



(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)

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

- c. Using the definition, find the length of the circle of radius r (circumference) defined parametrically by: (4mks)
- $$x = r \cos t \quad \text{and} \quad y = r \sin t, \quad 0 \leq t \leq 2\pi$$
- 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 $(0, \pm 6)$ (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 $\rho = 4 \sin \varphi \sin \theta + 2 \sin \varphi \cos \theta$ (4mks)

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)

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

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 $x(t) = 3t + 2$, $y(t) = t^2 - 1$, for $-3 \leq t \leq 2$ (6mks)
- 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: $y = x^2 - 8x + 15$ (6mks)