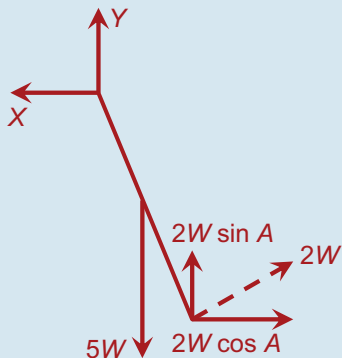


**Equation 1:**  $Y + \frac{3}{5} \left[ \frac{5}{6} W \right] = W$   
 $\Rightarrow 2Y + W = 2W$   
 $\Rightarrow 2Y = W$   
 $\Rightarrow Y = \frac{1}{2} W$

**Equation 2:**  $X = \frac{4}{5} \left[ \frac{5}{6} W \right]$   
 $\Rightarrow X = \frac{2}{3} W$

**Answer:** The horizontal and vertical reactions at the hinge are  $\frac{2}{3}W$  and  $\frac{1}{2}W$ . The tension in the string is  $\frac{5}{6}W$ .

**Q. 2.** (i) Here is a diagram of the forces acting on the rod:

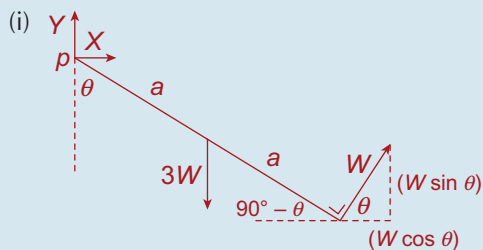


①  $Y + 2W \sin A = 5W$   
 ②  $X = 2W \cos A$   
 ③ Take moments about P  
 $5W(l \sin A) = 2W(2l)$   
 $\Rightarrow \sin A = \frac{4}{5} \Rightarrow \cos A = \frac{3}{5}$

①  $Y + \frac{8}{5}W = 5W \Rightarrow Y = \frac{17}{5}W$   
 ②  $X = \frac{6}{5}W$

(ii)  $A = \sin^{-1} \frac{4}{5} = 53^\circ$

**Q. 3.**



(ii) ①  $Y + W \sin \theta = 3W$   
 ②  $X + W \cos \theta = 0$

③ Taking moments about p, using unresolved forces:

$3W(a \sin \theta) = W(2a)$   
 $\Rightarrow \sin \theta = \frac{2}{3}$   
 $= 0.6667$

$\Rightarrow \theta = 41^\circ 49'$

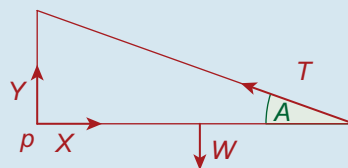
(iii)  $X = -W \cos \theta$   
 $= -W \left( \frac{\sqrt{5}}{3} \right)$   
 $= -\frac{\sqrt{5}}{3} W$   
 $Y = 3W - W \sin \theta$   
 $= 3W - W \left( \frac{2}{3} \right)$   
 $= \frac{7W}{3}$

**Q. 4.** Since  $\tan A = \frac{5}{12}$

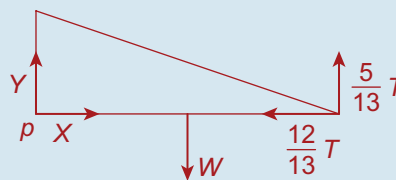
$\cos A = \frac{12}{13}$

$\sin A = \frac{5}{13}$

**Forces**



**Resolved**



①  $Y + \frac{5}{13} T = W$

②  $X = \frac{12}{13} T$