

Math 415 Assignment 1
Due Thursday, September 8,
at the beginning of class

After solving a PDE, always check your answer.

Throughout this assignment, $u = u(x, y)$ is a function of two variables.

Question 1. Solve the PDE

$$u_{xx} - 3u_x + 2u = 0.$$

Question 2. Solve the PDE

$$y^2 u_x + e^x u_y = 0.$$

Question 3. Solve the PDE

$$u_x - (xy - e^{-\frac{1}{2}x^2})u_y = 0.$$

Question 4. Find a function u with

$$u_x + u_y + u = e^{x+2y}$$

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

Question 5. Solve the PDE

$$u_x + u_y = x.$$

Question 6. Consider the PDE

$$u_{xx} + u_{yy} = 0.$$

(a) Verify that for every $n \in \mathbb{N}$, the function

$$u(x, y) = \exp(nx) \sin(ny)$$

is a solution of this PDE.

(b) Observe that for all $a, b, c \in \mathbb{R}$, the polynomial

$$p(x, y) = a + bx + cy$$

is a solution of the PDE above. Find polynomials of degree 2 and 3 which are also solutions of the PDE.