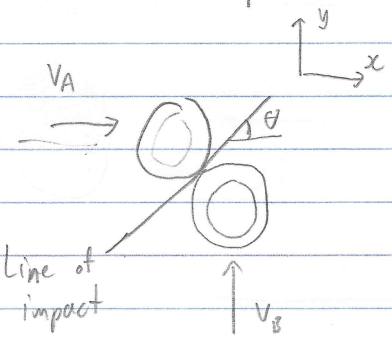
20-P-MOM-DY-Ex 7

On an air hockey table, two pucks collide in the middle of the rink. Puck A had an initial velocity $2\ m/s\ \hat{j}$ and Puck B had an initial velocity $3\ m/s\ \hat{i}$ according to the xy-axis as shown. If the coefficient of restitution $e = 0.4$ between the pucks, what are the velocities of the pucks after the impact. The line of impact is $\theta = 30°$ above x-axis. mass is the same.



Solution:

Referencing line of impact,

$(V_a)_x = V_A \cos\theta = 1.732\ m/s$ $(V_b)_x = V_b \cos\theta = 2.598\ m/s$

$(V_a)_y = -V_A \sin\theta = -1\ m/s$ $(V_b)_y = V_b \sin\theta = 1.5\ m/s$.

$$e = 0.4 = \frac{(V_b)_2 - (V_a)_2}{(V_a)_1 - (V_b)_1}$$ y-direction

$$= \frac{(V_b)_{2y} - (V_a)_{2y}}{-2.5}$$

$(V_b)_{2y} - (V_a)_{2y} = -1$

$(V_b)_{2y} = (V_a)_{2y} - 1$

conservation of linear momentum

$m(V_a)_y + m(V_b)_y = m(V_a)_{2y} + m(V_b)_{2y}$

$0.5 = (V_a)_{2y} + (V_b)_{2y}$

$2(V_a)_{2y} = 1.5$

$(V_a)_{2y} = 0.75\ m/s$

$(V_b)_{2y} = -0.25\ m/s$

velocity along line of impact is conserved

$(V_a)_x = (V_a)_{2x} = 1.732\ m/s$ $(V_b)_x = (V_b)_{2x} = 2.598\ m/s$

$(V_A)_2 = 1.887\ m/s \nearrow 23°$ off line of impact

$(V_b)_2 = 2.61\ m/s \searrow -5.49$ off line of impact.

$(V_A)_2 = 1.1356\ \hat{i} + 1.507\ \hat{j}$

$(V_b)_2 = 2.598\ \hat{i} - 0.2497\ \hat{j}$