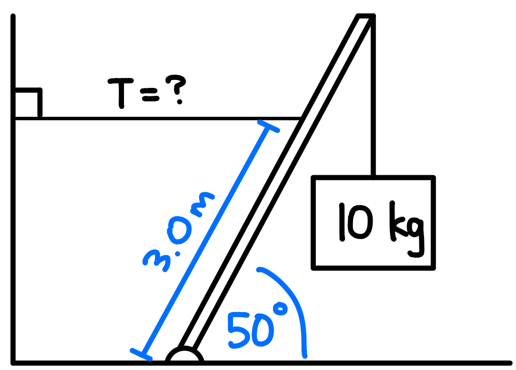
A uniform 5.0 m long beam of mass 50 kg is hinged to the floor. A 10 kg load hangs from the end of the beam. The apparatus is prevented from falling with a cable attached to the wall as shown.

a) What is the tension in the cable?

b) What are the magnitude and direction of the force of the hinge?



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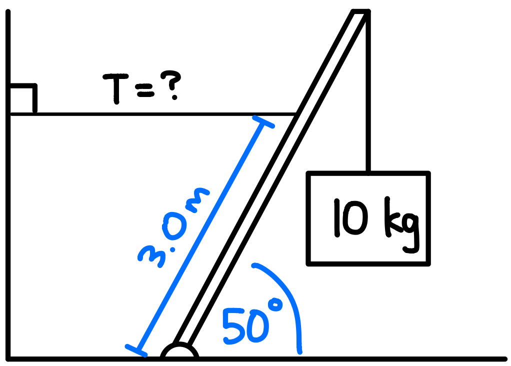
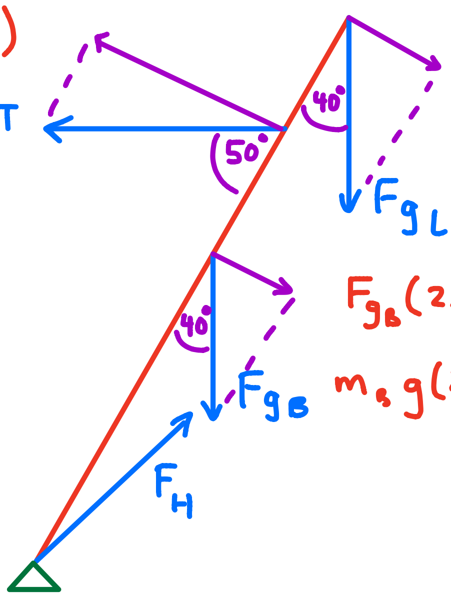


a)



$$\tau_{cw} = \tau_{ccw}$$

$$F_{gB}(2.5)\sin 40^\circ + F_{gL}(5.0)\sin 40^\circ = T(3.0)\sin 50^\circ$$

$$m_B g(2.5)\sin 40^\circ + m_L g(5.0)\sin 40^\circ = T(3.0)\sin 50^\circ$$

$$T = \frac{m_B g(2.5)\sin 40^\circ + m_L g(5.0)\sin 40^\circ}{3.0\sin 50^\circ}$$

$$= \boxed{480\text{ N}}$$

b)

$$F_{NET} = 0$$

$$\Sigma F_x = 0$$

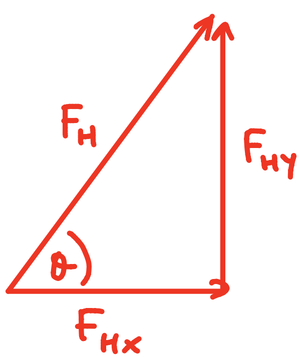
$$F_{Hx} = T = 480\text{ N}$$

$$\Sigma F_y = 0$$

$$F_{Hy} = F_{gB} + F_{gL}$$

$$= (m_b + m_L)g$$

$$= 588\text{ N}$$



$$F_H = \sqrt{F_{Hx}^2 + F_{Hy}^2}$$

$$= 759\text{ N}$$

$$\theta = \tan^{-1}\left(\frac{F_{Hy}}{F_{Hx}}\right)$$

$$= 50.8^\circ$$

759 N 50.8° ABOVE THE HORIZONTAL