

## Graphing Using Transformations

### Graphing $y = A \sin Bx$

We use transformations of the parent graphs  $y = \sin x$  and  $y = \cos x$  to graph more different functions.

#### Vertical Stretch/Compression

$y = A \sin x$  and  $y = A \cos x$

- Vertical stretch ( $A > 1$ ), vertical compression ( $0 < A < 1$ )
- $A$  is the amplitude of the graph and its always positive (amplitude =  $|A|$ )

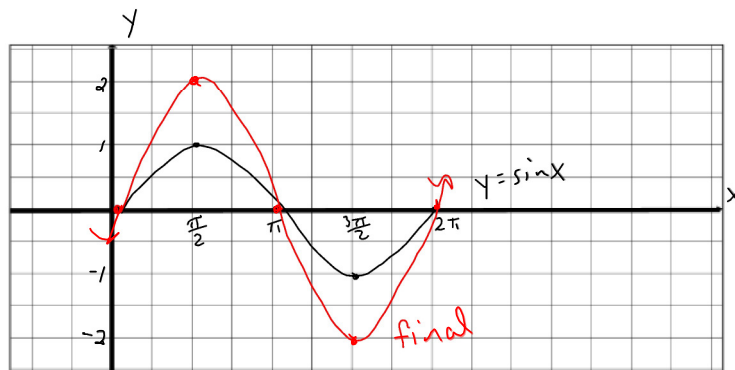
Ex.1.) Determine the amplitude of the graph of each function

a)  $y = \frac{2}{3} \sin x$   
 $\frac{2}{3}$

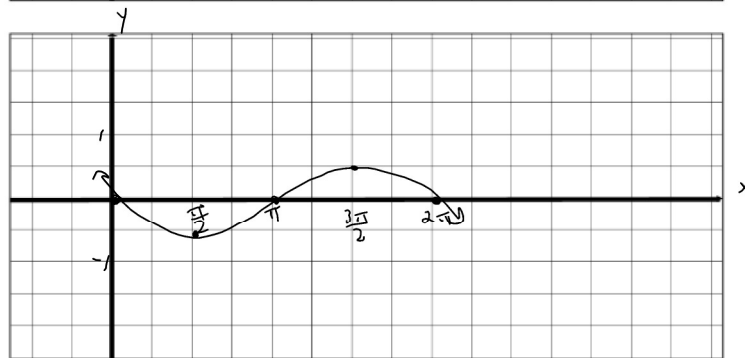
b)  $y = -4 \cos x$   
4

Ex. 2) Sketch the following functions.

a)  $y = 2 \sin x$   
↑  
mult y-coords  
by 2



b)  $y = -\frac{1}{2} \sin x$   
↑ reflects    ↓ compress



# Graphing $y = A \sin Bx$ . notebook

## Horizontal Stretch/Compression

$y = \sin Bx$  and  $y = \cos Bx$

- horizontal stretch ( $0 < B < 1$ ) by a factor of  $\frac{1}{|B|}$  (reciprocal)
- horizontal compression ( $B > 1$ ) by a factor of  $\frac{1}{|B|}$   
*sine, cosine stretch*
- B affects the period ( $p = \frac{2\pi}{B}$  or  $p = \frac{\pi}{B}$ )  
*tangent*

Ex. 3) Determine the period of each function

a)  $y = \cos 6x$

$$p = \frac{2\pi}{6} = \frac{\pi}{3}$$

b)  $y = \sin \frac{2}{3}x$

$$p = \frac{2\pi}{\frac{2}{3}} = 2\pi \cdot \frac{3}{2} = 3\pi$$

c)  $y = \tan \frac{x}{7}$

$$p = \frac{\pi}{\frac{1}{7}} = 7\pi$$

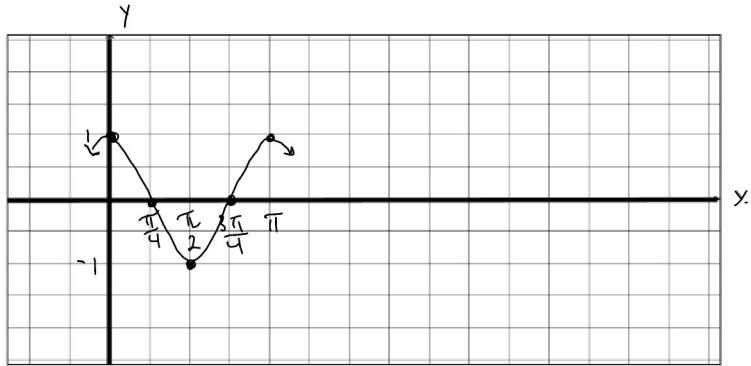
$$y = \tan\left(\frac{1}{7}x\right)$$

Ex. 4) Sketch the following functions.

a.)  $y = \cos 2x$

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

$\pi \div 4$   
scale  $\frac{\pi}{4}$

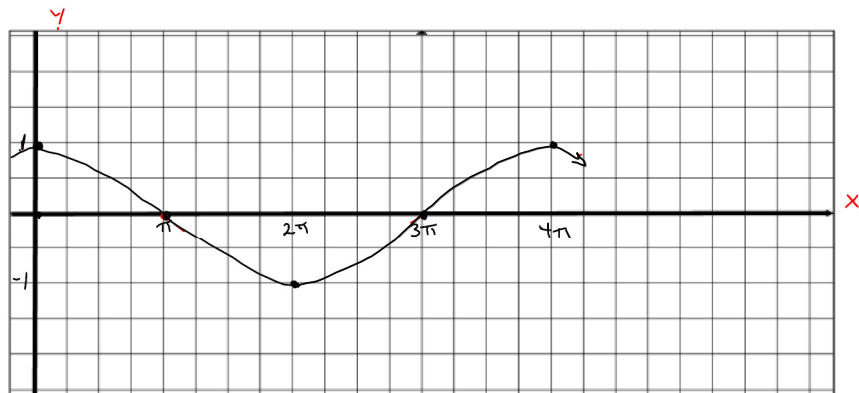


b.)  $y = \cos \frac{1}{2}x$

period =  $\frac{2\pi}{\frac{1}{2}} = 4\pi$

$4\pi \div 4 = \pi$

point every  $\pi$  units



max, median, min, median, max

# Graphing $y=AsinBx$ .notebook

## Graphing $y = A\sin B(x - C) + D$

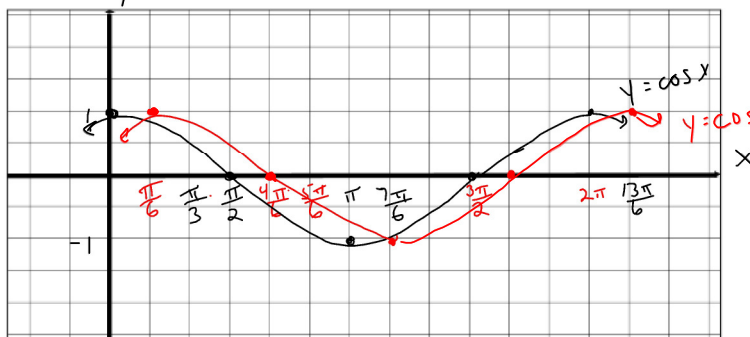
### Horizontal Translation

$y = \sin(x - C)$  and  $y = \cos(x - C)$

➤  $C$  is the phase shift (horizontal movement left or right)

Ex. 5) Determine the phase shift of  $y = \cos\left(x - \frac{\pi}{6}\right)$   
*phase shift  $\frac{\pi}{6}$  right*

Ex. 6) Graph  $y = \cos\left(x - \frac{\pi}{6}\right)$ .



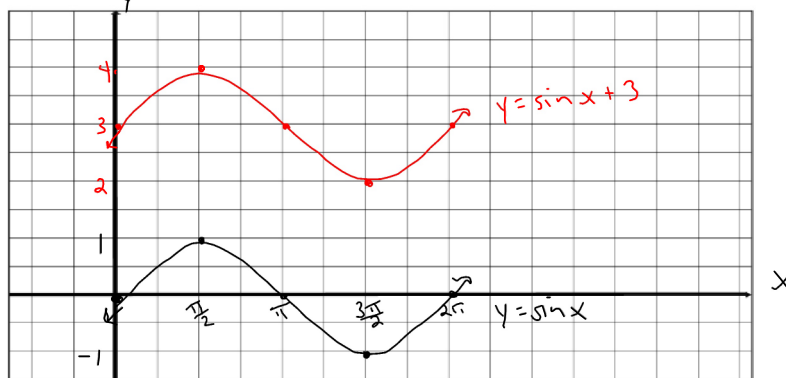
*Each square is  $\frac{\pi}{6}$  units  
 move one square to the  
 right*

### Vertical Translation

$y = \sin x + D$  and  $y = \cos x + D$

➤  $D$  is the displacement (movement up or down)

Ex. 7) Graph  $y = \sin x + 3$ .  
*up 3*



# Graphing $y=AsinBx$ .notebook

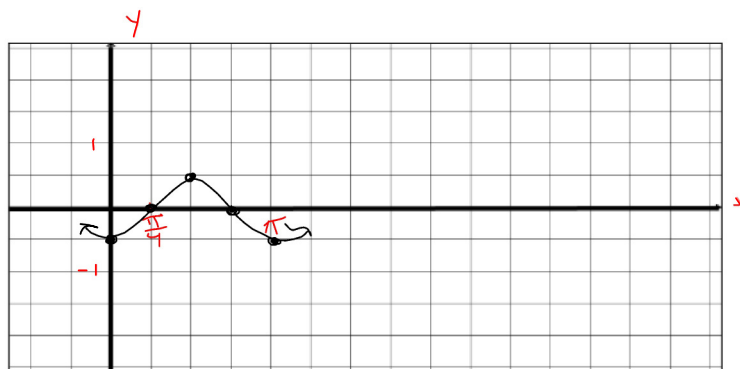
c)  $y = -\frac{1}{2} \cos 2x$

period =  $\frac{2\pi}{b}$     ↑    ↑

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

$\pi \div 4$

point every  $\frac{\pi}{4}$  units



min, med, max, med, min  
 $-\frac{1}{2}$     0     $\frac{1}{2}$     0     $-\frac{1}{2}$

pg 233  
 #4, 6, 8, 9  
 sketch 8a, c  
 9b, d

pg 250  
 #1a, b, 2b, 5  
 sketch