Assignment 2 – Hints

1.12 The potential has an extra term proportional to $1/r^2$. This is the same form as the centrifugal term in V_{eff}. The integral for the orbit can therefore be solved in the same way.

Work out and investigate the modified orbit. By how much must ϕ increase in order to proceed from one value of $r = r_{\min}$ to the next? It is a fine idea to use Taylor approximations where appropriate.

I'll give you that the answer for α is between 1 and 10.

1.13 The point of closest approach is related to b and v_∞. Solve for the value of b such that $r_{\min} = R$; some algebra may be required.

1.17 The first question wants you to show that the trajectory obey's Snell's law, using the value of n provided. You can get this via energy and angular momentum conservation.

For the second question, use the $db/d\theta$ formula. You need to do some algebra to get the answer into the requested form, unless you see a cleverer way than I did.

For the final question, make note of the argument at the bottom of page 27.

3.3 Here you need to write out the Cartesian coordinates of the masses to get T correctly. You will have two coupled equations of motion. To look at small oscillations, linearize both cooridinates around their equilibrium (here stationary) values. The two linear equations that result can be combined algebraically to eliminate one variable, and the resulting equation should be that of a harmonic oscillator, exhibiting the desired frequency.