



MACHAKOS UNIVERSITY

University Examinations 2018/2019

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS, STATISTICS AND ACTUARIAL SCIENCE

FIRST YEAR SECOND SEMESTER EXAMINATIONS FOR THE DEGREES OF
BACHELOR OF EDUCATION

SMA 102-BASIC MATHEMATICS

DATE: 27/9/2019

TIME: 2:00 – 4:00 PM

INSTRUCTIONS TO CANDIDATES

Attempt question ONE and any other TWO questions

QUESTION ONE (30 MARKS)

(a) Given that $A = \{1, 2, 3, 4, 5, 9, 10\}$. list the members of the following sets

(i) $\{x^2 : x^2 \in A\}$

(ii) $\left\{\frac{x}{2} : \frac{x}{2} \in A\right\}$

(iii) $\{4x + 1 : 4x + 1 \in A\}$ (3marks)

(b) Determine the value of x for which the following expression does not exist

$$\frac{2x+5}{x^2-x-6} \quad (5 \text{ marks})$$

(c) Given that $z_1 = 1 + 2j$, $z_2 = 2 - 3j$, $z_3 = -4 + j$, $z_4 = -3 - 2j$. Determine $\frac{z_1 - z_4}{z_2 - z_4}$ giving

your answer in the form $a + bj$ (6marks)

- (d) Obtain the first four terms of the expansion of $(2 - \frac{1}{2}x)^7$ in ascending powers of x (5marks)
- (e) Resolve $\frac{3x+5}{x^2-2x-3}$ into partial fraction (6marks)
- (f) Express $\cos 3\theta$ in terms of powers of $\cos \theta$. (5marks)
- (g) A mixed hockey team containing 5 men and 6 women is to be chosen from 7 men and 9 women. In how many ways can this be done? (5marks)

QUESTION TWO

- a) Let $\mathbb{E} = \{1, 2, 3, \dots, 20\}$

$$A = \{5, 10, 15, 20\}$$

$$B = \{2, 4, 6, 8, 10, 12, 14, 16, 18, 20\}$$

$$C = \{3, 6, 9, 12, 15, 18\}$$

Draw a Venn diagram, label the regions and place each element in the appropriate region

(10marks)

- b) Given that $\mathbb{E}$ is the set of positive integers less than 100 and sets A and B are subsets of

$\mathbb{E}$, A is the set of multiples of 5 and B is the set of multiples of 7

- (i) List the members of $A, B, A \cap B, A \cup B$ (4marks)
- (ii) Describe in words the members of set $A \cap B$ (2marks)
- (iii) Write down the values of $n(A), n(B), n(A \cap B)$, and $n(A \cup B)$ (4marks)

QUESTION THREE

- (a)
 - (i) Express $3-2j$ in polar form. (3marks)
 - (ii) Determine the three cube roots of $8(1-j)$ in polar form (5marks)
- (b)
 - (i) Express $\frac{\sin 5\theta}{\sin \theta}$ in terms of power of $\sin \theta$. (6marks)

(ii) Express $\cos^6 \theta$ in terms of cosines of multiples of θ . (6 marks)

QUESTION FOUR

(a) Obtain the first four terms of the expansion of $(1 + \frac{1}{2}x)^{10}$ in ascending powers of x
hence find the value of $(1.005)^{10}$, correct to 4dps (8 marks)

(b) Determine the value of $(\sqrt{3} - j)^9$, expressing the result in both polar and $a+bj$ forms
(12marks)

QUESTION FIVE

(a) Resolve $\frac{6x^2+7x-49}{(x-4)(x+1)(2x-3)}$ into partial fractions. (10 marks)

(b) The expression $ax^2 + bx + c$ is divisible by $x-1$, has remainder 2 when divided by $x+1$, and has a remainder 8 when divided by $x-2$. Determine the values of a, b, c (10 marks)