Partial Differential Equations
Practice Quiz 2

FOR EACH PROBLEM: Say in words what you are doing at each of the steps and do all of the calculations. Your solutions should make very clear to me that you understand ALL of the steps and the logic behind the steps. For all the new PDE material say WHY you are doing that step or making that choice.

Eigenfunction Expansion

Solve using Eigenfunction Expansion. You first need to transform to homogeneous boundary conditions.

$$u_t = u_{xx} \;\; 0 \leq x \leq 1$$
$$u(0,t) = \cos(t)$$
$$u(1,t) = 1$$
$$u(x,0) = 1$$

Now redo the problem using a Sine or Cosine Integral Transform. You will not need to first transform the boundary conditions.

Transform Methods

Solve using the given transform

1. **Fourier:**

$$u_t = u_{xx} + 2u_x \quad -\infty < x < \infty$$
$$u(x,0) = e^{-x^2}$$

you should leave your answer in terms of a convolution integral.

How would you transform this into a pure diffusion problem?

2. **Laplace:**

$$u_t = u_{xx} \quad -\infty < x < \infty$$
$$u(x,0) = e^x sin(x)$$

you should end up with a nice answer.

Laplace's Equation - Separation of Variables

$$u_{xx} + u_{yy} = 0 \quad 0 \leq x \leq 1 \quad 0 \leq y \leq 1$$

$$u(0, y) = 0$$

$$u(1, y) = 1$$

$$u(x, 0) = 0$$

$$u(x, 1) = 0$$