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(The University Of Choice)

**MASINDE MULIRO UNIVERSITY OF
SCIENCE AND TECHNOLOGY
(MMUST)**

**UNIVERSITY EXAMINATIONS
2021/2022 ACADEMIC YEAR**

**SECOND YEAR FIRST SEMESTER EXAMINATIONS
DIPLOMA
MECHANICAL ENGINEERING
SUPPLEMENTARY/SPECIAL**

COURSE CODE: DME 071

COURSE TITLE: MATHEMATICS III

DATE: 28-07-2022 TIME: 11:00-13:00

TIME: 2 HOURS

Instructions to candidates

- i. Answer **Question ONE** and any other **TWO** questions.
- ii. All symbols have their usual meaning.
- iii. A scientific calculator and SMP MATHS Tables are required

1. (a) Solve the differential equation

$$\frac{dy}{dx} = \frac{y^2 + xy^2}{x^2y - x^2}$$

(10 marks)

- (b) find all the first and second partial derivatives of

$$z = \frac{x+y}{x-y} \text{ hence show that } \frac{\partial^2 z}{\partial y \partial x} = \frac{\partial^2 z}{\partial x \partial y}$$

(20 marks)

2. if $y = \frac{ws^3}{d^4}$, find the percentage increase in y when w increases by 2%, s decreases by 3% and d increases by 1%

(20 marks)

3. solve the homogeneous differential equation

$$\frac{dy}{dx} = \frac{2xy + 3y^2}{x^2 + 2xy}$$

(20 marks)

4. a) If $x^2 + y^2 - 2x - 6y + 5 = 0$, find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = 3, y = 2$

(10 marks)

- b) The total surface area s of a cone of base radius r and perpendicular height h is

$$\text{given by } s = \pi r^2 + \pi r \sqrt{h^2 + r^2}$$

if r and h are each increasing at the rate of 0.25cm/s, find the rate at s increasing at the instant when $r=3\text{cm}$ and $h=4\text{cm}$.

(10 marks)