

# F20 PHYSICS 137B: HW 6

October 16 at 11:59 pm

September 29, 2020

## 1 Griffiths problems

Do the following problems from Griffiths: 7.31, 7.45, 7.47, 8.4, 8.19

## 2 Other problems

### 2.1

Apply the variational method to a particle in a box of width  $L$  to find the ground state energy using a second-degree polynomial as a trial function.

### 2.2

It is known that a square well has at least one bound state, no matter how weak the potential (i.e. how shallow the well). Use the variational method to prove that this is a general property of *any* potential which is purely attractive (i.e.  $V(x) < 0$  for all  $x$ , and  $V \rightarrow 0$  as  $x \rightarrow \pm\infty$ ). Do this by using the trial function

$$\psi(x) = Ae^{-\alpha x^2}, \tag{2.1}$$

and showing that  $\alpha$  can always be chosen such that  $E_0(\alpha)$  is negative. Why does this constitute a proof?