Numerical Solutions for Schroedinger's Equation

The Quantized Bouncing Particle

Integration limi: $z_{max} := 3$ Mass: $m := 2$ Acceleration due to gravity: $g := 1$

The first 10 roots of the Airy function are as follows:

$a_1 := 2.33810$ $a_2 := 4.08794$ $a_3 := 5.52055$ $a_4 := 6.78670$ $a_5 := 7.94413$

$a_6 := 8.02265$ $a_7 := 10.04017$ $a_8 := 11.00852$ $a_9 := 11.93601$ $a_{10} := 12.82877$

Calculate energy analytically by selecting appropriate Airy function root.

$i := 1$ $E := \left(\frac{m \cdot g^2}{2}\right)^{\frac{1}{3}} \cdot a_i$ $E = 2.338$

Generate the associated wavefunction numerically: Potential energy: $V(z) := m \cdot g \cdot z$

Given $\frac{-1}{2 \cdot m} \cdot \frac{d^2}{dz^2}\Psi(z) + V(z) \cdot \Psi(z) = E \cdot \Psi(z)$ $\Psi(0.0) = 0.0$ $\Psi'(0.0) = 0.1$

$\Psi := \text{Odesolve}(z, z_{max})$ Normalize wavefunction: $\Psi(z) := \frac{\Psi(z)}{\sqrt{\int_0^{z_{max}} \Psi(z)^2 \, dz}}$