Ex.

Two balls are moving according to the following diagram. What is the initial
and final linear momentum of this closed system?

\[ m_1 = 100 \text{ kg} \quad v_1 = 5 \text{ m/s} \]
\[ m_2 = 75 \text{ kg} \quad v_2 = 6 \text{ m/s} \]

The initial linear momentum of each object is:

\[ p_{1i} = m_1 v_1 = (100 \text{ kg})(5 \text{ m/s}) = 500 \text{ kg m/s} \]
\[ p_{2i} = m_2 v_2 = (75 \text{ kg})(-6 \text{ m/s}) = -450 \text{ kg m/s} \]

The total initial linear momentum is then:

\[ p_i = p_{1i} + p_{2i} = 500 \frac{\text{kg m}}{\text{s}} - 450 \frac{\text{kg m}}{\text{s}} \]
\[ p_i = + 50 \frac{\text{kg m}}{\text{s}} \]

This means that the total initial linear momentum of the system is 50 kg m/s to the
right (positive direction).

From conservation of linear momentum \( (p_i = p_f) \), the total final linear momentum
of the system after the collision MUST BE 50 kg m/s to the right (positive
direction).

\[ p_f = 50 \frac{\text{kg m}}{\text{s}} \]