Example 1

A 10 kg block is pushed across the floor with a 50 N horizontal force. The force of friction between the block and the floor is 30 N.

(a) What is the net force acting on the box?

(b) What is the acceleration of the box?

(a) $F_{net} = F_p - F_f$

$= 50N - 30N$

$F_{net} = 20N$

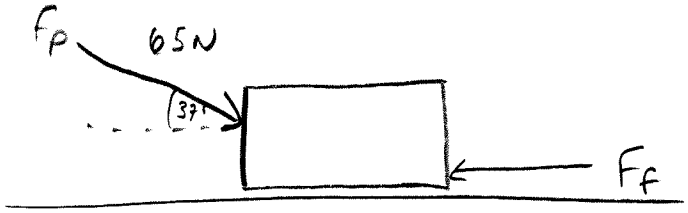
(b) $F = ma$

$20N = (10kg)\,a$

$a = 2\ m/s^2$

Example 2

A snowblower is pushed with a 65 N force at an angle of 37° with the horizontal. The snowblower is moving with a constant velocity. Calculate the force of friction acting on the snowblower.



$F_{net} = 0$

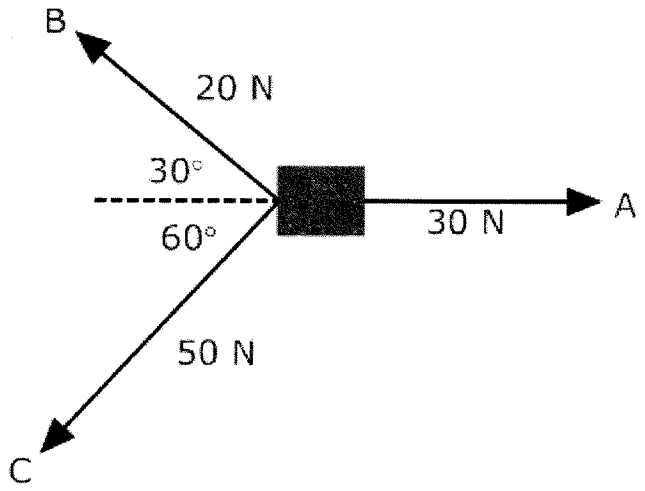
$F_p \cos 37 - F_f = 0$

$65 \cos 37 - F_f = 0$

$F_f = 52\ N$

Example 3

Three people, labeled A, B, and C, are pulling on a sled as shown. Calculate the net force on the sled.



X

$-F_B \cos 30 - F_C \cos 60 + F_A$

$-20\cos 30 - 50\cos 60 + 30$

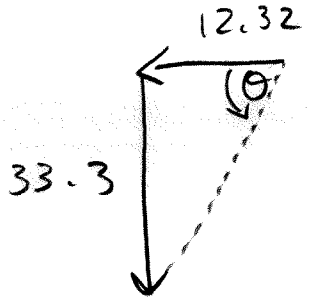
$-12.32\ N$

Y

$F_B \sin 30 - F_C \sin 60$

$20\sin 30 - 50\sin 60$

$-33.3\ N$



$F_{net} = \sqrt{33.3^2 + 12.32^2}$

$= 35.5\ N$

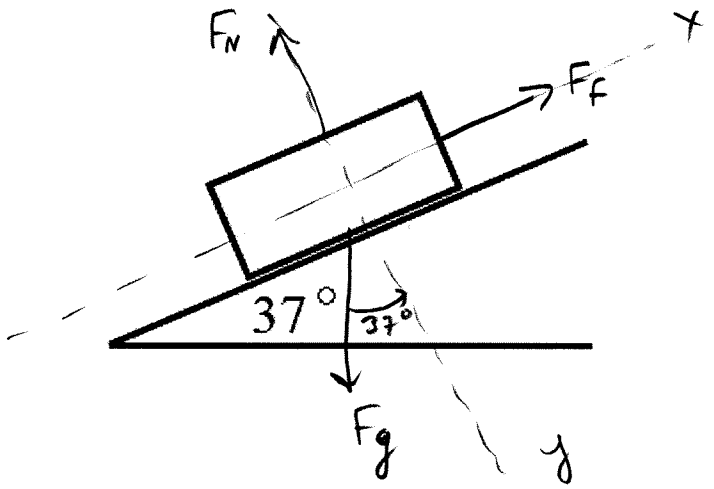
$\tan\theta = \frac{33.3}{12.32}$

$\theta = 69.7°$

$F_{net} = 35.5\ N \quad 69.7°$ S of W

Example 4

A 5.0 kg block is stationary on an incline plane as shown. Calculate the force of friction acting on the block.



* Down the slope is +ve.

X

$F_g \sin 37 - F_f = 0$

$mg \sin 37 - F_f = 0$

$(5\,kg)(9.8\,m/s^2) \sin 37 = F_f$

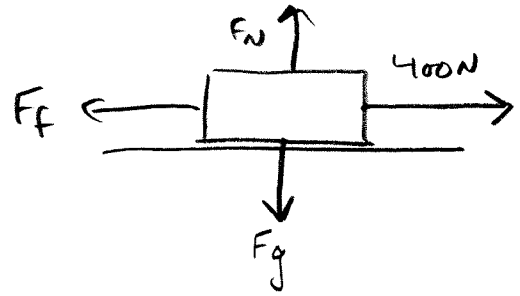
$f_f = 29.5\,N$

y

$-F_g \cos 37 + F_N = 0$

Example 5

A horizontal force of 400.0 N is required to pull a 1760 N trunk across the floor at constant speed. Calculate the coefficient of sliding friction.



$F_g = 1760\,N$

X

$-F_f + 400 = 0$

$F_f = 400\,N$

y

$F_N - F_g = 0$

$F_N - 1760N = 0$

$F_N = 1760N$

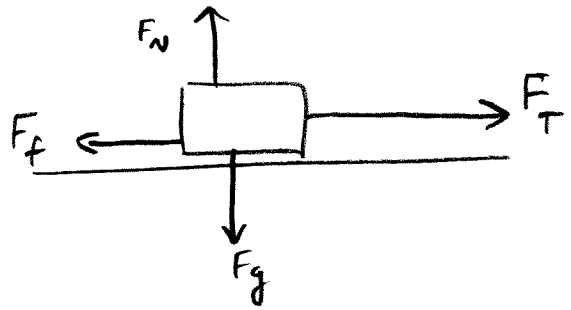
$F_f = \mu F_N$

$400 = \mu(1760)$

$\mu = 0.23$

Example 6

A 65 N boy sits on a sled weighing 52 N on a horizontal surface. The coefficient of friction between the sled and the snow is 0.012. The sled is pulled at constant speed by a rope held horizontally. What is the tension (the pull) in the rope?



$F_g = 65N + 52N = 117N$

x

$-F_f + F_T = 0$

$F_T = F_f$

y

$F_N - F_g = 0$

$F_N = 117N$

$F_f = \mu F_N$

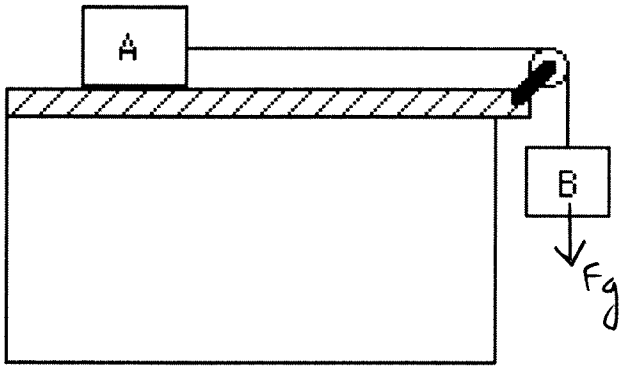
$= 0.012\,(117N)$

$= 1.4$

$F_T = 1.4N$

Example 7

A 20 kg block (A) rests on a frictionless table; a cord attached to the block extends horizontally to a pulley at the edge of the table and a 10 kg mass (B) hangs at the end of the cord.



(a) Calculate the acceleration of the block and mass.
(b) Calculate the tension in the cord.

(a) only force is due to gravity on B

$F = mg = (10\,kg)(9.8\,m/s^2) = 98\,N$

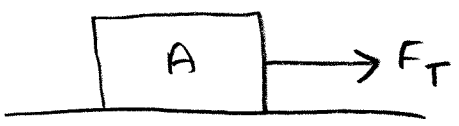
both A + B accelerate under this force.

$F = ma$

$98\,N = (20\,kg + 10\,kg)\,a$

$a = 3.3\,m/s^2$

(b)



Force of tension can be found by isolating block A

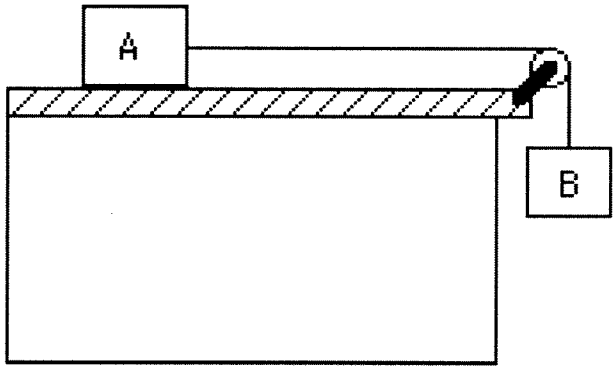
$F = ma$

$F_T = (20\,kg)(3.3\,m/s^2)$

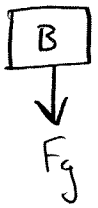
$F_T = 66\,N$

Example 8

A 20 kg block (A) rests on a table; a cord attached to the block extends horizontally to a pulley at the edge of the table and a 10 kg mass (B) hangs at the end of the cord. The coefficient of friction between block A and the table is 0.12.



Calculate the acceleration of block A.



$F_g = mg = (10kg)(9.8\ m/s^2) = 98N$

$F_p - F_f = ma$

$98 - 23.52 = (20+10)a$

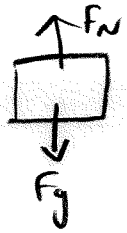
$a = 2.48\ m/s^2$

$F_f = \mu F_N$

$F_f = .12(196N)$

$= 23.52N$

since friction only acts on block A



$F_N = mg = (20kg)(9.8m/s^2)$

$= 196N$