1) Introduction to Quantum Mechanics 2nd ed., Griffiths Chapter 2
   - 2.34
   - 2.46
   - 2.52

2) Consider the potential

   \[ V(x) = \begin{cases} 
   \infty, & \text{if } x < 0, \\
   \alpha \delta(x - a), & \text{if } x \geq 0,
   \end{cases} \]

   where \( a \) and \( \alpha \) are real positive constants with the appropriate units. A particle starts out in the “well” \( 0 < x < a \), but because of tunneling its wave function gradually “leaks” out through the delta-function barrier.

   a) Solve the time-independent Schrödinger equation for this potential; impose appropriate boundary conditions, and determine the “energy”, \( E \). (An implicit equation will do.)

   b) Writing \( E = E_0 + \Gamma \) (with \( E_0 \) and \( \Gamma \) real) calculate (in terms of \( \Gamma \)) the characteristic time it takes the particle to leak out of the well, (that is, the time it takes before the probability is \( 1/e \) that it’s still in the region \( 0 < x < a \)).