PHYS 4310, Quiz 3

1. In class, we obtained the ground state of the harmonic oscillator, $\Psi_0(x,t)$, where $\Psi_0(x,t) = A\exp\left(\frac{-m\omega}{2\hbar}x^2\right)\exp\left(-i\frac{\hbar\omega}{2}t\right)$. Find A such that $\int_{-\infty}^{\infty}|\Psi_0(x,t)|^2dx = 1$.

2. During our analytical solution of the harmonic oscillator stationary states, $\psi_n(\xi)$, we found that we could generically write our solution as $\psi(\xi) = h(\xi)\exp\left(-\xi^2/2\right)$. Using this relation and the (dimensionless) time-independent Schrödinger equation, $\frac{d^2\psi}{d\xi^2} = \left(\xi^2 - K\right)\psi$, show that $h(\xi)$ can be written as: $\frac{d^2h}{d\xi^2} + 2\xi\frac{dh}{d\xi} + (K-1)h = 0$.