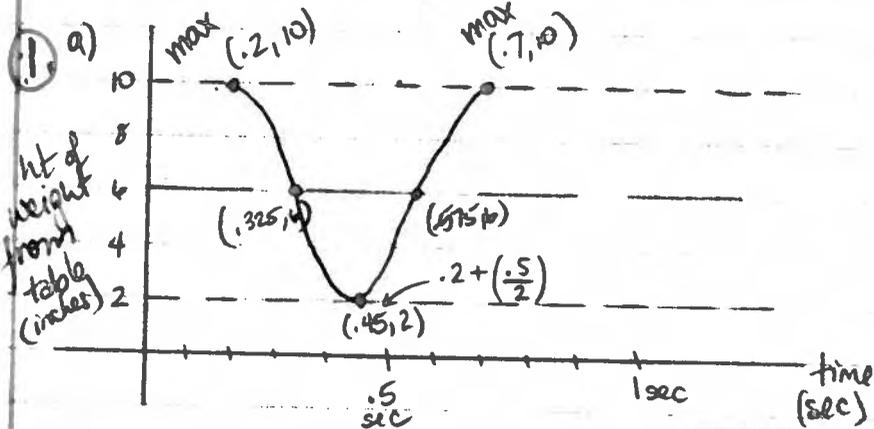


9-3 Homework: p. 531, #1-10



$\text{vert. shift} = 6 = k$   
 $\text{phase shift} = 0.2 = h$   
 $\text{amplitude} = 4 = A$   
 $\text{period} = 0.5$   
 $\hookrightarrow \frac{2\pi}{B} = 0.5$   
 $2\pi = 0.5B$   
 $4\pi = B$

b) equation:  $h = 6 + 4 \cos [4\pi (t - 0.2)]$

c) height at

0 sec	$t = 0 \rightarrow h = 2.764$ inches
1.2 sec	$t = 1.2 \rightarrow h = 10$ inches
3.7 sec	$t = 3.7 \rightarrow h = 10$ inches

d) weight at 8":

$$8 = 6 + 4 \cos [4\pi (t - 0.2)]$$

$$\frac{1}{2} = \cos [4\pi (t - 0.2)]$$

$$\pm 1.047 \pm 2\pi n = 4\pi (t - 0.2)$$

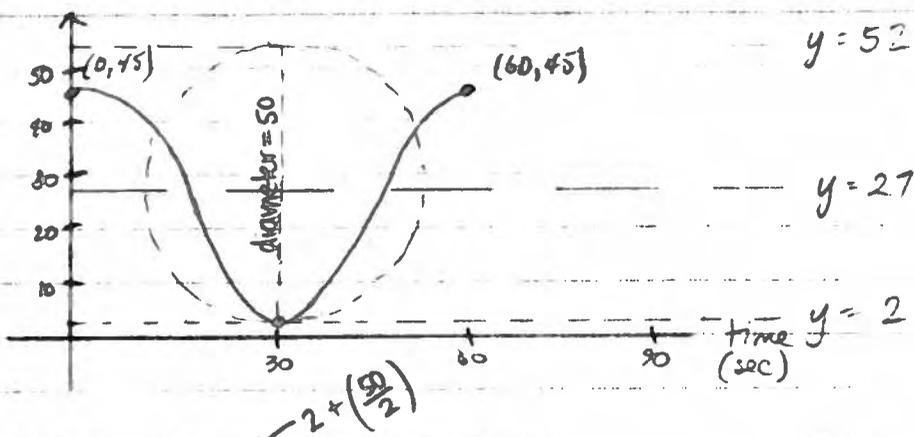
$$\pm .083 \pm .5n = t - 0.2$$

$$\left\{ \begin{array}{l} .283 \pm .5n \\ .117 \pm .5n \end{array} \right\} = t$$

1st 3 times:

$$t = 0.117 \text{ sec}, 0.283 \text{ sec}, 0.617 \text{ sec}$$

2. a) seat height (feet)



b) vertical shift =  $27 = k$   
 amplitude =  $25 = A$   
 period =  $60$

$$\uparrow \frac{2\pi}{B} = 60$$

$$2\pi = 60B$$

$$\frac{\pi}{30} = B$$

horizontal shift

$$45 = 27 + 25 \cos \left[ \frac{\pi}{30} (0 - h) \right]$$

$$\frac{18}{25} = -\cos \left[ \frac{\pi}{30} (-h) \right]$$

$$\pm 0.767 = \frac{\pi}{30} (-h)$$

$$\pm 7.324 = -h$$

$$\pm 7.324 = h$$

$$\text{equation: } h = 27 + 25 \cos \left[ \frac{\pi}{30} (t - 7.324) \right]$$

c) height at 35 sec  $\rightarrow t = 35$ ;  $h = 2.737$  ft  
 25 sec  $\rightarrow t = 85$ ;  $h = 20.086$  ft  
 2 min  $\rightarrow t = 120$ ;  $h = 45$  ft

d) 5<sup>th</sup> time the seat is at its lowest

$$2 = 27 + 25 \cos \left[ \frac{\pi}{30} (t - 7.324) \right]$$

$$-1 = \cos \left[ \frac{\pi}{30} (t - 7.324) \right]$$

$$\pm \pi \pm 2\pi n = \frac{\pi}{30} (t - 7.324)$$

$$\pm 30 \pm 60n = t - 7.324$$

$$\left\{ \begin{array}{l} 37.324 \pm 60n \\ -22.676 \pm 60n \end{array} \right\} = t$$

times at  $h = 2$  ft

37.324 sec

97.324 sec

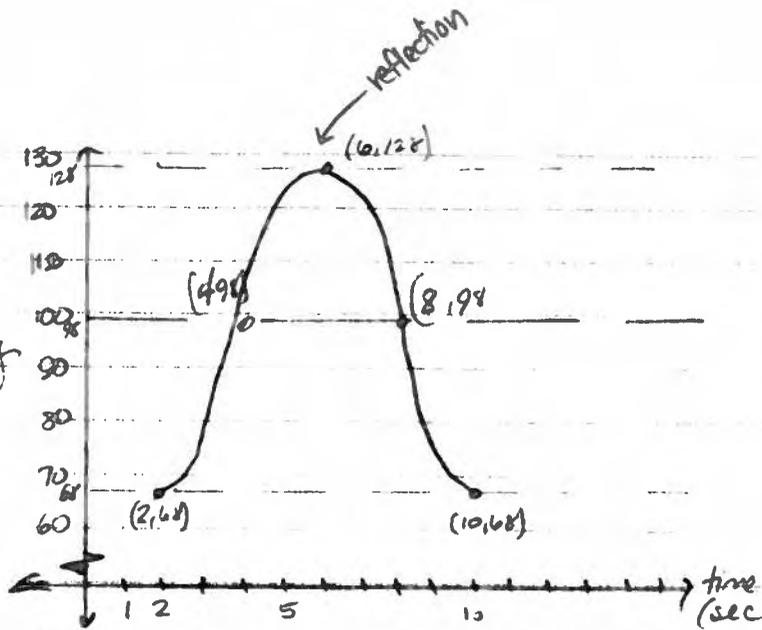
157.324 sec

217.324 sec

277.324 sec  $\leftarrow$  5<sup>th</sup> time

3. a)

lung capacity  
(cm<sup>3</sup>)



vert. shift =  $98 = k$   
 phase shift =  $-2 = h$   
 amplitude =  $30 = A$   
 period =  $8 \text{ sec}$   
 $\frac{2\pi}{B} = 8$   
 $2\pi = 8B$   
 $\frac{\pi}{4} = B$

equation:  $C = 98 - 30 \cos \left[ \frac{\pi}{4} (t - 2) \right]$

b) lung capacity at

0 sec	$\Rightarrow t = 0$	$C = 98 \text{ cm}^3$
3 sec	$\Rightarrow t = 3$	$C = 76.787 \text{ cm}^3$
10 sec	$\Rightarrow t = 10$	$C = 68 \text{ cm}^3$

c) lung capacity at its highest  $\rightarrow 128 \text{ cm}^3$   
 $C = 128 \text{ cm}^3$  at

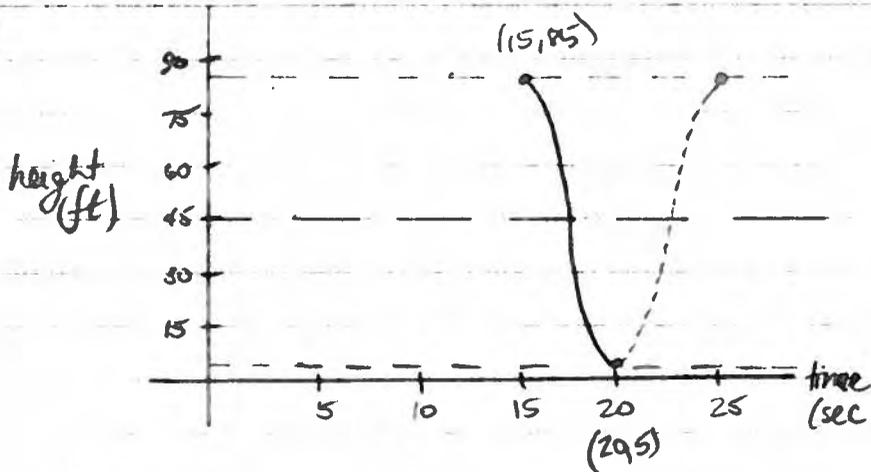
6 sec	} add period (8 seconds)
14 sec	
22 sec	

Alternate eq<sup>n</sup>s (no flip on cos)

phase shift =  $-2$   $y = 98 + 30 \cos \left[ \frac{\pi}{4} (t + 2) \right]$

(in) phase shift =  $4$   $y = 98 + 30 \sin \left[ \frac{\pi}{4} (t - 4) \right]$

4.



$5 \times \left( \frac{5\pi}{2} \right)$   
 vertical shift = 45  
 phase shift = 15 = h  
 amplitude = 40 = A  
 period = 10  
 $\downarrow$   
 $\frac{2\pi}{B} = 10$   
 $2\pi = 10B$   
 $\frac{\pi}{5} = B$

equation  $h = 45 + 40 \cos \left[ \frac{\pi}{5}(t - 15) \right]$

time when  $h = 78$

$$y_2 = 78 = \left[ 45 + 40 \cos \left[ \frac{\pi}{5}(t - 15) \right] \right]$$

$$\frac{33}{40} = \cos \left[ \frac{\pi}{5}(t - 15) \right]$$

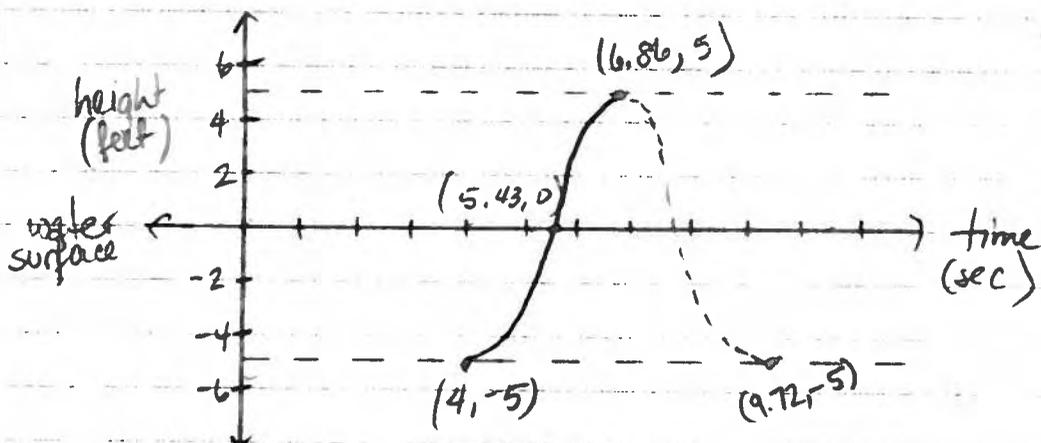
$$\pm .601 \pm 2\pi n = \frac{\pi}{5}(t - 15)$$

$$\pm .956 \pm 10n = t - 15$$

$$\left\{ \begin{array}{l} 15.956 \pm 10n \\ 14.044 \pm 10n \end{array} \right\} = t$$

15.956 seconds  
(in this section)

5.



vertical shift =  $0 = k$

amplitude =  $5 = A$

period =  $\frac{143}{25} = 5.72$

$$\hookrightarrow \frac{2\pi}{B} = \frac{143}{25}$$

$$\frac{143B}{25} = 2\pi$$

$$B = \frac{50\pi}{143}$$

horizontal shift for cosine = 4

$$h = -5\cos\left[\frac{50\pi}{143}(t - 4)\right]$$

horizontal shift for sine = 5.43

$$h = 5\sin\left[\frac{50\pi}{143}(t - 5.43)\right]$$

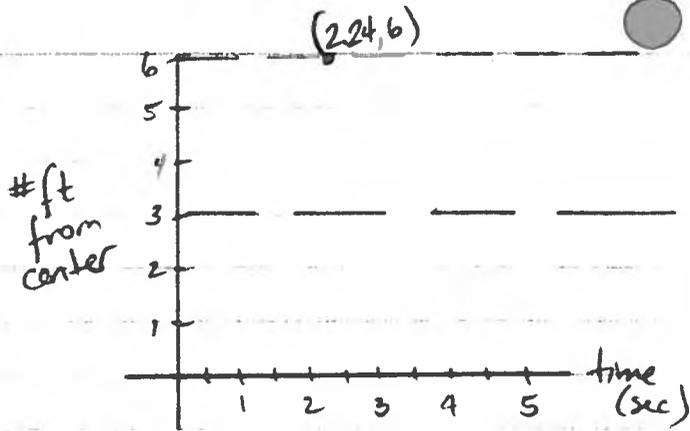
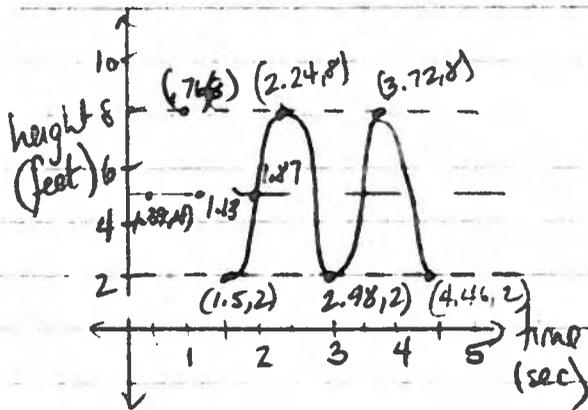
height of dolphin: 0 sec ;  $t = 0 \rightarrow h = 1.566$

2.56 sec ;  $t = 2.56 \rightarrow h = .055$

3.68 sec ;  $t = 3.68 \rightarrow h = -4.694$

(verified with both eq<sup>s</sup>)

6.



vertical shift = 5  
amplitude = 3  
phase shift = 1.5 (flip)  
period = 1.48

$$\downarrow$$
$$\frac{2\pi}{B} = 1.48B$$
$$2\pi = 1.48B$$
$$B = \frac{50\pi}{37}$$

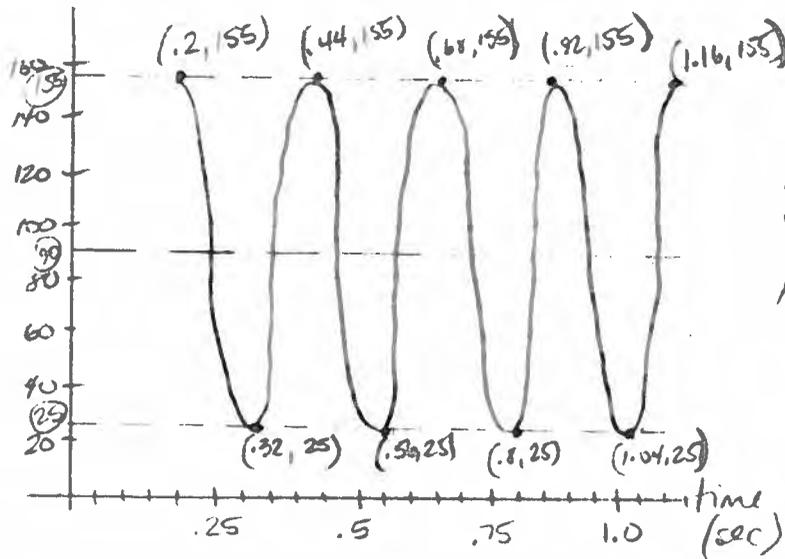
$$h = 5 - 3\cos\left[\frac{50\pi}{37}(t - 1.5)\right]$$

When is  $h = 4$ ?

- $t = .39 \text{ sec}$
- $t = 1.13 \text{ sec}$
- $t = 1.87 \text{ sec}$

B

height (#cm) above ground



vertical shift = 90 =  
 phase shift = 0.2 =  
 amplitude = 65 =  
 period = 0.24

$$\downarrow$$

$$\frac{2\pi}{B} = .24$$

$$2\pi = .24B$$

$$\frac{25\pi}{3} = B$$

equation:  $y = 90 + 65 \cos \left[ \frac{25\pi}{3} (t - 0.2) \right]$

$$100 = 90 + 65 \cos \left[ \frac{25\pi}{3} (t - 0.2) \right] \quad \text{note: } 1 \text{ m} = 100 \text{ cm}$$

$$\frac{10}{65} = \cos \left[ \frac{25\pi}{3} (t - 0.2) \right]$$

$$\pm 1.416 \pm 2\pi n = \frac{25\pi}{3} (t - 0.2)$$

$$\pm .054 \pm \frac{6 \cdot n}{25} = t - 0.2$$

$$\left\{ \begin{array}{l} 0.254 \pm \frac{6 \cdot n}{25} \\ 0.146 \pm \frac{6 \cdot n}{25} \end{array} \right\} = t$$

$$t = 0.146 \text{ sec}, 0.254 \text{ sec}, 0.386 \text{ sec}, 0.494 \text{ sec}$$

Assuming the waves conform to a sine graph (i.e., the height of the wave  $y$  varies sinusoidally with time), we should be able to determine an equation to describe this phenomenon and predict how long the seabed was ~~be~~ exposed.

10. From the information given, we can determine a few things.

$$k = 0 \text{ (sea level)}$$

$$h = 0$$

$$A = 55 \text{ feet (max)}$$

$$\text{Period} = 12 \text{ minutes} = \frac{2\pi}{B}$$

$$12B = 2\pi$$

$$B = \frac{2\pi}{12} = \frac{\pi}{6}$$

So, the equation is  $y = -55 \sin\left[\frac{\pi}{6}t\right]$

reflection

The seabed is exposed when the  $y$ -value is below -25 feet.

$$y = -55 \sin\left[\frac{\pi}{6}t\right]$$

$$-25 = -55 \sin\left[\frac{\pi}{6}t\right]$$

$$\frac{5}{11} = \sin\left[\frac{\pi}{6}t\right]$$

$$\pi - .472 = \left\{ \begin{array}{l} .472 \pm 2\pi n \\ 2.670 \pm 2\pi n \end{array} \right\} = \frac{\pi}{6}t$$

$$\left\{ \begin{array}{l} .901 \pm 12n \\ 5.099 \pm 12n \end{array} \right\} = t$$

So, the seabed is exposed between .901 minutes and 5.099 minutes, or it is exposed for roughly four minutes.