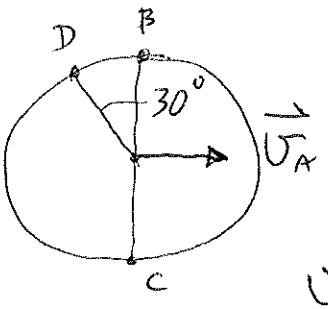
PROB. 15-111



$$D = (22\,IN)\left(\frac{ft}{12\,IN}\right) = 1.833\ ft$$

$$v_A = \left(48\ \frac{MI}{HR}\right)\left(\frac{HR}{3600\,S}\right)\left(\frac{5280\ ft}{MI}\right) = 70.4\ \frac{ft}{S}$$

a) FIND $\vec{a}_B$

$v_C = 0$, $v_A = r\omega$, $\omega = \frac{v_A}{r}$

$$\omega = \frac{(70.4\ \frac{ft}{S})}{(0.9167\ ft)} = 76.8\ \frac{RAD}{S}$$

$$\vec{a}_B = \vec{a}_A + \alpha\hat{k} \times \vec{r}_{B/A} - \omega^2 \vec{r}_{B/A}$$

$\alpha = 0$, $\vec{a}_A = 0$

$$\vec{a}_B = -(76.8\ \tfrac{RAD}{S})^2 \cdot (0.9167\ ft)\,\hat{j} \quad \boxed{= (-5407)\,\hat{j}\ \frac{ft}{S^2}}$$

b) FIND $\vec{a}_C$

$$\vec{a}_C = \cancel{\vec{a}_A}^{\,0} + \cancel{\alpha\hat{k} \times \vec{r}_{C/A}}^{\,0} - \omega^2 \vec{r}_{C/A}$$

$$\vec{a}_C = -(76.8)^2(-0.9167)\,\hat{j} \quad \boxed{= (5407)\,\hat{j}\ \frac{ft}{S^2}}$$

c) FIND $\vec{a}_D$

$$\vec{a}_D = \cancel{\vec{a}_A}^{\,0} + \cancel{\alpha\hat{k} \times \vec{r}_{D/A}}^{\,0} - \omega^2 \vec{r}_{D/A}$$

$$\vec{r}_{D/A} = (-0.9167 \cdot \sin 30^\circ)\,\hat{i} + (0.9167 \cdot \cos 30^\circ)\,\hat{j}$$

$$\vec{r}_{D/A} = (-0.4583)\,\hat{i} + (0.7939)\,\hat{j}\ ft$$

$$\vec{a}_D = -(76.8)^2\left[(-0.4583)\,\hat{i} + (0.7939)\,\hat{j}\right]$$

$$\vec{a}_D = (2703)\,\hat{i} + (-4683)\,\hat{j}\ , \quad \theta = TAN^{-1}\left(\frac{4683}{2703}\right) = 60^\circ$$

$$\boxed{\vec{a}_D = 5407\ \frac{ft}{S^2} \ \swarrow 60^\circ}$$