$$= \frac{m_1 \times 3R + 8m_1 \times 0}{m_1 + 8m_1} = \frac{3m_1 R}{9m_1} \Rightarrow \boxed{x_{cm} = \frac{R}{3}}$$

$y_{cm} = 0 \quad (\because y_1 = y_2 = 0)$ $\quad \boxed{CM \equiv \left(\frac{R}{3}, 0\right)}$

Motion of CM :

n-particle system

$$\begin{cases} \vec{v} = \frac{d\vec{r}}{dt} \\ \vec{a} = \frac{d\vec{v}}{dt} \end{cases}$$

$m_1, m_2, m_3 \; \cdots\cdots \; m_n$

$\vec{r}_1, \vec{r}_2, \vec{r}_3 \; \cdots\cdots, \vec{r}_n$

$$\vec{r}_{cm} = \frac{1}{M} \cdot (m_1\vec{r}_1 + m_2\vec{r}_2 + \cdots\cdots + m_n\vec{r}_n) \quad — (1)$$

Differentiating eq. (1) w.r.t time

$$\frac{d\vec{r}_{cm}}{dt} = \frac{1}{M} \frac{d}{dt}(m_1\vec{r}_1 + m_2\vec{r}_2 + \cdots\cdots + m_n\vec{r}_n).$$

$$\vec{v}_{cm} = \frac{1}{M}\left\{\frac{d}{dt}(m_1\vec{r}_1) + \frac{d}{dt}(m_2\vec{r}_2) + \cdots\cdots + \frac{d}{dt}(m_n\vec{r}_n)\right\}$$

$$\vec{v}_{cm} = \frac{1}{M}\left\{m_1\frac{d\vec{r}_1}{dt} + m_2\frac{d\vec{r}_2}{dt} + \cdots\cdots + m_n\frac{d\vec{r}_n}{dt}\right\}$$

$$\checkmark \; \vec{v}_{cm} = \frac{1}{M}\left\{m_1\vec{v}_1 + m_2\vec{v}_2 + \cdots\cdots + m_n\vec{v}_n\right\} \quad — (2)$$

Differentiating eq (2) w.r.t time

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

$$\frac{d\vec{v}_{cm}}{dt} = \frac{1}{M} \cdot \frac{d}{dt}(m_1\vec{v}_1 + m_2\vec{v}_2 + \cdots\cdots + m_n\vec{v}_n)$$

$$= \frac{1}{M}\left\{m_1\frac{d\vec{v}_1}{dt} + m_2\frac{d\vec{v}_2}{dt} + \cdots\cdots + m_n\frac{d\vec{v}_n}{dt}\right)$$

$$\checkmark \; \vec{a}_{cm} = \frac{1}{M}\left\{m_1\vec{a}_1 + m_2\vec{a}_2 + \cdots\cdots + m_n\vec{a}_n\right) \quad — (3)$$

$$M\vec{a}_{cm} = m_1\vec{a}_1 + m_2\vec{a}_2 + \cdots\cdots + m_n\vec{a}_n \quad — (4).$$

$$m_1\vec{a}_1 = \vec{F}_1 + \vec{F}_1^{int}, \quad m_2\vec{a}_2 = \vec{F}_2 + F_2^{int}, \; \cdots\cdots \; m_n\vec{a}_n = \vec{F}_n + \vec{F}_n^{int}$$

by Eq (4)

$$M\vec{a}_{cm} = (\vec{F}_1 + \vec{F}_1^{int}) + (\vec{F}_2 + F_2^{int}) + \cdots\cdots + (\vec{F}_n + F_n^{int})$$

$$M\vec{a}_{cm} = (\vec{F}_1 + \vec{F}_2 + \cdots\cdots + \vec{F}_n) + (\vec{F}_1^{int} + \vec{F}_2^{int} + \cdots\cdots + \vec{F}_n^{int})$$

$$M\vec{a}_{cm} = \vec{F}^{ext} + \Sigma F^{int}$$

$\because$ For a system $\Sigma F^{int} = 0 \Rightarrow \checkmark \; \boxed{M\vec{a}_{cm} = \vec{F}^{ext}} \quad — (5)$