

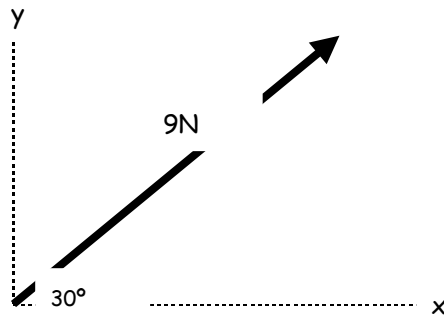
## Statics

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### Resolving Forces into Components

This concept was introduced in earlier work on vectors as it is far easier to deal with a number of forces if we can split them into their horizontal and vertical components.

The diagram below shows a 9N force acting at an angle of  $30^\circ$  to the horizontal. Find the components of the force in the horizontal and vertical direction.



$$x \text{ component} = 9 \times \cos 30^\circ = \frac{9\sqrt{3}N}{2}$$

$$y \text{ component} = 9 \times \sin 30^\circ = \frac{9}{2}N$$

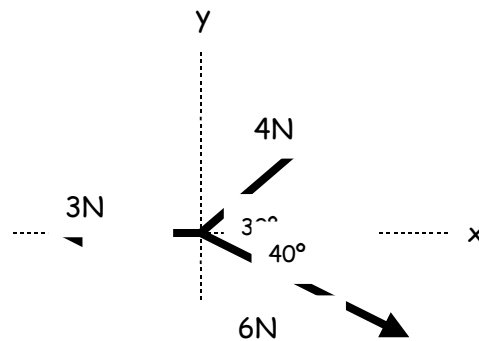
### Resolving Several Forces into Components

All we have to do is find all of the x components and add them together to give the x component of the resultant force. This

idea is applied to the y component and from this we can find the direction of the resultant.

### Example 3

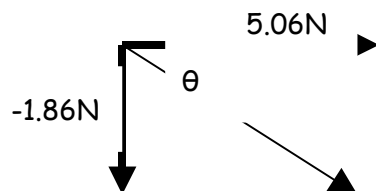
The diagram below shows a number of forces. Find the resultant of the forces and its direction.



The best way to attack this problem is to use a table:

Force	x component	y component
3N	- 3	0
4N	$4 \times \cos 30^\circ$	$4 \times \sin 30^\circ$
6N	$6 \times \cos 40^\circ$	$-6 \times \sin 40^\circ$
Total	5.06	-1.86

The resultant can be represented pictorially as:



The resultant has a magnitude of:

$$= \sqrt{5.06^2 + 1.86^2}$$

$$= 5.39N$$

In the direction of:

$$\text{Tan}^{-1}\left(\frac{-1.86}{5.06}\right) = -20.2^\circ$$

### Equilibrium of Coplanar Forces

If a system is being acted upon by a series of forces that all lie in the same plane then it will be in equilibrium if their resultant vector is zero.

#### Example 4

A particle is in equilibrium under the forces  $(8\mathbf{i} + 10\mathbf{j})\text{N}$ ,  $(-6\mathbf{i} - 5\mathbf{j})\text{N}$  and  $(a\mathbf{i} + b\mathbf{j})\text{N}$ . Find the values of  $a$  and  $b$ .

Equating coefficients gives:

$$8 + a - 6 = 0$$

$$a = -2$$

$$10 - 5 + b = 0$$

$$b = -5$$