Week 13 SI Answers

1. a. $P(t)=4264-1223\cos\left(\frac{2\pi}{5}t\right)$

$4800=4264-1223\cos\left(\frac{2\pi}{5}t\right)$

$\vdots$

$\cos\left(\frac{2\pi}{5}t\right)=-\frac{546}{1223}$ — let $u=\frac{2\pi}{5}t$

$\cos(u)=-\frac{546}{1223}$

$u=\cos^{-1}\left(-\frac{546}{1223}\right)$

$\frac{2\pi}{5}t=\pi-\cos\left(\frac{546}{1223}\right)$ & $\frac{2\pi}{5}t=\pi+\cos\left(\frac{546}{1223}\right)$

$t=\frac{5}{2\pi}\left(\pi-\cos\left(\frac{546}{1223}\right)\right)$ & $t=\frac{5}{2\pi}\left(\pi+\cos\left(\frac{546}{1223}\right)\right)$

$\boxed{t=1.62}$ $\boxed{t=3.38}$

Since this # is negative, the 2 answers must be in Q_2 & Q_3.

b. $14=7.7+10.7\sin\left(\frac{2\pi}{63}t\right)$

$\frac{6.3}{10.7}=\sin\left(\frac{2\pi}{63}t\right)$ — let $u=\frac{2\pi}{63}t$

$\sin(u)=\frac{6.3}{10.7} \Rightarrow u=\sin^{-1}\left(\frac{6.3}{10.7}\right)$

$\frac{2\pi}{63}t=\sin^{-1}\left(\frac{6.3}{10.7}\right)$ & $\frac{2\pi}{63}t=\pi-\sin^{-1}\left(\frac{6.3}{10.7}\right)$

$t=\frac{63}{2\pi}\sin^{-1}\left(\frac{6.3}{10.7}\right)$ & $t=\frac{63}{2\pi}\left(\pi-\sin^{-1}\left(\frac{6.3}{10.7}\right)\right)$

$\boxed{t=6\text{ days}}$ $\boxed{t=25\text{ days}}$

— let $u=2\theta$

c. $R(\theta)=\frac{V_0^2\sin 2\theta}{32} \Rightarrow 435=\frac{160^2\sin 2\theta}{32} \Rightarrow \sin(2\theta)=\frac{435}{800}$

$\sin(u)=\frac{435}{800} \Rightarrow u=\sin^{-1}\left(\frac{435}{800}\right)$

$\vdots$

$2\theta=\sin^{-1}\left(\frac{435}{800}\right)$ & $2\theta=\pi-\sin^{-1}\left(\frac{435}{800}\right)$

$\theta=\frac{\sin^{-1}\left(\frac{435}{800}\right)}{2}$ $\theta=\frac{\pi-\sin^{-1}\left(\frac{435}{800}\right)}{2}$

$\boxed{\theta=.29}$ $\boxed{\theta=1.28}$

2.

$a = ?$ $\quad A = ?$

$b = 60$ $\quad B = 33^\circ$

$c = 71$ $\quad C = ?$

Finding C_1: $\dfrac{\sin(C)}{71} = \dfrac{\sin(33^\circ)}{60}$

$\sin(C) = \dfrac{71\sin(33^\circ)}{60}$

$C = \sin^{-1}\left[\dfrac{71\sin(33^\circ)}{60}\right]$

$C = 40.13^\circ$

Finding C_2:

$180^\circ - 40.13^\circ = 139.87^\circ$

Solving for A + a

=> Using C_1

$180^\circ - (40.13^\circ + 30^\circ) = A_1$

$A_1 = 106.87^\circ$

$\dfrac{a_1}{\sin(106^\circ)} = \dfrac{60}{\sin(33^\circ)}$

$a_1 = \dfrac{60\sin(106)}{\sin(33^\circ)}$

$a_1 = 105.42$

=> Using C_2

$180 - (139.87 + 30^\circ) = A_2$

$A_2 = 7.13^\circ$

$\dfrac{a_2}{\sin(7.13^\circ)} = \dfrac{60}{\sin(33^\circ)}$

$a_2 = \dfrac{60\sin(7.13^\circ)}{\sin(33^\circ)}$

$a_2 = 13.67$

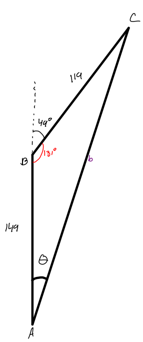
$\therefore$ $C = 40.1^\circ$, $A = 106.9^\circ$, $a = 105.4$

or

$C = 139.9^\circ$, $A = 7.1^\circ$, $a = 13.7$

3.

a.



$A = ?$ $\quad b^2 = a^2 + c^2 - 2ac\cos(B)$

$b^2 = 119^2 + 149^2 - 2 \cdot 119 \cdot 149\cos(131^\circ)$

$b = 244.19$

$\dfrac{\sin A}{a} = \dfrac{\sin B}{b}$

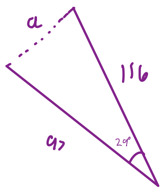
$\sin A = \dfrac{a\sin B}{b}$

$A = \sin^{-1}\left(\dfrac{a\sin B}{b}\right) \Rightarrow \boxed{A = 21.57^\circ}$

or

$A = 180^\circ - \sin^{-1}\left(\dfrac{a\sin B}{b}\right) \Rightarrow \boxed{A = 158.42^\circ}$

b.



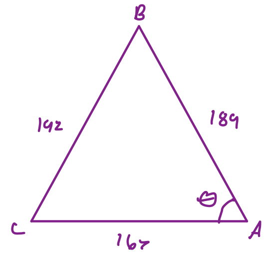
$$a^2 = b^2 + c^2 - 2ac\cos(A)$$

$$a^2 = 97^2 + 116^2 - 2(97)(116)\cos(29)$$

$$a^2 = 3182.56$$

$$\boxed{a = 56.41}$$

c.



$$a^2 = b^2 + c^2 - 2bc\cos(A)$$

$$\cos(A) = \frac{b^2 + c^2 - a^2}{2bc}$$

$$A = \cos^{-1}\left(\frac{b^2 + c^2 - a^2}{2bc}\right)$$

$$A = \cos^{-1}\left(\frac{167^2 + 189^2 - 142^2}{2 \cdot 167 \cdot 189}\right)$$

$$\boxed{A = 64.9^\circ}$$