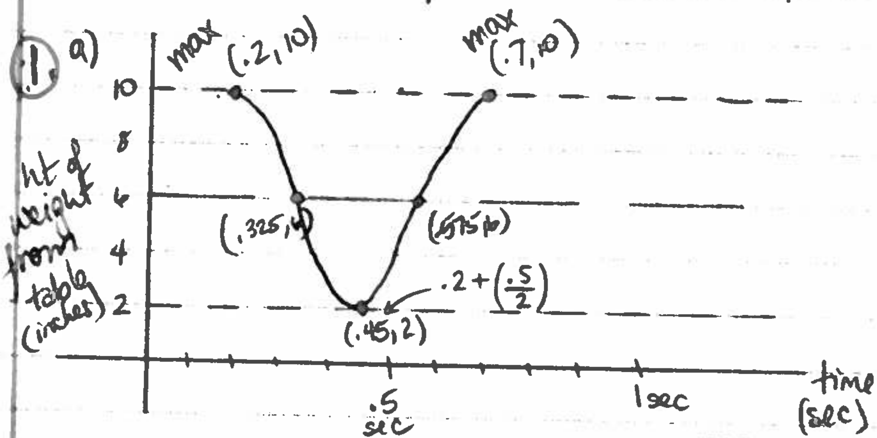
$\boxed{9\text{-}3}$ Homework: p. 531, #1-10

1. a)



$2 + \left(\frac{10-2}{2}\right)$

vert. shift = 6 = k

phase shift = 0.2 = h

amplitude = 4 = A

period = .5

$\hookrightarrow \frac{2\pi}{B} = .5$

$2\pi = .5B$

$4\pi = B$

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

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":

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

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

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

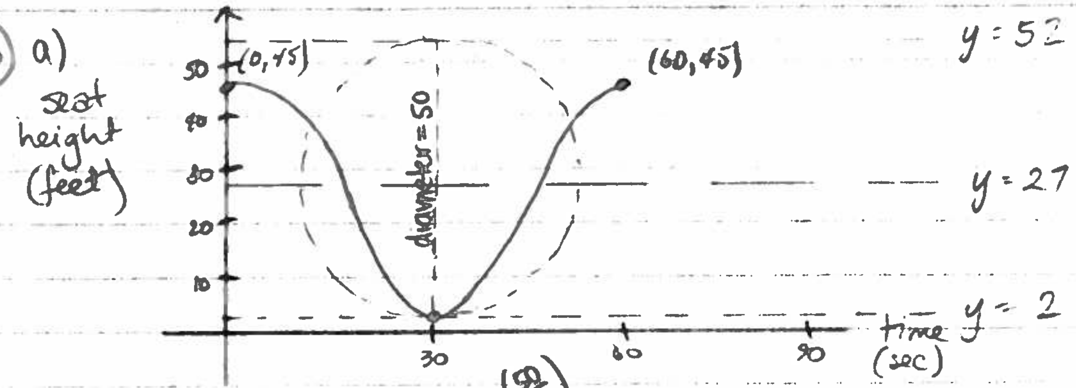
$$\pm .083 \pm .5n = t - 0.2$$

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

1st 3 times:

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

2. a)



b) vertical shift = 27 = k $\leftarrow 2 + \left(\frac{50}{2}\right)$

amplitude = 25 = A

period = 60

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

$2\pi = 60B$

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

horizontal shift

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

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

$\pm .767 = \frac{\pi}{30}(-h)$

$\pm 7.324 = -h$

$\pm 7.324 = h$

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^{th} time the seat is at its lowest

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

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

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

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

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

times at h = 2 ft

37.324 sec

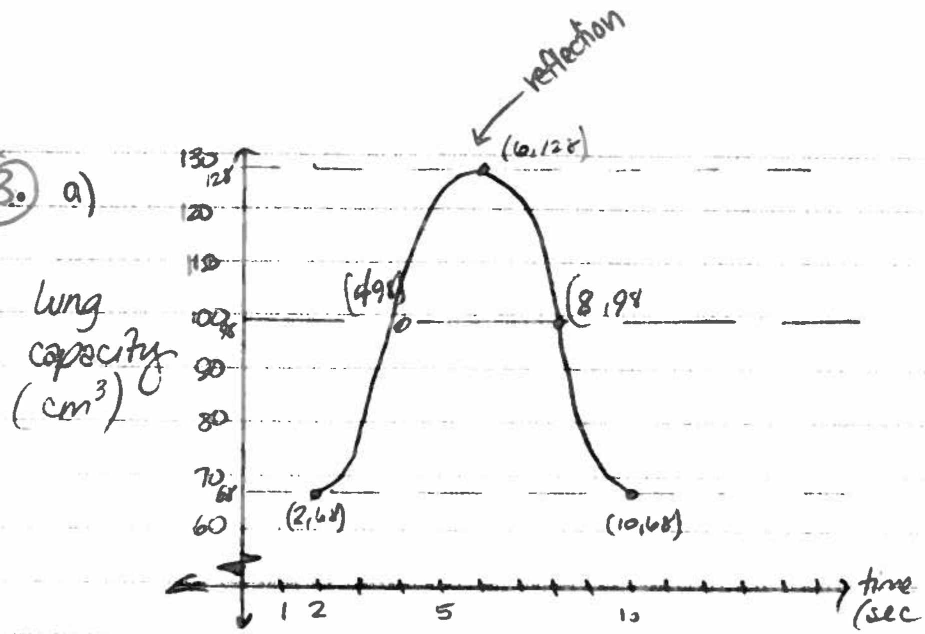
97.324 sec

157.324 sec

217.324 sec

277.324 sec $\leftarrow 5^{th}$ time

3. a)



$68 + \left(\frac{128-68}{2}\right)$

vert. shift = 98 = k

phase shift = 2 = h

amplitude = 30 = A

period = 8 sec

$\frac{2\pi}{B} = 8$

$2\pi = 8B$

$\frac{\pi}{4} = B$

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

b) lung capacity at
0 sec $\Rightarrow t = 0$; $c = 98\ cm^3$
3 sec $\Rightarrow t = 3$; $c = 76.787\ cm^3$
10 sec $\Rightarrow t = 10$; $c = 68\ cm^3$

c) lung capacity at its highest $\rightarrow 128 cm^3$

$c = 128\ cm^3$ at
6 sec
14 sec } add period (8 seconds)
22 sec

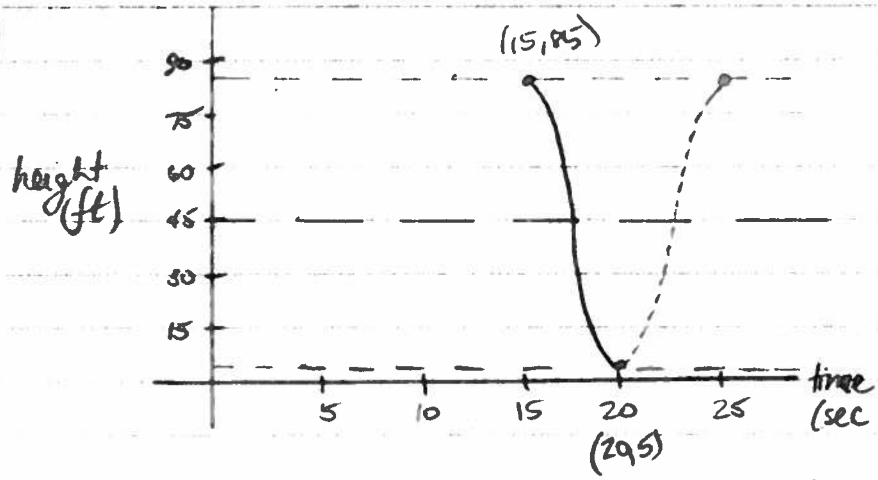
Alternate eq^ns (no flip on cos)

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

(sin)

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

4.



$5+\left(\frac{85-5}{2}\right)$

vertical shift = 45

phase shift = 15 = h

amplitude = 40 = A

period = 10

$\frac{2\pi}{B} = 10$

$2\pi = 10B$

$\frac{\pi}{5} = B$

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

time when $h = 78$

$Y_1 =$

$Y_2 = 78 = \left[45 + 40\cos\left\{\frac{\pi}{5}(t-15)\right\}\right]$

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

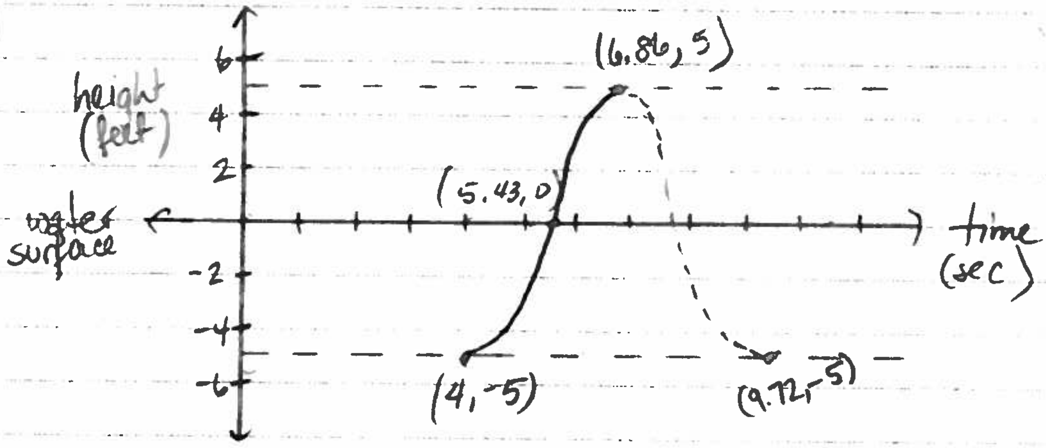
$\pm .601 \pm 2\pi n = \frac{\pi}{5}(t-15)$

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

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

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

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

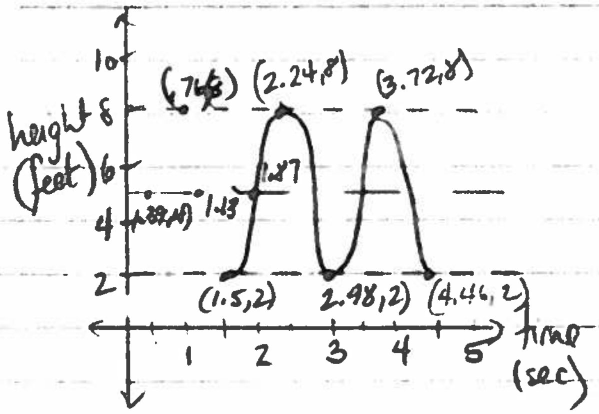
height of dolphin: 0 sec ; $t = 0 \rightarrow h = 1.566$

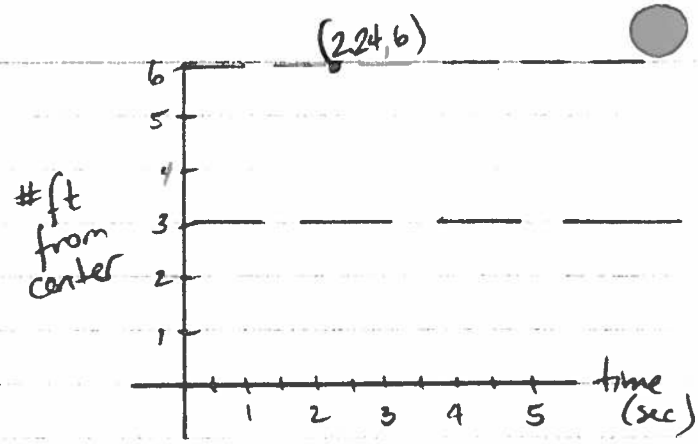
2.56 sec ; $t = 2.56 \rightarrow h = .055$

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

(verified with both eq$^{\underline{n}}$s)

6.





vertical shift = 5

amplitude = 3

phase shift = 1.5 (flip)

period = 1.48

$$\frac{2\pi}{B} = 1.48B$$

$$2\pi = 1.48B$$

$$B = \frac{50\pi}{37}$$

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

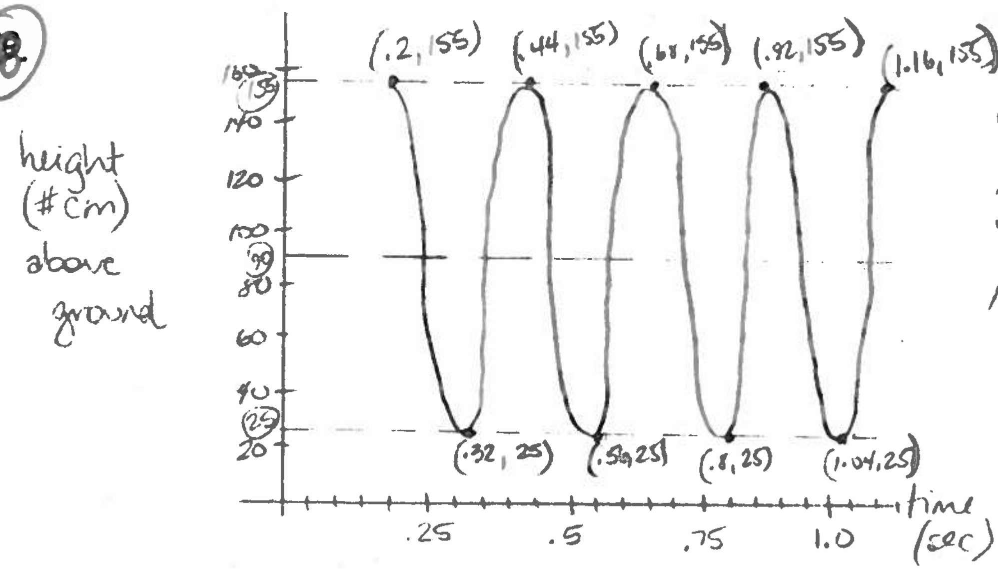
When is $h = 4$?

$t = .39$ sec

$t = 1.13$ sec

$t = 1.87$ sec

B.



vertical shift = 90 =

phase shift = 0.2 =

amplitude = 65 =

period = 0.24

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

$2\pi = .24B$

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

equation: $y = 90 + 65\cos\left[\frac{25\pi}{3}(t - .2)\right]$

$100 = 90 + 65\cos\left[\frac{25\pi}{3}(t - .2)\right]$ note: 1 m = 100cm

$\frac{10}{65} = \cos\left[\frac{25\pi}{3}(t - .2)\right]$

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

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

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

t = 0.146 sec, 0.254 sec, 0.386 sec, 0.494 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 (sea level)
h = 0
A = 55 feet (max)
Period = 12 minutes $= \frac{2\pi}{B}$

$12B = 2\pi$

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

reflection

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

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

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

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

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

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

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

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