Newton's Second Law

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Physical quantities

Quantity	symbol	vector/scalar	unit
Displacement	$\vec{\mathbf{D}}$	vector	m
Velocity	$\vec{\mathbf{v}}$	vector	m/s
Acceleration	$\vec{\mathbf{a}}$	vector	m/s^2
Time	t	scalar	s
Force	$\vec{\mathbf{F}}$	vector	N
Mass	m	scalar	kg

Newton's Second Law in words

- **Newton's words:**[1] A change in motion is proportional to the motive force impressed and takes place along the straight line in which that force is impressed.
- **Modern version:** An object's acceleration is directly proportional to the net force acting on the object and inversely proportional to it mass.

[1] Translated from Latin to English by I. Bernard Cohen, Anne Whitman, and Julia Budenz.

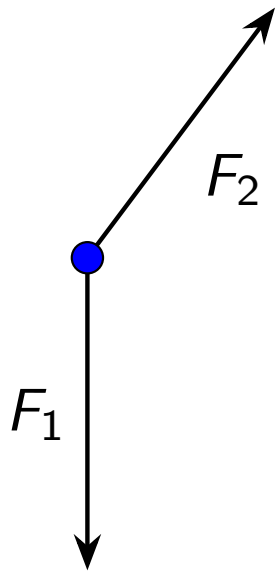
Newton's Second Law

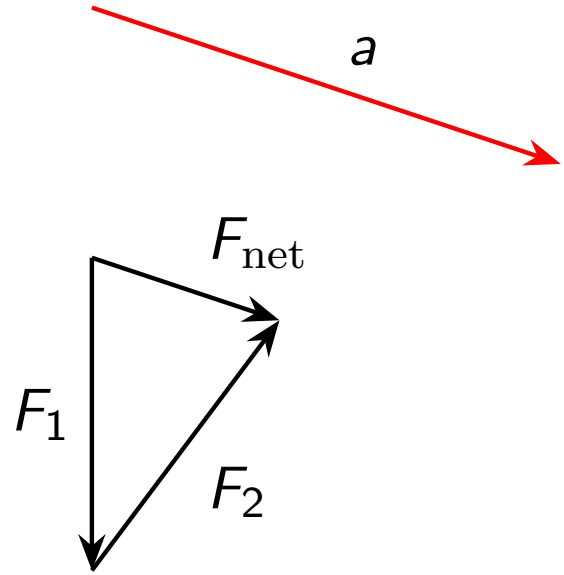
The acceleration of an object is directly proportional to the total force that acts on the object, and inversely proportional to the mass of the object.

$$\vec{\mathbf{a}} = \frac{\vec{\mathbf{F}}_{\text{net}}}{m}$$

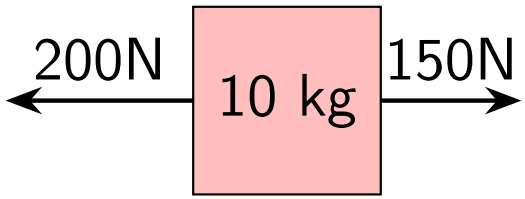
$$a_x = \frac{F_{\text{net},x}}{m} \qquad a_y = \frac{F_{\text{net},y}}{m}$$

Add forces to get the net force.





Two forces in one dimension



(a) Starting from rest, how far will it go in 5 s?

(b) Starting instead at 10 m/s to the right, where will it be in 5 s?