QUIZZ

a) $H = \frac{\hbar}{2}\begin{pmatrix} A & b \\ b & -A \end{pmatrix}$

EIGENVALUES $(A-\lambda)(-A-\lambda) - b^2 = 0$

$-A^2 + \lambda^2 - b^2 = 0 \quad \rightsquigarrow \lambda = \pm\sqrt{A^2+b^2}$

$E_{1,2} = \pm \frac{\hbar}{2}\sqrt{A^2+b^2}$

b) $H_0 = \frac{\hbar}{2}\begin{pmatrix} A & \\ & -A \end{pmatrix} \quad V = \frac{\hbar}{2}\begin{pmatrix} & b \\ b & \end{pmatrix}$

$E_1^0 = \frac{\hbar}{2}A \quad E_2^0 = -\frac{\hbar}{2}A \quad |1^0\rangle = \begin{pmatrix} 1 \\ 0 \end{pmatrix} \quad |2^0\rangle = \begin{pmatrix} 0 \\ 1 \end{pmatrix}$

FIRST ORDER $\delta E_1^0 = \langle 1^0|V|1^0\rangle = 0 \quad \delta E_2^0 = 0$

SECOND ORDER $\delta E_1^0 = \frac{|\langle 1^0|V|2^0\rangle|^2}{E_1^0 - E_2^0}$

USE $\langle 1^0|V|2^0\rangle = (1\ 0)\frac{\hbar}{2}\begin{pmatrix} 0 & b \\ b & 0 \end{pmatrix}\begin{pmatrix} 0 \\ 1 \end{pmatrix} = \frac{b\hbar}{2}$

$\delta E_1^0 = +\frac{\left(b\frac{\hbar}{2}\right)^2}{A\hbar} = +\hbar\frac{b^2}{4A}$ //

$\delta E_2^0 = -\delta E_1^0 = -\hbar\frac{b^2}{4A}$ //

CHECK $E_1 = \frac{\hbar}{2}\sqrt{A^2+b^2} = A\frac{\hbar}{2}\sqrt{1+b^2/A^2}$

$\simeq A\frac{\hbar}{2}\left\{1 + \frac{b^2}{2A^2} + \dots\right\} = \underbrace{A\frac{\hbar}{2}}_{E_1^0} + \underbrace{\frac{b^2}{2A}\frac{\hbar}{2}}_{\delta E_1} +$