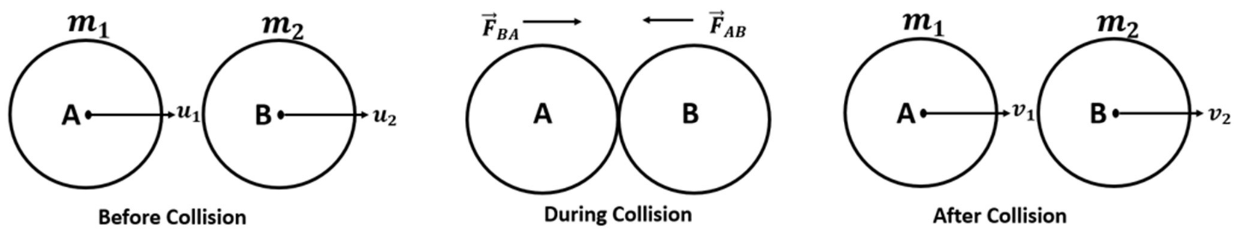
Thus, this equation verifies the principle of conservation of linear momentum.

Proof of principle of conservation of momentum using 2nd law and 3rd law of motion. [For LQ]

Consider two bodies: A and B of masses m_1 and m_2 are moving in a straight linear path with velocities u_1 and u_2 respectively with $u_1 > u_2$.



Since $u_1 > u_2$, as they will undergo collision for short time say $'t'$, and after collision they separate from each other with velocities v_1 *and* v_2 respectively as shown in figure.

Let, $\vec{F}_{AB}$ be force on body 'A' due to body 'B' and $\vec{F}_{BA}$ be force on body 'B' due to body 'A' (during collision), Then from newton's 2nd law of motion,

$$\vec{F}_{AB} = \frac{Change\ in\ momentum\ of\ A}{time}$$

$$\therefore F_{AB} = \frac{m_1v_1 - m_1u_1}{t} ------(1)\ (Action)$$

Similarly,

$$F_{BA} = \frac{m_2v_2 - m_2u_2}{t} ------(2)\ (Reaction)$$

Next, from Newton's 3rd law of motion,

$$\vec{F}_{AB} = -\vec{F}_{BA} \quad ; -ve \text{ sign indicated the opposite direction}$$

$$or, \frac{m_1v_1 - m_1u_1}{t} = -\frac{m_2v_2 - m_2u_2}{t}$$

$$or, m_1v_1 - m_1u_1 = -m_2v_2 + m_2u_2$$

$$\therefore \boldsymbol{m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2}$$

Therefore,

$$\boldsymbol{Total\ momentum\ before\ collision = Total\ momentum\ after\ collision}$$

Thus, the principle of conservation of linear momentum is verified using Newton's 2nd and 3rd laws of motion.

- *In the absence of net external force, the total momentum before the collision is equal to the total momentum after the collision.*