DASC 2594\_Multivariable Math for Data Scientists\_Unit #1\_Linear Equations, Matrix Algebra, Determinants, and Invertibility

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| **Stage 1 Desired Results** | | |
| ESTABLISHED GOALS  **Timeframe:** (maximum) 13 days  **Lesson Plans Referenced**:   * DASC 2594\_Unit 1\_Lesson Plan 1\_Introduction to Linear Systems of Equations * DASC 2594\_Unit 1\_Lesson Plan 2\_Matrix Algebra * DASC 2594\_Unit 1\_Lesson Plan 3\_Determinants, Volume, and Linear Transformations | ***Acquisition*** | |
| *Students completing Unit 1 of DASC 2594 should be able to:*   * Identify a system of linear equations * Solve a system of equations using augmented form * Develop an intuition for span and linear independence * Understand the linear equation AX = b and find solutions when they exists * Explain when solutions to the linear equation Ax = b do not exist and explain why there is no solution * Understand, identify, and use matrix transformations including reflections, contractions/expansions, shears, and projections. * Calculate a matrix determinant and develop an intuition about the relationship between matrix determinants and invertibility * Understand and apply the invertible matrix theorem | *Students will be skilled at…*   * Applying the rules of vector and matrix addition, subtraction, and multiplication * Identifying when a matrix is invertible * Solving systems of equations * Manipulating and interacting with different matrix objects in software * Understanding warning and error messages in software when applying matrix algebra methods |
| ***Meaning*** | |
| UNDERSTANDINGS  *Students will understand …*   * Fundamental matrix operations * Systems of equations * Relationship between linear algebra and geometry * The importance of invertible matrices * How coordinate systems are represented in matrix form | ESSENTIAL QUESTIONS   1. What is a linear system of equations? 2. How can a linear system of equations be expressed in matrix form? 3. What are the techniques and tools for working with matrix equations and how to manipulate matrices 4. What is linear independence? Why is linear independence important? 5. How are matrix operations interpreted as transformations? 6. What are the geometric interpretations of matrix transformations? 7. What are the basic operations that you can use with matrices? 8. What properties of matrices allow for solutions to linear systems of equations? 9. What are different matrix structures and what do these different matrix forms imply? 10. What is a vector space and how are subspaces defined? 11. What is the relationship between rank, linear independence, and vector subspaces? 12. What is a determinant? 13. How is a determinant a measure of volume? 14. What is the relationship between determinants and matrix transformations? |
| ***Transfer*** | |
| *Students will be able to independently use their learning to…*   * Identify and solve systems of equations using computer software * Solve novel linear algebra equations using tools and techniques learned in class * Describe how matrix algebra is used to solve data science problems | |
| **Stage 2 - Evidence** | | |
| **Evaluative Criteria** | **Assessment Evidence** | |
| Rubric Names: | PERFORMANCE TASK(S)    *Pre-Test:*  *Formative Assessment :*   * *HW 01: Introduction to Linear Systems of Equations* * *HW 02: Matrix Transformations and Matrix Operations* * *HW 03: Matrix Inverses and Partitioned /Structured Matrices* * *HW 04: Coordinate Systems, Rank, Subspaces, and Determinants*   *Summative Assessment:*   * Exam (In class and take home) | |
|  | OTHER EVIDENCE:   * In class questions using learning software (google forms, etc.) * Student feedback and questions | |
| **Stage 3 – Learning Plan** | | |
| *Summary of Key Learning Events and Instruction*  *Unit #1 (maximum) 13 days*  Textbook: To be determined (likely will be primarily based on class lecture notes)  Technology: RStudio /RStudio Server / RStudio Connect;  Prerequisite Knowledge/Course(s): Fundamental understanding of Calculus at the level of Calculus II and ability to program in R  **Activity 1 (6 days):** List Topic Refer to DASC 2594\_Unit 1\_Lesson Plan 1\_Introduction to Linear Systems of Equations  **Activity 2 (5 days):**  List Topic Refer to DASC 2594\_Unit 1\_Lesson Plan 2\_Matrix Algebra  **Activity 3 (2 days):**  List Topic Refer to DASC 2594\_Unit 1\_Lesson Plan 3\_Determinants, Volume, and Linear Transformations | | |

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| **Learning Accommodations** | |
| **Student Accommodations** | **Accelerated Students** |
| Compliance/ADA/504 | Challenge Students who want/need more |