Kinematics for H.S.D

- $\vec{a}_B = \vec{a}_A + \vec{\alpha} \times \vec{r}_{B/A} - \cancel{\omega^2}^{\,0}\,\vec{r}_{B/A}$

$$a_B \hat{\imath} = a_A \cos\theta\,\hat{\imath} - a_A \sin\theta\,\hat{\jmath} + (\alpha \hat{k}) \times (L\hat{\imath})$$

$$= (a_A \cos\theta)\,\hat{\imath} + (L\alpha - a_A \sin\theta)\,\hat{\jmath}$$

$\hat{\jmath}$: $0 = L\alpha - a_A \sin\theta \Rightarrow a_A = \frac{L}{\sin\theta}\alpha$

- $\vec{a}_G = \vec{a}_A + \vec{\alpha} \times \vec{r}_{G/A} - \omega^2 \vec{r}_{G/A}$

$$= a_A \cos\theta\,\hat{\imath} - a_A \sin\theta\,\hat{\jmath} + (\alpha \hat{k}) \times \left(\frac{L}{2}\hat{\imath}\right)$$

$$= (a_A \cos\theta)\,\hat{\imath} + \left(-a_A \sin\theta + \frac{\alpha L}{2}\right)\hat{\jmath}$$

$$= (L\alpha \cot\theta)\,\hat{\imath} + \left(-\alpha L + \frac{\alpha L}{2}\right)\hat{\jmath}$$

$\therefore$ $\boxed{\begin{array}{l} a_{Gx} = L\alpha \cot\theta \\ a_{Gy} = -\frac{\alpha L}{2} \end{array}}$ Substitute back into Newton eqn.