There are 3 problems in the quiz.

(8 points) 1. The equation \((\tan^2 x) u_{xx} - 2y(\tan x) u_{xy} + y^2 u_{yy} + (\tan^3 x) u_x = 0\) is parabolic in the domain \(0 < x < \pi/2, \ y > 0\).

a) Find new variables in terms of which the equation has the canonical form.

b) Write down the differential equation in the new variables and transform it to the canonical form. (*Calculate the differential equation in the new variables completely, not only the principal part.*)

(8 points) 2. The equation \(x^2 u_{xx} + 2xyu_{xy} - 3y^2 u_{yy} - 2u_x + 4yu_y + 16x^4 u = 0\) is hyperbolic in the domain \(x > 0, \ y > 0\).

a) Find new variables in terms of which the equation has the canonical form.

b) Write down the differential equation in the new variables and transform it to the canonical form. (*Calculate the differential equation in the new variables completely, not only the principal part.*)

(6 points) 3. The equation \(y^2 u_{xx} + 2xyu_{xy} + 2x^2 u_{yy} + u_y = 0\) is elliptic in the domain \(x > 0, \ y > 0\).

a) Determine new variables \(\xi, \eta\) by the equations \(\xi_x = x, \ \xi_y = -y, \ \eta_x = x, \ \eta_y = 0\).

b) Write down the differential equation in the variables \(\xi, \eta\), and transform it to the canonical form. (*Calculate the differential equation in the variables \(\xi, \eta\) completely, not only the principal part.*)