Math 8501, Fall 2018

# Theory of Ordinary Differential Equations

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*— Linear Algebra: revision and examples —*

(1) Recall the concepts of vector spaces, matrices, linear maps, coordinate changes for linear maps, eigenvalues and eigenspaces, semi-simple and non-semi-simple matrices, characteristic polynomials, geometric and algebraic multiplicity, Jordan normal form.

(2) Compute the Jordan normal form (with the associated coordinate change to $\begin{pmatrix} 1 & 1 \\ -1 & -1 \end{pmatrix}$. Compute the projection on the kernel in the original variables and in the Jordan normal form. Find all invariant subspaces for this matrix.

(3) Compute the Jordan normal form (optionally the associated coordinate change) for

$$\begin{pmatrix} 1 & 1 & 0 \\ 0 & 1 & 2 \\ 0 & 0 & 2 \end{pmatrix}, \begin{pmatrix} 1 & 1 & 0 \\ 0 & 1 & 2 \\ 0 & -1 & 1 \end{pmatrix}, \begin{pmatrix} 1 & 1 & 0 \\ 0 & 1 & 0 \\ 0 & 2 & 1 \end{pmatrix}.$$