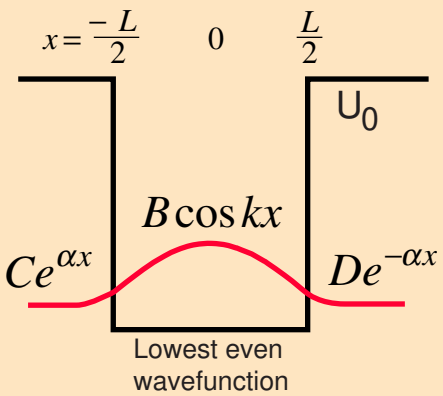

The condition of continuity for the wavefunction at the boundaries gives:

$$Ce^{-\alpha L/2} = B\cos(-kL/2) \quad \text{so} \quad C = D$$

$$De^{-\alpha L/2} = B\cos(kL/2)$$

The condition of continuity for the derivative of the wavefunction gives:

$$\alpha Ce^{-\alpha L/2} = -kB\sin(-kL/2)$$

$$\alpha De^{-\alpha L/2} = -kB\sin(kL/2)$$

Dividing either of these two sets gives:

$$\alpha = k\tan\frac{kL}{2} = \sqrt{\beta^2 - k^2}$$