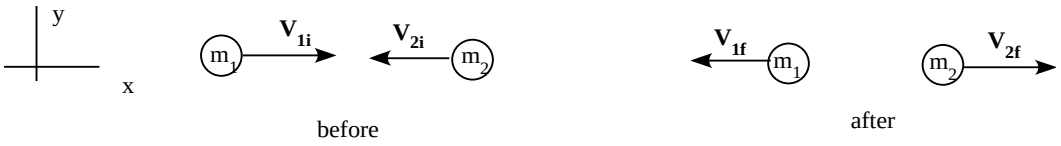
ELASTIC COLLISION IN 1-D

Consider two particles that undergo an elastic head-on collision



Since the collision is in 1D we will drop the vector notation for velocities and use components for velocities which can be negative or positive.

Cons. of Momentum

$$m_1 v_{1i} + m_2 v_{2i} = m_1 v_{1f} + m_2 v_{2f}$$

$$(1) \qquad m_1 \ v_{1i} - v_{if} \ = m_2 \ v_{2f} - v_{2i}$$

Conservation of Kinetic Energy

$$\frac{1}{2} m_1 v_{1i}^2 + \frac{1}{2} m_2 v_{2i}^2 = \frac{1}{2} m_1 v_{1f}^2 + \frac{1}{2} m_2 v_{2f}^2$$

$$m_1 \ v_{1i}^2 - v_{1f}^2 \ = m_2 \ v_{2f}^2 - v_{2i}^2$$

$$(2) \qquad m_1 \ v_{1i} - v_{if} \quad v_{1i} + v_{if} \ = m_2 \ v_{2f} - v_{2i} \quad v_{2f} + v_{2i}$$

Dividing (2) by (1) gives:

$$v_{1i} + v_{1f} = v_{2f} + v_{2i}$$

$$(3) \quad \boxed{v_{2f} - v_{1f} = - \ v_{2i} - v_{1i}}$$

The relative velocity of the particles before and after the collision have the same magnitude but opposite sign.