Newton's Laws of Motion

Newton's Laws are spelled out in the book.

Here is a short summary of their content and their implications.

- Newton-1 $\hookleftarrow$ Galileo's principle of inertia
- Newton-2 : $m\vec{a} = \vec{F}_{net} \equiv \sum \vec{F}$

Comments

(i) $[\vec{F}] = \frac{kg \cdot m}{s^2} = 1\ N(ewton)$

(ii) If $\sum \vec{F} = 0 \Rightarrow \vec{a} = \frac{d\vec{v}}{dt} = 0$ so $\vec{v} = const$

i.e. Newton-1 is a special case of Newton-2

(iii) $\vec{a} \parallel \vec{F}_{net}$ (but $\vec{v}$ can have different direction)

(iv) Two types of problems can be analyzed:

(a) known (observed) motion $\Rightarrow$ infer net force

(b) given forces $\Rightarrow$ infer motion

$$\frac{\sum \vec{F}}{m} = \vec{a} \longrightarrow \vec{v} \longrightarrow \vec{r}$$

antiderivatives (b)

derivatives (a)

- Newton-3 : action-reaction principle (forces come in pairs!)

example 1 (Giordano), baseball bat and ball

example 2 (later in more detail): gravitational interaction between, e.g. Earth and Moon