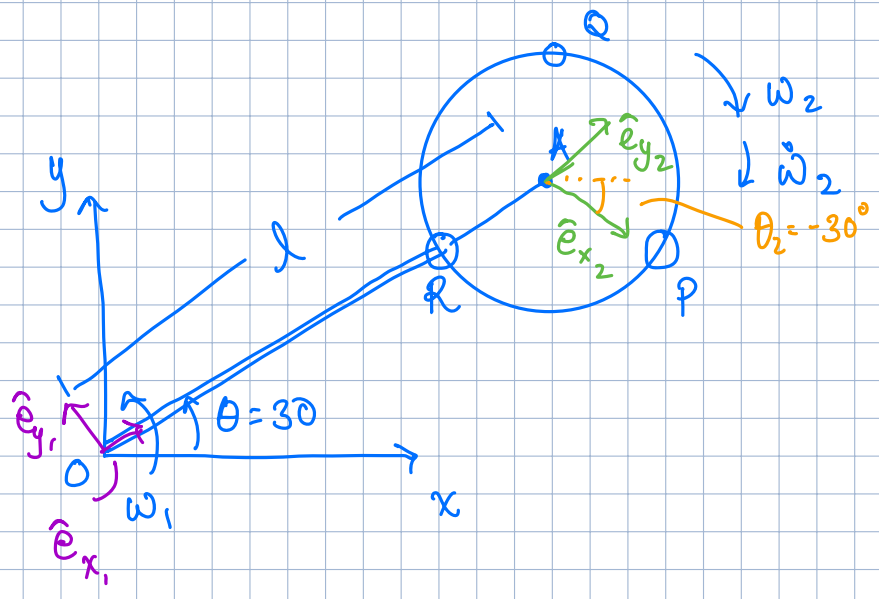

$$\vec{\omega}_1 = \omega_1 \hat{k}$$
$$\vec{\omega}_2 = -\omega_2 \hat{k}$$

$B_1: \{\hat{e}_{x_1}, \hat{e}_{y_1}\}$ Fixed to rod

$B_2: \{\hat{e}_{x_2}, \hat{e}_{y_2}\}$ Fixed to disc

$$\vec{\omega}_{B_1} = \vec{\omega}_1 = \omega_1 \hat{k}$$
$$\vec{\omega}_{B_2} = \vec{\omega}_1 + \vec{\omega}_2 = (\omega_1 - \omega_2)\hat{k}$$

$$\vec{r}^{\,P} = \vec{r}_{A/O} + \vec{r}_{P/A}$$

$$\vec{r}_{A/O} = l\,\hat{e}_{x_1}$$

$$\vec{r}_{P/A} = r\,\hat{e}_{x_2}$$

$$\vec{r}^{\,P} = l\hat{e}_{x_1} + r\hat{e}_{x_2}$$

$$\vec{v}_P = l\frac{d}{dt}(\hat{e}_{x_1}) + r\frac{d}{dt}(\hat{e}_{x_2})$$

$$\vec{v}_P = l\omega_1 \hat{e}_{y_1} + r(\omega_1 - \omega_2)\hat{e}_{y_2}$$

$\Rightarrow$ Plug in $\hat{e}_{y_1}$ & $\hat{e}_{y_2}$

$$\vec{v}_P = (-3.5\,\hat{i} + 4.3\,\hat{j})\ \text{m/s}$$

Transformations:

$$\hat{e}_{x_1} = \cos\theta\,\hat{i} + \sin\theta\,\hat{j}$$
$$\hat{e}_{y_1} = -\sin\theta\,\hat{i} + \cos\theta\,\hat{j}$$
$$\hat{e}_{x_2} = \cos\theta_2\,\hat{i} + \sin\theta_2\,\hat{j}$$
$$\hat{e}_{y_2} = -\sin\theta_2\,\hat{i} + \cos\theta_2\,\hat{j}$$

$$\frac{d}{dt}\hat{e}_{x_1} = \vec{\omega}_1 \times \hat{e}_{x_1} = \omega_1 \hat{e}_{y_1}$$

$$\frac{d}{dt}\hat{e}_{x_2} = (\vec{\omega}_1 + \vec{\omega}_2) \times \hat{e}_{x_2}$$
$$\frac{d}{dt}\hat{e}_{x_2} = (\omega_1 - \omega_2)\hat{e}_{y_2}$$

$$a_p = l\omega_1 \frac{d}{dt}\hat{e}_{y_1} + r(-\dot{\omega}_2)\hat{e}_{y_2} + r(\omega_1-\omega_2)\frac{d}{dt}\hat{e}_{y_2}$$

$$\frac{d}{dt}(\hat{e}_{y_1}) = \omega_1 \hat{k} \times \hat{e}_{y_1} = -\omega_1 \hat{e}_{x_1}$$

$$\frac{d}{dt}(\hat{e}_{y_2}) = (\omega_1-\omega_2)\hat{k} \times \hat{e}_{y_2} = -(\omega_1-\omega_2)\hat{e}_{x_2}$$

$$\vec{a}_p = -l\omega_1^2 \hat{e}_{x_1} - r\dot{\omega}_2 \hat{e}_{y_2} - r(\omega_1-\omega_2)^2 \hat{e}_{x_2}$$

$$\boxed{\vec{a}_p = -18.07\,\hat{i} - 9.29\,\hat{j} \ \ m/s^2}$$

(c) $\vec{L} = m\vec{v} = 0.5(\vec{v}^P)$

$$\vec{L} = (-1.75\,\hat{i} + 2.16\,\hat{j}) \ \ kg \cdot m/s$$

(d) $\Sigma F = m\vec{a} = 0.5(\vec{a}^P)$

$$\Sigma F = (-9.03\,\hat{i} - 4.65\,\hat{j}) \ N$$