FORCES

A force is either a push or pull which when applied to an object causes it to:

(a) Move the object from a position of rest
(b) Change the speed or the direction of the object
(c) Change the shape of the object

Force is a vector quantity since it has magnitude and direction. The symbol for force is **F**. The unit is **NEWTONS (N).**

There are many types of forces:

(a) Tension
(b) Contact Force
(c) Expansive Force
(d) Up thrust
(e) Resistance
(f) Friction
(g) Magnetic Force
(h) Electric Force

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Read, understand and make notes if necessary on the forces listed above.

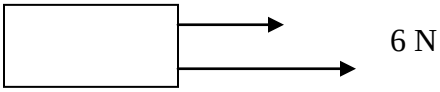
We can represent forces on a line diagram or by scale drawing. We can determine the resultant force of two or more forces by using a scale drawing or calculations.

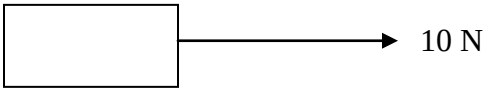
Solving Parallel Forces

Parallel forces act on the same line on the same object and can be added arithmetically to find the resultant force. Remember that we have to consider the direction of each force.

FORCES ACTING ON A BODY FORCE ***RESULTANT***

(A)





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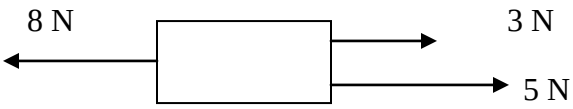
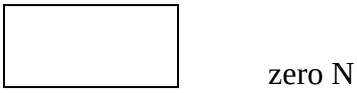




(C)

Parallelogram Law for Adding Forces

If two forces act at a point on the same object we can represent them in magnitude and direction by drawing the sides of a parallelogram from tht point. We can solve these types of forces by scale drawings.

Examples

(a) A 6N and 10N force act on a point on an object so that the angle between them is 35. Using a scale drawing calculate the resultant force. Use a scale of 1 cm to represent 1 N.

(b) A 5N and 7N force act on a point on an object so that the angle between them is 40. Using a scale drawing calculate the resultant force. Use a scale of 1 cm to represent 1 N.

Forces at Right Angles

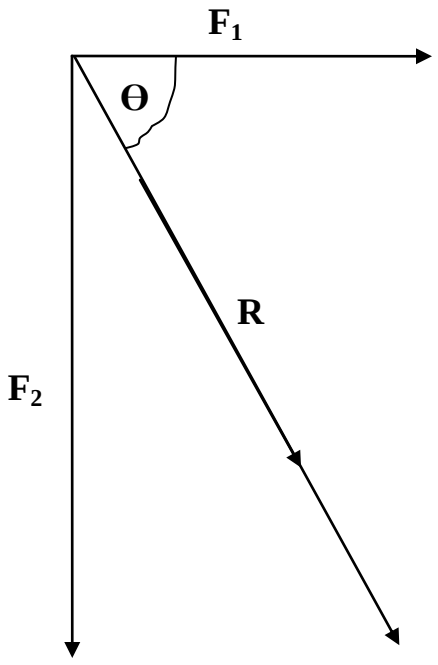
When a forces act at right angles to each other we can determine the resultant force by using:

(a) Pythagoras theorem to determine the magnitude of the resultant force

$$\mathbf{R^2 = [F_1]^2 + [F_2]^2}$$

(b) Trigometric ratio to determine the angle of the resultant force relative to one of the original forces.

$$\mathbf{\text{Tan } \Theta = \frac{\text{Opposite}}{\text{Adjacent}}}$$



Examples

(a) A 3N and 4N force act at right angles to each other on the same point of an object. Calculate the resultant force which is equal to the combined effect of these two forces.

(b) A 5N and 12N force act at right angles to each other on the same point of an object. Calculate the resultant force which is equal to the combined effect of these two forces.

Examples

A boy of mass 50 kg sits on one side of the see saw 2.4 m from the pivot. If a girl balances the see saw by sitting 3 m from the pivot on the opposite side to the boy, what is her weight?

A plank AB is 5 m long. It is pivoted at a point A where AO is 2 m long. A boy of weight 600 N sits at a point C which is 1 m from O. The plank is in equilibrium. Calculate the weight of the plank. (NB. The weight of the plank acts through its center)

AB is a uniform plank with the pivot at the centre of gravity. A boy of mass 20 kg sits 2 m from the pivot on the right side. A girl of mass 40 kg sits 3 m behind him on the same side. A man of 80 kg sits on the left side of the pivot and balances the plank. Find his distance from the pivot.

Parallel Forces in Equilibrium

When an object is in equilibrium and two (2) or more parallel forces are acting on it, we can say that:

(a) the sum of the forces acting on it in one direction is equal to sum of the forces acting on it in the opposite direction.

(b) the sum of the anticlockwise moments is equal to the sum of the clockwise moments.

Example

A motorcycle of 2000 N is driving across a bridge of weight 5000 N. The weight of the bridge acts through its centre of gravity. The bridge is 50 m long. Calculate the supporting contact forces at C_1 and C_2 given that the motorcycle is 45 m from the pillar at C_2.