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Bb Examples
Chapter 5

Example 1

A particle is moving with constant velocity v=2i-4j. There are only two forces acting on the particle, one of them is F1=2i-6j. What is the other force?

Constant Velocity $\Rightarrow$ acceleration $= 0 \Rightarrow$

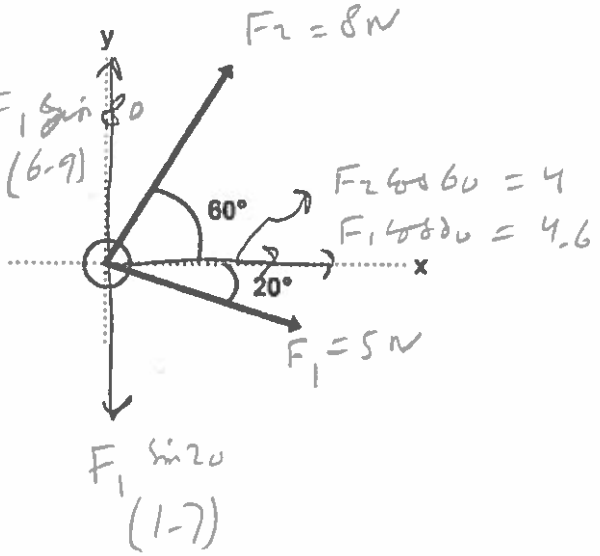
$F_{net} = 0$

$\Rightarrow \vec{F_1} + \vec{F_2} = 0 \Rightarrow \vec{F_1} = -\vec{F_2}$

$\vec{F_2} = -2i + 6j$

Example 2

A ball of mass 0.3 kg slides on a frictionless surface under the influence of only two forces as shown in the figure. F1has a magnitude of 5.0N and F2 has a magnitude of 8.0N. Determine the magnitude and direction of the ball's acceleration.



X - dir

$F_{net} = F_1 \cos 20 + F_2 \cos 60$

$= 8.6$

X - dir

$F_{net} = F_2 \sin 80 - F_1 \sin 20$

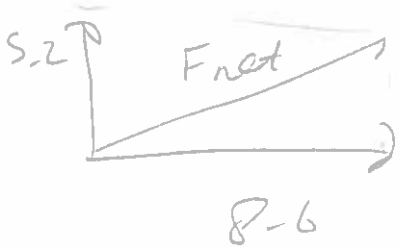
$= 6.9 - 1.7$

$= 5.2$

$F_{net} = ma$

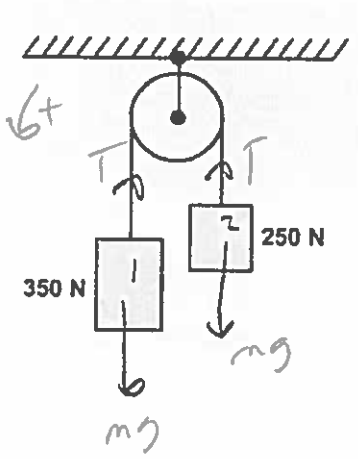
$\sqrt{(8.6)^2 + (5.2)^2} = (0.3)a$

$\therefore a = 33.5 \, m/s^2$



Example 3

A string that passes over a massless pulley as shown connects two blocks weighing 250N and 350N respectively. What is the tension in the string?



$F_{net} = ma$

m_1: $350 - T = \left(\frac{350}{g}\right) a = 35.7a$ (1)

m_2: $T - 250 = \left(\frac{250}{g}\right) a = 25.5a$ (2)

$350 - 250 = (35.7 + 25.5)a$

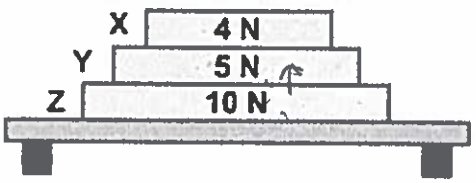
$\therefore$ $a = 1.63\ m/s^2$ substitute in (1) $\Rightarrow$

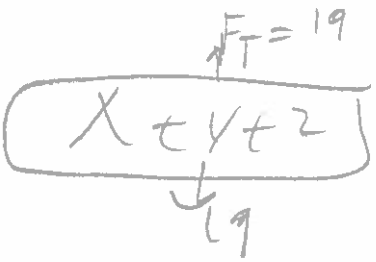
$350 - T = (35.7)(1.63)$

$T = 350 - 58.3 = 291.7\ N$

Example 4

Three books (X, Y, and Z) rest on a table. The weight of each book is indicated. What is the force exerted by book Z on book Y.



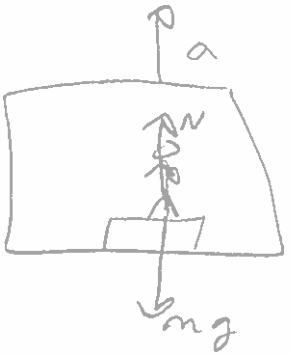


$F_{ZY} = 5 + F_{XY} = 5 + 4 = 9\ N$

$19 - 5 = F_{XY} = 9\ N$

Example 5

A man weighing 700N is in an elevator that is accelerating upward at 4 m/s^2. What is the force exerted on him by the floor of the elevator.



$a = 4\ m/s^2$

$F_{net} = ma$

$N - mg = ma$

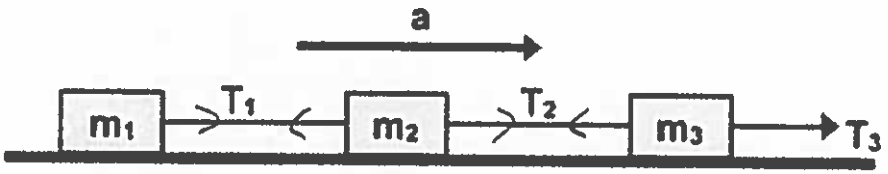
$N = ma + mg$

$= 700(4 + 9.8)$

$= 9660\ N$

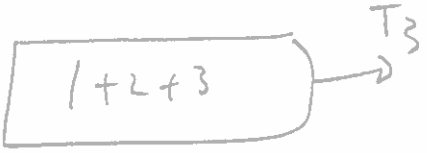
Example 6

Three blocks are connected and pulled to the right on a horizontal frictionless table by a force with a magnitude T3=650N. If m1=12.0kg, m2=24.0kg, and m3=31.0kg, calculate the acceleration of the system and the tensions T1 and T2 in the interconnecting cords.



$F_{net} = ma$

$650 = (12 + 24 + 31)a \Rightarrow a = 9.7\ m/s^2$



$F_{net} = ma$

$T_1 = 12 \times 9.7$

$T_1 = 116.5\ N$

$349.3 - T_1 = 24a$

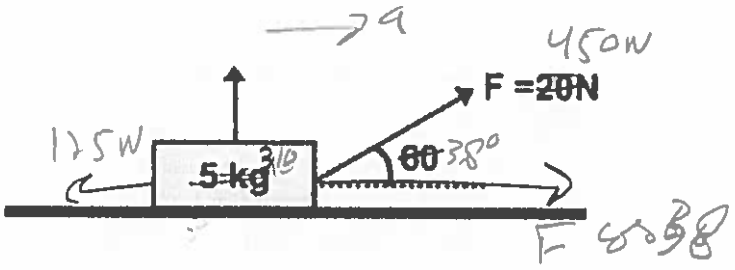
$T_1 = 116.5\ N$

$650 - T_2 = 31a$

$T_2 = 349.3\ N$

Example 7

A boy pulls a box of mass 310kg with a force of 450N, which is inclined 38° to the horizontal. The floor exerts a horizontal force of magnitude 125N that opposes the motion. Calculate the acceleration of the box.



$F_{net} = ma$

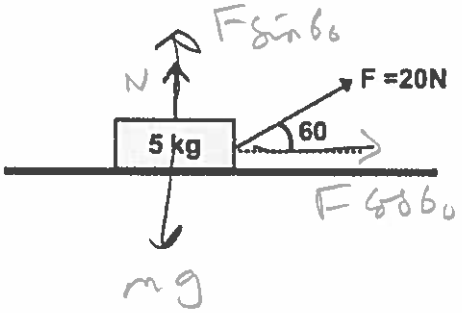
$450\cos 38 - 125 = m\,a$

$354.6 - 125 = (310)(a)$

$\therefore a = 0.74\ m/s^2$

Example 8

Calculate the normal exerted by the floor on the block of the following figure.



on the y-direction:

$F_{net} = 0$

$\therefore F\sin 60 + N = mg$

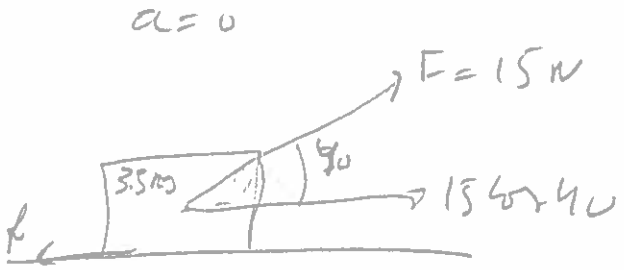
$20\sin 60 + N = (5)(9)$

$-17.3 + N = 49$

$\therefore N = 31.7\ N$

Example 9

A 3.5kg block is pulled at constant velocity along a horizontal floor by a force F=15N that makes an angle of 40° with the horizontal. Find the magnitude of the force of friction between the block and the floor.



x – dir :

$F_{net} = ma$

$15\cos 40 - R = 0$

$11.5 = R$