1. Let $A \in M_{n\times n}$. We say A is a *diagonalizable* matrix if and only if there exist two matrices P and D both in $M_{n\times n}$ such that:

1A. P is what kind of a matrix? _____ **1B.** D is what kind of a matrix?_____

1C. A equals what product in terms of P and D? _____

2. If $A = \begin{bmatrix} 65 & 6 & -30 \\ -20 & 3 & 10 \\ 120 & 12 & -55 \end{bmatrix}$, then A has eigenvalues 3 and 5. An eigenvector for 3 is $\begin{bmatrix} -3 \\ 1 \\ -6 \end{bmatrix}$, and 5 has multiplicity 2. Use this information and the Diagonalization Theorem to diagonalize the matrix A. (Just find P and D.)

P=_____ D = _____

3. Give an example of a matrix $S \in M_{2\times 2}$ which *is* invertible, but is *not* diagonalizable, and explain why S has these two properties.

4. Suppose $Q \in M_{2\times 2}$ and Q has the form $\begin{bmatrix} a & a \\ -a & -a \end{bmatrix}$ where a is some real number.

4A. Find the determinant of Q. det=_____

4B. Is Q invertible? Circle one: Y N

4C. Find and simplify the characteristic polynomial of Q. polynomial is _____

4D. Find the eigenvalues of Q along with their multiplicities. eigvals & multiplicities _____

4E. Find a basis for the eigenspace of each eigenvalue.

4F. Is Q diagonalizable? Why or why not?