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

**Unit 3: Vectors, Vector Geometry, and Vector-valued Functions**

**Lesson Plan 8: Vectors, Geometry, and Vector-Valued Functions**

**John Tipton, 2020**

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| **Units** | **Lesson Plan 8** | **Readings** |
| **Unit 3**  **Vectors, Vector Geometry, and Vector-valued Functions** | **Essential Questions**   * What are important mathematical operations on vectors? * What are some underlying geometries that can be defined using vector-valued functions? * How does one apply derivatives to vector-valued functions? What is the physical meaning of these derivatives of vector-valued functions? | Chapters 13 and 14 in Briggs et. al. |
| **Day 1**   * Understand and apply properties of cross products * Apply the cross product to examples including torque, magnetic force of a moving charge |
| **Day 2**   * Calculate the distance from a point to a line * Understand and apply the equation of a plane * Define and identify parallel and orthogonal planes |
| **Day 3**   * Define and apply equations for quadratic surfaces, cylinders, ellipses, and cones * Apply the trace of a surface defined by the intersection of a plane (not matrix trace) |
| **Day 4**   * Define a curve in space using vector-valued functions * Define the derivative and tangent vector of a vector-valued function * Understand and apply derivative rules for vector-valued functions * Understand and apply indefinite and definite integrals of vector-valued functions |
| **Day 5**   * Understand and apply position, velocity, speed, and acceleration using vector valued functions * Use and understand examples of straight-line and circular motion using vector calculus * Apply vector calculus to motion in a gravitational field |
| **Day 6**   * Understand arc length and use arc length to measure the length of a vector valued function * Define and use the curvature of a vector valued function * Understand the principal unit vector and understand the properties of the principal unit vector * Apply vector-valued functions to understand torsion and acceleration |