Sample Questions from Past Qualifying Exams

This list may give the impression that the exams consist of a series of questions fired at the student one after another. In fact most exams have more the character of a conversation with considerable give and take. Hence this list cannot be expected to indicate accurately the difficulties involved.

The list indicates the professor associated to each question where available. Some have been in the MGSA files for a while, and this information has been lost (if it was ever there).

The listing by section is approximate, since some questions may fit under more than one heading.

Ordinary Differential Equations

- Let $\frac{d}{dt}\mathbf{x} = A(t)\mathbf{x}$, where $A(t)$ is a 2×2 periodic matrix with period ω. Are the solutions periodic?

- Show that a fundamental matrix is the product of a periodic matrix and an exponential matrix.

- What are Floquet multipliers?

- Condier $\frac{d}{dt}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} f(x,y) \\ g(x,y) \end{pmatrix}$, where $f(0,0) = g(0,0) = 0$. Give examples of what can happen near the origin in terms of eigenvalues. Give assumptions on f and g.