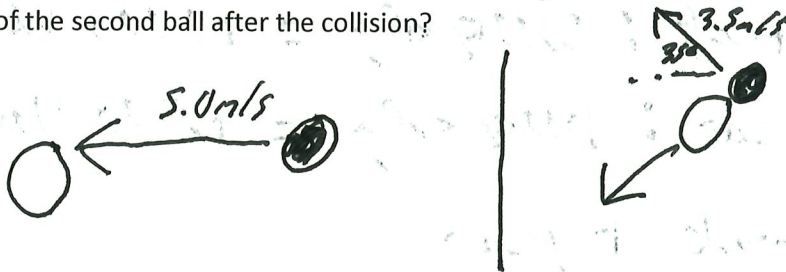## Collisions on 2D

A 0.5 kg ball is travelling at 5.0 m/s to the left when it strikes a stationary 0.75 kg ball at an angle, after the collision the first ball is moving at 3.5 m/s at an angle of 35° above its original path. What is the velocity of the second ball after the collision?

p of first ball before collision: $0.5 kg \times 5.0 m/s = 2.5 \frac{kg \cdot m}{se}$ left

p of first ball after collision: $0.5 kg \times 3.5 m/s$

$= 1.75 \frac{kg \cdot m}{sec}, 35°$ up from left

p of second ball
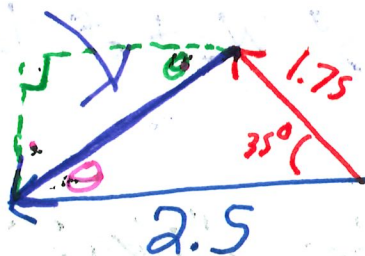
$(p_2)^2 = 1.75^2 + 2.5^2 - 2(1.75)(2.5)\cos 35°$

$p_2 = 1.4646 \frac{kg \cdot m}{sec}$

$\frac{\sin \theta}{1.75} = \frac{\sin 35}{1.4646}$ $\theta = 43°$

$p_2 = 1.4646 \frac{kg \cdot m}{sec}, 43°$ below left

$v = \frac{1.4646}{0.75} = 2.0 m/s, 43°$ below left

A 2500 kg truck is travelling at 16 m/s to the West when it is struck by a 1200 kg car travelling 36 m/s North. The vehicles stick together. What is velocity of the vehicles after the collision. What kind of collision is this? What is the change in kinetic energy of the system?

p initial of truck : $2500 \, kg \times 16 \frac{m}{s} = 40\,000$ west

p initial of car : $1200 \, kg \times 36 \frac{m}{s} = 43200$ North

p total $= p_{truck} + p_{car}$
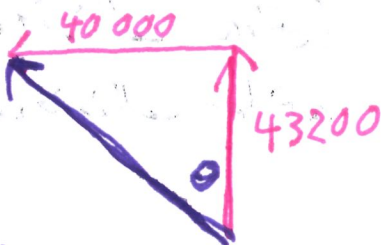
$\sqrt{40\,000^2 + 43200^2}$

$= 58874.78 \frac{kg \cdot m}{sec}$

$\tan^{-1}\left(\frac{40\,000}{43200}\right) = 43°$ West of North

total mass after collision: $2500 \, kg + 1200 \, kg$

$3700 \, kg$

$V = \dfrac{58874.78 \frac{kg \cdot m}{sec}}{3700 \, kg} = 16 \, m/s, \ 43°$ West of North

Perfectly inelastic

E_K at start : $\frac{1}{2}(2500) 16^2 + \frac{1}{2}(1200)(36)^2 = 1097600 \, J$

E_K at end : $\frac{1}{2}(3700)(15.9)^2 = 467698.5 \, J$

$\Delta E_K = 630000 \, J$ loss