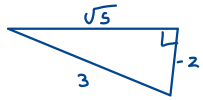
Week 10 SI Answers

1. a. $\cot\left(\sin^{-1}\left(-\frac{2}{3}\right)\right)$ $\therefore \theta = \sin^{-1}\left(-\frac{2}{3}\right)$

– Therefore, θ must be in Q4

$\sin = \frac{opp}{hyp}$ $\therefore$



$-2^2 + b^2 = 9$

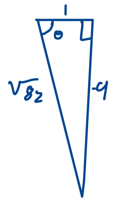
$4 + b^2 = 9$

$b = \sqrt{5}$

$\cot\theta = \frac{adj}{hyp}$ $\therefore \cot\theta = \boxed{-\frac{\sqrt{5}}{2}}$

b. $\cos\left(\tan^{-1}(-9)\right)$ $\therefore \theta = \tan^{-1}(-9)$ – must be in Q4

$\tan = \frac{opp}{adj}$ $\therefore \tan\theta = \frac{-9}{1}$



$81 + 1 = \sqrt{82}$

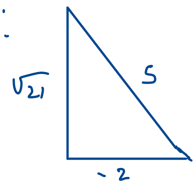
$\cos\theta = \frac{adj}{hyp}$

$= \frac{1}{\sqrt{82}}$ or $\boxed{\frac{\sqrt{82}}{82}}$

c. $\tan\left(\cos^{-1}\left(-\frac{2}{5}\right)\right)$ $\therefore \theta = \cos^{-1}\left(-\frac{2}{5}\right)$

– In Q_2 bc $\cos < 0$, + must be in range of $\cos^{-1}$

$\cos\theta = \frac{2}{5}$ $\therefore$



$\tan\theta = \frac{opp}{adj} = \boxed{-\frac{\sqrt{21}}{2}}$

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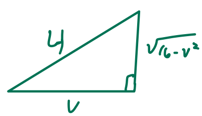
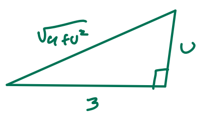
2. a. $\tan\left(\cos^{-1}\frac{v}{4}\right)$ $\therefore \theta = \cos^{-1}\frac{v}{4}$



$\cos\theta = \frac{v}{4} = \frac{adj}{hyp}$

$\therefore \tan\theta = \frac{opp}{adj} = \boxed{\frac{\sqrt{16-v^2}}{v}}$

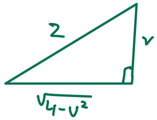
b. $\cos\left(\sin^{-1}\frac{v}{\sqrt{9+v^2}}\right)$ $\therefore \theta = \sin^{-1}\frac{v}{\sqrt{9+v^2}}$



$\sin\theta = \frac{v}{\sqrt{9+v^2}} = \frac{opp}{hyp}$

$\therefore \cos\theta = \frac{adj}{hyp} = \boxed{\frac{3}{\sqrt{9+v^2}}} = \boxed{\frac{3\sqrt{9+v^2}}{9+v^2}}$

c. $\sin\left(\tan^{-1}\frac{v}{\sqrt{4-v^2}}\right)$ $\therefore \theta = \tan^{-1}\frac{v}{\sqrt{4-v^2}}$

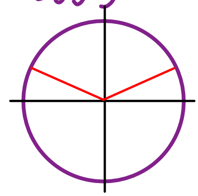


$\tan\theta = \frac{v}{\sqrt{4-v^2}}$

$\sin\theta = \boxed{\frac{v}{2}}$

3.a. $L(t) = 12 + 3.1\sin\left(\frac{2\pi}{365}\right) \Rightarrow 14 = 12 + 3.1\sin\left(\frac{2\pi}{365}\right)$

$\frac{2}{3.1} = \sin\left(\frac{2\pi}{365}t\right)$ - Let $u = \frac{2\pi}{365}t$



$\frac{2}{3.1} = \sin u \quad \therefore u = \sin^{-1}\left(\frac{2}{3.1}\right) + \pi - \sin^{-1}\left(\frac{2}{3.1}\right)$

$\Rightarrow \frac{2\pi}{365}t = \sin^{-1}\left(\frac{2}{3.1}\right)$ $\qquad$ $\Rightarrow \frac{2\pi}{365}t = \pi - \sin^{-1}\left(\frac{2}{3.1}\right)$

$t = \frac{365}{2\pi}\cdot\sin^{-1}\left(\frac{2}{3.1}\right)$ $\qquad$ $t = \frac{365}{2\pi}\cdot\left[\pi - \sin^{-1}\left(\frac{2}{3.1}\right)\right]$

$t = \boxed{41 \text{ days}}$ After March 20th $\qquad$ $t = \boxed{142 \text{ days}}$ After March 20th

b. $R(\theta) = \frac{V_0^2 \sin 2\theta}{32} \Rightarrow 102 = 200\sin 2\theta \Rightarrow \sin 2\theta = \frac{102}{200}$

$u = 2\theta \quad \therefore \frac{102}{200} = \sin u \Rightarrow u = \sin^{-1}\left(\frac{102}{200}\right)$ or $u = \pi - \sin^{-1}\left(\frac{102}{200}\right)$

$2\theta = \sin^{-1}\left(\frac{102}{200}\right)$ $\qquad$ $2\theta = \pi - \sin^{-1}\left(\frac{102}{200}\right)$

$\theta = \frac{\sin^{-1}\left(\frac{102}{200}\right)}{2}$ $\qquad$ $\theta = \frac{\pi}{2} - \frac{\sin^{-1}\left(\frac{102}{200}\right)}{2}$

$\boxed{\theta = .27 \text{ rad}}$ or $\boxed{\theta = 1.3 \text{ rad}}$

c $P(t) = 4067 - 1187\cos\left(\frac{2\pi}{7}t\right) \Rightarrow 4700 = 4067 - 1187\cos\left(\frac{2\pi}{7}t\right) \Rightarrow -\frac{633}{1187} = \cos\left(\frac{2\pi}{7}t\right)$

- must be in $Q_2 + Q_3$ bc cos is − in those

$u = \frac{2\pi}{7}t \quad \therefore -\frac{633}{1187} = \cos u \Rightarrow u = \pi - \cos^{-1}\left(-\frac{633}{1187}\right)$ or $u = \pi + \cos^{-1}\left(-\frac{633}{1187}\right)$

- u is in $[0, 2\pi]$

$\left[0 \le \frac{7}{2\pi}u \le 7\right]\frac{2\pi}{7}$

$0 \le u \le 2\pi$

$\frac{2\pi}{7}t = \pi - \cos^{-1}\left(-\frac{633}{1187}\right)$ $\qquad$ $\frac{2\pi}{7}t = \pi + \cos^{-1}\left(-\frac{633}{1187}\right)$

$t = \frac{7}{2\pi}\left(\pi - \cos^{-1}\left(-\frac{633}{1187}\right)\right)$ $\qquad$ $t = \frac{7}{2\pi}\left(\pi + \cos^{-1}\left(-\frac{633}{1187}\right)\right)$

$\boxed{t = 2.38 \text{ Years}}$ $\qquad$ $\boxed{t = 4.62 \text{ years}}$