Beckfoot

Subject: Science (Physics)	Topic: Forces- Part 1	Year Group: 9

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Equations in this topic

1	Mass, weight and gravity	**Weight = mass x gravitational field** Units: Weight in Newtons (N) Mass in kilograms (kg) Gravitational field in Newtons per kg (N/kg)
2	Work done	**Work done = force x distance** Units: Work done in Joules (J) Force in Newtons (N) Distance in metres (m)
3	Spring constant	**Force = spring constant x extension** Units: Force in Newtons (N) Spring constant in Newtons per metre (N/m) Extension in metres (m)
4	Moments **(PHYSICS ONLY)**	**Moment = force x distance** Units: Moment in Newton metres (Nm) Force in Newtons (N) Distance in metres (m)
5	Pressure **(PHYSICS ONLY)**	**Pressure = force / area** Units: Pressure in pascals (pa) Force in Newtons (N) Area in metres^2 (m^2)

Resultant forces - examples

Two forces, 3 newtons (N) and 2 N, act to the right. Calculate the resultant force.

3 N + 2 N = 5 N to the right

Two forces acting in the same direction

A force of 5 N acts to the right, and a force of 3 N act to the left. Calculate the resultant force.

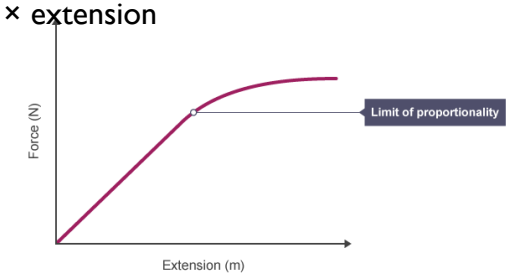
5 N - 3 N = 2 N to the right

Two forces acting in opposite directions

Required practical – Hooke's law

Extension happens when an object increases in length. The extension of an elastic object, such as a spring, is described by Hooke's law:

force = spring constant × extension



Key Vocabulary

1	Resultant Force	The resultant force is a single force that has the same effect as two or more forces acting together
2	Scalar	A quantity that has magnitude only
3	Vector	A quantity that has both magnitude and direction
4	Weight	A result of mass and the gravitational field you are in
5	Mass	The number of particles in an object. Stays the same wherever you are in the universe
6	Work done	Whenever a force is used to move an object through a distance work is done on that object.
7	Inelastic deformation	An object will not return to its original shape and size when the force is removed.
8	Elastic deformation	An object will not return to its original shape and size when the force is removed.
9	Spring constant	Spring constant is a measure of the stiffness of a spring up to its elastic limit.

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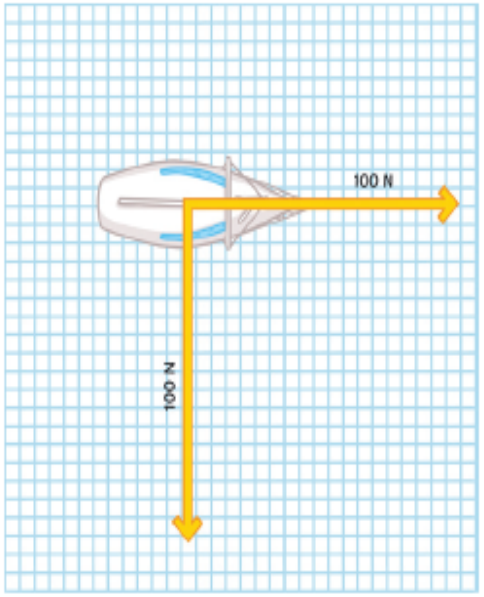
Resultant forces – Vector diagrams

A **scale vector diagram** can be used to calculate **resultant forces** that are not acting directly opposite of one another, on a straight line.

Worked example 1:

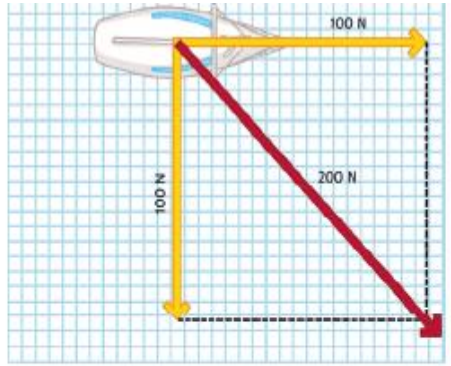
A boat is being pulled toward the harbour by two winch motors. Each motor is pulling with a force of 100N and they are working at right angles to one another.

To find the resultant force, you would first draw construction lines from the end of each arrow parallel to the other force arrow.



Remember that the size of the arrow is representative of the size of the force being exerted.

Where the construction lines intercept indicates the direction of the resultant force: from the centre of mass through the intercept.



The resultant force is the sum of the forces acting so in this example, that is 200N.

Key Vocabulary

1	Contact Forces	The objects are touching e.g. friction, air resistance, tension and contact force
2	Non-contact Forces	The objects are not touching e.g. gravitational, electrostatic and magnetic forces

Worked example 2:

A horse-drawn carriage is pulled by two horses at 400N each. One of the horses is pulling in a different direction to the other horse. Show the resultant force and direction of the horse-drawn carriage.

As before, you will need to draw construction lines from the end of each force arrow and parallel to the other one. The intercept represents the direction of the resultant force. The resultant force is the sum of the individual forces so in this example, it is 800N.