

Paper:BSM 3-Algebra-III and Differential equations-I (SSC 540)

Programme	B.Sc
Subject	Mathematics
Semester	III
University	Kuvempu University
Session	40

Differential Equations of First order and First Degree

Problems on Homogeneous Differential Equations

Recap of previous class

- Solution of first order first degree differential equation in variable separable form.

Objectives

Problems on homogeneous differential equations of first order and first degree

Session Outcomes:

- able to solve some of homogeneous differential equations

Prerequisites

- Standard formulae of differentiation
- Standard formulae of integration
- Solution of DE in variable separable form

Problems :

1) Solve

$$\left(x \cos \frac{y}{x} + y \sin \frac{y}{x}\right) y - \left(y \sin \frac{y}{x} - x \cos \frac{y}{x}\right) x \frac{dy}{dx} = 0$$

2) Solve $x \sin \left(\frac{y}{x}\right) dy = \left[y \sin \frac{y}{x} - x\right] dx$

3) Solve $(1 + e^{\frac{x}{y}})dx + e^{\frac{x}{y}}\left(1 - \frac{x}{y}\right)dy = 0$

Ans: $x + ye^{\frac{x}{y}} = c$

Session Summary:

Homogeneous differential equations can be solved by the substitution

$$y = vx \quad \text{and} \quad \frac{dy}{dx} = v + x \frac{dv}{dx}$$

$$\text{Or } x = vy \quad \text{and} \quad \frac{dx}{dy} = v + y \frac{dv}{dy}$$

Question:

1) Solve $\left(x \sin \frac{y}{x} - y \cos \frac{y}{x}\right) dx + x \cos \frac{y}{x} dy = 0$

Ans : $x \sin \frac{y}{x} = c$

Question:

2) Solve $\left(x \tan \frac{y}{x} - y \sec^2 \frac{y}{x}\right) dx + x \sec^2 \left(\frac{y}{x}\right) dy = 0$

Ans : $x \tan \frac{y}{x} = c$

References

- Manjunath, B. V. and Nandeeshkumar(2018).
A textbook of B.Sc Mathematics(First).College
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- Raisinghania, M. D.(2014).Ordinary and
partial differential equations
(Sixth). S. Chand,New Delhi.