Linear Algebra Standards

Module E: How can we solve systems of linear equations?

☐ ☐ **E1. Systems as matrices.** I can translate back and forth between a system of linear equations, a vector equation, and the corresponding augmented matrix.

☐ ☐ **E2. Row reduction.** I can explain why a matrix isn't in reduced row echelon form, and put a matrix in reduced row echelon form.

☐ ☐ **E3. Systems of linear equations.** I can compute the solution set for a system of linear equations or a vector equation.

Module V: What is a vector space?

☐ ☐ **V1. Vector spaces.** I can explain why a given set with defined addition and scalar multiplication does satisfy a given vector space property, but nonetheless isn't a vector space.

☐ ☐ **V2. Linear combinations.** I can determine if a Euclidean vector can be written as a linear combination of a given set of Euclidean vectors by solving an appropriate vector equation.

☐ ☐ **V3. Spanning sets.** I can determine if a set of Euclidean vectors spans $\mathbb{R}^n$ by solving appropriate vector equations.

☐ ☐ **V4. Subspaces.** I can determine if a subset of $\mathbb{R}^n$ is a subspace or not.

☐ ☐ **V5. Linear independence.** I can determine if a set of Euclidean vectors is linearly dependent or independent by solving an appropriate vector equation.

☐ ☐ **V6. Basis verification.** I can explain why a set of Euclidean vectors is or is not a basis of $\mathbb{R}^n$.

☐ ☐ **V7. Basis computation.** I can compute a basis for the subspace spanned by a given set of Euclidean vectors, and determine the dimension of the subspace.

☐ ☐ **V8. Polynomial and Matrix computation.** I can answer questions about vector spaces of polynomials or matrices.

☐ ☐ **V9. Basis of solution space.** I can find a basis for the solution set of a homogeneous system of equations.

Module A: How can we understand linear maps algebraically?

☐ ☐ **A1. Linear map verification.** I can determine if a map between vector spaces of polynomials is linear or not.

☐ ☐ **A2. Linear maps and matrices.** I can translate back and forth between a linear transformation of Euclidean spaces and its standard matrix, and perform related computations.

☐ ☐ **A3. Kernel and Image.** I can compute a basis for the kernel and a basis for the image of a linear map, and verify that the rank-nullity theorem holds for a given linear map.

☐ ☐ **A4. Injectivity and surjectivity.** I can determine if a given linear map is injective and/or surjective.

Module M: What algebraic structure do matrices have?

☐ ☐ **M1. Matrix Multiplication.** I can multiply matrices.

☐ ☐ **M2. Invertible Matrices.** I can determine if a square matrix is invertible or not.

☐ ☐ **M3. Matrix inverses.** I can compute the inverse matrix of an invertible matrix.

☐ ☐ **M4. Row operations as matrix multiplication.** I can can express row operations through matrix multiplication.

Module G: How can we understand linear maps geometrically?

☐ ☐ **G1. Row operations and Determinants.** I can describe how a row operation affects the determinant of a matrix.

☐ ☐ **G2. Determinants.** I can compute the determinant of a 4×4 matrix.

☐ ☐ **G3. Eigenvalues.** I can find the eigenvalues of a 2×2 matrix.

☐ ☐ **G4. Eigenvectors.** I can find a basis for the eigenspace of a 4×4 matrix associated with a given eigenvalue.