Intermediate Dynamics
Exercises #7 Answers

1. a) $\underset{\sim}{F}_B = -\underset{\sim}{F}_A = \dfrac{m\,a\,b\,(b^2-a^2)}{12(a^2+b^2)^{3/2}}\left(-\omega^2\,\underset{\sim}{j}' + \alpha\,\underset{\sim}{k}'\right)$

   b) $T = \dfrac{m\,a^2\,b^2\,\alpha}{6(a^2+b^2)}$

2. a) $\underset{\sim}{F}_B = -\underset{\sim}{F}_A = \frac{1}{6}\,m\,a\left[\left(3\omega^2-\alpha\right)\underset{\sim}{i}' - \left(\omega^2+3\alpha\right)\underset{\sim}{j}'\right]$

   b) $T = \frac{10}{3}\,m\,a^2\,\alpha$

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

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

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

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

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

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

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

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