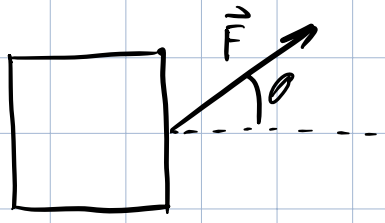
A rope is attached to a block. The rope pulls on the block with a force of 230 N at an angle of 20°.



What is the x and y component of the force?

$$\hat{F} = \langle \cos(\theta_x), \cos(\theta_y), \cos(\theta_z) \rangle$$

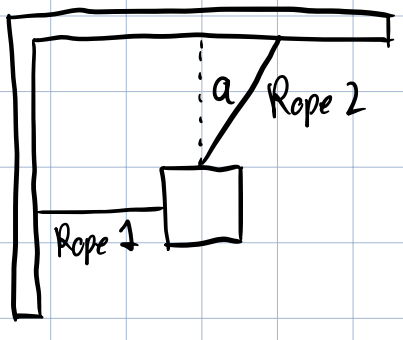
$$\theta_x = 20$$
$$\theta_y = 90 - 20 = 70$$

$$\hat{F} = \langle 0.940, 0.342, 0 \rangle$$

$$\vec{F}_x = 216.129\ N$$

$$\vec{F}_y = 78.665\ N$$

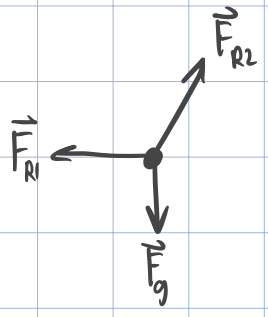
A box of mass 45 kg hangs motionless from two ropes. a is 36°. Choose the box as the system.



Is $\frac{d\vec{p}}{dt}$ zero or non zero?

Zero

What is the y component of the gravatational force acting on the block?



$$\vec{F}_g = |\vec{F}|\hat{F}$$

$$= mg\langle 0, -1, 0\rangle$$

$$= \langle 0, -441, 0\rangle N$$

What is the y component of the force on the block due to rope 2?

$$\vec{F}_{R2} = -\vec{F}_g$$

$$= \langle 0, 441, 0\rangle N$$

What is the magnitude $\vec{F}_{R2}$?

$$\vec{F}_{R2} = |\vec{F}_{R2}|\hat{F}_{R2}$$

$$= |\vec{F}_{R2}|\langle \cos(a_x), \cos(a_y), \cos(a_z)\rangle$$

$$a_x = 90 - 36 = 54 \qquad a_y = 36$$

$$= |\vec{F}_{R2}|\langle 0.588, 0.809, 0\rangle$$

$$\langle \vec{F}_{R2x}, 441, \vec{F}_{R2z} \rangle = |\vec{F}_{R2}| \langle 0.588, 0.809, 0 \rangle$$

$$441 = |\vec{F}_{R2}| \cdot 0.809$$

$$|\vec{F}_{R2}| = 545.106 \text{ N}$$

What is the x component of the force on the block due to rope 2?

Using the math above:

$$\vec{F}_{R2x} = |\vec{F}_{R2}| \cdot 0.588$$

$$\vec{F}_{R2x} = 320.405 \text{ N}$$

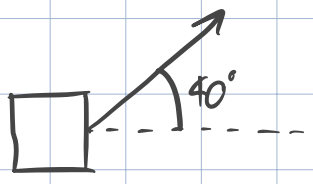
What is the x component of the force on the block due to rope 3?

$$\vec{F}_{R1x} = -\vec{F}_{R2x}$$

$$= -320.405 \text{ N}$$

You pull with a force 245N on a rope that is attached to a block of mass 30kg, and the block slides across the floor at a constant speed of 1.7 m/s. The rope is 40° from horizontal.

What is the x component of the tension force exerted by the rope on the block?



$$\vec{F}_{net\,x} = \vec{F}_{t\,x} + \vec{F}_{f\,x}$$

$$\vec{F}_t = |\vec{F}_t|\hat{F}$$

$$= |\hat{F}_t| \langle \cos(\theta_x), \cos(\theta_y), 0 \rangle$$

$$\theta_x = 40 \qquad \theta_y = 90 - 40 = 50$$

$$= 245 \langle 0.766, 0.643, 0 \rangle$$

$$= \langle 187.681, 157.483, 0 \rangle \text{ N}$$

What is the x component of the force exerted by the floor on the block?

$$\vec{F}_{f\,x} = -\vec{F}_{t\,x}$$

$$= -187.681 \text{ N}$$

What is the y component of the force by the rope on the block?

$\vec{F}_{t\,y} = 157.483\ \text{N}$

What is the y component of the force by the Earth on the block?

$\vec{F}_g = |\vec{F}_g|\hat{F}_g$

$= mg\langle 0, -1, 0\rangle$

$= \langle 0, -294, 0\rangle\ \text{N}$

What is the y component of the force by the floor on the block?

$\vec{F}_{net\,y} = \vec{F}_{g\,y} + \vec{F}_{t\,y} + \vec{F}_{N\,y}$

$0 = \vec{F}_{g\,y} + \vec{F}_{t\,y} + \vec{F}_{N\,y}$

$\vec{F}_{N\,y} = -\vec{F}_{g\,y} - \vec{F}_{t\,x}$

$= 136.517\ \text{N}$