KISII UNIVERSITY

UNIVERSITY EXAMINATIONS

SECOND YEAR EXAMINATION FOR THE AWARD OF THE DEGREE OF BACHELOR OF SCIENCE IN APPLIED COMPUTER SCIENCE FIRST SEMESTER 2022/2023 [SEPTEMBER-DECEMBER, 2022]

ACMP 203: MATHEMATICAL METHODS FOR COMPUTER SCIENTISTS

STREAM: Y2S1   **TIME: 2 HOURS**

DAY: FRIDAY, 9:00 – 11:00 AM   **DATE: 09/12/2022**

INSTRUCTIONS

1. *Do not write anything on this question paper.*
2. *Answer question ONE and any other TWO questions.*

QUESTION ONE (COMPULSORY)

a) (i)What are the disadvantages of the Simpson's 3/8 rule compared with the Simpson's 1/3 rule.   (3marks)

(ii)Using illustrations discuss the following properties of vectors:

- o   Equal Vectors   (2marks)

- o   Negative of a vector   (2marks)

- o   Addition of Vectors   (2marks)

- o   Zero or Null Vector   (2marks)

b) Find the derivative of each of the following:
   i.   Sin $(5x + 2)$ (3marks)

   ii. $[1 + \cos (x\,2 - 1)]^{3/2}$ (3marks)

   iii. $\cos (e^{-x})$ (3marks)

c) The velocity of a particle which starts from rest is given by the following table.

T(sec)	0	2	4	6	8	10	12	14	16	18	20
V(ft/sec)	0	16	29	40	46	51	32	18	8	3	0

Evaluate using trapezium rule, the total distance travelled in 20 seconds.

(6marks)

d) The position vectors of point $\overrightarrow{X}$ and $\overrightarrow{Y}$ are $\underset{\sim}{x}$ = 2i + j – 3k and $\underset{\sim}{y}$ = 3i + 2j – 2k,

respectively. Find $/\overrightarrow{XY}/$ (4marks)

QUESTION TWO

a) Differentiate each of the following with respect to x and find dy/dx:
   (i) $y^2 + x^3 - xy + \cos y = 0$

(4marks)

   (ii) $3xy^2 + \cos y^2 = 2x^3 + 5.$

(4marks)

b) Geoffrey bought 5tins of plums and 3tins of peaches from a supermarket for Ksh.75, while James bought 3tins of plums and 5tins of peaches for Ksh.77

i) Set up the simultaneous equations which represent the given information

(2marks)

ii) Write down the matrix equation (2marks)

iii) Using the matrix method, find the cost of

- 4 tins of plums

(5marks)

- 2 tins of peaches (3marks)

QUESTION THREE

a) Find the approximate value of I $= \int_0^1 \frac{dx}{1+x}$ using the Simpson's 1/3 rule with 2, 4 and 8 equal subintervals. Using the exact solution, find the absolute errors.

(10marks)

b) (i) A vector $\overrightarrow{OP}$ has a magnitude of 2 u nits in the direction 030^0. Find its resolutions along the x and y axis respectively. (4marks)

(ii) Four vectors of magnitude 2, $4\sqrt{2}$, 6, 8 units are inclined at angles of 30^0, 45^0, 60^0, 120^0 to the $x-axis$ respectively. Find the magnitude and direction of the resultant vector $\vec{R}$. (6marks)

QUESTION FOUR

The position vectors of points P,Q and R are $\begin{bmatrix} 1 \\ -1 \\ 3 \end{bmatrix}$ $\begin{bmatrix} 3 \\ 3 \\ 1 \end{bmatrix}$ and $\begin{bmatrix} 6 \\ 9 \\ -2 \end{bmatrix}$ respectively.

   i.   Find (i) PQ (2marks)

         (ii) PR (2marks)

   ii.   Hence or otherwise, show that points P, Q and Rare collinear. (6marks)

a) A particle is projected from the origin. Its speed was recorded as shown in the table below.

Time(sec)	0	5	10	15	20	25	30	35
Speed (m/s)	0	2.1	5.3	5.1	6.8	6.7	4.7	2.6

Use the trapezoidal rule to estimate the distance covered by the particle within the 35 seconds. (10marks)

QUESTION FIVE

a) Show that the area of a parallelogram is given by $|\vec{A} \times \vec{B}|$. Hence, find the area of a parallelogram with sides $\vec{A} = 3\vec{\imath} + \vec{\jmath} - 2\vec{k}$ and $\vec{B} = \vec{\imath} - 3\vec{\jmath} + 4\vec{k}$. (10marks)

b) Using the trapezium rule, evaluate the integral $I = \int_{1}^{0} \frac{dx}{x^2+6x+10}$ with 2 and 4 subintervals. Compare with the exact solution. Comment on the magnitudes of the errors obtained. (10marks)