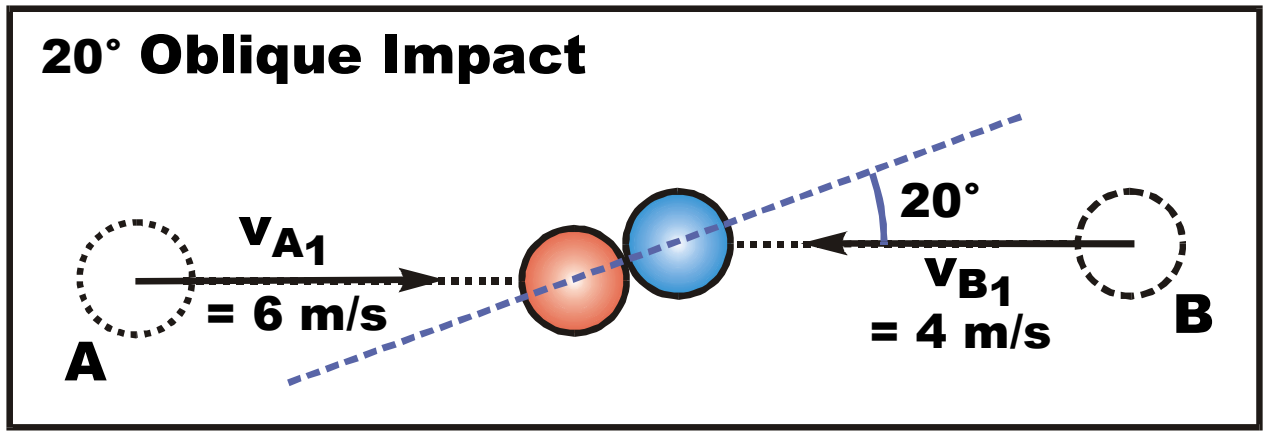
Particle Impact: Ex Prob 5 (Fully-Oblique)

Two identical particles A and B strike one another obliquely (off-center) as shown below. Please determine the velocity vectors of particles A and B (with respect to a horizontal-vertical coordinate system) after impact.



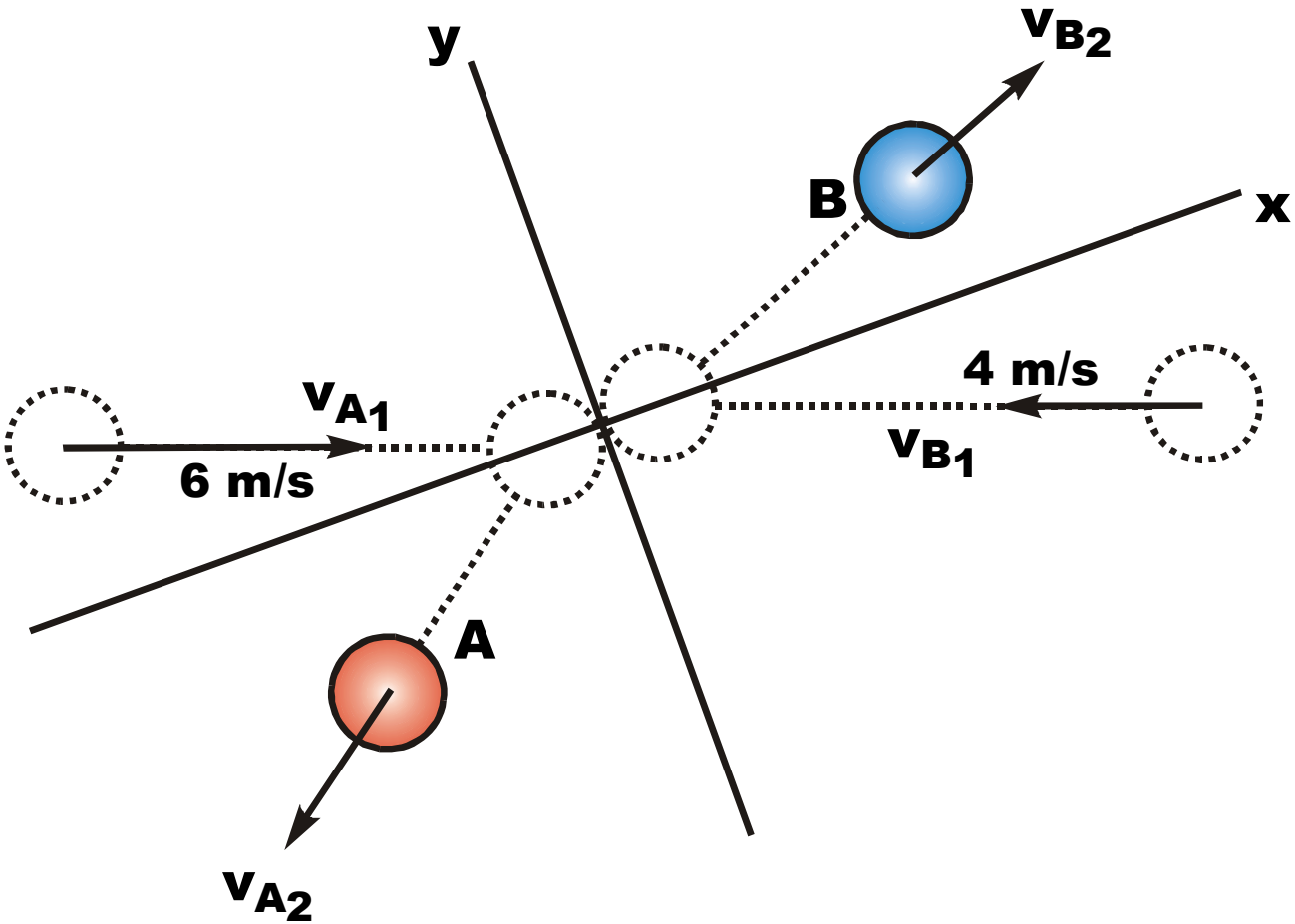
Find $\vec{v}_{A2}$ and $\vec{v}_{B2}$ after impact. **e = 0.8**

Masses of A and B are equal ($m_A = m_B$).

What's the first step?

What's the key theoretical principle that unlocks this problem?

Identify Plane of Contact (y), Line of Impact (x), assume v_{A2} and v_{B2} directions, and resolve all vectors into components.



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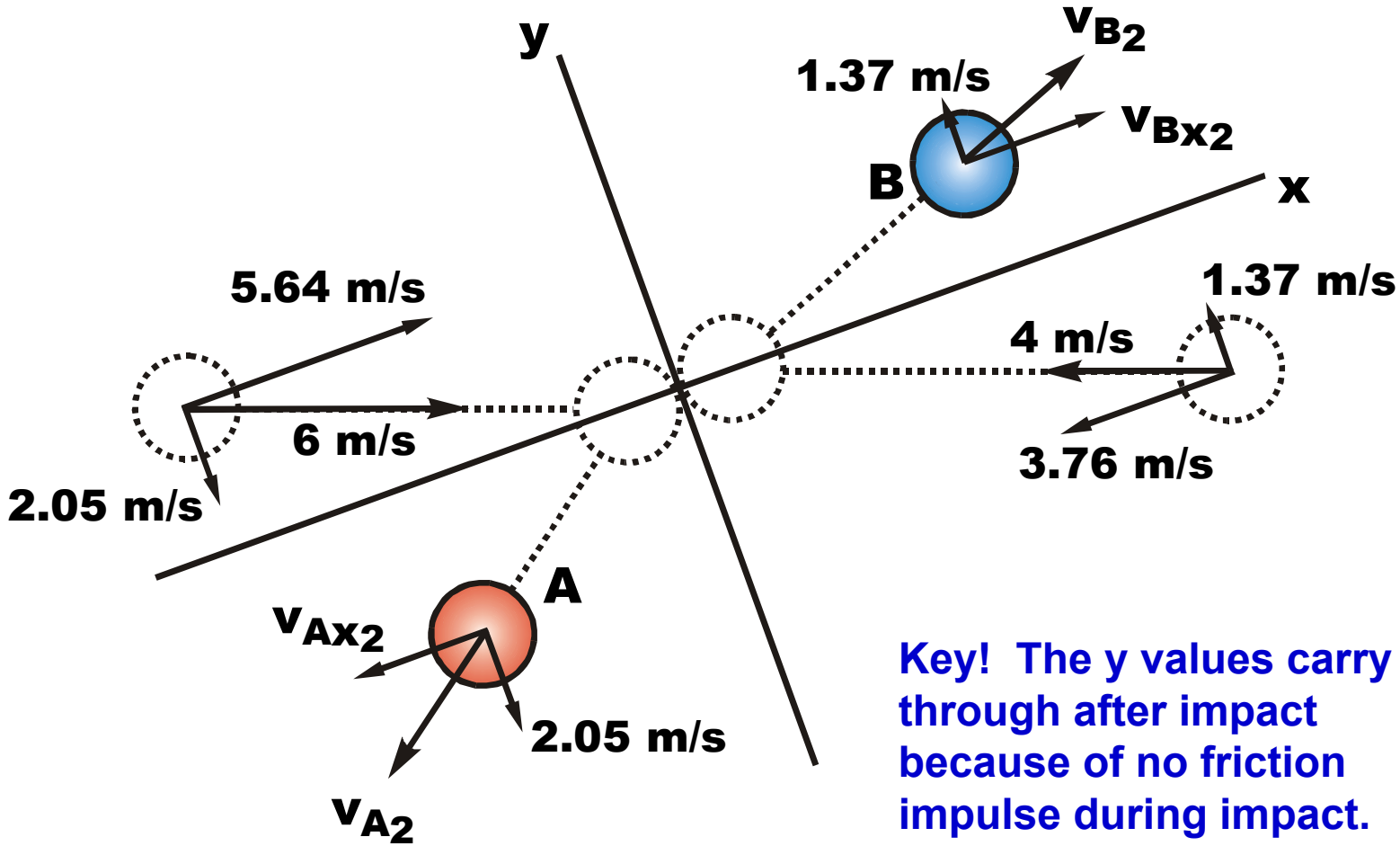
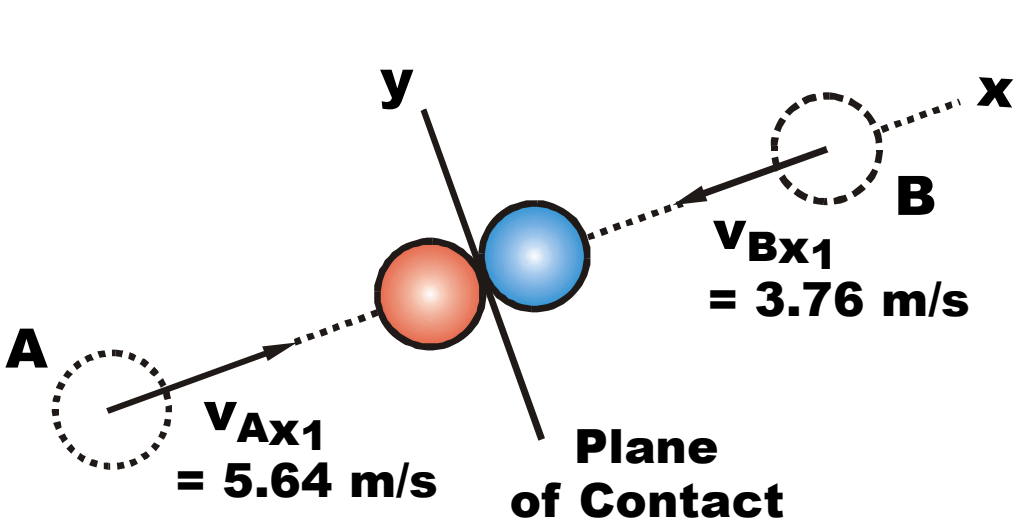


Key! The y values carry through after impact because of no friction impulse during impact.

Once the y-values (along the plane of contact) are determined, all that is left is to determine the x-values (along the line of impact). This is a simple straight line problem!



e = 0.8

20 deg rotation

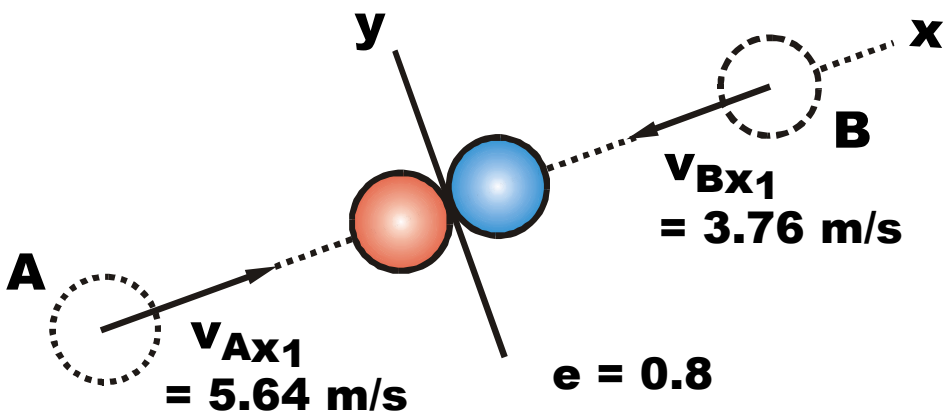
Write these two eqns, and solve for the two unknowns v_{Ax2}, v_{Bx2}

+→

$$m_A v_{Ax_1} + m_B v_{Bx_1} = m_A v_{Ax_2} + m_B v_{Bx_2}$$

+→

$$e = \frac{(v_{Bx_2} - v_{Ax_2})}{(v_{Ax_1} - v_{Bx_1})}$$



+

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+

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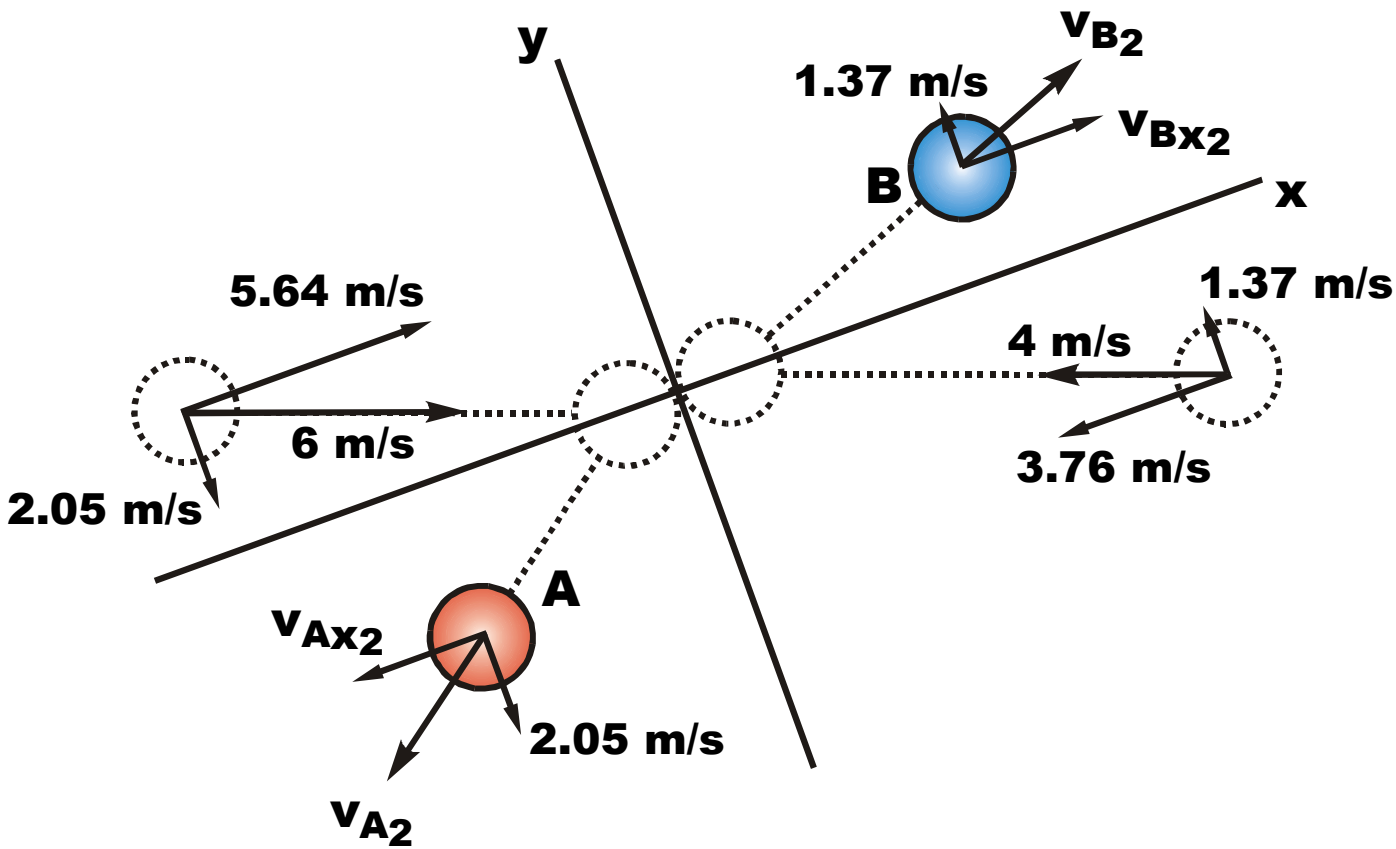
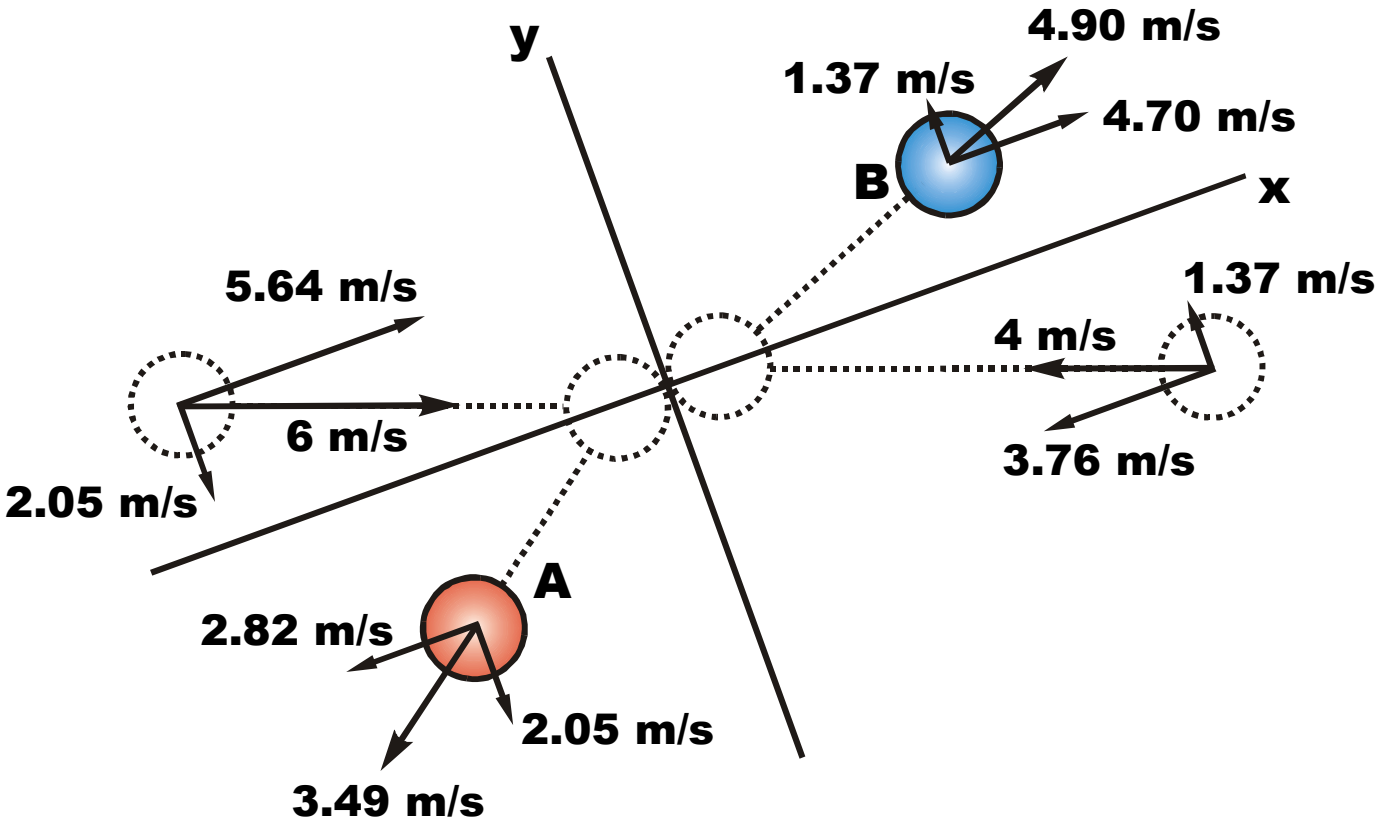

y
v_{B_2}
1.37 m/s
v_{Bx_2}
B
x
1.37 m/s
4 m/s
5.64 m/s
6 m/s
3.76 m/s
2.05 m/s
A
v_{Ax_2}
2.05 m/s
v_{A_2}

Find magnitudes only of v_{A2} and v_{B2}:



Write v_{A2} and v_{B2} *as vectors* in the horiz-vertical coord system: