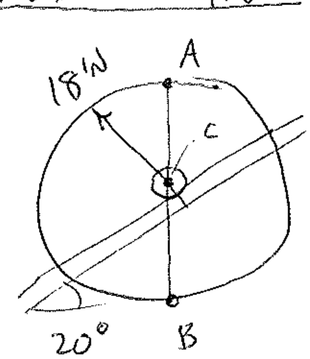
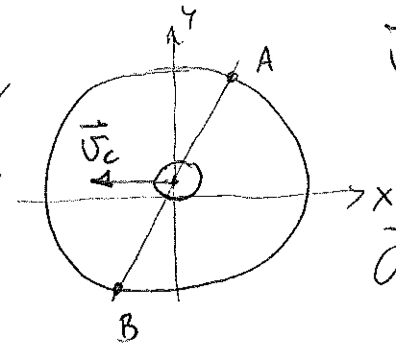
PROB. 15-118



$r_s = 1.5$ IN

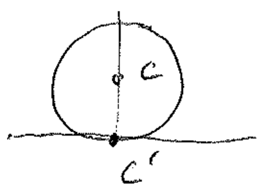
$v_c = 1.2 \frac{IN}{s}$

$a_c = 0.5 \frac{IN}{s^2}$



$\vec{v}_c = (-1.2)\hat{i} \frac{IN}{s}$

$\vec{a}_c = (-0.5)\hat{i} \frac{IN}{s^2}$



VELOCITY

$\vec{v}_c = \cancel{\vec{v}_{c'}}^{\,0} + \omega \hat{k} \times \vec{r}_{c/c'}$ NO SLIPPING

$$\vec{v}_c = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 0 & \omega \\ 0 & 1.5 & 0 \end{vmatrix} = [0 - (\omega)(1.5)]\hat{i} = (-1.5\omega)\hat{i}$$

$-1.2 = -1.5\omega \Rightarrow \omega = 0.8 \frac{RAD}{s}$

$\vec{a}_c = \vec{a}_{c'} + \alpha \hat{k} \times \vec{r}_{c/c'} - \omega^2 \vec{r}_{c/c'}$

$\vec{a}_{c'} = (\cancel{a_{c'x}}^{\,0})\hat{i} + (a_{c'y})\hat{j} = (a_{c'y})\hat{j}$ NO SLIPPING

$$\alpha \hat{k} \times \vec{r}_{c/c'} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 0 & \alpha \\ 0 & 1.5 & 0 \end{vmatrix} = (-1.5\alpha)\hat{i} \ \frac{IN}{s^2}$$

$-\omega^2 \vec{r}_{c/c'} = -(0.8)^2(1.5)\hat{j} = (-0.96)\hat{j} \ \frac{IN}{s^2}$

$(-0.5)\hat{i} = (a_{c'y})\hat{j} + (-1.5\alpha)\hat{i} + (-0.96)\hat{j}$

X-DIRECTION: $-0.5 = -1.5\alpha \Rightarrow \alpha = \frac{1}{3} \ \frac{RAD}{s^2}$

Y-DIRECTION: $0 = a_{c'y} - 0.96 \Rightarrow a_{c'y} = 0.96$

PROB. 15-118 CONT.

$$\vec{a}_{c'} = (0.96)\hat{j} \ \frac{\text{in}}{s^2}$$

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

$$\vec{r}_{A/C} = (18 \cdot \sin 20^\circ)\hat{i} + (18 \cdot \cos 20^\circ)\hat{j}$$

$$\vec{r}_{AC} = (6.156)\hat{i} + (16.91)\hat{j} \ \text{in}$$

$$\alpha\hat{k} \times \vec{r}_{A/C} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 0 & \frac{1}{3} \\ 6.156 & 16.91 & 0 \end{vmatrix}$$

$$= [0 - (\tfrac{1}{3})(16.91)]\hat{i} - [0 - (\tfrac{1}{3})(6.156)]\hat{j}$$

$$= (-5.638)\hat{i} + (2.052)\hat{j} \ \frac{\text{in}}{s^2}$$

$$-\omega^2 \vec{r}_{A/C} = -(0.8)^2[(6.156)\hat{i} + (16.91)\hat{j}]$$

$$= (-3.940)\hat{i} + (-10.82)\hat{j} \ \frac{\text{in}}{s^2}$$

$$\vec{a}_A = (-0.5)\hat{i} + (-5.638)\hat{i} + (2.052)\hat{j}$$
$$+ (-3.94)\hat{i} + (-10.82)\hat{j}$$

$$\vec{a}_A = (-10.08)\hat{i} + (-8.768)\hat{j} \ \frac{\text{in}}{s^2}, \quad \theta = \tan^{-1}\left(\frac{8.768}{10.08}\right) = 41.02^\circ$$

$$a_A = 13.36 \ \frac{\text{in}}{s^2} \quad 41.02^\circ$$

ROTATE BACK TO ORIGINAL COORDINATES:

$$\theta = 41.02 + 20^\circ = 61.02^\circ$$

$$\boxed{\vec{a}_A = 13.36 \ \frac{\text{in}}{s^2} \quad 61.02^\circ}$$

PROB. 15-118 CONT.

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

$$\vec{r}_{B/C} = (-18 \cdot \sin 20°)\hat{i} + (-18 \cdot \cos 20°)\hat{j}$$

$$\vec{r}_{B/C} = (-6.156)\hat{i} + (-16.91)\hat{j} \text{ IN}$$

$$\alpha\hat{k} \times \vec{r}_{B/C} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 0 & \frac{1}{3} \\ -6.156 & -16.91 & 0 \end{vmatrix}$$

$$= [0 - (\tfrac{1}{3})(-16.91)]\hat{i} - [0 - (\tfrac{1}{3})(-6.156)]\hat{j}$$

$$= (5.638)\hat{i} + (-2.052)\hat{j} \ \frac{\text{IN}}{s^2}$$

$$-\omega^2 \vec{r}_{B/C} = -(0.8)^2[(-6.156)\hat{i} + (-16.91)\hat{j}]$$

$$= (3.940)\hat{i} + (10.82)\hat{j} \ \frac{\text{IN}}{s^2}$$

$$\vec{a}_B = (-0.5)\hat{i} + (5.638)\hat{i} + (-2.052)\hat{j} + (3.94)\hat{i} + (10.82)\hat{j}$$

$$\vec{a}_B = (9.078)\hat{i} + (8.768)\hat{j}, \quad \theta = \tan^{-1}\left(\frac{8.768}{9.078}\right) = 44.00°$$

ROTATE BACK TO ORIGINAL COORDINATES:

$$\theta = 44.00 + 20° = 64.0°$$

$$\boxed{\vec{a}_B = 12.62 \ \frac{\text{IN}}{s^2} \ \angle 64°}$$