



PDE and Boundary-Value Problems (Winter Term 2015/2016)  
Assignment H1 - Homework

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**Problem 1.1 (Classification - 4 Points)**

Classify the following equations:

- (a)  $u_t = u_{xx} + 2u_x + u$
- (b)  $u_t = u_{xx} + e^{-t}$
- (c)  $u_{xx} + 3u_{xy} + u_{yy} = \sin x$
- (d)  $u_{tt} = uu_{xxxx} + e^{-t}$

**Problem 1.2 (Transformation into normal form - 12 Points)**

Transform into normal form the following equations

- (a)  $u_{xx} - 2xu_{xy} - \frac{1}{x}u_x = 0, \quad x > 0,$
- (b)  $u_{xx} + 2u_{xy} + x^2u_x = e^{-x^2/2}.$

**Problem 1.3 (Definition of the type - 9 Points)**

Define the type (elliptic, parabolic, etc.) of the following equations

- (i)  $xu_{xx} + 2xu_{xy} + (x - 1)u_{yy} = 0,$
- (ii)  $u_{xy} - 2u_{xz} + u_{yz} + u_x + \frac{1}{2}u_y = 0,$
- (iii)  $u_{xx} + 2u_{xy} + 2u_{xz} + u_{yy} + 2u_{yz} + u_{zz} - u = 0.$

**Problem 1.4 (Solving PDE - 5 Points)**

Can you find all functions  $u(x, y)$  that satisfy to the equation

$$\frac{\partial^2 u(x, y)}{\partial x \partial y} = 0?$$

How many are there?

**Deadline for submission:** November 2, 10:15 a.m. (Lecture Hall 001, Building E1 3)