

Tuesday MAY 24, 2016  
 Lesson #17

Project Tuesday  
 June 7

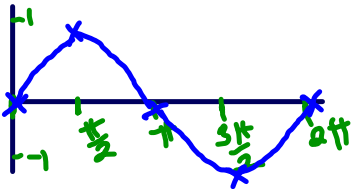
- Final Exam on Thursday June 2  
 - based on Test #1-#6 & HW  
 14, 15, 16, 17

- Folder Tuesday June 7  
 HW # 13-#20

Aim: What's an horizontal shift?

Do Now: graph each transformation from the parent function

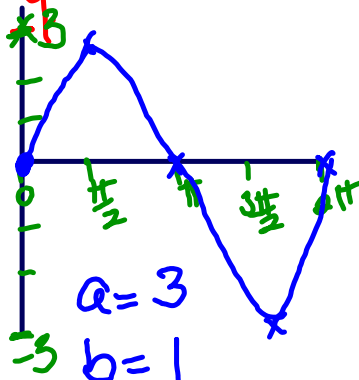
a)  $y = |\sin|x$



$a = 1$   
 $b = 1$

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

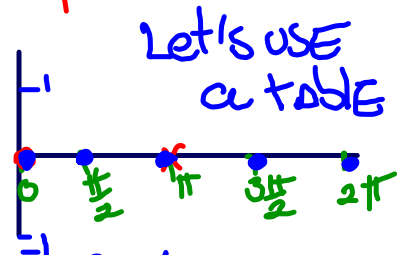
b)  $y = 3 \sin|x$



$a = 3$   
 $b = 1$

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

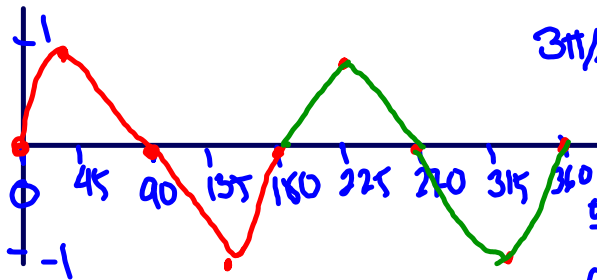
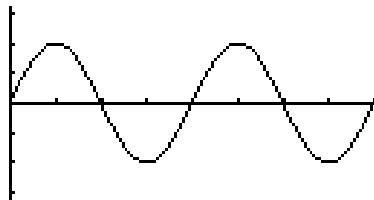
c)  $y = |\sin 2x$



$a = 1$   
 $b = 2$

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

$y = \sin 2x$



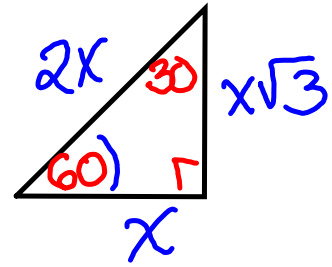
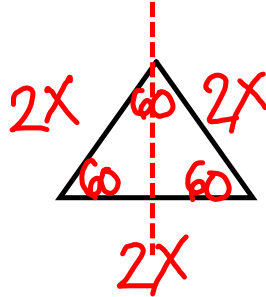
Table

<u>RADIANS</u>	$x$	$\sin 2x$	$y$
0	0	$\sin 2(0)$	0
$\pi/4$	45	$\sin 2(45)$	1
$2\pi/4$	90	$\sin 2(90)$	0
$3\pi/4$	135	$\sin 2(135)$	-1
$4\pi/4$	180	$\sin 2(180)$	0
$5\pi/4$	225	$\sin 2(225)$	1
$6\pi/4$	270	$\sin 2(270)$	0
$7\pi/4$	315	$\sin 2(315)$	-1
$8\pi/4$	360	$\sin 2(360)$	0



## II - Reference Angles (QI)

<u>II</u>	<u>I</u>
$180 - \theta$	$60 = \theta$
$180 + \theta$	$360 - \theta$
<u>III</u>	<u>IV</u>



$$\cos 60^\circ = \frac{\text{ADJ}}{\text{hyp}} = \frac{x}{2x} = \frac{1}{2} = 0.5$$

$$\sin 60^\circ = \frac{\text{OPP}}{\text{hyp}} = \frac{x\sqrt{3}}{2x} = \frac{\sqrt{3}}{2} \approx 0.86$$

Q

I  $\cos 60 = 0.5$

II  $\cos 120 = -0.5$

III  $\cos 240 = -0.5$

IV  $\cos 300 = 0.5$

I  $\sin 60 = \frac{\sqrt{3}}{2}$

II  $\sin 120 = \frac{\sqrt{3}}{2}$

III  $\sin 240 = -\frac{\sqrt{3}}{2}$

IV  $\sin 300 = -\frac{\sqrt{3}}{2}$



$\tan 60 = \sqrt{3}$

$\tan 120 = -\sqrt{3}$

$\tan 240 = +\sqrt{3}$

$\tan 300 = -\sqrt{3}$

### III - Transformations

1) Parent function

$$y = a \cos(bx + d) + c$$

where  $a = b = 1$   $\rightarrow$  ex  $y = \cos x$   
 $d = c = 0$

2)  $a \rightarrow$  Amplitude

$b \rightarrow$  frequency

$d \rightarrow$  horizontal shift (Left/Right)

- Right

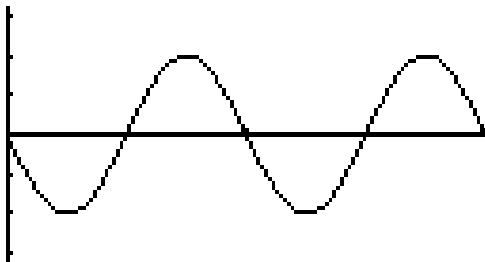
+ Left

$c \rightarrow$  vertical shift (up/down)

EXAMPLES

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

$y = \sin (2x + \pi)$   
 [ In the calculator



TO FIND

$a = 1$

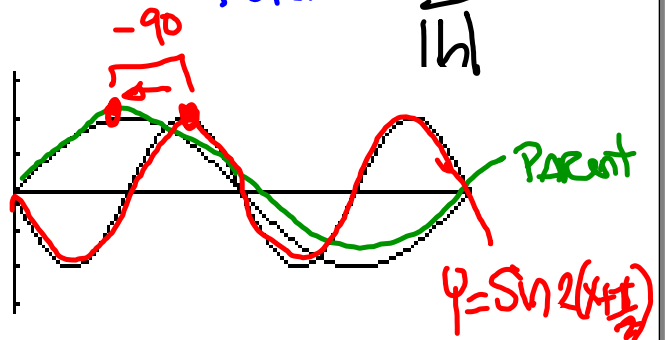
$b = 2$

$c = 0$

$d = \pi/2$

PHASE SHIFT  $-\frac{\pi}{2}$

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



Example 2

$$y = 3 \cos 2\left(x + \frac{\pi}{6}\right)$$

To find

$$a = 3$$

$$b = 2$$

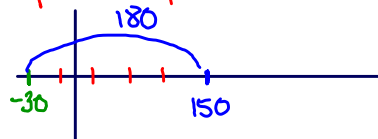
$$\text{PERIOD} = \pi \quad \frac{2\pi}{|b|} = \frac{2\pi}{2} = \pi$$

$$\text{PHASE SHIFT} = -\frac{\pi}{6} \text{ (OR } -30^\circ)$$

$$c = 0$$

Steps to Graph

1) Where does my graph begin?  
At the phase shift  $-30^\circ$



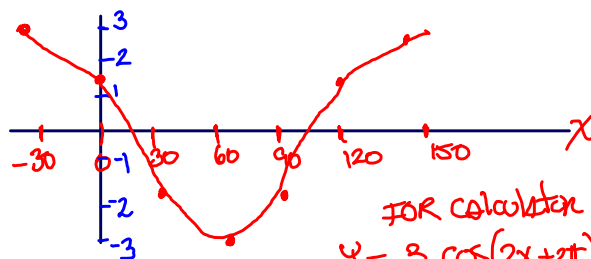
2) Where does my graph end?  
PERIOD + PHASE SHIFT

3) What are the appropriate steps?

$30^\circ$   
 $\boxed{-30}$ , 0, 30, 60, 90, 120,  $\boxed{150}$  step  
 begin

4) Amplitude =  $\left| \frac{a - (-a)}{2} \right|$   
 $a = 3$

$$y = 3 \cos\left(2\left(x + \frac{\pi}{6}\right)\right) \quad \left| \frac{3 - (-3)}{2} \right| = 3$$



FOR calculator  
 $y = 3 \cos\left(2x + \frac{\pi}{6}\right)$   
 OR  $y = 3 \cos(2x + 60)$