



**JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND
TECHNOLOGY
SCHOOL OF BIOLOGICAL PHYSICAL MATHEMATICS AND ACTUARIAL
SCIENCE**

**UNIVERSITY EXAMINATION FOR DEGREE OF BACHELOR OF
EDUCATION SCIENCE/BACHELOR OF SCIENCE(ACTUARIAL SCIENCE
WITH IT)**

1ST YEAR 1ST SEMESTER 2022/2023 ACADEMIC YEAR

MAIN CAMPUS

COURSE CODE: WMB 9109

COURSE TITLE: ANALYTIC GEOMETRY

EXAM VENUE:

STREAM:

DATE: 21/12/2022

EXAM SESSION: 9.00-11.00AM

TIME: 3.00 HOURS

Instructions:

- 1. Answer question one (compulsory) and any other two questions.**
- 2. Candidates are advised not to write on the question paper.**
- 3. Candidates must hand in their answer booklets to the invigilator while in the examination room.**

QUESTION ONE (COMPULSORY 30 MARKS)

- a) Use the third order matrix determinant to determine the equation of a line passing through the points (5, -2) and (-2, 3) giving your answer in double intercept form, hence declaring the intercepts. (4 marks)
- b) Define the Conic sections below
- i) Ellipse
- ii) Parabola (4 marks)
- c) Determine the the distance between two parallell lines $y = 2x - 4$ and the line $4y - 8x - 16 = 0$ (4 marks)
- d) Calculate the area of a circle which passes through (9, 7), (-8, 0) and (16,0). (Take $\pi = 3.142$) (6 marks)
- e) Determine the area of an ellipse $\frac{(x-1)^2}{25} + \frac{y^2}{9} = 1$ leaving your answer in terms of π (4 marks)
- f) A line L_1 has an equation $y = 4x + 6$. Calculate the acute angle between L_1 and L_2 whose equation is $y + 3x + 7 = 0$ (4 marks)
- g) Convert the following Cartesian coordinates in to polar coordinates giving positive coordinates only.
- (i)(3, 4) (ii) (1,-2) (4 marks)

QUESTION TWO (20 MARKS)

- a) The equation of an ellipse are given by $169x^2 + 25y^2 - 200x + 399 = 0$
Determine on the xy plane
- (i) The centre of the ellipse (4 marks)
- (ii) The foci (3 marks)
- (iii) The vertices (2 marks)
- (iv) The eccentricity (1 mark)
- (v) The equations of the directrices (3 marks)
- (vi) The Equations of the axes of the ellipse (2 marks)
- b) Consider the polar curve of a conic section given by $r = \frac{2}{1 + 2 \cos \theta}$, sketch the curve hence determine the eccentricity, and focus of the conic section. (5 marks)

QUESTION THREE (20 MARKS)

- a) The equation of a hyperbola $25y^2 - 16x^2 - 50y + 32x = -409$ Find
- (i) The centre and axes of the hyperbola (6 marks)
- (ii) The foci (3 marks)

(iii) Eccentricity (1 mark)

(iv) the equations of the directrices of the hyperbola (2 marks)

(v) the equation of the asymptotes of the hyperbola. (4 marks)

b) Determine the pair of parametric equations for the curve $\frac{x^2}{100} - \frac{y^2}{64} = 1$ (4 marks)

QUESTION FOUR (20 MARKS)

a) Determine the distance between two parallel lines $y = 4x - 6$ and the line $y - 4x - 8 = 0$ (4 marks)

b) An analytic geometry student came across a sketch of a parabola. He identified three points on the parabola $(2, 4)$, $(-2, 6)$ and $(0, \frac{9}{2})$. Given that the axis of the parabola is parallel to the y -axis.

i) What is the equation of the parabola in the form $(x - h)^2 = 4a(y - k)$, (6 marks)

ii) Determine the focus and vertex of the parabola. (3 marks)

iii) Find the equation of the directrix and axis of symmetry of the parabola. (3 marks)

c) Identify the conic sections given below

(i) $x^2 - \sqrt{5}xy + y^2 - 12x + 3y = 0$

(ii) $r = \frac{4}{2 - \cos\theta}$

(4 marks)

QUESTION FIVE (20 MARKS)

a) Find the cartesian equation represented by the pairs of parametric equations given below.

(i) $x = 3t + 1$, $y = t^2 + 1$

(ii) $x = \cos 2\theta$, $y = \sin 4\theta$ (6 marks)

b) (i) A second degree curve is represented by the equation

$17x^2 + 2xy + 17y^2 - 23\sqrt{2}x + 41\sqrt{2}y - 71 = 0$. By eliminating the cross product term give the new equation of the conic section on the new $x'y'$ plane and state the equation of its axis. (8 marks)

(ii) On the new $x'y'$ plane determine the foci, the eccentricity and the directrices of the conic section. (6 marks)