Worksheet #11

(Friday, January 30, 2026)

Name

Questions (5 pts):

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

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

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

(b) 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.