

Answer on Question #61307-Physics-Mechanics | Relativity

A rope extend from pt B (2,0,4) ft. Through a metal loop attach to a wall at point A (6,7,0) ft. to point C (12,0,6) ft. The rope exerts forces F_{ab} and F_{ac} on the loop at A. If $F_{ab} = F_{ac} = 200\text{lbs}$, determine the resultant force exerted on the loop by the rope.

Solution

$$F_{ab} = F_{ac} = F$$

$$\mathbf{ab} = (2 - 6, 0 - 7, 4 - 0) = (-4, -7, 4)ft$$

$$\mathbf{ac} = (2 - 12, 0 - 0, 4 - 6) = (-10, 0, -2)ft$$

$$\cos \theta = \frac{\mathbf{ab} \cdot \mathbf{ac}}{|\mathbf{ab}||\mathbf{ac}|} = \frac{(-4)(-10) + (-7)(0) + (4)(-2)}{\sqrt{(-4)^2 + (-7)^2 + (4)^2}\sqrt{(-10)^2 + (0)^2 + (-2)^2}} = \frac{8\sqrt{26}}{117}$$

The resultant force exerted on the loop by the rope is

$$F_{res} = \sqrt{F^2 + F^2 - 2F^2 \cos \theta} = F\sqrt{2(1 - \cos^2 \theta)} = 200 \sqrt{2 \left(1 - \left(\frac{8\sqrt{26}}{117} \right)^2 \right)} = 265 \text{ lbs}$$

Answer: 265 lbs.