# Principle of Linear Impulse and Momentum



* $\vec{F}_i = m\,\vec{a}_i \Rightarrow \sum \vec{F} = m\,\vec{a}$

$$\Rightarrow \sum \vec{F} = m\,\frac{d\vec{v}}{dt}$$

$$\Rightarrow \sum \vec{F}\,dt = m\,d\vec{v} \quad \text{for a particle}$$

Conder the summation over $t \in [t_1, t_2] \Rightarrow v \in [v_1, v_2]$.

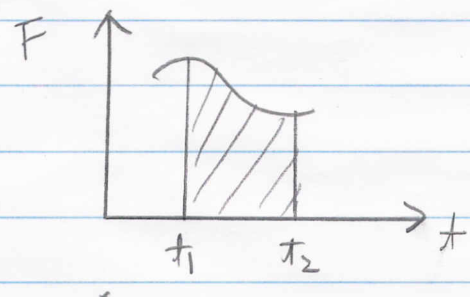
$$\sum \int_{t_1}^{t_2} \vec{F}\,dt = m \int_{\vec{v}_1}^{\vec{v}_2} d\vec{v}$$

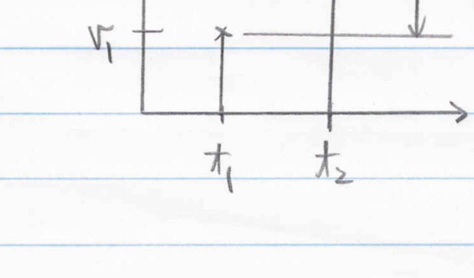
$$\Rightarrow \boxed{\sum \int_{t_1}^{t_2} \vec{F}\,dt = m\vec{v}_2 - m\vec{v}_1}$$

Linear momentum $\boxed{\vec{L} = m\vec{v}}$ $\left(\frac{kg\cdot m}{s}\right)$ or $\left(\frac{slug\cdot ft}{s}\right)$

Linear impulse $\boxed{\vec{I} = \int \vec{F}\,dt}$ $(N\cdot s \text{ or } lb\cdot s)$

* Variation of momentum during $[t_1, t_2]$ is due to the summation of impulses during $[t_1, t_2]$.




$$m\vec{v}_2 - m\vec{v}_1 = \sum \int_{t_1}^{t_2} \vec{F}\,dt$$