


# Weight, Normal Force and Force Diagrams

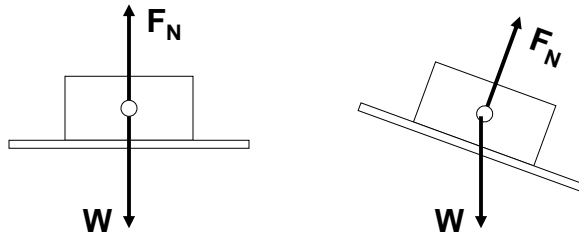


## **Weight**

- Force of gravity on a mass
- $W = mg$

## Normal Force

- The force acting perpendicular to the surface that the object is resting on.



- On a flat surface, the normal force,  $F_n$ , is equal to weight of the object.

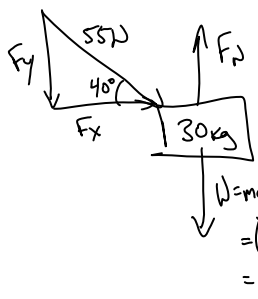
## Forces Applied at Angles

- When applying a force at an angle, some of the applied force is used to move the object and some is used to change the normal force.

## Forces Applied at Angles Example 1

- A 30 kg lawnmower is pushed with a force of 55 N. If the handle of the mower makes an angle of  $40^\circ$  to the horizontal, what is the acceleration of the lawn mower and the normal force that the ground is supplying to the mower?

## Forces Applied at Angles Example 1



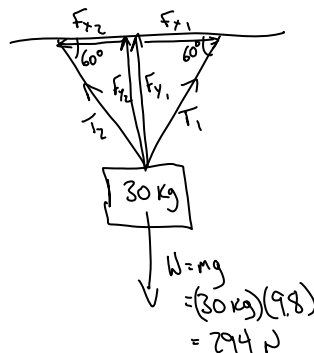
Handwritten calculations for Example 1:

$$F_y = 55 \text{ N} \sin 40^\circ = 35.4 \text{ N}$$
$$F_x = 55 \text{ N} \cos 40^\circ = 42.1 \text{ N}$$
$$F_{\text{net}} = F_x = MA$$
$$42.1 \text{ N} = (30 \text{ kg})A$$
$$A = \frac{42.1 \text{ N}}{30 \text{ kg}} = 1.4 \text{ m/s}^2$$
$$F_N = F_y + W$$
$$= 35.4 \text{ N} + 294 \text{ N}$$
$$F_N = 329.4 \text{ N}$$
$$W = mg = (30 \text{ kg})(9.8 \text{ m/s}^2) = 294 \text{ N}$$

## Forces Applied at Angles Example 2

- You hang a 30 kg sign from the ceiling using 2 cables. If each of the cables make a  $60^\circ$  angle with the ceiling, what is the tension in each cable?

## Forces Applied at Angles Example 2



$$F_{y2} + F_{y1} = 294 \text{ N}$$
$$2F_{y2} = 294 \text{ N}$$
$$F_{y2} = 147 \text{ N}$$

$$\sin 60^\circ = \frac{147 \text{ N}}{T_1}$$
$$T_1 = \frac{147 \text{ N}}{\sin 60^\circ}$$
$$T_1 = 169.7 \text{ N}$$

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**Notes**