(iii) **NZL:** $\Sigma F = ma$

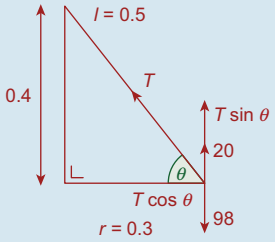
$\leftarrow R\cos\theta = m\omega^2 r$

$\Rightarrow \frac{12R}{13} = 10\omega^2(12)$

$\Rightarrow \omega^2 = \frac{254.8(12)}{130(1.2)}$

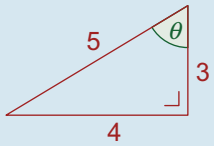
$\Rightarrow \omega = 4.427$ rad/s

Q. 8. Error in question: Read 0.4 m for 0.3 m



$r = 0.3$

(i) From triangle we get $r = 0.3$



(ii) $\uparrow = \downarrow$

$T\sin\theta + 20 = 98$

$\Rightarrow \frac{4T}{5} = 78$

$\Rightarrow T = 97.5$ N

(iii) **NZL:** $\Sigma F = ma$

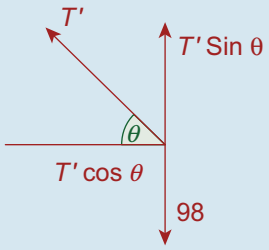
$\leftarrow T\cos\theta = m\omega^2 r$

$\Rightarrow 97.5\left(\frac{3}{5}\right) = 10(\omega^2)(0.3)$

$\Rightarrow \omega = 4.416$ rad/s

$= 4.4$ rad/s (to one decimal place)

(iv)



$\uparrow = \downarrow$

$\frac{4T'}{5} = 98$

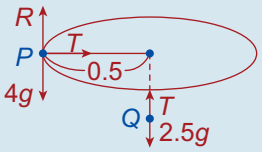
$\Rightarrow T' = 122.5$

$\leftarrow T'\cos\theta = m\omega^2 r$

$\Rightarrow 122.5\left(\frac{3}{5}\right) = 10\omega^2(0.3)$

$\Rightarrow \omega = \sqrt{24.5}$ rad/s

Q. 9.



Since Q is in equilibrium, $T = 2.5g = 24.5$ N.

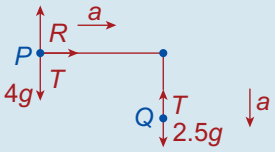
For P, $F_c = m\omega^2 r$

$\Rightarrow T = 4\omega^2(0.5)$

$\Rightarrow 24.5 = 2\omega^2$

$\Rightarrow \omega = \sqrt{12.25}$

$= 3.5$ rads/sec



Q: $2.5g - T = (2.5)a$

P: $T = 4a$

Adding gives: $2.5g = 6.5a$

$\Rightarrow a = \frac{5}{13}g$

$= \frac{49}{13}$ m/s^2

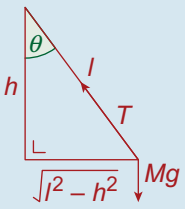
$u = 0, \quad a = \frac{49}{13}, \quad s = 0.5, \quad v = ?$

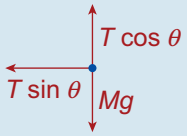
$v^2 = u^2 + 2as$

$\Rightarrow v^2 = 0 + 2\left(\frac{49}{13}\right)(0.5)$

$\Rightarrow v = \frac{7}{\sqrt{13}}$

Q. 10. (i) **Forces** **Resolved**





Since $\cos\theta = \frac{h}{l}$, $\sin\theta = \frac{\sqrt{l^2 - h^2}}{l}$

(ii) ① $T\cos\theta = Mg$

$\Rightarrow \frac{hT}{l}Mg \Rightarrow T = \frac{Mgl}{h}$

② $T\sin\theta = M\omega^2\left(\sqrt{l^2 - h^2}\right)$

$\Rightarrow T\left(\frac{\sqrt{l^2 - h^2}}{l}\right) = M\omega^2\sqrt{l^2 - h^2}$

$\Rightarrow T = M\omega^2 l$