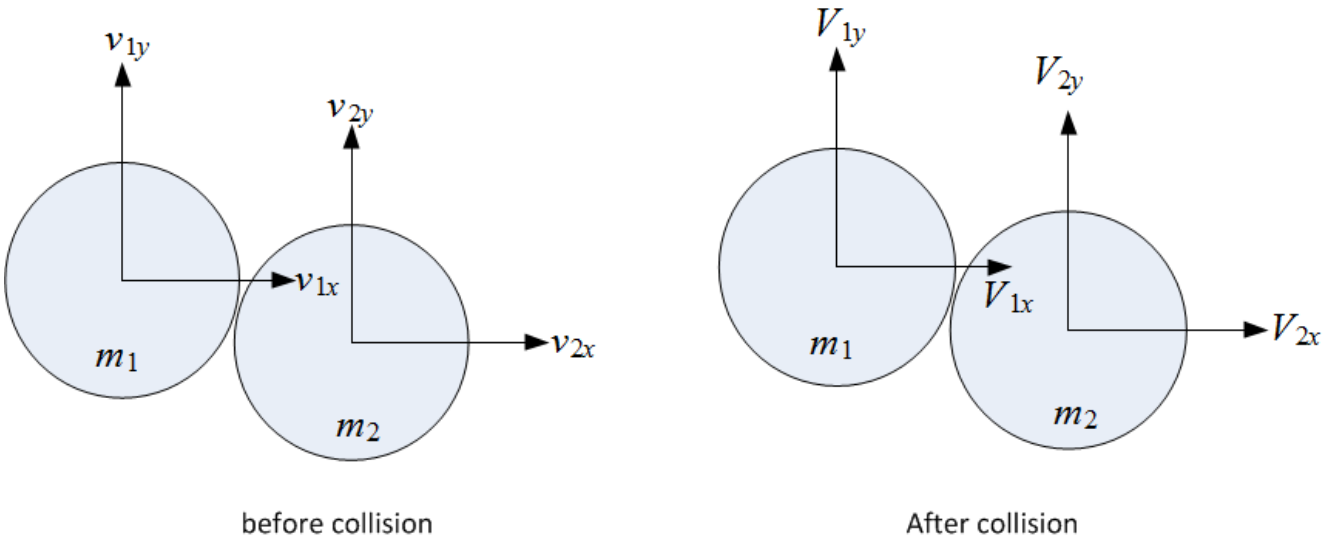
Some notes made during making the collision demo

Written by Nasser M. Abbasi

June 28, 2015

Given 2 particles v, u with velocity components as shown.



In elastic collision linear momentum in the x and y directions holds

$$m_1 v_{1x} + m_2 v_{2x} = m_1 V_{1x} + m_2 V_{2x} \tag{1}$$
$$m_1 v_{1y} + m_2 v_{2y} = m_1 V_{1y} + m_2 V_{2y} \tag{2}$$

In addition, kinetic energy is constant. Let $v_1^2 = \left(v_{1x}^2 + v_{1y}^2\right)$, $v_2^2 = \left(v_{2x}^2 + v_{2y}^2\right)$, $V_1^2 = \left(V_{1x}^2 + V_{1y}^2\right)$, $V_2^2 = \left(V_{2x}^2 + V_{2y}^2\right)$ then

$$\frac{1}{2} m_1 v_1^2 + \frac{1}{2} m_2 v_2^2 = \frac{1}{2} m_1 V_1^2 + \frac{1}{2} m_2 V_2^2$$
$$m_1 \left(v_{1x}^2 + v_{1y}^2\right) + m_2 \left(v_{2x}^2 + v_{2y}^2\right) = m_1 \left(V_{1x}^2 + V_{1y}^2\right) + m_2 \left(V_{2x}^2 + V_{2y}^2\right) \tag{3}$$

We have 3 equations above, but 4 unknowns $(V_{1x}, V_{1y}, V_{2x}, V_{2y})$. The 4th equation comes from knowing that after collision, particles will travel at 90^0 trajectories.