

Newton's 2nd Law

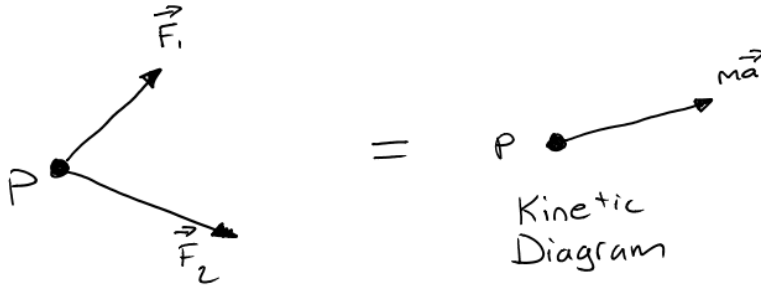
$$\vec{F} = m\vec{a}$$

$$W = mg$$

Weight mass

9.81 m/s²
or 32.2 ft/s²

Free-Body Diagram (FBD) and the Kinetic Diagram



Newton's 2nd Law for a System of Particles

$$\sum \vec{F}_i + \sum \vec{f}_i = \sum m_i \vec{a}_i$$

External Forces Internal Forces due to contact with adjacent particles in the system Particle i

$$\sum \vec{F}_i = \sum m_i \vec{a}_i$$

- Could also use the center of mass for the system

$$\sum \vec{F}_i = m \vec{a}_G$$

total mass center of mass for the system

Rectangular Components

$$\sum \vec{F} = m\vec{a}$$
$$\sum \{ \sum F_x \hat{i} + \sum F_y \hat{j} + \sum F_z \hat{k} \} = m(a_x \hat{i} + a_y \hat{j} + a_z \hat{k})$$

$$\begin{aligned} \sum F_x &= ma_x \\ \sum F_y &= ma_y \\ \sum F_z &= ma_z \end{aligned}$$

Normal and Tangential Coordinates

$$\sum \vec{F} = m\vec{a}$$
$$\sum F_t \vec{u}_t + \sum F_n \vec{u}_n + \sum F_b \vec{u}_b = m(a_t \vec{u}_t + a_n \vec{u}_n)$$

$$\begin{aligned} \sum F_t &= ma_t \\ \sum F_n &= ma_n \\ \sum F_b &= 0 \end{aligned}$$

