

National University of Sciences & Technology
School of Electrical Engineering and Computer Science
Department of Basic Sciences

MATH-243: Vector Calculus (3+0): BEE-2k20-C Fall 2021

Quiz - 5: Partial Differential Equations	
CLO-3: Develop analytical solutions of partial differential equations.	
Maximum Marks: 10	Instructor: Dr. Naila Amir
Date: 24 - 12 - 2021	Duration: 10 Minutes
Name: Master Solution	CMS ID:

Question:

Classify the following partial differential equations in terms of:

- Order & Degree.
- linearity (linear/quasi-linear/non-linear).
- homogeneity (homogeneous/non-homogeneous)
- Furthermore, if it is a linear/ quasi-linear 2nd order partial differential equation, classify it as parabolic, elliptic, or hyperbolic.

<p>1. $u_{yy} + u_{xy} + 2u_{xz} = (u^2 e^{u_x})^{2/3}$.</p> <p>(a) Order = 2 Degree = 3</p> <p>(b) Non-linear [\because highest order term is not linear]</p> <p>(c) Homogeneous [No term without "u"]</p> <p>(d) Not applicable because PDE is non-linear.</p>	<p>2. $(y + \frac{x}{2})u_{xx} + (x + 2y)u_{xy} + (y + \frac{x}{2})u_{yy} + xy^2 = 0$.</p> <p>(a) Order = 2 degree = 1</p> <p>(b) Linear</p> <p>(c) Non-homogeneous [xy^2, independent of u]</p> <p>(d) $A = y + \frac{x}{2}$, $B = x + 2y$, $C = y + \frac{x}{2}$</p> $B^2 - 4AC = (x + 2y)^2 - 4(y + \frac{x}{2})(y + \frac{x}{2})$ $= (x + 2y)^2 - \frac{4}{4}(2y + x)^2$ $= (x + 2y)^2 - (x + 2y)^2$ $= 0$ <p>\Rightarrow the given PDE is parabolic.</p>
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