

We have looked at graphs of the form

$$f(t) = a \sin t + d$$

Where "a" measures the steepness of the graph  
 if  $a > 1$  it's a vertical stretch  
 if  $a < 1$  it's a vertical compression  
 by a factor of "a"

Where "d" shifts the graph up or down vertically by "d" units.

Now let's consider  $f(t) = a \sin bt + d$  where "b" will effect the period of the graph. Before "b" was 1 resulting in a period of  $2\pi$ .

By definition the period for sine and cosine is  $= \frac{2\pi}{|b|}$

The increments (sine: on, above, on, below, on OR cosine: above, on, below, on, above) on the x axis are found by taking the Period and dividing it into 4 increments. So now what you will do, is take  $\frac{2\pi}{|b|}$  and that number is going to be divided into 4 to find the increments..... for example:

Graph 2 full periods:

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

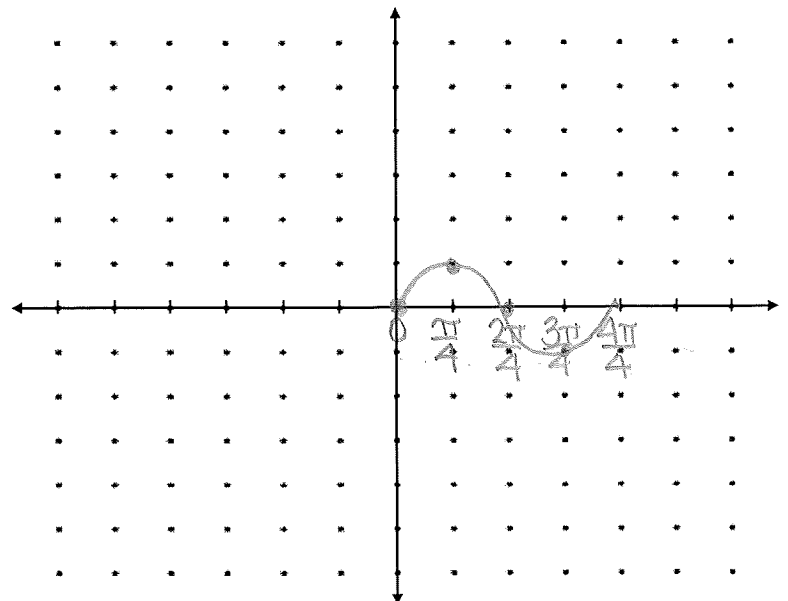
$f(t) = \sin 2t$        $b = 2$

Amplitude: 1

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

Increments:  $\frac{\pi}{4} \leftarrow$  x axis

V. Shift: —



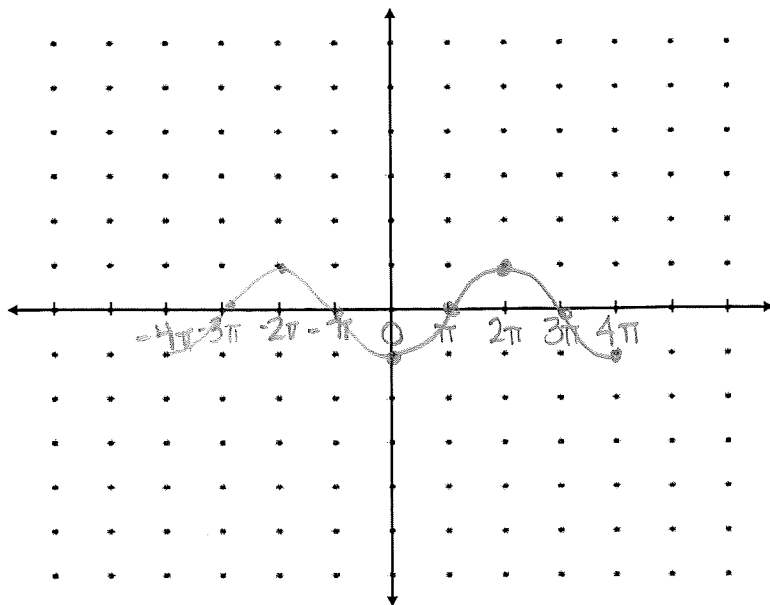
Graph  $f(t) = -\cos \frac{1}{2}t$   $b = \frac{1}{2}$

Amplitude: 1

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

Increments:  $\frac{4\pi}{4} = \pi$

V. Shift: —



**When  $b > 1$ , you will have a horizontal compression by a factor of  $1/b$ .**  
**When  $b < 1$ , you will have a horizontal stretch by a factor of  $1/b$ .**

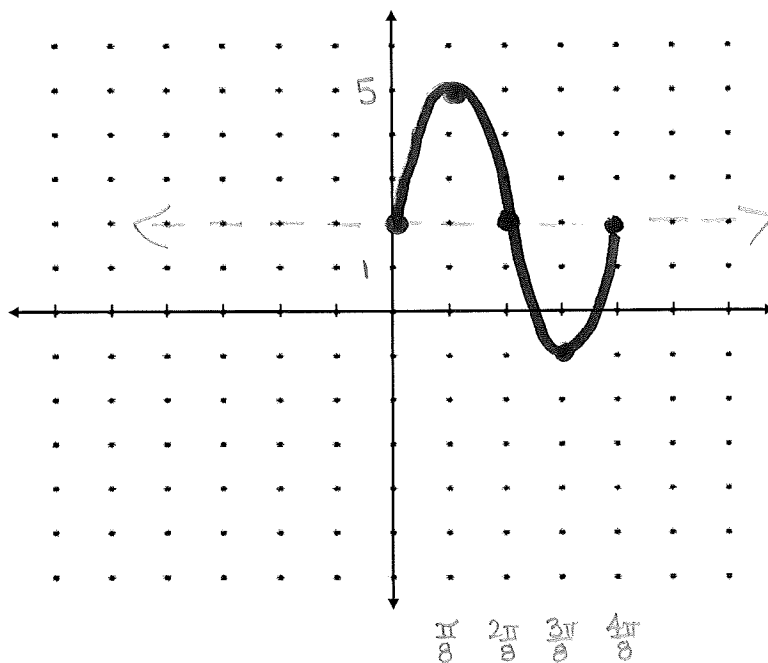
Graph  $f(t) = 3 \sin 4t + 2$

Amplitude: 3

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

Increments:  $\frac{\pi}{2} \cdot \frac{1}{4} = \frac{\pi}{8}$

V. Shift: 2 up



Example: Write an equation for a sine function with the given information:

Amplitude of  $\frac{1}{2}$ , and period is  $\frac{\pi}{2}$  and shifted 3 units down.

$f(t) = a \sin bt + d$

$f(t) = \frac{1}{2} \sin \frac{1}{4}t - 3$

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

~~$\pi b = 4\pi$~~   
 ~~$b = 4$~~

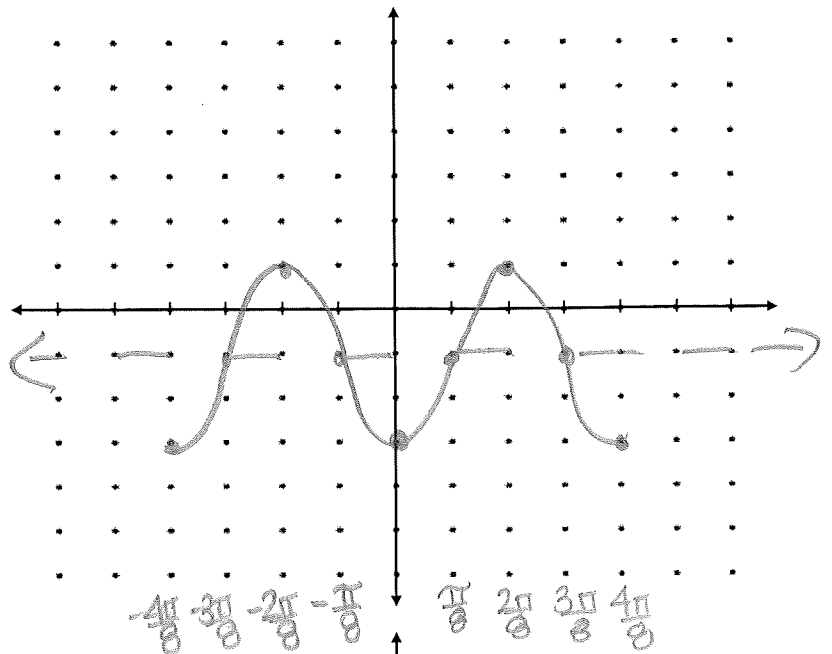
Algebra 2 13.5 Homework

Name \_\_\_\_\_

In 9-17, graph two complete periods!!!  
 LABEL YOUR GRAPHS! BE NEAT!!

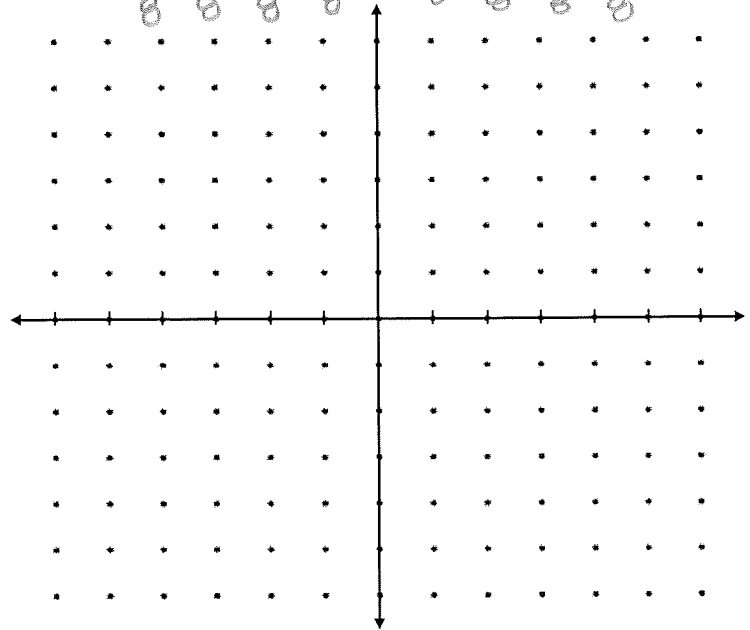
1. Graph  $f(t) = -2\cos 4t - 1$

Amplitude: 2  
 Period:  $\frac{2\pi}{4} = \frac{\pi}{2}$   
 Increments:  $\frac{\pi}{2}, \frac{1}{4} = \frac{\pi}{8}$   
 V. Shift: 1 down



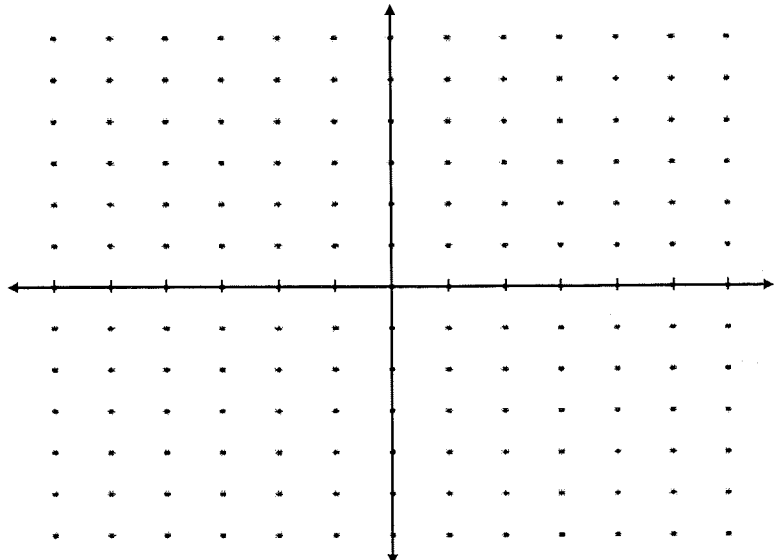
2. Graph  $f(t) = -3\sin 2t + 2$

Amplitude: \_\_\_\_\_  
 Period: \_\_\_\_\_  
 Increments: \_\_\_\_\_  
 V. Shift: \_\_\_\_\_



3. Graph  $f(t) = 4\cos \frac{t}{2} + 1$

Amplitude: \_\_\_\_\_  
 Period: \_\_\_\_\_  
 Increments: \_\_\_\_\_  
 V. Shift: \_\_\_\_\_



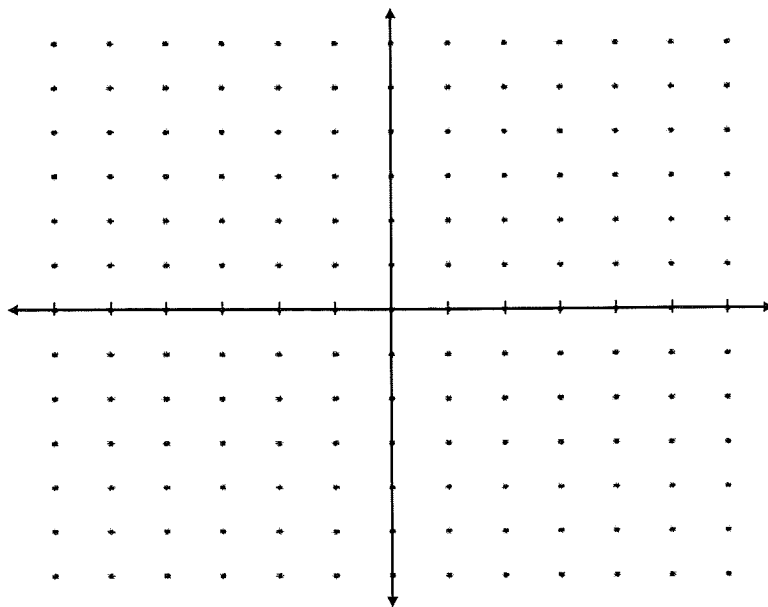
4. Graph  $f(t) = -3 \cos \frac{t}{2} + 2$

Amplitude: \_\_\_\_\_

Period: \_\_\_\_\_

Increments: \_\_\_\_\_

V. Shift: \_\_\_\_\_



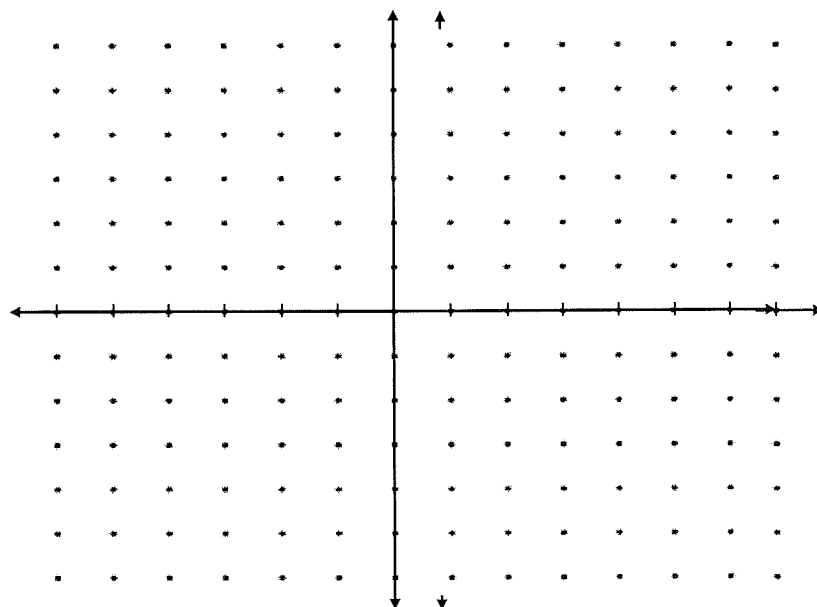
5. Graph  $f(t) = 2 \cos 4t$

Amplitude: \_\_\_\_\_

Period: \_\_\_\_\_

Increments: \_\_\_\_\_

V. Shift: \_\_\_\_\_



6. Graph  $f(t) = 3 \sin \frac{t}{4}$

Amplitude: \_\_\_\_\_

Period: \_\_\_\_\_

Increments: \_\_\_\_\_

V. Shift: \_\_\_\_\_

