



THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)

(A Centre of Excellence)

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

UNIVERSITY EXAMINATION FOR DEGREE IN BACHELOR OF SC./ENG. IN
ELECTRICAL & ELECTRONICS/ MECHANICAL & AUTOMOTIVE &
BUILDING & CIVIL ENGINEERING

SMA 2171/AMA 4102: GEOMETRY

END OF SEMESTER EXAMINATION

SERIES: AUGUST 2012

TIME: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- Answer Booklet

This paper consist of **FIVE** questions in **TWO** sections **A & B**

Answer question **ONE (COMPULSORY)** and any other **TWO** questions

Maximum marks for each part of a question are as shown

This paper consists of **THREE** printed pages

SECTION A (COMPULSORY)

Question One (30 marks)

$$r \cos\left(\theta - \frac{\pi}{3}\right) = 3$$

a) Find the Cartesian equation of the curve in polar form given as **(4 marks)**

$$4 \cos x - 6 \sin x = 5$$

b) Solve the equation for values in the range $0^\circ \leq x \leq 360^\circ$, correct to 0.1°

(5 marks)

$$x^2 + y^2 - 4x - 2y + 1 = 0$$

- c) Describe the circle represented by $(2 + \sqrt{3}, 2)$ hence determine the equation of the tangent and the normal lines at the point **(6 marks)**

- d) Two sides of an acute angled triangular piece of land are 48m and 26m respectively. If the area of the plot is 550m^2 , find the length of the third side and the 3 angles of the triangular plot. **(7 marks)**

$$16x^2 + 25y^2 - 160x + 50y - 1175 = 0$$

- e) Reduce the equation to the appropriate standard form and sketch the ellipse it represents. **(8 marks)**
- f) Find the equation of a plane containing the points (1,1,0), (0,1,2) and (2, 3, -8). **(5 marks)**

SECTION B (Answer any TWO questions from this section)

Question Two (20 marks)

- a) In a triangular lawn the length of two sides and their included angle are $a = 12\text{m}$, $b = 10\text{m}$ and $\angle c = 30^\circ$ calculate the radius of the circumcircle just touching the three corners. **(4 marks)**

$$ax + by + c = 0$$

- b) Find an equation in the form $ax + by + c = 0$ for a line which passes through the point of intersection of the lines $x - 3y = 4$ and $3x + y = 2$ being also perpendicular to the line $4x - 3y - 7 = 0$ **(6 marks)**

$$x^2 - 4y^2 + 2x + 8y - 7 = 0$$

- c) Discuss the equation stating all properties of the hyperbola hence sketch the curves indicating some of these properties. **(10 marks)**

Question Three (20 marks)

$$\vec{P} = 2\vec{i} + 3\vec{j} + 4\vec{k} \quad \vec{Q} = 4\vec{i} - 3\vec{j} + 2\vec{k} \quad \vec{i}, \vec{j}, \vec{k}$$

- a) If \vec{P} and \vec{Q} where $\vec{i}, \vec{j}, \vec{k}$ are unit vectors, determine:

$$\vec{P} \cdot \vec{Q}$$

- i) **(3 marks)**

$$\vec{P} \quad \vec{Q}$$

- ii) The angle between the vectors \vec{P} and \vec{Q} **(4 marks)**

$$3\cos 2\theta + \sin \theta = 1 \quad 0^\circ \leq \theta \leq 360^\circ$$

- b) Solve the equation for values of θ **(6 marks)**

$$5y = 3x - 5$$

$$4x^2 - 25y^2 = 15$$

- c) Find the points in which the lines cut the hyperbola and the equations of the tangents to the hyperbola at these points. **(7 marks)**

Question Four (20 marks)

- a) Plot accurately the graph of the polar equation $r = \sin 2\theta$ and mark the lines of symmetry exist in this figure. **(7 marks)**
- b) Solve the equation $12 \cos^2 \theta + \sin^2 \theta = 11$ on the domain $\theta^\circ \leq \theta \leq 360^\circ$ **(5 marks)**
- c) Determine the point(s) of intersection of the line $2y = x + 6$ and the parabola $y^2 = 8x$ hence find the equations of the tangent and normal lines at these intersection points. **(8 marks)**

Question Five (20 marks)

- a) Given an equation of a line in the form $\frac{x-2}{3} = \frac{y-4}{5} = \frac{z-7}{2}$ express it in the form $\vec{r} = \vec{a} + t\vec{u}$ hence determine whether the point (8, 14, 11) lies on the line. **(4 marks)**
- b) Prove that $\sin 3A = 3\sin A - 4\sin^3 A$ **(4 marks)**
- c) Find the equation for a hyperbola with asymptotes $y = \pm \frac{4}{3}x$ and a foci $(\pm 10, 0)$ **(5 marks)**
- d) Two planes leave an international airport at 11:00am. The first plane flies due west and a speed of 600km/hr and the second moves in a bearing N30° E at a speed of 1000km/hr. Calculate how far apart the planes will be at 1:00pm and the bearing of the 2nd from the 1st at that point in time. **(7 marks)**