

Homework 1

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1 Problem 1

In this problem we will estimate the following quantity $b^2 - ac$ to classify the second-order linear partial differential equations.

1. $u_{xy} - u_x = 0$ is hyperbolic everywhere. Since

$$0.5^2 - 0.25 > 0.$$

2. $u_{xx} + u_{xy} + yu_{yy} + 4u = 0$

$$0.5^2 - y = 0.25 - y.$$

In this case we will have the following possibilities:

- parabolic, if $y = 0.25$;
 - elliptic, if $y > 0.25$;
 - hyperbolic, if $y < 0.25$.
3. $2u_{xx} + 4u_{xy} + 2u_{yy} + u_y = 0$ is parabolic everywhere. Since

$$4 - 4 = 0.$$