9.17: Particle in a Box with Multiple Internal Barriers

Integration limit: $x_{max} = 1$

Effective mass: $\mu = 1$

Barrier height: $V_0 = 100$

Potential energy:

$$V(x) = \begin{vmatrix} V_0 \; if \; (x \geq .185)(x \leq .215) + (x \geq .385)(x \leq .415) + (x \geq .585)(x \leq .615) + (x \geq .785)(x \leq .815) \\ 0 \; otherwise \end{vmatrix}$$

Numerical integration of Schrödinger's equation:

Given

$$\frac{-1}{2\mu}\frac{d^2}{dx^2}\psi(x) + V(x)\psi(x) = E\psi(x)$$

$$\psi(0) = 0$$

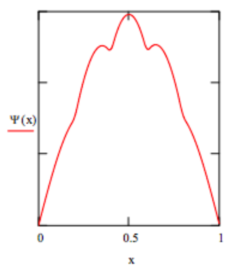
$$\psi'(0) = 0.1$$

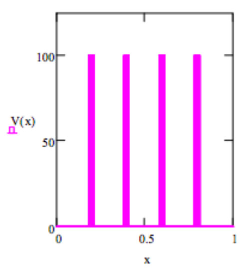
$$\psi = Odesolve(x, x_{max}$$

Normalize wave function:

$$\psi(x) = \frac{\psi(x)}{\sqrt{\int_0^{x_{max}} \psi(x)^2 dx}}$$

Enter energy guess: E = 18.85





Calculate kinetic energy:

$$T = \int_0^1 \psi(x)\frac{-1}{2}\frac{d^2}{dx^2}\psi(x)dx = 5.926$$

Calculate potential energy:

$$V = E - T = 12.924$$

Tunneling probability:

$$\frac{V}{V_0} \times 100 = 12.924$$