Q. 3. 1: $R = mg$

2: $\mu R = m\omega^2 r$

$\Rightarrow \frac{1}{8}(mg) = m\omega^2(0.1)$

$\Rightarrow \omega^2 = 12.25$

$\Rightarrow \omega = 3.5$ rads/sec

Q. 4. 1: $R = mg$

2: $\mu R = \frac{mv^2}{r}$

$\Rightarrow \frac{1}{2}(mg) = \frac{m(36)}{r}$

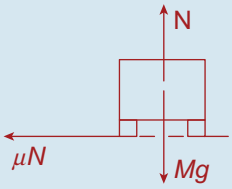
$\Rightarrow r = \frac{72}{g}$

$= \frac{720}{98}$

$= \frac{360}{49}$

$= 7$ m (to nearest metre)

Q. 5. **Force**



$\mu = 0.25$

$r = 20$

$\uparrow = \downarrow$

$N = mg$

NZL: $\sum F = ma$

$\Rightarrow \mu N = \frac{mv^2}{r}$

$\Rightarrow \mu mg = \frac{mv^2}{r}$

$\Rightarrow v = \sqrt{\mu gr}$

$\Rightarrow v = \sqrt{0.25(9.8)(20)}$

$\Rightarrow v = 7$ m/s

Q. 6. $\tan A = \frac{v^2}{gr}$

$\Rightarrow \frac{1}{8} = \frac{4{,}900}{(9.8)r}$

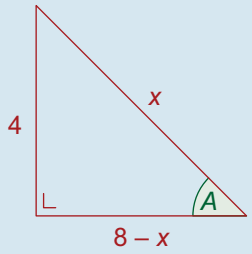
$\Rightarrow r = 4{,}000$ m $= 4$ km

Q. 7. $\tan A = \frac{v^2}{gr}$

$\Rightarrow \frac{5}{12} = \frac{v^2}{10(4{,}800)}$

$\Rightarrow v = \sqrt{20{,}000} = 141$ m/s

Q. 8. (i)



Let $|pr| = x$

$\therefore |qr| = 8 - x$

By Pythagoras, $x^2 = (4)^2 + (8 - x)^2$

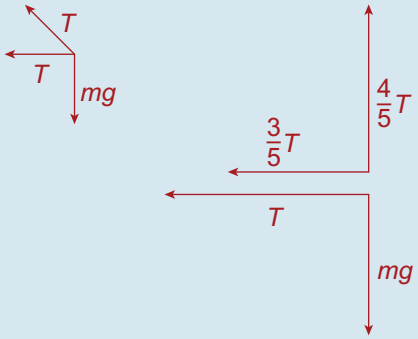
$\Rightarrow x^2 = 16 + 64 - 16x + x^2$

$\Rightarrow x = 5$

$\therefore \sin A = \frac{4}{5}$, $\cos A = \frac{3}{5}$

$\therefore r = 3$

(ii) **Forces** **Resolved**



1: $\frac{4}{5}T = mg$

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

2: $T + \frac{3}{5}T = m\omega^2 r$

$\therefore \frac{8}{5}\left(\frac{5}{4}mg\right) = m\omega^2 r$

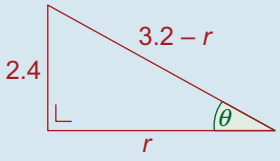
$\therefore 2mg = m\omega^2 r$

$\therefore 2g = \omega^2 r$

$\therefore 2g = 3\omega^2$

$\therefore \omega = \sqrt{\frac{2}{3}g}$ rad/s

Q. 9.



$r^2 + (2.4)^2 = (3.2 - r)^2$ (Pythagoras)

(i) Solving gives $r = 0.7$ m