

## [gex121] PDE solved via reduction to ODE I

The 2<sup>nd</sup>-order PDE with boundary conditions as stated,

$$u_{xy} = u_x + 2, \quad u(0, y) = 0, \quad u_x(x, 0) = x^2,$$

is a well-posed PDE problem.

(a) Try to find the unique solution by invoking DSolve command of Mathematica. When Mathematica throws in the towel, it just repeats the command.

(b) Convert the PDE into the derivative of an ODE,

$$\frac{\partial}{\partial x}(u_y - u) = 2,$$

and solve it by first integrating both sides and then solving the resulting 1<sup>st</sup>-order ODE.

(c) Use Mathematica to check if your solution  $u(x, y)$  indeed solves the original PDE and the two boundary conditions.

**Solution:**