Show that the eigenfunctions of the 1D particle in a box are orthonormal.

Show that a dipole operator of the form, \( \hat{\mu} = \mu_0 \hat{x} \) can lead to a transition between two levels in the 1D particle in a box.

Show that eigenfunctions of degenerate energy states of the 2D particle in a box are orthogonal.

How does a dipole operator of the form \( \hat{\mu} = \mu_0 \hat{r} = \mu_{0,x} \hat{x} + \mu_{0,y} \hat{y} \) affect eigenfunctions of degenerate energy states of the 2D particle in a box? Can it interconvert these states?