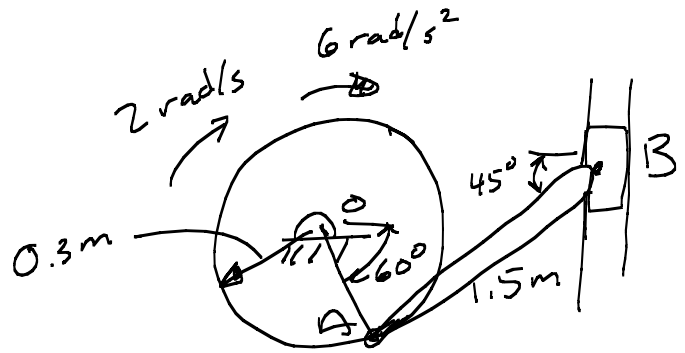
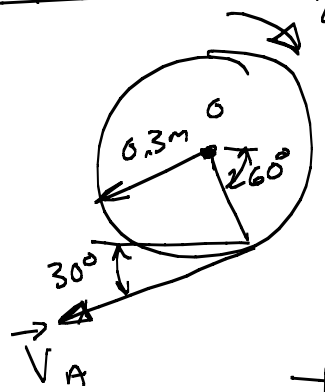
Determine: Acceleration at B



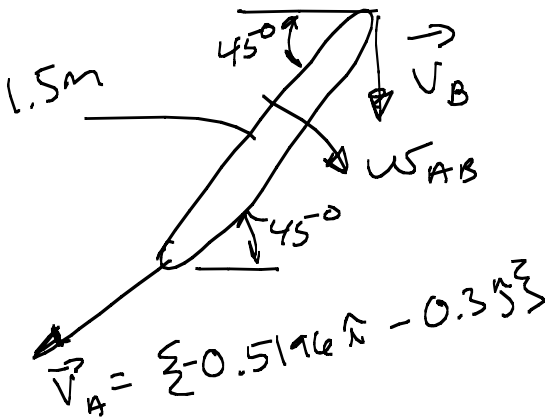
Velocity Analysis



$$\vec{V}_A = \vec{\omega}_{AO} \times \vec{r}_{A/O}$$

$$\vec{V}_A = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 0 & -2 \\ 0.3\cos 60^\circ & -0.3\sin 60^\circ & 0 \end{vmatrix}$$

$$\vec{V}_A = \{-0.5196\hat{i} - 0.3\hat{j}\} \text{ m/s}$$



$$\vec{V}_B = \vec{V}_A + \vec{V}_{B/A}$$

$$\vec{V}_{B/A} = \vec{\omega}_{AB} \times \vec{r}_{B/A}$$

$$\vec{r}_{B/A} = \{1.5\cos 45^\circ \hat{i} + 1.5\sin 45^\circ \hat{j}\}$$

$$-V_B \hat{j} = \{-0.5196\hat{i} - 0.3\hat{j}\} + \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 0 & -\omega_{AB} \\ 1.5\cos 45^\circ & 1.5\sin 45^\circ & 0 \end{vmatrix}$$

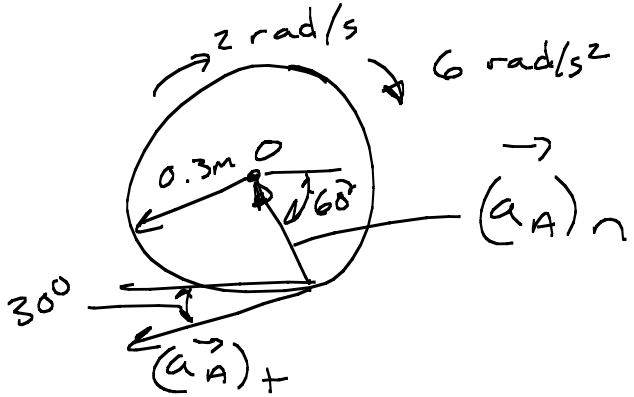
$$-V_B \hat{j} = \{-0.5196\hat{i} - 0.3\hat{j}\} + \{\omega_{AB}(1.5\sin 45^\circ)\hat{i} - \omega_{AB}(1.5\cos 45^\circ)\hat{j}\}$$

$\hat{i}$-comp

$$0 = -0.5196 + \omega_{AB}(1.5\sin 45^\circ)$$

$$\omega_{AB} = 0.4899 \text{ rad/s}$$

Acceleration Analysis



$$(\vec{a}_A)_t = \vec{\alpha} \times \vec{r}_{A/O}$$

$$= \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 0 & -6 \\ 0.3\cos 60^\circ & -0.3\sin 60^\circ & 0 \end{vmatrix}$$

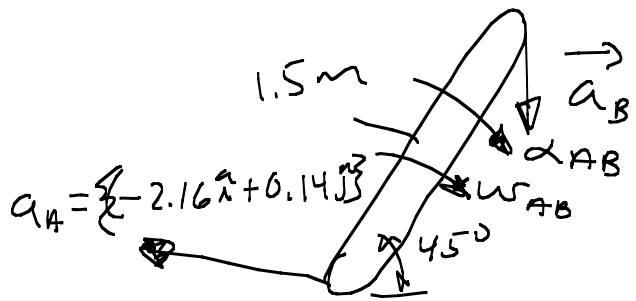
$$(\vec{a}_A)_t = \{-1.56\,\hat{i} - 0.9\,\hat{j}\}\ m/s^2$$

$$(\vec{a}_A)_n = -\omega_{AO}^2\,\vec{r}_{A/O} = -(2\ rad/s)^2\{0.3\cos 60^\circ\,\hat{i} - 0.3\sin 60^\circ\,\hat{j}\}$$

$$(\vec{a}_A)_n = \{-0.6\,\hat{i} + 1.04\,\hat{j}\}\ m/s^2$$

$$\vec{a}_A = (\vec{a}_A)_t + (\vec{a}_A)_n = \{-1.56\,\hat{i} - 0.9\,\hat{j}\} + \{-0.6\,\hat{i} + 1.04\,\hat{j}\}$$

$$\boxed{\vec{a}_A = \{-2.16\,\hat{i} + 0.14\,\hat{j}\}\ m/s^2}$$



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

$$-a_B \hat{j} = \{-2.16\hat{i} + 0.14\hat{j}\} + \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 0 & -\alpha_{AB} \\ 1.5\cos 45^\circ & 1.5\sin 45^\circ & 0 \end{vmatrix} - (0.4899)^2 (1.5\cos 45^\circ \hat{i} + 1.5\sin 45^\circ \hat{j})$$

$$-a_B \hat{j} = \{-2.16\hat{i} + 0.14\hat{j}\} + \{\alpha_{AB}(1.5\sin 45^\circ)\hat{i} - \alpha_{AB}(1.5\cos 45^\circ)\hat{j}\} - \{(0.4899)^2(1.5\cos 45^\circ)\hat{i} + (0.4899)^2(1.5\sin 45^\circ)\hat{j}\}$$

$\hat{i}$-comp

$$0 = -2.16 + \alpha_{AB}(1.5\sin 45^\circ) - (0.4899)^2(1.5\cos 45^\circ)$$

$$\boxed{\alpha_{AB} = 2.28 \text{ rad/s}^2}$$

$\hat{j}$-comp

$$-a_B = 0.14 - (2.28)(1.5\cos 45^\circ) - (0.4899)^2(1.5\sin 45^\circ)$$

$$\boxed{a_B = 2.53 \text{ m/s}^2}$$