Problem 2.27

(a)Sketch this potential.
(b)Write the wave function for the three regions { x<-a, -a<x<a, x>a}.
(c)Consider the even solutions first by writing the wave functions in the three regions such that the result will be even.
(d)Apply the boundary conditions to show that the allowed k values must satisfy the transcendental equation, $\frac{\hbar^2 k}{m\alpha} = 1 + e^{-2ka}$.
(e)Graph both the left-hand side and the right-hand side versus k to show that there is always one solution.
(f)Consider the odd solutions by writing the wave functions in the three regions such that the result will be odd.
(g)Apply the boundary conditions to show that the allowed k values must satisfy the transcendental equation, $\frac{\hbar^2 k}{m\alpha} = 1 - e^{-2ka}$.
(h)Graph both the left-hand side and the right-hand side versus k to show that there is at most one solution.
(i)Solve to transcendental equation for each of the two values of α to get the energies of the allowed solutions for each case.

Problem 2.28

(a)Sketch this potential.
(b)Write the wave function for the three regions { x<-a, -a<x<a, x>a}.
(c)Use the boundary conditions to get four equations for the five unknown amplitudes.
(d)Use Mathematica to find the transmission and reflection coefficients and show they sum to one.
(e)Graph the transmission coefficient versus k. Explain the fluctuations on physical grounds.