



(Knowledge for Development)

KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS

2021/2022 ACADEMIC YEAR

END OF SEMESTER EXAMINATIONS

SECOND YEAR FIRST SEMESTER

SPECIAL/ SUPPLEMENTARY EXAMINATION

FOR THE DEGREE OF BACHELOR OF SCIENCE

COURSE CODE: MAT 224/MAA 213.

COURSE TITLE: ANALYTIC GEOMETRY

DATE: 28/07/2022

TIME: 2:00 PM – 4:00 PM

INSTRUCTIONS

Answer Questions ONE and Any other TWO

QUESTION ONE [30MKS]

- a. Find the point of intersection of the lines (5mks)

$$\vec{r}_1(t) = \langle -1 + 3t, 2 - 4t, 3 + 2t \rangle,$$

$$\vec{r}_2(t) = \langle 5 + t, -6, 7 + 2t \rangle.$$

- b. Find the arc length of the following curve given in polar form: (4mks)

$$r = a(1 + \cos \theta), \quad a > 0, \quad 0 \leq \theta \leq 2\pi$$

- c. Find an xy equation for the curve $x = 1 + 2 \sin t$, $y = -2 + 2 \sin t$ (4mks)

- d. Find the coordinates of the vertex, focus and the equation of the directrix of

$$(y + 3)^2 = -8(x - 4). \quad (4mks)$$

- e. Convert the rectangular coordinates $(1, -3, 5)$ to cylindrical coordinates. (4mks)

- f. Find what length of canvas $3/4$ m. wide is required to make a conical tent 8m in diameter and 3m high. (4mks)

- g. Find an equation of the plane through the point $(2, 4, -1)$ with normal vector

$$\mathbf{n} = \langle 2, 3, 4 \rangle \quad (5mks)$$

QUESTION TWO [20MKS]

- a. Find the equation of the ellipse with center at $(-3, -2)$, focus at $(-3, 3)$ and vertex at $(-3, -9)$. Graph the ellipse (8mks)

- b. Given two lines $L_1 : x = 1 + t, y = -2 + 3t, z = 4 - t$
 $L_2 : x = 2t, y = 3 + t, z = -3 + 4t$ (7mks)

Determine whether they intersect each other, or they are parallel, or neither (skew lines).

- c. Convert point $(-8, 8, -7)$ from Cartesian coordinates to cylindrical coordinates. (5mks)

QUESTION THREE [20MKS]

- a. Samuel has a cylinder of surface area 1728π square units. Find the height of the cylinder if the radius of the base of the cylinder is 24 units. (4mks)
- b. Find an equation for the plane containing $P = (1, 2, 3)$, $Q = (-2, 4, 1)$ and $R = (0, 6, -2)$. (6mks)
- c. Find the arc length of the following curve given in polar form: (10mks)

$$r = 1 + \sin \theta \quad 0 \leq \theta \leq 2\pi$$

QUESTION FOUR [20MKS]

- a. Find the parametric equations of the line passing through the point $(-1, 2, 3)$ and parallel to the vector $\langle 3, 0, -1 \rangle$ (3mks)
- b. Find the cylindrical equation for the ellipsoid $x^2 + 4y^2 + z^2 = 1$ (4mks)
- c. Find the coordinates of the center, foci and vertices and the equations of the asymptotes of $\frac{(x-3)^2}{4} - \frac{(y+2)^2}{16} = 1$ (6mks)
- d. Plot the point with the following cylindrical coordinates and express its location in rectangular coordinates. (7mks)

$$\left(4, \frac{2\pi}{3}, -2 \right)$$

QUESTION FIVE [20MKS]

- a. Find a formula for the distance D from a point $P_1(x_1, y_1, z_1)$ to the plane $ax + by + cz + d = 0$ (6mks)
- b. Sketch the graph of the curve described by the following set of parametric equations $x = t^3 - t$, $y = t^2$, $0 \leq t < \infty$ (6mks)
- c. Write the given equation in the standard form. Determine the coordinates of the center, vertices and foci. Find the equations of the asymptotes. $4x^2 - 9y^2 + 16x - 18y + 43 = 0$ (8mks)