Homework due Nov. 1st

Math 124A: PDEs (Fall 2007)

1. Solve the diffusion equation on the whole line with initial data $\phi(x) = \delta(x+3)+4\delta(x)$. (For graduate students: instead of this, solve the diffusion equation with initial data $\phi(x) = \delta(x+3) + 4\delta'(x)$.)

2. Section 3.1, #1

3. Section 3.1, #2 [Hint: Define a new function $v(x,t) = u(x,t) - 1$ and solve for v.]

4. Solve the following problem on the half-line

$$\begin{cases} u_t = ku_{xx} & \text{on } 0 < x < \infty,\ 0 < t < \infty \\ u(x,0) = -x & (\text{on } 0 < x < \infty) \\ u_x(0,t) = 0 & (\text{on } 0 < t < \infty) \end{cases}$$

   Your answer will be in terms of $\mathscr{E}$rf.

5. Solve

$$\begin{cases} v_t - \frac{1}{4}v_{xx} = e^{-x} & \text{on } -\infty < x < \infty \\ v(x,0) = x^2 \end{cases}$$

   You should be able to finish doing all the integrals!

6. Solve

$$\begin{cases} v_t - kv_{xx} = 2e^{-t^2} & \text{on } 0 < x < \infty \\ v(x,0) = 1 \\ v(0,t) = e^{-t^2} \end{cases}$$

   You may have integrals in your answer!