

MTH 204

Name: Key

Quiz 1

Section: D/E

20 Jan 2006

Read the directions carefully.
Please neatly in pencil. You must
show all work to get full credit.

LEAD Sessions - Wednesdays

CSF ~~CSB~~

6:00-7:30

Test 1 - 27 Jan

1.1-2.3.

1. Give the order to the following ODEs. Determine whether the equation is linear or non linear. If the equation is nonlinear, explain why.

a. $x \frac{d^3 y}{dx^3} - \left(\frac{dy}{dx} \right)^4 + y = 0$

3rd order

Nonlinear since $\frac{dy}{dx}$ is raised to the 4th power.

b. $(1+x)y'' - 4xy' + 5y = \cos(x)$

2nd order

Linear

c. $\frac{d^2 R}{dt^2} = -\frac{K}{R^2}$

2nd order

Nonlinear since degree on R is not one.

d. $t^5 y^{(4)} - t^3 y''' + 6y = 0$

4th order

Linear

e. $\frac{d^2 y}{dx^2} = \sqrt{1 + \left(\frac{dy}{dx} \right)^3}$

2nd order

Nonlinear since the degree on $\frac{dy}{dx}$ is not equal to one.

2. Let $x(t) = c_1 \cos(t) + c_2 \sin(t)$ be a two-parameter family of solutions to the differential equation $x'' + x = 0$. Find a particular solution using the given initial conditions.

a. $x(0) = -1$; $x'(0) = 8$

$$x(t) = c_1 \cos(t) + c_2 \sin(t)$$

$$x(0) = c_1 \cos(0) + c_2 \sin(0) = c_1(1) + c_2(0) = -1$$

$$\Rightarrow c_1 = -1$$

$$x(t) = -\cos(t) + c_2 \sin(t)$$

$$x'(t) = \sin(t) + c_2 \cos(t)$$

$$x'(0) = \sin(0) + c_2 \cos(0) = 0 + c_2 = 8$$

$$\Rightarrow c_2 = 8$$

$$\text{So } x(t) = -\cos(t) + 8\sin(t)$$

b. $x(\frac{\pi}{2}) = 0$; $x'(\frac{\pi}{2}) = 1$

$$x(\frac{\pi}{2}) = c_1 \cos(\frac{\pi}{2}) + c_2 \sin(\frac{\pi}{2}) = c_1(0) + c_2(1) = 0$$

$$\Rightarrow c_2 = 0$$

$$x(t) = c_1 \cos(t)$$

$$x'(t) = -c_1 \sin(t)$$

$$x'(\frac{\pi}{2}) = -c_1 \sin(\frac{\pi}{2}) = -c_1(1) = 1$$

$$\Rightarrow c_1 = -1$$

$$x(t) = -\cos(t)$$

3. Bonus (2pts): Where have you seen the answers to these questions worked out before?

You've seen the answers doing the homework or checking my site!