## MA 341 W/ Dmitry Zenkov

3 midterms, I Final "Webworks" & webassign for HW expect an email. If not received by Frir morning, email!

Differential Equations

1) Prerequisites: MA 242 (partials,
Continuity), MA 241 (more important:
integration techniques) (symbolic
Manipulation with formulae)

Equation ("to be solved")
-algebraic eqns: 5x + 10 = 0 (linear)
A quadratic: x2-2x+4=0

-difficult to solve: x + a sin x = 0

identifying and classifying exns by type to know how to solve them

Functional Equations: unknowns are

$$y^{2}(x) = 1 - \sin^{2}(x)$$
  
 $y^{2}(x) = 1 - \sin^{2}(x)$   
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equations that contain derivatives of the unknown quality

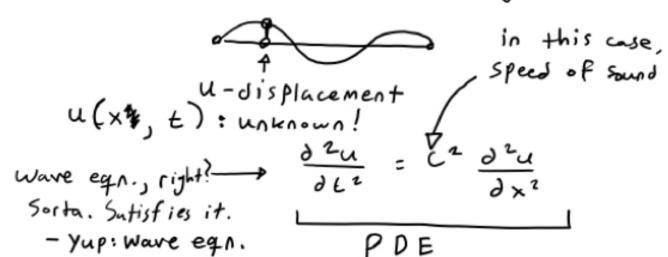
$$\frac{9x}{9\lambda} = \lambda(x)$$
 or  $\frac{9x}{9\lambda} = \lambda$   
 $\overline{6x} \lambda(x) = 3$ 

Origins

- Classical Mechanics
- Physics
- Engineering

- 1. Ordinary Differential Equations (ODES) 2. Partial Differential Equations (PDE'S)
- 1. ODE's: unknown functions are functions of a single variable
- 2. PDE'S: unknown functions defend on two or more variables

  extraveling waves on strings:



The order of an ODE is

the highest order of the

derivative of the unknown

function.

1) is first-order. a) is second-order

$$y'' = \frac{dy}{dx} \qquad y''(x) = \frac{d^2y}{dx^2} \qquad y^{(n)}(x)$$

$$\frac{dy}{dx} - y + \left(\frac{d^2y}{dx^2}\right)^2 = 0$$

$$Second-order \quad ordinary \quad differential \quad eqn$$

$$y'(x) + \left(\frac{dy}{dx}\right)^2 = \sin\left(\frac{d^4y}{dx^4}\right) \qquad (3)$$

$$Hh-order \quad ODE$$

$$F-a \quad function \quad of \quad n+2 \quad vers$$

$$F(x, y(x), y'(x), \dots, y^{n}(x)) = 0$$

$$input \quad for \quad unknown \quad function \quad differential \quad eqn.$$

$$A \quad relationship \quad between \quad all \quad of \quad those \quad quantities,$$

$$ex|For \quad (3), \qquad all \quad of \quad those \quad quantities,$$

$$F(y(x), \frac{dy}{dx}, \frac{d^4y}{dx^4}) = 0$$

$$hose \quad y'(x) + \left(\frac{dy}{dx}\right)^2 - \sin\left(\frac{d^4y}{dx^4}\right) = 0$$