Numerical Solutions for the Radial Equation for the 3D Oscillator

Reduced mass: $\mu := 1$ Angular momentum: $L := 0$ Integration limit: $r_{max} := 6$

Force constant: $k := 1$

Solve Schrodinger's equation numerically use Mathcad's ODE solve block:

Given

$$\frac{-1}{2\cdot\mu}\cdot\frac{d^2}{dr^2}\Psi(r) - \frac{1}{r\cdot\mu}\cdot\frac{d}{dr}\Psi(r) + \left[\frac{L\cdot(L+1)}{2\cdot\mu\cdot r^2} + \frac{1}{2}\cdot k\cdot r^2\right]\cdot\Psi(r) = E\cdot\Psi(r) \qquad \Psi(.001) = .1 \qquad \Psi'(.001) = .1$$

$\Psi := \text{Odesolve}(r, r_{max})$ Normalize the wavefunction: $\Psi(r) := \left(\int_0^{r_{max}} \Psi(r)^2\cdot 4\cdot\pi\cdot r^2\, dr\right)^{\frac{-1}{2}}\cdot\Psi(r)$

Energy guess: $E \equiv 7.5$