1 $r(\theta)$ – Orbital Path for Another Force

A particle of mass m moves with angular momentum l and with total energy E about a fixed center with a force

$$F(r) = -\frac{k}{r^2} + \frac{\lambda}{r^3} \tag{1.1}$$

where k and λ are greater than zero, and r is the distance from the particle to the center. **(a)** Show that the equation for the orbit, $r(\theta)$, may have the form

$$\frac{\alpha}{r} = 1 + \epsilon \cos(\beta\theta)\,, \tag{1.2}$$

finding the constants α, ϵ, and β in terms of the given quantities m, k, λ, l, and E. Assume that the potential energies are zero at $r = \infty$ in defining the total energy, E. **(b)** For what values of β is the orbit closed?