1 Newton's Laws of Motion

Often a conflict between what is definition vs. observation

1.1 Newton's First Law (N1)

Isolated objects move uniformly in inertial reference frames ($\vec{a} = 0 \Leftrightarrow \vec{v} = \text{constant}$)

$$\vec{a}_n = 0 \quad \Leftrightarrow \quad \vec{v} = \text{constant} \tag{1.1.1}$$

Definition

Inertial reference frame: The property that isolated objects move uniformly

Observation

1. Inertial reference frames can always be found
2. Generic reference frames are often inertial

1.2 Newton's Second Law (N2)

For object A in inertial reference frames,

$$\vec{F}_A = m_A \vec{a}_A \tag{1.2.1}$$

Definition

Mass: The object which can be accelerated by a force

Observation

1. $\vec{a} \parallel \vec{F}$
2. Forces add as vectors

1.3 Newton's Third Law (N3)

Definition

Observation