Phys 451 **Winter 2026**

Worksheet #11

(Friday, January 30, 2026)

Name

Questions (5 pts):

As we showed, the second-order energy correction is given by

$E_n^{(2)} = \langle n^{(0)}|H'|n^{(1)}\rangle$, where $|n^{(1)}\rangle = \sum_{k\neq n} \frac{H'_{kn}}{E_n^{(0)} - E_k^{(0)}} |k^{(0)}\rangle$, where $H'_{kn} = \langle k^{(0)}|H'|n^{(0)}\rangle$.

(a) Plug in the expression for $|n^{(1)}\rangle$ in the expression for the second-order energy correction and simplify the expression as much as possible.

(b) **If you have time:** Based on the expressions for the second-order energy correction and first-order state correction and given that the corrections are supposed to be "small", develop a criterion for what exactly is "small" – i.e. criterion for validity of perturbation theory.