(Knowledge for Development)

KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS

2020/2021 ACADEMIC YEAR

FIRST YEAR FIRST SEMESTER

SPECIAL/SUPPLEMENTARY EXAMINATION

FOR THE DEGREE OF BACHELOR OF EDUATION AND BACHELOR OF SCIENCE

COURSE CODE: **MAP 112**

COURSE TITLE: **BASIC MATHEMATICS AND ANALYTIC GEOMETRY**

DATE: 30/09/2021 **TIME:** 11:00 AM- 1:00 PM

INSTRUCTIONS TO CANDIDATES

Answer Question One and Any other TWO Questions

TIME: 2 Hours

This Paper Consists of 4 Printed Pages. Please Turn Over.

QUESTION ONE (30 MARKS)

a) Classify the equation $Ax^2 + Bxy + Cy^2 + Dx + Ey + F = 0$ (3 marks)

a) Find the distance between the lines $3x + 4y = 9$ and $6x + 8y = 15$ (5 marks)

b) If the slope of a line passing through the point A (1, 1) is $\frac{3}{4}$, then find points on the line which are 5 units away from the point A. (5 marks)

c) Find the equation of a parabola, directrix and its sketch having its vertex at $(-1, 2)$ and focus at $(0,2)$. (5 marks)

d) Find the equation of the straight line which passes through the point $(1, -2)$ and cuts off equal intercepts from axes. (3 marks)

e) *Verify whether the circles* $x^2 + y^2 - 6x + 8y - 23 = 0$ *and* $x^2 + y^2 - 5x - 2y + 16 = 0$ *are orthogonal.* *(4 marks)*

f) Analyze and sketch the graph of $x^2 + 6y + 8x + 25 = 0$ (5 marks)

QUESTION TWO (20 MARKS)

a) Solve the following using synthetic division tableau
$(x^3 - 2x^2 + 1) \div (x - 3)$ (3 marks)

b) Find the zeros of $f(x) = x^3 - 6x^2 + 11x - 6$ (3 marks)

c) Write an equation for a parabola with focus at (2,5) and directrix $x = -6$. Sketch its graph. (7 marks)

d) Using trigonometric substitution convert the following equation into parametric form.
$\frac{x^2}{49} - \frac{y^2}{25} = 1$ (3 marks)

e) Convert the following equations to Cartesian equations and identify their graphs.
$x = t^2 + t, y = 2t - 1 \; -1 \leq t \leq 3$ (6 marks)

QUESTION THREE (20 MARKS)

a) Sketch the graphs of the following equations and give their respective equations of asymptotes.

i. $\frac{(x-2)^2}{25} + \frac{(y+3)^2}{16} = 1$

ii. $\frac{(x-1)^2}{4} - \frac{(y+2)^2}{1} = 1$ (8 marks)

b) Find the equation of a parabola, directrix and its sketch having its vertex at $(-1, 2)$ and focus at $(0,2)$. (5 marks)

c) Convert the polar equation given below to Cartesian equations and identify their graphs

$r = 2a\ cos\ \theta + 2b\ sin\ \theta$ (5 marks)

d) Convert the cartesian equations given below to polar equation

$x^2 + y^2 = 25$ (2 marks)

QUESTION FOUR (20 MARKS)

a) Derive the equation of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ (8 marks)

b) Sketch the graph of $(x + 4)^2 = -12(y + 1)$ (5 marks)

c) Convert the following set of parametric equations to cartesian equations.

$x = 6\ cos\ t, y = 2 \sin t, , 0 \leq \theta \leq 2\pi.$ (3 marks)

d) Convert the following from polar to cartesian

i. $(3, \frac{\pi}{2})$

ii. $r = 2\ sec\ \theta$ (4 marks)

QUESTION FIVE (20 MARKS)

a) Given the equation of an ellipse $9x^2 - 18x + 25y^2 + 100y = 116$

i. Write the equation in standard form. (3marks)

ii. Find the foci, center, the vertices of the curve and sketch it. (6 marks)

b) Find equation of an ellipse with foci $(-4,0)$ and $(4,0)$ that passes through $(0,3)$ (4 marks)

c) Find the vertex, axis of symmetry, focus, directrix and sketch the graph of the parabola $x^2 + 4x + 4y - 4 = 0$ (7 marks)