Math 246, Professor David Levermore
Group Work Exercises for Discussion
Wednesday, 2 September 2020

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) $\dfrac{\mathrm{d}^5 u}{\mathrm{d}x^5} + x^3 \dfrac{\mathrm{d}^2 u}{\mathrm{d}x^2} = \tan(x).$

(2) $\dfrac{\mathrm{d}^3 v}{\mathrm{d}r^3} + \left(\dfrac{\mathrm{d}^2 v}{\mathrm{d}r^2}\right)^6 = \sin(r).$

(3) $\dfrac{\mathrm{d}^2 w}{\mathrm{d}s^2} = \dfrac{w + \tan(s)}{4 + s^2}.$

(4) $\dfrac{\mathrm{d}^3 x}{\mathrm{d}t^3} + e^x = e^t.$

Second Set of Group Work Exercises [3]

(1) Find the general solution of

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

(2) Solve the initial-value problem

$$\frac{\mathrm{d}y}{\mathrm{d}t} + \cos(t) y = 0\,, \qquad y(\tfrac{\pi}{2}) = 3\,.$$

(3) Find the general solution of

$$\frac{\mathrm{d}u}{\mathrm{d}t} + 3u = e^{-t}\,.$$

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) $\dfrac{\mathrm{d}y}{\mathrm{d}t} + \dfrac{2}{t-8}\, y = \dfrac{e^t}{t^2 - 25}\,, \qquad y(-4) = 5.$

(2) $\dfrac{\mathrm{d}y}{\mathrm{d}t} + \dfrac{2}{t-8}\, y = \dfrac{e^t}{t^2 - 25}\,, \qquad y(-8) = 3.$

(3) $\dfrac{\mathrm{d}y}{\mathrm{d}t} + \dfrac{2}{t-8}\, y = \dfrac{e^t}{t^2 - 25}\,, \qquad y(7) = -2.$