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Impulse and Momentum

Linear Momentum

for a particle $\vec{G} = m\vec{v}$ vector quantity

for a system of particles

$$\vec{G} = \sum m_i \vec{v}_i$$

note $\vec{v}_i = \dfrac{d\vec{r}_i}{dt}$ $\quad \vec{r}_i$ is pos'n vector of m_i one particle in sys.

$$\therefore \vec{G} = \sum m_i \dot{\vec{r}}_i = \frac{d(\sum m_i r_i)}{dt}$$ for constant mass

$$\Rightarrow \vec{G} = m\vec{v}_G$$

$\vec{v}_G$ is velocity of centre of MASS.

Newton's 2nd Law $\vec{F} = m\vec{a}$ can be written

Resultant force $\rightarrow \sum \vec{F} = \dot{\vec{G}}$ so $\int_{t_1}^{t_2} \sum \vec{F}\, dt = \vec{G}_2 - \vec{G}_1$ vector

we can write scalar equations for components
e.g. $\sum F_x = \dot{G}_x$ & $\int_{t_1}^{t_2} \sum F_x = G_{x_2} - G_{x_1}$ etc for y, z.

> we call $\int_{t_1}^{t_2} \sum \vec{F}\, dt$ the linear impulse on the body during the time-interval t_1 to t_2

Linear impulse = change in momentum
for a given time interval