

Introduction to Ordinary Differential Equations

Outline for Exam 5

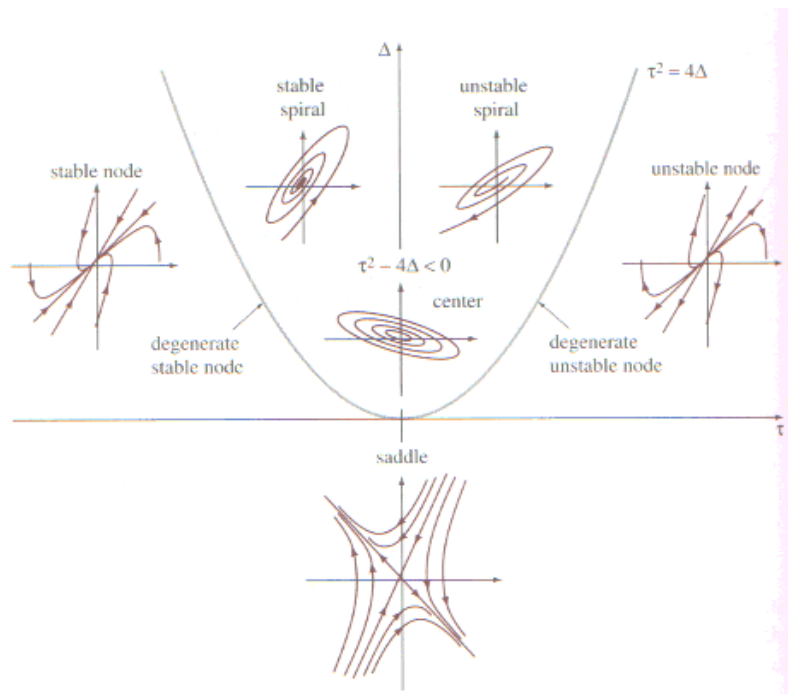
Test Date: 04/19/2023

NO BOOKS OR NOTES WILL BE PERMITTED! NO ELECTRONIC DEVICES ARE PERMITTED!

- I. Classification of Equilibria for 2×2 Non-Linear Autonomous Systems
 - A. Identify Nullclines for the System
 - B. Find all Equilibria for the System
 - C. Compute the Linearization Matrix by taking Partial Derivatives
 - D. Use Trace and Determinant to Classify Equilibria (you should know the details of the trace-determinant plane on the next page)

- II. Laplace Transform Techniques
 - A. Definition of the Laplace Transform (be able to compute the Laplace Transform by the definition for simple functions)
 - B. Find Laplace Transforms by properties of the transform (for example, transform of $f'(t)$, $e^{at}f(t)$, and $tf(t)$)
 - C. Find Inverse Laplace Transforms by Partial Fractions, Table Lookup, and Convolution
 - D. Solve ODEs by Laplace Transform
 - E. Solve First and Second Order ODEs with Piecewise Continuous Forcing Terms and Impulsive Forces (i.e. with unit step functions and Dirac deltas)
 - F. A Table of Laplace Transforms will be provided!

The Trace-Determinant Plane



$$\tau = \text{Tr}(M), \quad \Delta = \text{Det}(M)$$