



MACHAKOS UNIVERSITY

University Examinations 2016/2017

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

FIRST YEAR FIRST SEMESTER EXAMINATION FOR BACHELOR OF EDUCATION

SMA 102: BASIC MATHEMATICS

DATE: 24/7/2017

TIME: 8:30 – 10:30 AM

INSTRUCTIONS

Answer ALL the questions in Section A and ANY TWO Questions in Section B

SECTION A

QUESTION ONE (30 MARKS)

- a) Define the following terms.
- i Absolute complement
 - ii Power set
 - iii Universal set
 - iv Subset
 - v Set
 - vi Function (6 marks)
- b) If $a = 3$, $tn = 96$, $sn = 189$. Find r and n where a is the first term tn is the n^{th} term s_n is the sum of the n term r is the common ration and n is the number of terms. (4 marks)
- c) How many terms of the progression $-1, 1, 3, 5, \dots$ must be used if we want the sum to be 360? (4 marks)
- d) Differentiate between existential quantification and universal quantification. (2 marks)

- e) Prove that the square of an even integer is even and the square of an odd integer is odd. (4 marks)
- h) Express $Z = -i + 1$ in polar form (4 marks)
- i) Simplify $i(8p + 4iq)$ (3 marks)
- j) Find the power set of the following set $A = \{1,2,3\}$ (4 marks)
- k) Determine the number of ways in which the letters of the word statistics can be arranged in a row. (3 marks)

SECTION B

QUESTION TWO (20 MARKS)

- a) Show that $\lceil(p \vee q)$ and $\lceil p \wedge \rceil q$ are logically equivalent (5 marks)
- b) Construct the truth table for the disjunction of two proposition (4 marks)
- c) The first term of a G.P. is 5, and the common ratio is -3, which term is equal to -135? (4 marks)
- d) Give an example of tautology and contradiction (4 marks)
- e) Construct the truth table for the bi conditional of two proposition (4 marks)

QUESTION THREE (20 MARKS)

- a) A committee of 6 people is to be selected from 5 women and 6 men. In how many ways:
- Can the committee be selected if at least three women must be in the committee? (4 marks)
 - Can the committee be selected if three men must be in the committee? (3 marks)
- b) Let 1,2,3,4 be four letters. In how many ways can you arrange two of them? (3 marks)
- c) Four men and their wives sit on the bench. In how many ways can they be arranged if
- There is no restriction (2 marks)
 - Each man must sit next to his wife. (3 marks)
- d) In how many ways can 9 people sit at a round table (2 marks)
- e) Simplify $\frac{16!}{9!7!} + \frac{16!}{10!6!} + \frac{16!}{11!5!}$ (3 marks)

QUESTION FOUR (20 MARKS)

- a) Let $U = \{1,2,3,4,5,6,7,8,9,10,11,12\}$, $A = \{1,3,5,7,9,11\}$ $B = \{2,3,5,7,11\}$ $C = \{2,3,6,12\}$ and $D = \{2,4,8\}$

Determine the set

- i $A \cup B$
 - ii $A \cap C$
 - iii $(A \cup B) \cap C^c$
 - iv $(C \cap A) \cup D$ (8 marks)
- b) A market researcher investigating consumer preference for three brands of soda namely, coke, fanta and sprite in a certain town gathered the following information; from a sample of 800 consumers 230 took coke 245 took fanta and 325 took sprite. 30 took all the three brands of soda, 70 took coke and sprite, 110 took coke only, 185 took sprite only. Required
- i Present the above information in a venn diagram (4 marks)
 - ii Determine the number of customers who took fanta only (2 marks)
 - iii Determine the number of customers who took coke and fanta only (2 marks)
 - iv Determine the number of customers who took fanta and sprite only (2 marks)
 - v Determine the number of customers who took none of the brands of soda. (2 marks)

QUESTION FIVE (20 MARKS)

- a) If $Z = -2\sqrt{3} - 2i$, find $|z|$ and the argument of Z (4 marks)
- b) Solve $Z^3 - 1 = 0$, obtaining its three roots. If w is a root not equal to 1, show that the other root may be denoted by w^2 and prove that $1 + w + w^2 = 0$ (10 marks)
- c) Use De Moivres theorem to simplify $(1 + i\sqrt{3})^4$ (2 marks)
- d) Find all the cube roots of $-\sqrt{2} + i\sqrt{2}$ (4 marks)