



THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)

(A Centre of Excellence)

Faculty of Engineering & Technology

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

DIPLOMA IN BUILDING & CIVIL ENGINEERING (DBC 12S)

DIPLOMA IN ARCHITECTURE (DA 12S)

AMA 1109: ALGEBRA

END OF SEMESTER EXAMINATION

SERIES: DECEMBER 2012

TIME: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer Booklet*

This paper consists of **FIVE** questions. Answer any **THREE** questions
 Maximum marks for each part of a question are as shown
 This paper consists of **THREE** printed pages

Question One

- a) A Contractor sinks a well at a cost of kshs 20 thousand for first 10 metres, kshs 22.5 thousand for the next 10 metres and kshs 25 thousand for the following 10 metres and so on. If the total cost is K£ 562.5 thousand, find:
 (i) Depth of the well
 (ii) Cost of the last 10th metre (6 marks)

- b) Find the 8th term in the binomial expansion of $(2x - 3)^{14}$ (4 marks)

- c) (i) Expand $\sqrt{\frac{1-x}{1+x}}$ neglecting terms containing x^3 and higher and giving the answer as:
 $1 - x + \frac{x^2}{x}$

- (ii) By putting $x = \frac{1}{8}$ in the expansion show that $\sqrt{7} = 2\frac{83}{128}$ (10 marks)

Question Two

- a) Solve the equation $\sqrt{3} \cos \theta + 3 \sin \theta = 3$ for $0 \leq \theta \leq 360^\circ$ (6 marks)

- b) Evaluate $\frac{1}{\sqrt{3}}$ using binomial expansion method (6 marks)

- c) (i) Solve $z^3 + 1 - 3j = 0$ giving the answer in the form $a + bj$
 (ii) Represent the roots in (i) on an Argand diagram (8 marks)

Question Three

- a) A Surveyor 100m at station A N30°W from the foot of a tower finds the angle of elevation to the top of the tower as 15°. The Surveyor then moves 200m to station B N40°E and finds the angle of elevation to be 20°. Determine:
 (i) Distance of station B from the towers foot
 (ii) Distance between the two stations (8 marks)

- b) A mechanical plant cost K£40,000 when new. It depreciates at a rate of 2% per annum. Find:
 (i) Its cost at the end of 10th year
 (ii) The year when it will be worthy K£ 5,000 (6 marks)

Question Four

- a) A model has 25 polygonal sides. The last side is 8 times the shortest side. All the sides have a perimeter 1100mm. Find the dimension of the 5th side. **(6 marks)**

- b) By using $\tan \frac{x}{2} = t$ or $R \sin(x - \alpha) = c$ solve $2 \sin x - \cos x - 1 = 0$ for $0^\circ \leq x \leq 360^\circ$ **(8 marks)**

- c) Given $z_1 = 2 - j$ $z_2 = -3 - 2j$. Find $z_3 = \frac{z_1}{z_2^2}$ in the form $r(\cos \theta + j \sin \theta)$ **(6 marks)**
- Question Five**

- a) A contractor requires 1250 bags of cement this month 750 bags next month, 450 bags the following month and so on. Find:
 (i) Number of bags required in the 10th month
 (ii) The time when 5 bags will be needed **(7 marks)**

- b) (i) Expand up to the term containing x^3 the following.

$$\frac{1}{\sqrt{\left(1 - \frac{x}{5}\right)}}$$

- (ii) By putting $x = 1$ in the expansion obtained in (i) find $\sqrt{5}$ correct to 4 decimal places. **(8 marks)**

- c) The first and last terms of an A.P are 3 and 10 respectively. If the terms add up to 43, find the 5th term. **(5 marks)**