Assignment 3: Due on Thu, 10 Sep 2020

Q1) Find the energy levels of a particle moving in a potential field of the shape $V(x) = \begin{cases} \infty \ \forall \, x < 0 \\ \frac{1}{2}\mu\omega^2 x^2 \ \forall \, x \geq 0 \end{cases}$

Q2) Find the energy levels for a particle of mass m moving in the 3-D potential: $V(\vec{r}) = A(x^2+y^2+2\lambda xy)+Bz^2$; $A, \, B > 0$ and $-1 < \lambda < 1$

Q3) Find the functional forms for the spherical harmonics $Y_2^2(\Omega)$ and $Y_2^1(\Omega)$, By explicit integration, obtain the normalisation constants for them and show explicitly that they are orthogonal. What are the values of the corresponding energies and angular momenta?

Q4) Find the bound state energy levels for a particle of mass μ moving in the central potential:

$$V(r) = -\frac{A}{r} + \frac{B}{r^2}$$