

For particle B: 
$$e = \frac{\int R dt}{\int P dt} = \frac{(V_B)_2 - V}{V - (V_B)_1}$$

$$\Rightarrow e = \frac{(V_B)_2 - (V_A)_2}{(V_A)_1 - (V_B)_1} \leq 1 \quad \text{since } \int R dt \leq \int P dt$$

\* — (2)

iv) Assuming  $e = \text{known}$ , use (1) & (2).

$$(2) \Rightarrow (V_B)_2 = (V_A)_2 - e[(V_A)_1 - (V_B)_1]$$

$$\text{or } (V_A)_2 = (V_B)_2 + e[(V_A)_1 - (V_B)_1]$$

$$(1) \Rightarrow (V_A)_2 = \frac{m_B}{m_A} \left[ (V_B)_1 + \frac{m_A}{m_B} (V_A)_1 - (V_B)_2 \right]$$

$$\therefore \underbrace{(V_B)_2} - e[(V_A)_1 - (V_B)_1] = \frac{m_B}{m_A} \left[ (V_B)_1 + \frac{m_A}{m_B} (V_A)_1 - \underbrace{(V_B)_2} \right]$$

$$\Rightarrow (V_B)_2 = \left( \frac{m_A}{m_A + m_B} \right) \times \left\{ e[(V_A)_1 - (V_B)_1] + \frac{m_B}{m_A} (V_B)_1 + (V_A)_1 \right\}$$

\*

$$\text{And } (V_A)_2 = \left( \frac{2m_A + m_B}{m_A + m_B} \right) \times e[(V_A)_1 - (V_B)_1]$$

$$+ \left( \frac{m_A}{m_A + m_B} \right) \times \left[ \frac{m_B}{m_A} (V_B)_1 + (V_A)_1 \right]$$

\*

\* When  $e = 1 \Rightarrow$  Elastic Impact  $\Rightarrow \int \vec{F} dt = - \int \vec{R} dt$

$$\Rightarrow \underline{\underline{(V_B)_2 = \left( \frac{m_A}{m_A + m_B} \right) \left\{ 2(V_A)_1 + \left( \frac{m_B - m_A}{m_A} \right) \times (V_B)_1 \right\}}}$$

$$\begin{aligned} (V_A)_2 &= \left( \frac{2m_A + m_B}{m_A + m_B} \right) \times [(V_A)_1 - (V_B)_1] + \left( \frac{m_B}{m_A + m_B} \right) \times (V_B)_1 \\ &\quad + \left( \frac{m_A}{m_A + m_B} \right) \times (V_A)_1 \end{aligned}$$

$$= \frac{1}{m_A + m_B} \left[ (2m_A + m_B + m_A) \times (V_A)_1 + (m_B - 2m_A - m_B) \times (V_B)_1 \right]$$

$$\Rightarrow \underline{\underline{(V_A)_2 = \frac{1}{m_A + m_B} \left[ (3m_A + m_B) \times (V_A)_1 - 2m_A \times (V_B)_1 \right]}}$$

\* When  $e = 0 \Rightarrow$  Plastic impact  $\Rightarrow \int \vec{R} dt = 0$

$$\Rightarrow \underline{\underline{(V_B)_2 = \left( \frac{m_A}{m_A + m_B} \right) \times \left\{ \frac{m_B}{m_A} (V_B)_1 + (V_A)_1 \right\}}}$$

$$\underline{\underline{(V_A)_2 = \left( \frac{m_A}{m_A + m_B} \right) \times \left\{ \frac{m_B}{m_A} (V_B)_1 + (V_A)_1 \right\}}}$$

$\Rightarrow (V_B)_2 = (V_A)_2 \quad !! \Rightarrow$  Two particles join together \*