Eigenvalues and Such

Assume that M is a square matrix. Let I be the identity matrix of the same size as M.

- An **eigenvalue** of M is a number, λ such that there is a non-zero solution $\mathbf{v}$ for the system $M\mathbf{v} = \lambda\mathbf{v}$.
- Eigenvalues are the roots of $\det(M - \lambda I)$.
- An **eigenvector** associated to λ is any non-zero solution for the system $M\mathbf{v} = \lambda\mathbf{v}$.

Suppose that $\lambda_1, \lambda_2, \ldots, \lambda_n$ are the eigenvalues of M, with associated eigenvectors $\mathbf{v}_1, \mathbf{v}_2, \ldots, \mathbf{v}_n$. Let P be the square matrix whose columns are the eigenvectors. Let D be the matrix with λ_i's on the diagonal and zeroes elsewhere.

- $MP = PD$
- If all the eigenvalues are distinct, then P is invertible.
- $P^{-1}MP = D$