Indian Institute of Science Education and Research Mohali

Differential Equations for Scientists (IDC205) [1]

Academic Session 2016-17

Problem Sheet 01 *Due on* : **August 08, 2016**

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1. Using a computer program, or otherwise, draw the integral curves for the equation

$$\frac{d}{dx}(y) = x + y$$

passing through

(a) $P_0 = (0, 0)$, (b) $P_0 = (0, -1)$, (c) $P_0 = (0, 1)$.

2. Argue that there is no real valued differentiable function y satisfying the differential equation $\left|\frac{d}{dx}(y)\right| + |y| + 1 = 0$.

3. Find all values of n for which the function $y(x) = x^n$ is the solution of the differential equation

$$x^3 \frac{d^3}{dx^3}(y) + 2x^2 \frac{d^2}{dx^2}(y) - 10x \frac{d}{dx}(y) - 8y = 0.$$

4. The family of integral curves for a differential equation $\frac{d}{dx}(y) = g(x, y)$ represents circles that pass through the origin and have center on the x-axis. Determine the function g.

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[1] An interdisciplinary core elective course taught by Amit Kulshrestha during the odd semester of academic session 2016-17 at IISER Mohali.