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 and the corresponding augmented matrix.
- ☐ ☐ **E2. Row reduction.** I can 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.

Module V: What is a vector space?

- ☐ ☐ **V1. Vector property verification.** I can show why an example satisfies a given vector space property, but does not satisfy another given property.
- ☐ ☐ **V2. Vector space identification.** I can list the eight defining properties of a vector space, infer which of these properties a given example satisfies, and thus determine if the example is a vector space.
- ☐ ☐ **V3. Linear combinations.** I can determine if a Euclidean vector can be written as a linear combination of a given set of Euclidean vectors.
- ☐ ☐ **V4. Spanning sets.** I can determine if a set of Euclidean vectors spans $\mathbb{R}^n$.
- ☐ ☐ **V5. Subspaces.** I can determine if a subset of $\mathbb{R}^n$ is a subspace or not.

Module S: What structure do vector spaces have?

- ☐ ☐ **S1. Linear independence.** I can determine if a set of Euclidean vectors is linearly dependent or independent.
- ☐ ☐ **S2. Basis verification.** I can determine if a set of Euclidean vectors is a basis of $\mathbb{R}^n$.
- ☐ ☐ **S3. Basis computation.** I can compute a basis for the subspace spanned by a given set of Euclidean vectors.
- ☐ ☐ **S4. Dimension.** I can compute the dimension of a subspace of $\mathbb{R}^n$.
- ☐ ☐ **S5. Abstract vector spaces.** I can solve exercises related to standards V3-S4 when posed in terms of polynomials or matrices.
- ☐ ☐ **S6. 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. Injectivity and surjectivity.** I can determine if a given linear map is injective and/or surjective.
- ☐ ☐ **A4. Kernel and Image.** I can compute a basis for the kernel and a basis for the image of a linear map.

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.

Module G: How can we understand linear maps geometrically?

- ☐ ☐ **G1. Row operations.** I can represent a row operation as matrix multiplication, and compute how the operation affects the determinant.
- ☐ ☐ **G2. Determinants.** I can compute the determinant of a square 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 square matrix associated with a given eigenvalue.