A spin-1/2 particle has a magnetic moment $\boldsymbol{\mu}$ and is placed in a uniform magnetic field $\mathbf{B}$, which is aligned with the z-axis, so $\mathbf{B} = B_{\mathscr{z}} \hat{z} = B_{\mathscr{z}} \hat{z}$. It is known that the Hamiltonian operator for this sytem commutes with the spin component operator in the z direction (z basis?) but not with spin component operators in the x and y directions. The following argument should prove that hypothesis.

The Hamiltonian $\hat{H}$ =