(Knowledge for Development)

KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS

2021/2022 ACADEMIC YEAR

END OF SEMESTER EXAMINATIONS

SECOND YEAR FIRST SEMESTER

MAIN EXAMINATION

FOR THE DEGREE OF BACHELOR OF SCIENCE

MATHEMATICS

COURSE CODE: **MAA 213**

COURSE TITLE: **ANALYTIC GEOMETRY**

DATE: 03/02/2022 **TIME: 9:00 AM – 11:00 AM**

INSTRUCTIONS

Answer **Questions ONE and** Any other **TWO**

QUESTION ONE [30MKS]

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. Eliminate the parameter for each of the plane curves described by the following parametric equations (4mks)

$$x(t)=\sqrt{2t+4}, \qquad y(t)=2t+1, \quad -2\le t\le 6$$

c. Using the definition, find the length of the circle of radius r (circumference) defined parametrically by: (4mks)

$$x=r\cos t \quad and \quad y=r\sin t, \quad 0\le t\le 2\pi$$

d. Write down the equation of the line that passes through the points (2, −1, 3) and (1,4,−3). Write down all three forms of the equation of the line. (4mks)

e. Convert to rectangular coordinates the surface represented by a cylindrical equation $r^2\cos(2\theta)+z^2+1=0$ (3mks)

f. Find the equation of the ellipse with focus at (0,-3) and vertices at (0, ±6) (4mks)

g. Find the volume and the total surface area of a cone of radius 6.6cm and height of 12.5cm. (4mks)

h. Describe the surface given by the equation in spherical coordinate (4mks)
$\rho=4\sin\varphi\sin\theta+2\sin\varphi\cos\theta$

QUESTION TWO [20MKS]

a. Consider the line which passes through the point P(3, -5, -1), and which is parallel to the line x=1+6t, y=2+2t, z=3+6t (6mks)
Find the point of intersection of this new line with each of the coordinate planes

b. Write the given equation in the standard form. Determine the coordinates of the center, vertices and foci (7mks)
$2x^2+3y^2+8x-6y+5=0$

c. Plot and find the length of the graph of: (7mks)

$$f(x)=\frac{x^3}{12}+\frac{1}{x}, \qquad 1\le x\le 4$$

QUESTION THREE [20MKS]

a. The radius of a cylinder is 5 in. Find the surface area of the cylinder if the height of the cylinder is 15 in. (4mks)

b. Derive the standard form of equation of an ellipse (6mks)

c. Graph the equation; (10mks)
$2x^2+9y^2+16x-90y+239=0$

QUESTION FOUR [20MKS]

a. Sketch the curve described by the parametric equations (6mks)
$x(t) = 3t + 2, \quad y(t) = t^2 - 1, \quad for \quad -3 \le t \le 2$

b. Show that the planes $2x - 5y + 9z = 6$ and $4x - 10y + 11z = 0$ are not parallel. Find parametric equations for their line of intersection. (8mks)

c. For the given equation, $\frac{(x-3)^2}{4} - \frac{(y+2)^2}{16} = 1$, Find the coordinates of the center, foci and vertices. Find the equations of the asymptotes. (6mks)

QUESTION FIVE [20MKS]

a. Let L1 be the line through (1, 6, 2) with direction vector $\langle 1, 2, 1 \rangle$ and L2 be the line through (0, 4, 1) with direction vector $\langle 2, 1, 2 \rangle$. Determine if the lines are parallel, if they intersect or if they are skew. If they intersect, find the point at which they intersect. (6mks)

b. Plot the point with spherical coordinates $\left(8, \frac{\pi}{3}, \frac{\pi}{6}\right)$ and express its location in both rectangular and cylindrical coordinates (7mks)

c. Rewrite the equation in standard form and determine the vertex of its graph: (6mks)
$y = x^2 - 8x + 15$