

Problem Set : Differential Equations

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Contents

Chapter 1. Ordinaet differential equations	5
1. First order nonlinear ODE	6
2. Homogeneous linear ODE	7
3. Inhomogeneous linear ODE	8
Chapter 2. Linear partial differential equations	9
1. Spectral theory	10

CHAPTER 1

Ordinary differential equations

1. First order nonlinear ODE

1.1. Picard-Lindelöf theorem.

1.2. Exact differential equations.

1.3. Integrating factor.

2. Homogeneous linear ODE

2.1. Abel theorem.

2.2. Characteristic equations.

2.3. Power series.

3. Inhomogeneous linear ODE

3.1. Undetermined coefficients.

3.2. Variation of parameters.

CHAPTER 2

Linear partial differential equations

1. Spectral theory

PROBLEM 1.1. Let Ω be a bounded Lipschitz domain. Consider an eigenvalue problem

$$\begin{cases} -\Delta u = \lambda u, & x \in \Omega, \\ u = 0, & x \in \partial\Omega. \end{cases}$$