**DASC 2594 – Multivariable Math for Data Scientists**

**Unit 2: Vector Spaces, Eigen decompositions, Orthogonality, Symmetry, and Quadratic Forms**

**Lesson Plan 5: Eigenvectors and Eigenvalues**

**John Tipton, 2020**

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| **Units** | **Lesson Plan 5** | **Readings** |
| **Unit 2**  **Vector Spaces, Eigen decompositions, Orthogonality, Symmetry, and Quadratic Forms** | **Essential Questions**   * What are Eigenvalues? * Why are Eigenvalues important in data science? * What do Eigenvalues tell us about the behavior of dynamical systems? | Chapter 5 of Linear Algebra and It’s Applications. David C. Lay |
| **Day 1**   * Identify and calculate eigenvalues and vectors * Identify eigenvectors as a change of basis that contains maximal variability in the data |
| **Day 2**   * Identify and use properties of determinants to identify if a matrix is invertible * Use the characteristic equation det(A – lambda I) = 0 to determine if lambda is an eigenvalue * Identify similar matrices |
| **Day 3**   * Diagonalize a matrix * Understand how to factorize a matrix to diagonal form * Understand the relationship between linear independence and diagonalizability |
| **Day 4**   * Understand how Eigenvectors are used to characterize linear transformations |
| **Day 5**   * Applications of Eigenvalues and Eigenvectors to dynamical systems and differential equations in data science * Applications of Eigenvalues to data compression and dimension reduction in data science |