



# **MAASAI MARA UNIVERSITY**

## **UNIVERSITY EXAMINATIONS 2018/2019**

### **SCHOOL OF SCIENCE AND INFORMATION SCIENCES**

#### **UNIVERSITY EXAMINATIONS FOR THE DEGREE OF BACHELOR OF SCIENCE (MATHEMATICS, PHYSICS & APPLIED STATISTICS WITH COMPUTING)**

#### **FIRST YEAR SECOND SEMESTER EXAMINATION**

**COURSE CODE: MAT 1205/1208**

**COURSE TITLE: ANALYTICAL GEOMETRY**

**DATE: \_\_\_\_\_ TIME: \_\_\_\_\_**

#### **Instructions**

Answer Question **ONE** and ANY other **TWO** Questions

### QUESTION ONE (30 marks) Compulsory

- a) Given a quadrilateral with vertices at points (2,1), (7,1), (9,3) and (4,3), Show that the middle points of the diagonals intersect. **5mks**
- b) Determine the parametric equations of a line through the point P(-1,4) in the direction of the vector  $\vec{v} = \langle 1, 2 \rangle$ . **3mks**
- c) Show that the equation  $x^2 + y^2 - 4x + 10y - 13 = 0$  represents a circle and find its center and radius. **4mks**
- d) Find the polar equation of the curve represented by  $x^2 + y^2 = 9$ . **3mks**
- e) Express the rectangular coordinate equation  $x^2 + y^2 - z^2 = 1$  in spherical coordinates. **5mks**
- f) Show that a curve with polar equation  $r = 2\cos\theta$  is a circle, determine its center and radius. **5mks**
- g) Find  $\frac{d^2y}{dx^2}$  of the parametric equation  $y = t^3 - 3t, x = 3t$  **5mks**

### QUESTION TWO 20marks

- a) Given that  $l_1$  has slope  $\lambda$ , the tangent of the angle from  $l_1$  to  $l_2$  is  $\beta$ , proof that  $\frac{\lambda + \beta}{1 - \lambda\beta}$  represents equation of the slope of  $l_2$  hence find the equation of the line that passes through the point (2,3) and makes an angle of  $110^\circ$  with line  $5x + y - 3 = 0$ . **10mks**
- b) Determine the center and the radius of the circle passing through the points A(4,3) B(0,1) and C(1,0). **10mks**

### QUESTION THREE 20marks

a) Find the standard equation of the conic  $9x^2 - 4y^2 - 72x + 8y + 176 = 0$  and sketch it. **10mks**

b) Determine whether the planes  $x - 3y + 6z = 4$  and  $5x + y - z = 4$  are perpendicular, parallel or neither. Find the angle of their intersection and the set of parametric equations for the line of intersection. **10mks**

### QUESTION FOUR 20marks

a) Find the length of an arch of the cycloid  $x = r(\beta - \sin \beta)$ ,  $y = r(1 - \cos \beta)$  for  $0 \leq \beta \leq 2\pi$ . **7mks**

b) Determine the length of a parabola with equation  $y^2 = x$  from  $(0,0)$  to  $(1,1)$ . **7mks**

c) Derive the arc length function of the curve  $y = \frac{1}{3}x^3 + \frac{1}{4x}$ ;  $x > 0$  starting at  $P_0(1, \frac{7}{12})$ . **6mks**