

**Math 241, Fall 2004**  
**Outline for Midterm #2**

1. Partial Differential Equations

(a) Introduction

Knot definitions associated to PDE, such as order of a PDE, homogeneous, linear, elliptic, hyperbolic and parabolic.

(b) Heat Equations

- i. Be able to solve heat equation (and other PDE's) using Separations of Variables!
- ii. Uniqueness for solutions to the heat equations.
- iii. Maximum principle for the heat equation.

(c) Wave Equation

- i. Be able to solve wave equation (and other PDE's) using Separations of Variables!
- ii. Uniqueness for solutions to the wave equations.
- iii. D'Alembert's solution to the wave equations.

(d) Orthogonal Series Expansions

Using Generalized Fourier series to help in the last step of separation of variables.

(e) 2-dimensional problems

Using a double Fourier series to help in the last step of separation of variables.

(f) The Laplacian ( $\nabla^2 u = 0$ ) in other coordinates.

- i. Be able to convert and work with PDE's to other coordinate systems.
- ii. Using Legendrian-Fourier series to help in the last step of separation of variables.

2. Integral Transforms

(a) Laplace transform and PDE's

- i. Basic properties of the Laplace transform.
- ii. Know how to solve PDE's using Laplace transform.

(b) Fourier transform

- i. Fourier sine and cosine transforms.
- ii. Know definition of Fourier transform and its inverse.
- iii. Be able to compute Fourier transforms.
- iv. Be able to solve ODE's and PDE's using Fourier transforms.