Spin Operator Matrices

adapted from

1. Show that each of the spin operator matrices can be written as a linear combination of projection operators, where the projection operators are outer products of the eigenvectors with themselves and the coefficient of each term is the eigenvalue associated with the eigenvector used to make the projection operator.

2. If a projection operator made from a spin eigenvector (any direction, x, y, or z) acts on a vector, what transformation does the operator correspond to? Does this transformation correspond to making a measurement on an initial state?

3. If a spin operator acts on a vector, what transformation does the operator correspond to? Does this transformation correspond to making a spin measurement on an initial state?