

ME 5550 Intermediate Dynamics
Exercises #7 Answers

1. a) $\underline{F}_B = -\underline{F}_A = \frac{mab(b^2 - a^2)}{12(a^2 + b^2)^{3/2}}(-\omega^2 \underline{j}' + \alpha \underline{k}')$

b) $T = \frac{ma^2 b^2 \alpha}{6(a^2 + b^2)}$

2. a) $\underline{F}_B = -\underline{F}_A = \frac{1}{6}ma[(3\omega^2 - \alpha)\underline{i}' - (\omega^2 + 3\alpha)\underline{j}']$

b) $T = \frac{10}{3}ma^2\alpha$

3. a) $\underline{M} = \frac{1}{6}m\ell^2\omega\Omega C_\theta(-C_\theta \underline{i}' + S_\theta \underline{k}')$

b) $\ddot{\theta} - \Omega^2 S_\theta C_\theta = 0$

4. a) $\underline{F} = F_1 \underline{e}_1 + F_2 \underline{e}_2 + F_3 \underline{e}_3$

$F_1 = -m\ell\dot{\theta}\Omega C_\theta$

$F_2 = m\left[\frac{1}{2}\ell\ddot{\theta} - \left(b + \frac{1}{2}\ell S_\theta\right)\Omega^2 C_\theta\right] + mg S_\theta$

$F_3 = m\left[\frac{1}{2}\ell\dot{\theta}^2 + \left(b + \frac{1}{2}\ell S_\theta\right)\Omega^2 S_\theta\right] + mg C_\theta$

$\underline{M} = \frac{2}{3}m\ell^2\dot{\theta}\Omega C_\theta \underline{e}_2$

b) $\ddot{\theta} - \Omega^2 S_\theta C_\theta + \frac{3}{2\ell}(g S_\theta - b\Omega^2 C_\theta) = 0$

