ANSWERS

1 (b) (i) $\ddot{y} + \left[\frac{uk\left(d^2 + a^2\right)}{2d^2C}\right]\dot{y} + \left[\frac{u^2}{d}\left(\frac{\varepsilon}{r} + \frac{a^2k^2}{4dC^2}\right)\right]y = 0$; (ii) $\lambda = \frac{2\pi}{\sqrt{\frac{\varepsilon}{dr} + \frac{a^2k^2}{4d^2C^2}}}$

(iii) $\zeta = \frac{\left(1 + a^2/d^2\right)k}{4C\sqrt{\frac{\varepsilon}{dr} + \frac{a^2k^2}{4d^2C^2}}}$

2 (a) $N = -\frac{4}{3}L^3hK_y\delta$; $L/3$;

(b) At $\lambda_{\text{lim}} = \frac{1}{2}$, both solutions give $N = -\frac{1}{6}\mu ZL$ and $\frac{dN}{d\delta} = -\frac{4}{3}L^3hK_y$

(c) $N_{\max} = -\frac{3}{16}\mu ZL$ at $\lambda = \frac{2}{3}$

3 (c) $\delta = A\cos\omega t + B\sin\omega t + \frac{3MG}{2\omega R^2}t\sin\omega t$

4 (a) $a = \frac{\mu r_0}{2\mu - r_0v^2}$, $e = \frac{v^2r_0}{\mu}$; (b) $0.6921r_E$ = 4414 km.