

PROB. 14-40

$V_{A1} = 15 \frac{ft}{s}$ ,  $e=1$ ,  ~~$V_{A2}$~~  FIND  $V_{A2}$ ,  $V_{B2}$ ,  $V_{C2}$

$$\vec{V}_{A1} = (15 \cdot \cos 30^\circ) \hat{i} + (15 \cdot \sin 30^\circ) \hat{j}$$

$$\vec{V}_{A1} = (13) \hat{i} + (7.5) \hat{j} \frac{ft}{s}$$

$$\vec{V}_{A2} = (V_{A2}) \hat{j}$$

$$\vec{V}_{B2} = (V_{B2} \cdot \cos 45^\circ) \hat{i} + (-V_{B2} \cdot \sin 45^\circ) \hat{j}$$

$$\vec{V}_{B2} = (0.7071 V_{B2}) \hat{i} + (-0.7071 V_{B2}) \hat{j}$$

$$\vec{V}_{C2} = (0.7071 V_{C2}) \hat{i} + (0.7071 V_{C2}) \hat{j}$$

CONSERVE MOMENTUM:

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

$$(13) \hat{i} + (7.5) \hat{j} = (V_{A2}) \hat{j} + (0.7071 V_{B2}) \hat{i} + (-0.7071 V_{B2}) \hat{j} \\ + (0.7071 V_{C2}) \hat{i} + (0.7071 V_{C2}) \hat{j}$$

X-DIRECTION:

$$13 = 0.7071 V_{B2} + 0.7071 V_{C2}$$

$$V_{B2} = 18.38 - V_{C2}$$

Y-DIRECTION:

$$7.5 = V_{A2} - 0.7071 V_{B2} + 0.7071 V_{C2}$$

$$7.5 = V_{A2} - 0.7071 (18.38 - V_{C2}) + 0.7071 V_{C2}$$

PROB. 14-40 CONT.

$$7.5 = V_{A2} - 13 + 0.7071 V_{C2} + 0.7071 V_{C2}$$

$$1.414 V_{C2} = 20.5 - V_{A2}$$

$$V_{C2} = 14.5 - 0.7071 V_{A2}$$

$$V_{B2} = 18.38 - (14.5 - 0.7071 V_{A2})$$

$$V_{B2} = 3.88 + 0.7071 V_{A2}$$

CONSERVE ENERGY:

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

$$225 = V_{A2}^2 + (3.88 + 0.7071 V_{A2})^2 + (14.5 - 0.7071 V_{A2})^2$$

$$225 = V_{A2}^2 + 15.05 + 5.487 V_{A2} + 0.5 V_{A2}^2 \\ + 210.2 - 20.5 V_{A2} + 0.5 V_{A2}^2$$

$$2 V_{A2}^2 - 15.01 V_{A2} = 0$$

$$V_{A2} = 7.5 \frac{\text{ft}}{\text{s}}$$

$$V_{B2} = 3.88 + 0.7071(7.5) = 9.183 \frac{\text{ft}}{\text{s}}$$

$$V_{C2} = 14.5 - 0.7071(7.5) = 9.197 \frac{\text{ft}}{\text{s}}$$