

9.19: Numerical Solutions for the Two-Dimensional Harmonic Oscillator

Reduced mass: $\mu = 1$

Angular momentum: $L = 2$

Integration limit: $r_{\max} = 5$

Force constant: $k = 1$

Energy guess: $E = 3$

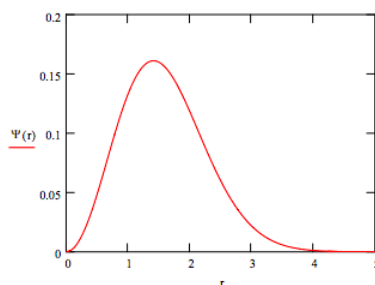
Solve Schrödinger's equation numerically. Use Mathcad's ODE solve block:

Given

$$\frac{-1}{2\mu} \frac{d^2}{dr^2} \psi(r) - \frac{1}{2\mu} \frac{d}{dr} \psi(r) + \left(\frac{L^2}{2\mu r^2} + \frac{1}{2} k r^2 \right) \psi(r) = E \psi(r) \quad \psi(.001) = 1 \quad \psi'(.001) = 0.1$$

$$\psi = \text{Odesolve}(r, r_{\max}, .001)$$

$$\psi(r) = \left(\int_0^{r_{\max}} \psi(r)^2 4\pi r^2 dr \right)^{-\frac{1}{2}} \psi(r)$$



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