PROB. 14-15

$W = 900^{LB}$, $\vec{v}_0 = (1200)\hat{i}\ \frac{ft}{s}$, PASSES THROUGH ORIGIN AT $t=0$, $W_A = 450^{LB}$, $W_B = 300^{LB}$, $W_C = 150^{LB}$, AT $t = 4^s$, $\vec{r}_A = (3840)\hat{i} + (-960)\hat{j} + (-1920)\hat{k}$ ft, $\vec{r}_B = (6480)\hat{i} + (1200)\hat{j} + (2640)\hat{k}$ ft

FIND $\vec{r}_C$, NEGLECT g

ASSUME NO EXTERNAL FORCES: $\vec{L} = \Sigma m_i \vec{v}_i = \text{CONSTANT}$

$$\left(\frac{W}{g}\right)\vec{v}_0 = \left(\frac{W_A}{g}\right)\vec{v}_A + \left(\frac{W_B}{g}\right)\vec{v}_B + \left(\frac{W_C}{g}\right)\vec{v}_C$$

ASSUME UNIFORM MOTION: $X = X_0 + vt$

$$\vec{r} = \vec{r}_0 + \vec{v}_0 \cdot t, \quad \vec{v} = \frac{1}{t}(\vec{r} - \vec{r}_0)$$

$$\vec{v}_A = \left(\frac{3840}{4}\right)\hat{i} + \left(-\frac{960}{4}\right)\hat{j} + \left(-\frac{1920}{4}\right)\hat{k}$$

$$\vec{v}_A = (960)\hat{i} + (-240)\hat{j} + (-480)\hat{k}\ \frac{ft}{s}$$

$$\vec{v}_B = \left(\frac{6480}{4}\right)\hat{i} + \left(\frac{1200}{4}\right)\hat{j} + \left(\frac{2640}{4}\right)\hat{k}$$

$$\vec{v}_B = (1620)\hat{i} + (300)\hat{j} + (660)\hat{k}\ \frac{ft}{s}$$

$$(900)(1200)\hat{i} = (450)\left[(960)\hat{i} + (-240)\hat{j} + (-480)\hat{k}\right]$$

$$+ (300)\left[(1620)\hat{i} + (300)\hat{j} + (660)\hat{k}\right]$$

$$+ (150)\left[(v_{Cx})\hat{i} + (v_{Cy})\hat{j} + (v_{Cz})\hat{k}\right]$$

X-DIRECTION: $(900)(1200) = (450)(960) + (300)(1620)$

$$+ (150)v_{Cx}$$

PROB. 14-15 CONT.

$v_{cx} = 1080 \frac{ft}{s}$

Y-DIRECTION: $0 = (450)(-240) + (300)(300) + (150)v_{cy}$

$v_{cy} = 120 \frac{ft}{s}$

Z-DIRECTION: $0 = (450)(-480) + (300)(660) + (150)v_{cz}$

$v_{cz} = 120 \frac{ft}{s}$

$\vec{v}_c = (1080)\hat{i} + (120)\hat{j} + (120)\hat{k} \frac{ft}{s}$

$\vec{r}_c = \vec{v}_c \cdot t = (4)[(1080)\hat{i} + (120)\hat{j} + (120)\hat{k}]$

$\vec{r}_c = (4320)\hat{i} + (480)\hat{j} + (480)\hat{k}$ ft