

**PDE and Boundary-Value Problems (Winter Term 2013/2014)**  
**Assignment H3 - Homework**

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**Problem 3.1 (Fourier Transform and Maple - 3x4=12 Points)**

Using Maple solve the problem

$$\text{PDE: } u_t = u_{xx}, \quad -\infty < x < \infty, \quad 0 < t < \infty$$

$$\text{IC: } u(x, 0) = \varphi(x), \quad -\infty < x < \infty$$

by means of the Fourier transform. Compare the solutions for the following values of the initial data:

- (a)  $\varphi(x) = \begin{cases} 1, & x > 0 \\ -1, & x < 0 \end{cases}$ ,
- (b)  $\varphi(x) = \begin{cases} \cos(x), & |x| < \pi/2 \\ 0, & |x| > \pi/2 \end{cases}$ ,
- (c)  $\varphi(x) = xe^{-2|x|}$ .

**Problem 3.2 (Solving the IBVP - 8 Points)**

Solve the problem

$$\text{PDE: } u_t(x, y, t) = u_{xx}(x, y, t) + u_{yy}(x, y, t), \quad 0 < x < 1, \quad 0 < y < 1, \quad 0 < t < \infty$$

$$\text{BCs: } \begin{cases} u_x(0, y, t) = 0 \\ u_x(1, y, t) = -u(1, y, t) \\ u(x, 0, t) = 0 \\ u(x, 1, t) = 0 \end{cases} \quad 0 < t < \infty$$

$$\text{IC: } u(x, y, 0) = \left(1 - \frac{x^3}{3}\right) y(1 - y), \quad 0 < x < 1, \quad 0 < y < 1$$

by using the method of separation of variables.

**Deadline for submission:** Wednesday, November 27, 10am