

9.6: Particle in a Semi-infinite Potential Well

Numerical Solutions to Schrödinger's Equation for the Particle in the Semi-infinite Box

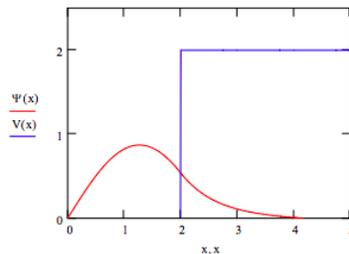
Parameters go here: $x_{min} = 0$ $x_{max} = 5$ $m = 1$ $lb = 2$

Potential energy $V(x) = if[(x \geq lb), V_0, 0]$

Given $\frac{d^2}{dx^2} \psi(x) = 2m(V(x) - E)\psi(x)$ $\psi(x_{min}) = 0$ $\psi'(0) = 0.1$

$$\psi := \text{Odesolve}(x, x_{max}) \quad \psi = \frac{\psi(x)}{\sqrt{\int_{x_{min}}^{x_{max}} \psi(x)^2 dx}}$$

Enter energy guess: $E = 0.766$

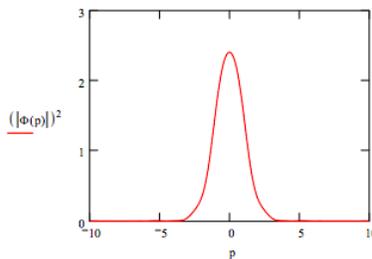


Calculate the probability that the particle is in the barrier: $\int_2^5 \psi(x)^2 dx = 0.092$

Calculate the probability that the particle is not in the barrier: $\int_0^2 \psi(x)^2 dx = 0.908$

Calculate and display the momentum distribution:

Fourier transform: $p = -10, -9.9 \dots 10$ $\Phi(p) = \int_{-x_{min}}^{x_{max}} \exp(-ipx) \psi(x) dx$



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