

**PHYS 240 homework #12 – due Mar 8 2013, 5:00pm, upload to Canvas**

**Newton's method and energy eigenvalues**

**1.** Consider a particle in a quantum square well potential of depth  $V < 0$  and half-width  $a$ . The energy eigenvalues,  $E > V$ , are given by the transcendental equation

$$\sqrt{-E} = \sqrt{E - V} \tan\left(\frac{a}{\hbar} \sqrt{2m(E - V)}\right)$$

for the even states and

$$\sqrt{-E} = -\sqrt{E - V} \cot\left(\frac{a}{\hbar} \sqrt{2m(E - V)}\right)$$

for the odd states. Write a program to obtain the first 10 energy eigenvalues of an electron for  $V = -13.6$  eV and  $a = 20a_0$ , where  $a_0$  is the Bohr radius.

**2.** Include any discussion in a report generated in L<sup>A</sup>T<sub>E</sub>X. Also submit your Python code separately.