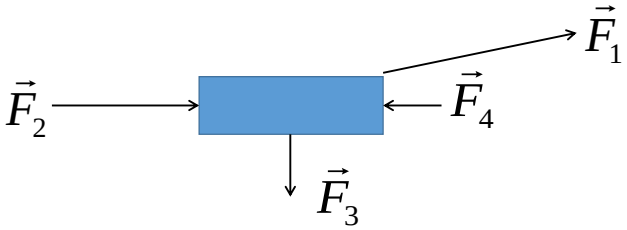
Newton's second law

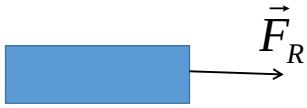
$$\left.\begin{array}{l} a \sim F \\ a \sim \dfrac{1}{m} \end{array}\right\} \; a \sim \frac{F}{m}$$

$$F \sim m.a$$

$$F = m.a$$

Newton's second law





$$\vec{F}_R = \vec{F}_1 + \vec{F}_2 + \ldots + \vec{F}_n \qquad \vec{F}_R = \Sigma \vec{F}_i$$

$$\vec{F}_R = m.\vec{a}$$

$$\vec{F}_{Rx} = m.\vec{a}_x$$

$$\vec{F}_{Ry} = m.\vec{a}_y$$

One newton is the force to give an object with a mass of 1 kg an acceleration of 1 m/s².

Examples

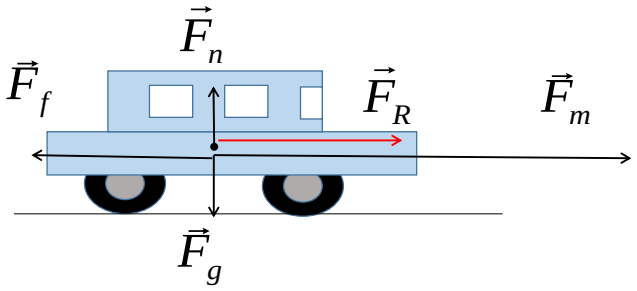
1)On a mass of 50 kg we have a net force of 250N. What is the acceleration?

$Given: m = 50kg; F_{res} = 250N$ $\quad Find: a$

$Solution: F_{res} = m.a$ $\quad a = \frac{F}{m}$ $\quad a = \frac{250N}{50kg} = 5{,}0\frac{N}{kg}$

2)A car, which has a mass of 1500 kg, drives on the freeway and has a speed of 110 km/h. He accelerates to 120 km/h during 5 seconds. There is a frictional force of 500N

Draw the forces at the centre of mass in this picture of a car.



Examples (2)

Sum of the vectors: $\vec{F}_R = \vec{F}_g + \vec{F}_n + \vec{F}_m + \vec{F}_f$

X-axis: $\vec{F}_f + \vec{F}_m = m.\vec{a}_x$

Y-axis: $\vec{F}_n + \vec{F}_g = m.\vec{a}_y \longrightarrow F_{R,y} = 0$

a_x ? $\quad$ **want** $a_y = 0$

$v_0 = 110km/h = 30{,}6\frac{m}{s}; v = 120km/h = 33{,}3\frac{m}{s}; t = 5{,}0s$

$v = a.t + v_0$ $\quad a = \frac{v - v_0}{t} = \frac{33{,}3 - 30{,}6}{5{,}0} = 0{,}54\frac{m}{s^2}$

Examples (2)

$$F_{R,x} = m.a_x = 1500kg.0{,}54\frac{m}{s^2} = 8{,}1.10^2\,N$$

What is the force of the motor?

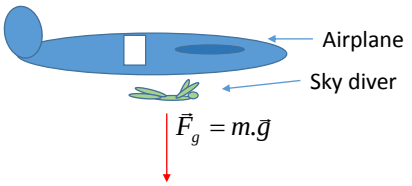
$$\vec{F}_w + \vec{F}_m = m.\vec{a}_x = \vec{F}_{R,x}$$

$$\vec{F}_m = \vec{F}_{R,x} - \vec{F}_w$$

$$F_m = 8{,}1.10^2\,N + 500N = 1{,}3.10^3\,N$$

Newton's second law

Example: sky diver



$\vec{F}_g = m.\vec{g}$

$\vec{F}_g = \vec{F}_R$

$m.\vec{g} = m.\vec{a}$

$\frac{N}{kg}$ $\frac{m}{s^2}$

Massa valt weg: doet er niet toe!