

MATH 311

Topics in Applied Mathematics

Lecture 21:

Boundary value problems.

Separation of variables.

Differential equations

A **differential equation** is an equation involving an unknown function and certain of its derivatives.

An **ordinary differential equation (ODE)** is an equation involving an unknown function of one variable and certain of its derivatives.

A **partial differential equation (PDE)** is an equation involving an unknown function of two or more variables and certain of its partial derivatives.

Examples

$$x^2 + 2x + 1 = 0 \quad (\text{algebraic equation})$$

$$f(2x) = 2(f(x))^2 - 1 \quad (\text{functional equation})$$

$$f'(t) + t^2 f(t) = 4 \quad (\text{ODE})$$

$$\frac{\partial u}{\partial x} + 3 \frac{\partial^2 u}{\partial x \partial y} - u \frac{\partial u}{\partial y} \quad (\text{not an equation})$$

$$\frac{\partial u}{\partial x} - 5 \frac{\partial u}{\partial y} = u \quad (\text{PDE})$$

$$u + u^2 = \frac{\partial^2 u}{\partial x \partial y}(0, 0) \quad (\text{functional-differential equation})$$