MOCK MIDTERM

Instructions: This is a mock midterm, designed to give you some practice for the actual midterm. It will be similar in length and in difficulty to the actual midterm, but beware that the actual exam might have different questions. So please also look at the study guide and the homework for a more complete study experience.

1		25
2		25
3		25
4		25
Total		100

1. *(25 points)* Solve the following PDE:

$$\begin{cases} \cos(y)u_x + \sin(x)u_y = 0 \\ u(x, 0) = (\cos(x))^2 \end{cases}$$

2. *(25 points)* Find the general solution of the following PDE:

$$u_{xx} + u_{xt} - 2u_{tt} = 0$$

3. *(25 points)* Find an explicit solution of the following heat equation, where $-\infty < x < \infty$:

$$\begin{cases} u_t = \dfrac{1}{4} u_{xx} \\ \quad u(x,0) = e^{2x} \end{cases}$$

Note: $S(x,t) = \dfrac{1}{\sqrt{4\pi kt}} e^{-\frac{x^2}{4kt}}$ $\qquad \displaystyle\int_{-\infty}^{\infty} e^{-y^2}\, dy = \sqrt{\pi}$

4. *(25 points)* Use the energy method to prove uniqueness of solutions of the following wave equation on $0 < x < l$

$$\begin{cases} u_{tt} = c^2 u_{xx} + f(x,t) \\ u(0,t) = g(t) \\ u(l,t) = h(t) \\ u(x,0) = \phi(x) \\ u_t(x,0) = \psi(x) \end{cases}$$

Note: Multiply your PDE by (some version of) u_t