4. (40 pts.) A 75 kg hockey player moving at 6.0 m/s along the x axis collides with an 85 kg hockey player moving at 7.5 m/s at an angle of 30° from the x axis. After the collision, the 75 kg hockey player moves off at 4.0 m/s at an angle of 25° from his original direction.

a. (10 pts.) *Before* doing any calculations, can you assume that the total mechanical energy of the system (kinetic + potential) is conserved during the collision? **Carefully** justify your answer.

b. (10 pts.) *Before* doing any calculations, can you assume that the total momentum of the system is conserved during the collision? **Carefully** justify your answer.

c. (20 pts.) Find the velocity *vector* of the 85 kg player after the collision.

Big Hint: It is easier and sufficient to simply solve for the x and y components of the velocity, rather than solving for the magnitude and direction.

4. (40 pts.) A 75 kg hockey player moving at 6.0 m/s along the x axis collides with an 85 kg hockey player moving at 7.5 m/s at an angle of 30° from the x axis. After the collision, the 75 kg hockey player moves off at 4.0 m/s at an angle of 25° from his original direction.

a. (10 pts.) *Before* doing any calculations, can you assume that the total mechanical energy of the system (kinetic + potential) is conserved during the collision? **Carefully** justify your answer.

No. You don't know if the forces involved in the collision were conservative or not. Muscle forces are involved, and we don't know a potential U for them.

b. (10 pts.) *Before* doing any calculations, can you assume that the total momentum of the system is conserved during the collision? **Carefully** justify your answer.

Yes. The muscle forces are all internal. There is no net external force acting on the players.

c. (20 pts.) Find the velocity *vector* of the 85 kg player after the collision.

Big Hint: It is easier and sufficient to simply solve for the x and y components of the velocity, rather than solving for the magnitude and direction.

$\vec{P}_i = \vec{P}_f$

x-components: $m_1 v_{1i} + m_2 v_{2i} \cos 30° = m_1 v_{1f} \cos 25° + m_2 v_{2fx}$

$(75)(6) + (85)(7.5)\cos 30° = (75)(4.0)\cos 25° + 85\, v_{2fx}$

$\boxed{8.59 \text{ m/s} = v_{2fx}}$

y-components: $m_1 v_{1i} \sin 0° + m_2 v_{2i} \sin 30° = m_1 v_1 \sin 25° + m_2 v_{2fy}$

$0 + (85)(7.5)\sin 30° = (75)(4.0)\sin 25 + 85\, v_{2fy}$

$\boxed{2.258 \text{ m/s} = v_{2fy}}$ or $\boxed{\vec{v}_{2f} = 8.88 \text{ m/s} @ 14.7°}$

Hockey Players (test question) – look at kinetic energy

$m_1 = 75\ kg$

$\vec{v}_{1i} = 6\ m/s\ @\ 0°$ $\qquad$ $\vec{v}_{1f} = 4.0\ m/s\ @\ 25°$

$m_2 = 85\ kg$

$\vec{v}_{2i} = 7.5\ m/s\ @\ 30°$ $\qquad$ $\vec{v}_{2f} = 8.88\ m/s\ @\ 14.7°$

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

$K_i = 3741\ J$ $\qquad$ $K_f = 3951\ J$

here $K_f > K_i$ internal work was done by muscles

but still $\vec{p}_i = \vec{p}_f$.