Math 246, Professor David Levermore
Group Work Exercises for Discussion
Monday, 26 August 2019

First Set of Group Work Exercises [4]

For each of the following ordinary differential equations, give its order and state whether it is linear or nonlinear. If it is nonlinear, identify a term that makes it so.

(1) $\dfrac{\mathrm{d}^4u}{\mathrm{d}x^4} + \left(\dfrac{\mathrm{d}^2u}{\mathrm{d}x^2}\right)^6 = \tan(x).$

(2) $\dfrac{\mathrm{d}^3v}{\mathrm{d}r^3} = 4r^2\dfrac{\mathrm{d}^2v}{\mathrm{d}r^2} + \sin(r).$

(3) $\dfrac{\mathrm{d}^5w}{\mathrm{d}s^5} = \dfrac{w + \cos(s)}{1 + s^4}.$

(4) $\dfrac{\mathrm{d}^2x}{\mathrm{d}t^2} + e^t = e^x.$

Second Set of Group Work Exercises [3]

(1) Find the general solution of

$$\frac{\mathrm{d}x}{\mathrm{d}t} = \cos(t)\,.$$

(2) Solve the initial-value problem

$$\frac{\mathrm{d}y}{\mathrm{d}t} = \cos(t)\,, \qquad y(\tfrac{\pi}{2}) = 3\,.$$

(3) Find the general solution of

$$\frac{\mathrm{d}u}{\mathrm{d}t} = \frac{12}{t^2 - 9}\,.$$

Third Set of Group Work Exercises [3]

Give the interval of definition for the solution of each of the following initial-value problem. Give reasons for your answers. Express each solution in terms of a definite integral.

(1) $\dfrac{\mathrm{d}y}{\mathrm{d}t} = \dfrac{e^t}{t^2 - 36}\,, \qquad y(-4) = 5.$

(2) $\dfrac{\mathrm{d}y}{\mathrm{d}t} = \dfrac{e^t}{t^2 - 36}\,, \qquad y(-8) = 3.$

(3) $\dfrac{\mathrm{d}y}{\mathrm{d}t} = \dfrac{e^t}{t^2 - 36}\,, \qquad y(7) = -2.$