Algebra Section III-V Summary

The course material is divided in five sections. We have finished Sections I-II and we are almost done with III-V (linear algebra). Hefferon's Linear Algebra covers almost everything we covered, except the *PLU decomposition* material we will discuss on December 2. This, and everything else that is not covered in the 2nd midterm is given in *italics*. Material in italics is part of the final!

Most of Hefferon's "Topic" sections at the end of each chapter are not part of this course: the exceptions are at the end of Chapter Two "Topic: Fields"; end of Chapter Three "Topic: *Line of best fit*"; and end of Chapter Four "Topic: Cramer's rule".

In Chapter Five of Hefferon, we only cover the first two sections, up to page 407, but "Appendix A-5: Sets, Functions, and Relations" is also part of the final. Material that is particularly relevant from Hefferon includes the following.

Systems of linear equations in two and three unknowns, row operations, Gauss and Gauss-Jordan elimination. $\mathbb{R}^n$ and its subspaces, linear combination, independence, generated subspace, base, dimension, coordinates, row- and column-space of matrices, null-space (kernel), space of solutions, solution in row space. Operations on matrices, inversion, change of coordinates. Operations on special matrices, *PLU decomposition, solving a system of equations using PLU*

The determinant as the signed volume of spanned parallelpiped, fundamental properties, determinant of matrices, permutations, transpositions, cycles, computing the determinant. Laplace theorem, multiplication theorem for determinants, Cramer's rule.

Fundamental properties of matrix rank. Linear mappings and ther matrices, matrix of orthogonal projection to subspace. Similarity of matrices.