

KABARAK



UNIVERSITY

UNIVERSITY EXAMINATIONS

2010/2011 ACADEMIC YEAR

**FOR THE DEGREE OF BACHELOR OF SCIENCE IN
ECONOMICS AND MATHEMATICS**

COURSE CODE: MATH 112

**COURSE TITLE: GEOMETRY AND ELEMENTARY
APPLIED MATHEMATICS**

STREAM: Y1S1

DAY: THURSDAY

TIME: 9.00 – 11.00 A.M.

DATE: 24/03/2011

INSTRUCTIONS

1. Answer **AQUESTION ONE** and any other **TWO** questions
2. Indicate question numbers clearly at the top of each page and show working methods clearly.
3. Observe further instructions on the answer booklet.

PLEASE TURNOVER

QUESTION ONE (30 MARKS)

- a) Define the following (i) linearly dependent vectors; (ii) linearly independent vectors; (iii) dot product of two vectors, (iv) complex number (v) square matrix (vi) inverse of matrix **[6marks]**
- b) Two forces F_1 and F_2 work on particle P. F_1 points due east and has magnitude 20 Kg and F_2 points northeast and has magnitude of 10 Kg. Find the resultant of F_1 and F_2 **[4 marks]**
- c) If \mathbf{a} has length 5 and \mathbf{b} has length 4 and the angle between them is 60° find $\mathbf{a} \cdot \mathbf{b}$ **[4 marks]**
- d) Find an equation of the line through $A(\frac{1}{2}, -\frac{1}{3})$ that is i) parallel to the line $6x+2y+5=0$ (ii) perpendicular to the line $6x+2y+5=0$ **[6 marks]**
- e) Express $\frac{3+4i}{3+2i}$ in the standard form **[4 marks]**
- f) If $(x, y) = (-1, \sqrt{3})$ are rectangular coordinates of a point P, find three different pairs of polar coordinate (r, θ) for P. **[6 marks]**

QUESTION TWO (20 MARKS)

- a) Prove De Moivre's theorem: $(\cos\theta + i\sin\theta)^n = (\cos n\theta + i\sin n\theta)$ and hence evaluate $(1-i)^8$ **[12 marks]**
- b) Prove that if two sides of a quadrilateral are equal and parallel, then the other two sides are equal and parallel **[8 marks]**

QUESTION THREE (20 MARKS)

- a) Find the determinant of the following matrix $\begin{bmatrix} 3 & 1 & 0 \\ -2 & 0 & 1 \\ 1 & 3 & -1 \end{bmatrix}$ **[5 marks]**
- b) A store sells 15 cars, 25 trucks and 35 motorcycles. The prices are Ksh 160000/= per car, 240,000/= per truck and 40000/= per motorcycle.
- (i) Define an output vector \mathbf{a} and price vector \mathbf{p} . **[5 marks]**
- (ii) Express the total value for the output in terms of these vectors and compute its value **[5 marks]**
- c) Find vectors perpendicular to the vectors (i) $\mathbf{a}=(2,1,0)$ and $\mathbf{b}=(1,2,3)$ **[5 marks]**

QUESTION FOUR (20 MARKS)

a) Consider the lines $7x + 2y = 7$ and $2x - 3y = 27$. Find

i) The angle between the lines

ii) The distance from their point of intersection to the line $x = 3y + 5$ **[8 marks]**

b) Find the lengths of the sides and cosines of the angles of a triangle with vertices P (1 , 2, -3), Q (1 , 3 ,-2) and R (2 ,4,5) **[4 marks]**

c) Find a vector **b** in the opposite direction $\mathbf{a}=(5,-12)$ that has the magnitude of 6. **[8 marks]**

QUESTION FIVE (20 MARKS)

a) Solve the following simultaneous equation by matrix algebra

$$2x - 3y = -4$$

$$5x + 7y = 1$$

[8 marks]

b) Determine the equation of a circle whose center is $(-2, 3)$ and it is tangent to the line $x + 2y = 4$

[6 marks]

c) use Cramer's rule to solve a system

$$\begin{cases} 2x - 3y = -4 \\ 5x + 7y = 1 \end{cases}$$

[6 marks]