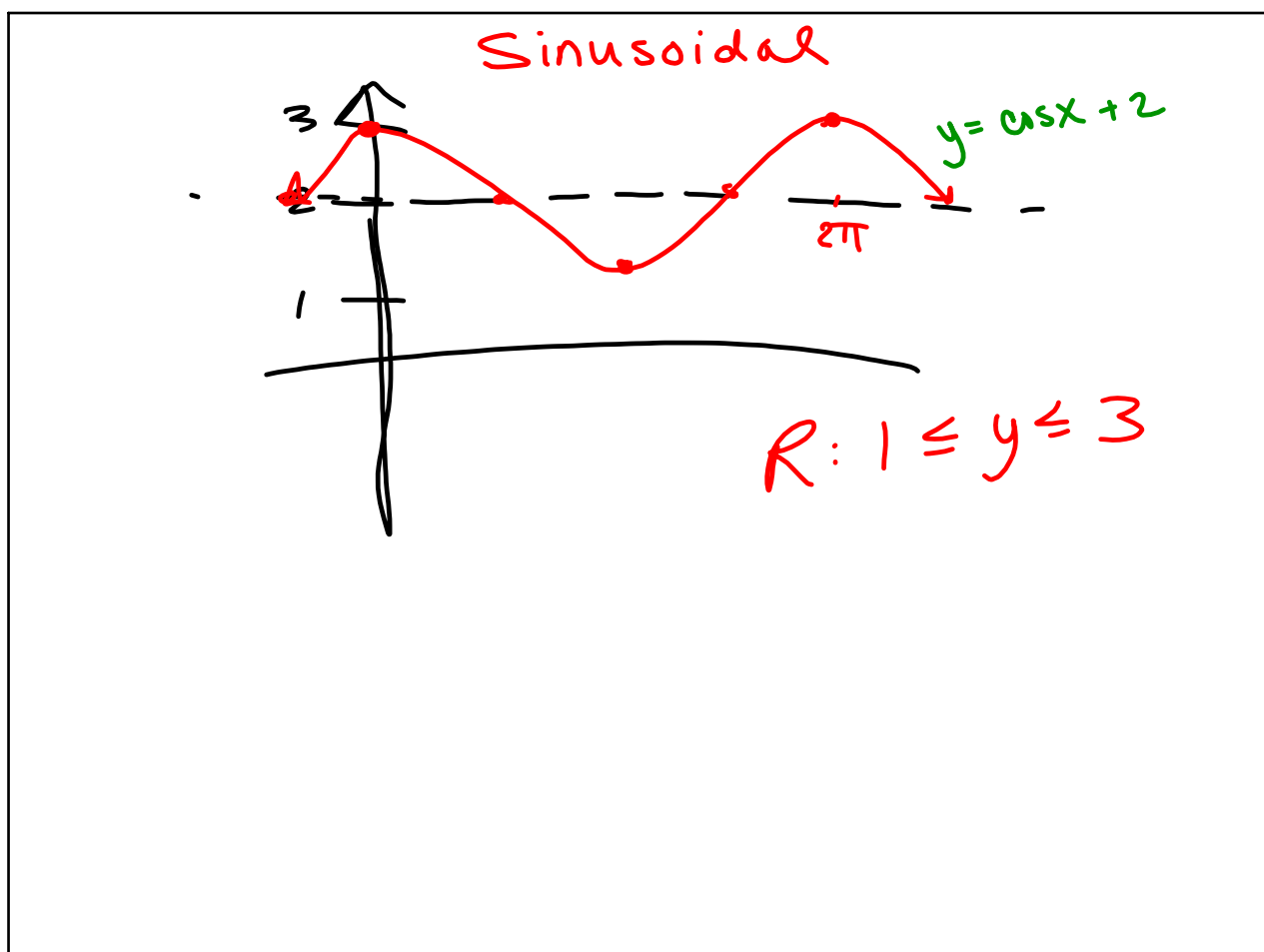
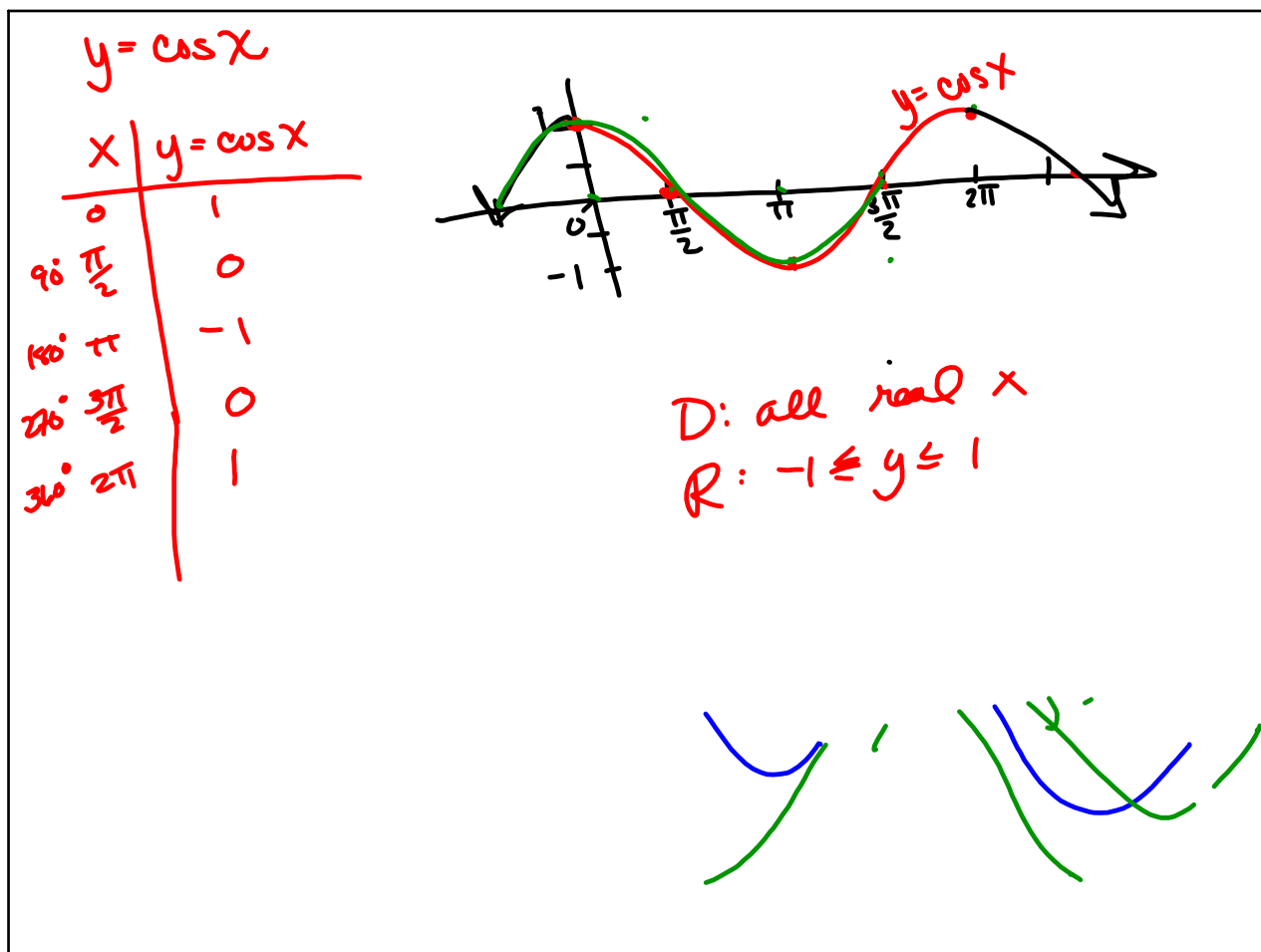
- You will sketch graphs of sine and cosine functions and graphs of translations of these functions.
- You will write equations using sine and cosine from the given graph

I. Basic Sine and Cosine Curves

$$y = \sin x$$

x	y = sin x
0	0
$\frac{\pi}{2}$ 90	1
π 180	0
$\frac{3\pi}{2}$ 270	-1
2π 360	0





EX1

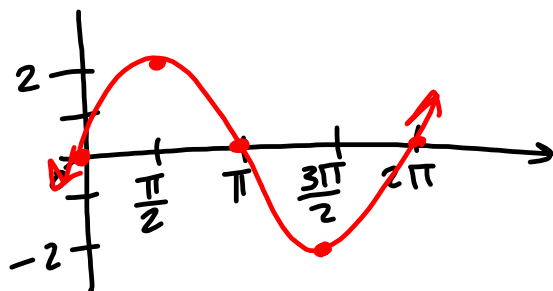
Sketch the graph of the following functions.



a. $y = 2 \sin x$

amp = 2

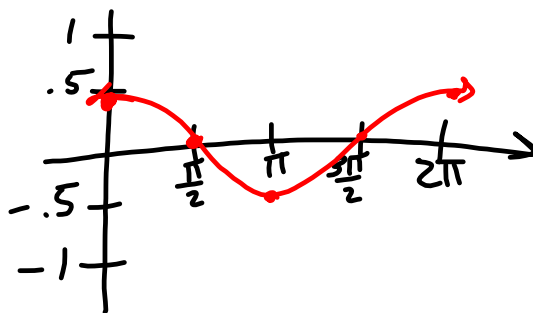
period = $\frac{2\pi}{1} = 2\pi$



b. $y = 0.4 \cos x$

amp = .4

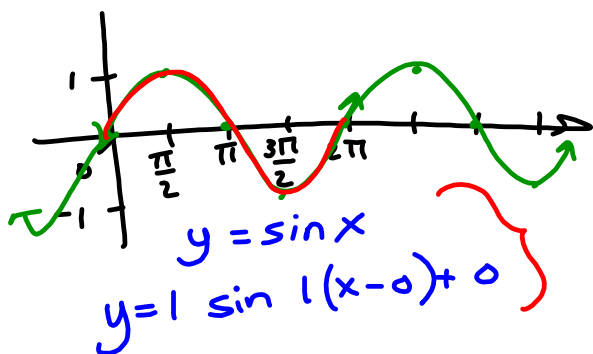
period = $\frac{2\pi}{1} = 2\pi$



II. Amplitude and Period of Sine and Cosine Curves

$$y = \underline{a} \sin b(x-c) + d$$

$$y = a \cos b(x-c) + d$$

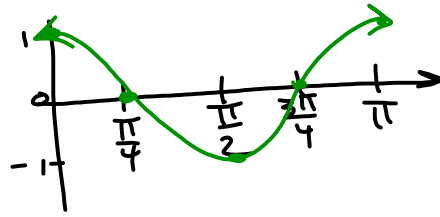
amplitude = $|a|$
(distance from midline)period = $\frac{2\pi}{b}$
(completes one cycle)shift = c
(horizontal, left or right)midline = d
(vertical shift, up or down)

EX2

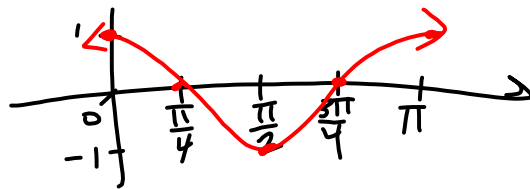
Sketch the graph of $y = \cos 2x$

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

amp = 1
period = π

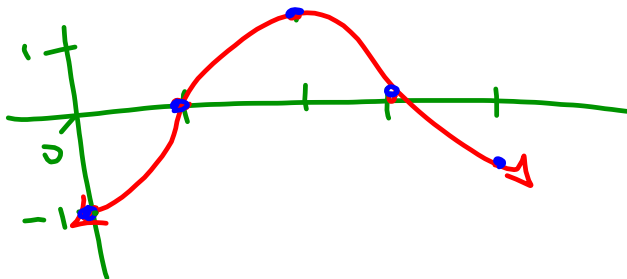


Graph 1 complete cycle
 $0 \leq x \leq \pi$



$$y = -\cos x$$

$$\text{amp} = 1$$

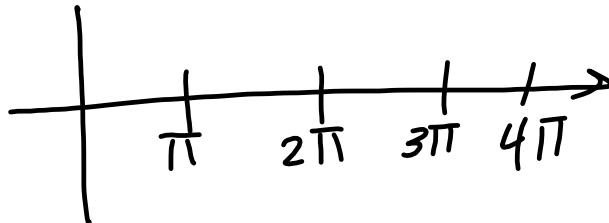


$$y = \sin \frac{\theta}{2} = \sin \frac{1}{2} \theta$$

$$a = 1$$

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

$$\text{period} = \frac{2\pi \left(\frac{2}{1}\right)}{\left(\frac{1}{2}\right) \left(\frac{2}{1}\right)} = 4\pi$$

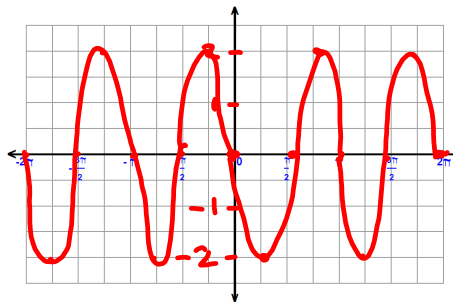


Warm Up

Sketch the graphs of $f(x)$ on the interval $-2\pi \leq x \leq 2\pi$

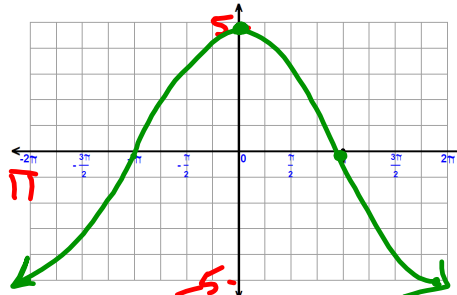
a) $f(x) = -2\sin 2x$

$a = -2$ amp = 2
 $b = 2$, period = $\frac{2\pi}{2} = \pi$



$5\cos \frac{1}{2}x$
 b) $f(x) = 5\cos \frac{x}{2}$

$a = 5$
 $b = \frac{1}{2}$ period = $\frac{2\pi}{\frac{1}{2}} = 4\pi$



III. Translations (shifts) of Sine & Cosine Curves

$$y = a \sin b(x - c) + d \quad y = a \cos b(x - c) + d$$

$|a|$ = amplitude

b = number of complete cycles in a 2π interval

c = horizontal shift (left or right c units)

d = vertical shift (midline)

$$y = 3 \sin(2x + \pi)$$

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

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

EX 3

Sketch the graph of the following on $-2\pi \leq x \leq 2\pi$

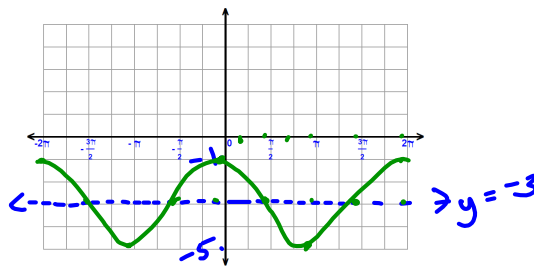
a) $y = 2 \cos x - 3$

$a = 2$ amplitude = 2

$b = 1$ period = 2π

$c = 0$ No p.s.

$d = -3$ midline = -3



b) $y = 1 + \sin 2x$

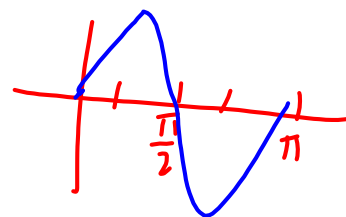
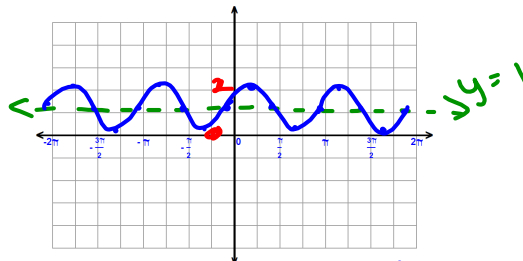
$y = \sin 2x + 1$

$a = 1$

$b = 2$ period = π

$c = 0$ No p.s.

$d = 1$ midline = 1



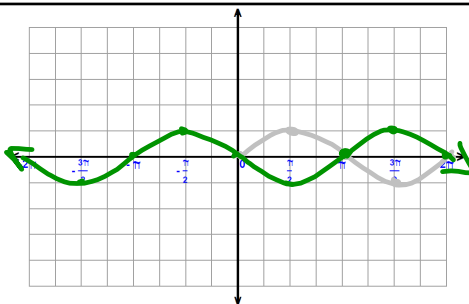
$$c) y = \sin(x - \pi)$$

$$a = 1$$

$$b = 1 \quad \text{period} = 2\pi$$

$$c = \pi \quad \text{ps} = \text{right } \pi$$

$$d = 0 \quad \text{midline} = 0$$



$$d) y = 2 + \cos(x + \pi)$$

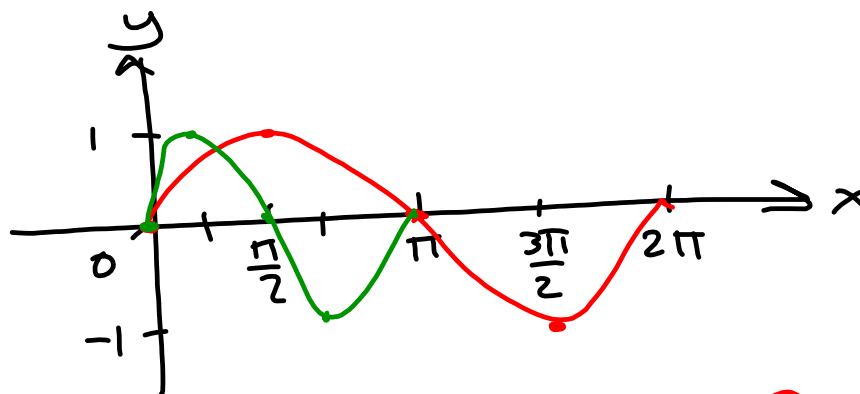
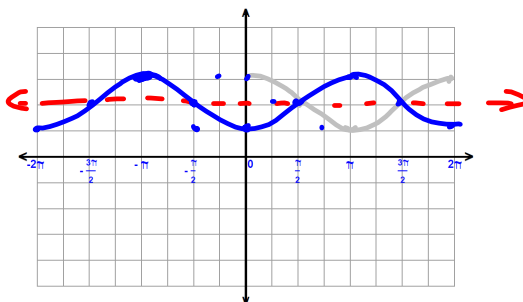
$$y = \cos(x + \pi) + 2$$

$$a = 1$$

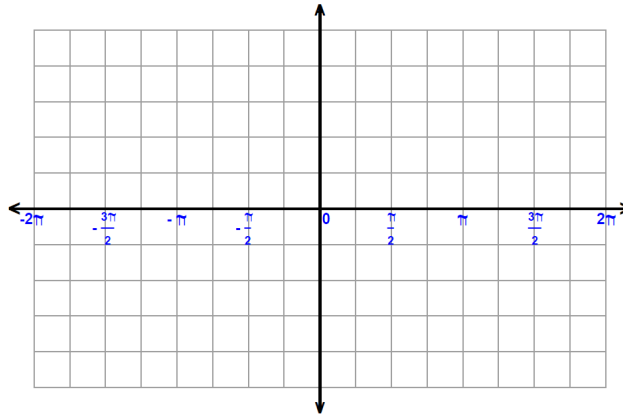
$$b = 1 \quad \text{period} = 2\pi$$

$$c = -\pi \quad \text{ps} = \text{left } \pi$$

$$d = 2 \quad \text{midline} = 2$$



e) $y = 2\sin(2x + \pi)$

**Practice**

With a partner graph the following functions on $-2\pi \leq x \leq 2\pi$

1. $f(x) = \cos x + 4$
2. $g(x) = -\sin\left(x - \frac{\pi}{2}\right)$
3. $h(x) = -1 - 3\cos(x + \pi)$