MA 401 Final Exam Review

1.1 PDE Models

Determine if a PDE is linear/nonlinear, homogeneous/nonhomogeneous
Verify that u is a solution to a PDE
Ex. p. 9-10 #2,3,4,5, 8 (I wouldn't give you the hint!)

1.2 Conservation Laws

Apply the Method of Characteristics
Solve Separable d.e.
Solve 1st Order Linear d.e.
Know what it means to be a Cauchy problem
Remember and be able to apply Calc 3 Chain Rule
Ex. p.25-26 #5,6,8

1.3 Diffusion

Types of Boundary Conditions (i.e., Dirichlet vs Neumann vs Robin, homogeneous/nonhomogeneous)
Steady state solutions (time independent solutions)
Ex. p. 36-37 #4, 6

1.9 Classifications of PDEs

Classify a PDE as hyperbolic, parabolic, or elliptic
Change variables & solve the PDE
Ex. p. 76-77 #1,2,3,5

2.1 Cauchy Problem for the Heat Equation

Solve the Cauchy Problem for the Heat Equation in terms of the erf function
Ex. p. 86 #1a

2.2 Cauchy Problem for the Wave Equation

Utilize d'Alembert's solution to solve the Cauchy wave equation
Ex. p.90-91 #2,6

2.6 Laplace Transforms

Use Laplace Transforms in our table to solve PDEs on semi-infinite domains
Solve ay''+by'+cy=0 and ay''+by'+cy=f (See examples 1,2,3bc, and 4 on this worksheet if you need a refresher)
See the Laplace Transform Worksheet
Ex. p. 115 #6,7,8,9

2.7 Fourier Transforms

Use Fourier Transforms in our table to solve PDEs on infinite domains
Apply the definition of convolution

See the Fourier Transform Worksheet
Ex. p. 122-123 #1,9,10,12

**** Power Series Solutions**

Use a power series expansion about x=0 to find a general solution for an ODE
State the recurrence relation for the coefficients
Be able to find the requested amount of nonzero terms
Ex. From the Handouts section of our moodle page: p. 443-444 #11,13,19,25,27,29,31

3.1 Fourier Method

Apply the product-sum formulas to evaluate integrals

3.3 Classical Fourier Series

Find the Fourier series, the Fourier cosine series, and the Fourier sine series
Find and graph an even or odd extension of a series
Determine the sum of a series at specified values of x
See the Fourier Series Worksheet & the homework for more examples
Ex. p. 153 #3(not including the frequency spectrum),5

4.2 Sturm-Liouville Problems

Determine all the eigenvalues and eigenfunctions of a SLP
Utilize hyperbolic trig functions when necessary
See the Sturm-Liouville Worksheet for more examples
Ex. p. 177-179 #2,3,6

4.1 Overview of Separation of Variables

Use the in-class solution of the heat equation with u(0,t)=u(L,t)=0, find a specific u(x,t)
Use the in-class solution of the wave equation with u(0,t)=u(L,t)=0, find a specific u(x,t)
Apply the Method of Separation of Variables to solve PDEs with bounded spatial domains
Ex. p. 166 #1,2,3a & the homework

4.3 Laplace's Equation

Ex. p. 195 #1,2,5

4.7 Sources on Bounded Domains

Solve PDEs where the source term is of the form f(x) and/or the boundary conditions are constants
See the Sources Worksheet for more examples
Ex. p. 214 #4, 5,7,8,9