Physics 401 Homework 8---Due November 4

1. For the finite square well bound state problem, the particle has a certain probability of being found in the classically forbidden region (*i.e.* outside the well).

    a. Show that ratio of the probability that it is found outsider\ the well to the probability that is found in the well for the even eigenstates is given by
    $$\frac{z\cos^2(z)}{\sqrt{z_0^2 - z^2}\,(z + \cos(z)\sin(z))}$$
    (Hint: you do not need to compute the normalization of the wavefunction to get this.)

    b. From a. show that the probability that the particle is outside the well is given by $P_{out} = \dfrac{z\cos^2(z)}{z\cos^2(z) + \sqrt{z_0^2 - z^2}\,(z + \cos(z)\sin(z))}$

2. Consider a finite square well with potential depth V_0 and the parameters such that $z_0 = 11.0$

    a. Solve numerically solve for the bound state energies of all of the even eigenstates. Express your answers as a fraction of V_0.

    b. Using the results of problem 1., numerically compute the probability that the particle is outside the well for all of the solutions to part a. Discuss how this probability changes from the most deeply bound states to the least bound. Does this behavior make sense physically? (Hint: use a computer to compute the probabilities.)

Griffths: 2.27, 2.29, 2.32