JUNE 2023
MAT 202SW
VECTOR ALGEBRA AND DIFFERENTIAL EQUATIONS
1 HOUR 30 MINUTES

Candidate's Index Number
Signature:

UNIVERSITY OF CAPE COAST
COLLEGE OF EDUCATION STUDIES
SCHOOL OF EDUCATIONAL DEVELOPMENT AND OUTREACH
INSTITUTE OF EDUCATION

FIVE-SEMESTER BACHELOR OF EDUCATION (SANDWICH) PROGRAMME
LEVEL 350, END-OF-FIRST SEMESTER EXAMINATIONS, JUNE 2023

19TH JUNE 2023 **VECTOR ALGEBRA AND DIFFERENTIAL EQUATIONS** **4:30 PM - 6:00 PM**

SECTION B
(40 MARKS)

Answer only TWO questions from this Section.

1.

a. If $\mathbf{A} = 3\mathbf{i} - \mathbf{j} - 4\mathbf{k}$, $\mathbf{B} = -2\mathbf{i} + 4\mathbf{j} - 3\mathbf{k}$, $\mathbf{C} = \mathbf{i} + 2\mathbf{j} - \mathbf{k}$, find

i. $|\mathbf{A} + \mathbf{B} + \mathbf{C}|$. **(5 Marks)**

ii. a unit vector parallel to $3\mathbf{A} - 2\mathbf{B} + 4\mathbf{C}$. **(5 Marks)**

b. Find the solution of $xy' = y + 2x^3 \sin^2 \frac{y}{x}$ by substituting $u = \frac{y}{x}$. **(10 Marks)**

2.

a. Two sides of a triangle are formed by the vectors $\mathbf{A} = 3\mathbf{i} + 6\mathbf{j} - 2\mathbf{k}$ and $\mathbf{B} = 4\mathbf{i} - \mathbf{j} + 3\mathbf{k}$. Determine the angles of the triangle. **(10 Marks)**

b. Solve the initial value problem $y' + y \tan x = \sin 2x$, $y(0) = 1$. **(10 Marks)**

$2xyy' = y^2 + x^2$

3.

a. By reducing to separable form, solve $(x^2 + y^2)dx - 2xydy = 0$. **(10 Marks)**

b. Show that $\mathbf{A} = \frac{1}{3}(2\mathbf{i} - 2\mathbf{j} + \mathbf{k})$, $\mathbf{B} = \frac{1}{3}(\mathbf{i} + 2\mathbf{j} + 2\mathbf{k})$ and $\mathbf{C} = \frac{1}{3}(2\mathbf{i} + \mathbf{j} - 2\mathbf{k})$ are mutually orthogonal unit vectors. **(10 Marks)**

4.

a. Determine whether $(1 - 2xy)dx + (4y^2 - x^2)dy = 0$ is exact or not, hence solve the equation. **(8 Marks)**

b. Find the area of a triangle with vertices of $(3, -1, 2)$, $(1, -1, -3)$ and $(4, -3, 1)$. **(12 Marks)**