

PROB. 14-39

$v_{A,1} = 15 \frac{ft}{s}$, $e=1$, FIND $v_{A,2}$, $v_{B,2}$, $v_{C,2}$

$$\vec{v}_{A1} = (15 \cdot \cos 45^\circ) \hat{i} + (15 \cdot \sin 45^\circ) \hat{j}$$

$$\vec{v}_{A1} = (10.61) \hat{i} + (10.61) \hat{j} \frac{ft}{s}$$

$$\vec{v}_{A2} = (v_{A2}) \hat{j}$$

$$\vec{v}_{B2} = (v_{B2} \cdot \sin 30^\circ) \hat{i} + (-v_{B2} \cdot \cos 30^\circ) \hat{j}$$

$$\vec{v}_{B2} = (0.5 v_{B2}) \hat{i} + (-0.866 v_{B2}) \hat{j}$$

$$\vec{v}_{C2} = (v_{C2} \cdot \cos 30^\circ) \hat{i} + (v_{C2} \cdot \sin 30^\circ) \hat{j}$$

$$\vec{v}_{C2} = (0.866 v_{C2}) \hat{i} + (0.5 v_{C2}) \hat{j}$$

CONSERVE MOMENTUM:

$$m \vec{v}_{A1} = m \vec{v}_{A2} + m \vec{v}_{B2} + m \vec{v}_{C2}$$

$$(10.61) \hat{i} + (10.61) \hat{j} = (v_{A2}) \hat{j} + (0.5 v_{B2}) \hat{i} + (-0.866 v_{B2}) \hat{j}$$

$$+ (0.866 v_{C2}) \hat{i} + (0.5 v_{C2}) \hat{j}$$

X-DIRECTION:

$$10.61 = 0.5 v_{B2} + 0.866 v_{C2}$$

$$v_{B2} = 21.22 - 1.732 v_{C2}$$

Y-DIRECTION:

$$10.61 = v_{A2} - 0.866 v_{B2} + 0.5 v_{C2}$$

PROB. 14-39 CONT.

$$10.61 = V_{A2} - 0.866(21.22 - 1.732 V_{C2}) + 0.5 V_{C2}$$

$$29 = V_{A2} + 2 V_{C2}$$

$$V_{C2} = 14.5 - 0.5 V_{A2}$$

$$V_{B2} = 21.22 - 1.732(14.5 - 0.5 V_{A2})$$

$$V_{B2} = -3.894 + 0.866 V_{A2}$$

CONSERVE ENERGY:

$$\frac{1}{2} M V_{A1}^2 = \frac{1}{2} M V_{A2}^2 + \frac{1}{2} M V_{B2}^2 + \frac{1}{2} M V_{C2}^2$$

$$225 = V_{A2}^2 + (-3.894 + 0.866 V_{A2})^2 + (14.5 - 0.5 V_{A2})^2$$

$$225 = V_{A2}^2 + 15.16 - 6.744 V_{A2} + 0.75 V_{A2}^2 + 210.2 - 14.5 V_{A2} + 0.25 V_{A2}^2$$

$$2 V_{A2}^2 - 21.24 V_{A2} = 0 \Rightarrow V_{A2} = 10.62 \frac{\text{ft}}{\text{s}}$$

$$V_{B2} = -3.894 + 0.866(10.62) = 5.305 \frac{\text{ft}}{\text{s}}$$

$$V_{C2} = 14.5 - 0.5(10.62) = 9.19 \frac{\text{ft}}{\text{s}}$$