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

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

**Lesson Plan 7: Symmetric Matrices and Quadratic Forms**

**John Tipton, 2020**

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| **Units** | **Lesson Plan 7** | **Readings** |
| **Unit 2**  **Vector Spaces, Eigen decompositions, Orthogonality, Symmetry, and Quadratic Forms** | **Essential Questions**   * What is the relationship between symmetric matrices and diagonal forms? * What is a quadratic form? * What is the principal axis of a quadratic form * How can quadratic forms be used to characterize matrices? * How can you solve constrained optimization problems using quadratic matrices * How is the singular value decomposition used in data compression and how is it related to principal component analysis | Chapter 7 of Linear Algebra and It’s Applications. David C. Lay |
| **Day 1**   * Understand that a matrix is diagonalizability if and only if it is a symmetric matrix * Apply the spectral theorem to symmetric matrices * Use the spectral decomposition to derive projection matrices |
| **Day 2**   * Definition of quadratic forms * Understand how quadratic forms are used to classify quadratic forms * Apply techniques from quadratic forms to solve constrained optimization problems |
| **Day 3**   * What is the singular value decomposition (SVD)? * What is the relationship between the SVD and the Eigen decomposition * How is the SVD used in statistics and data science? |