Conservation of Momentum in 2-D

Momentum is a conserved quantity. Momentum is conserved in any number of dimensions.

Law of Conservation of Momentum:

The total momentum of all objects before a collision is equal to the total momentum of all the objects after a collision, provided the system is isolated from external forces.

$$p_{before} = p_{after}$$

$$p_i = p_f$$

Collisions in Two-Dimensions (2-D):

Momentum is a vector quantity, therefore it can be broken into an x and y component.

$$p_i = p_f$$

in 2-D: $\quad\quad\quad p_{ix} = p_{fx} \quad$ and $\quad p_{iy} = p_{fy}$

$$m_1 v_{1ix} + m_2 v_{2ix} = m_1 v_{1fx} + m_2 v_{2fx}$$

$$m_1 v_{1iy} + m_2 v_{2iy} = m_1 v_{1fy} + m_2 v_{2fy}$$

<u>ex</u>.

Ball 1 (mass 0.15 kg) is moving towards the origin of the x-y plane at 0.9 m/s at 50° to the left of the +y axis and collides with Ball 2 (mass 0.26 kg) that is moving at 0.54 m/s along the +x axis. After the collision, Ball 2 is moving 0.70 m/s at 35° below the +x axis. What is the velocity of Ball 1 after the collision?