

Math 251 Sample Final

Rather than a list of problems, this is a list of topics. The posted notes have enough examples to serve as preparation.

1. Matrix operations, reduction to upper triangular form, elementary matrices.
2. Consistent systems.
3. The inverse of a matrix, general properties.
4. Determinants, general properties, the adjoint, Cramer's rule.
5. Linear independence, bases, dimension
6. Coordinates, change of basis, transition matrix.
7. The row, column and null spaces of a matrix.
8. Nullity, rank, the fundamental isomorphism theorem

$$n = \text{nullity}(A) + \text{rank}(A), \quad m = \text{nullity}(A^T) + \text{rank}(A).$$

9. Sums and direct sums of subspaces.

$$R^n = \ker(A) \oplus \text{range}(A^T), \quad R^m = \ker(A^T) \oplus \text{range}(A).$$

10. The dot product and norm, orthogonality.
11. The Gram-Schmidt process.
12. The orthogonal complement of a subspace
13. The projection matrix into a subspace, the oblique and orthogonal cases.
14. Affine varieties, equations of planes of various dimensions in E^n .
15. Intersection of different planes.
16. Eigenvalues and eigenvectors, algebraic and geometric multiplicities, defective and non defective matrices.
17. Similarity, diagonalization.