

Key words

gravity
parallel
resultant

1 Adding parallel forces

- Forces are vector quantities, having both magnitude and direction. A force is often represented as an arrow, whose length represents the relative magnitude of the force, and direction indicates the direction in which the force acts.
- A **resultant** force is a single force that produces the same effect as two or more forces.
- Parallel** forces act in either the same direction or in opposite directions.

2 Adding forces

- Extend the spring by pulling two force meters in different directions. The force exerted by the upper force meter is 6 N, and by the lower force meter, 4 N.
- The spring can be extended by the same amount by pulling a single force meter in a horizontal direction by 8 N.

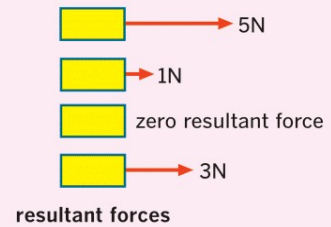
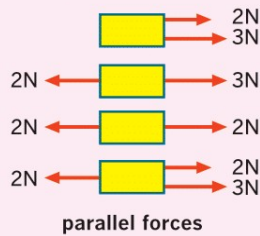
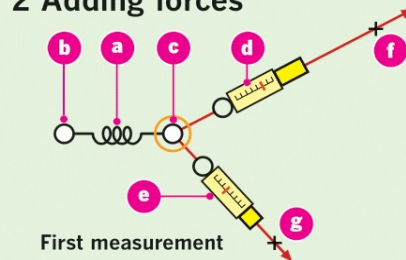
3 The parallelogram

- Remove the equipment and draw a line 6 cm long representing the 6 N force between c and f, mark the end A.
- To represent the 4 N force draw a line 4 cm long between c and g. Mark end B.
- Complete the parallelogram by making a 4 cm arc centered on A and a 6 cm arc centered on B.
- The diagonal of the parallelogram is 8 cm long, the size of the resultant force in the experiment.

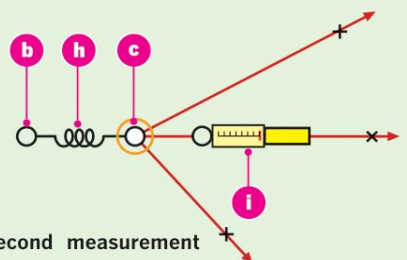
4 Components of weight

- Weight is the force that an object exerts on the ground by virtue of being pulled down by *gravity*. The weight of an object can be resolved into two forces (C_1 and C_2) acting perpendicularly to each other.
- $\cos \theta = C_2/F$ therefore $C_2 = F \cos \theta$
- $\cos \alpha = C_1/F$ therefore $C_1 = F \cos \alpha$
however $\cos \alpha = \sin \theta$ therefore $C_1 = F \sin \theta$.

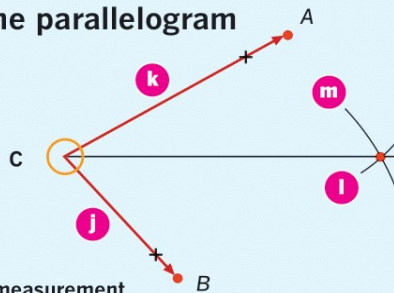
Adding forces

1 Adding parallel forces**2 Adding forces**

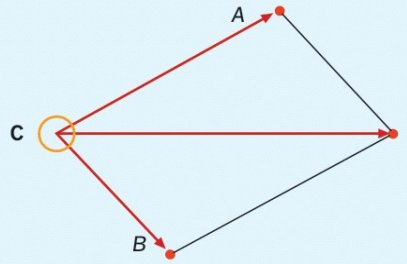
- First measurement**
- a stretched spring
 - b fixed end
 - c metal ring with circle drawn round to mark position
 - d force meter reads 6 N



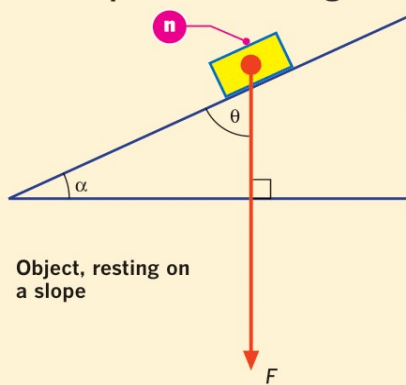
- Second measurement**
- e force meter reads 4 N
 - f mark direction of 6 N
 - g mark direction of 4 N
 - h stretched spring with same extension
 - i force meter reads 8 N

3 The parallelogram

- First measurement**
- j 4 cm line to represent 4 N
 - k 6 cm line to represent 6 N

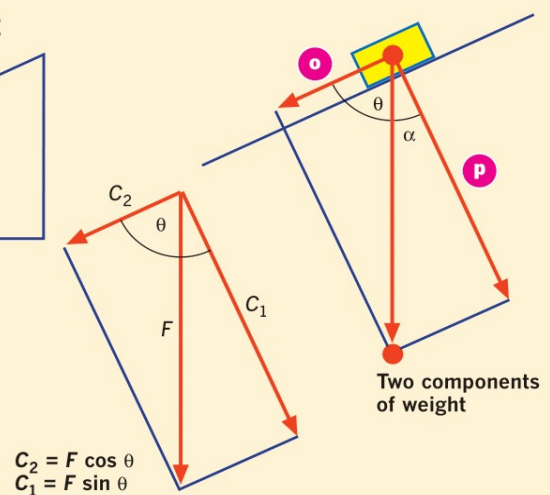


- Showing how the forces add**
- l point of arc radius 4 cm centered on A
 - m point of arc radius 6 cm centered on B

4 Components of weight

Object, resting on a slope

- n object
- o weight down the plane
- p weight perpendicular to plane



$$C_2 = F \cos \theta$$

$$C_1 = F \sin \theta$$