

Worksheet 8 - Never due

1. Give an example of each of the following. If it is not possible, write "NOT POSSIBLE".
 - (a) Give an example of a basis of \mathbb{R}^4 such that each element lies in the hyperplane $2w + 3x + y + z = 0$.
 - (b) Give an example of a basis of \mathbb{R}^4 such that each element lies in the hyperplane $2w + 3x + y + z = 1$.
 - (c) Give an example of a matrix that is orthogonally diagonalizable but not diagonalizable.
 - (d) Give an example of a matrix that is diagonalizable but not orthogonally diagonalizable.
 - (e) Give an example of a nonzero matrix A such that $A^2 = 0$.
 - (f) Give an example of a nonzero matrix A such that $A^2 = I$.
 - (g) Give an example of a nonzero matrix A such that $A^2 = I$ and the nullity of A is 1.
 - (h) Give an example of an orthogonal set that is not linearly independent.
 - (i) Give an example of an orthogonal set that is not spanning.
 - (j) Give an example of a 2×3 matrix whose rank is equal to its nullity.
 - (k) Give an example of 2 matrices A and B such that $A^3 = B^3$.
 - (l) Give an example of 2 matrices A and B such that A and B each have nullity 1 but AB has nullity 0.
 - (m) Give an example of 2 matrices A and B such that A and B each have nullity 0 but AB has nullity 1.
 - (n) Give an example of a diagonalizable matrix that is not invertible.
 - (o) Give an example of an invertible matrix that is not diagonalizable.
 - (p) Give an example of a symmetric matrix that is not diagonalizable.
 - (q) Give an example of a symmetric matrix that is not invertible.
 - (r) Give an example of an orthogonal matrix that is not invertible.
 - (s) Give an example of an invertible matrix that is not orthogonal.
 - (t) Give an example of a matrix with distinct eigenvalues that is not invertible.
 - (u) Give an example of a 3×3 orthogonal matrix with only one eigenvalue.
 - (v) Give an example of a 3×3 matrix whose only eigenvalue is 2.
 - (w) Give an example of a 3×3 invertible matrix whose only eigenvalue is 2.
 - (x) Give an example of a matrix A and an eigenvalue λ such that the algebraic multiplicity of λ is less than the geometric multiplicity.
 - (y) Give an example of a matrix A and an eigenvalue λ such that the geometric multiplicity of λ is less than the algebraic multiplicity.
 - (z) Give an example of a matrix A and an eigenvalue λ such that the eigenspace is 0-dimensional.