



W1-2-60-1-6

**JOMO KENYATTA UNIVERSITY
OF
AGRICULTURE AND TECHNOLOGY**

University Examinations 2021/2022

YEAR I SEMESTER I EXAMINATION FOR THE DEGREE OF BACHELOR OF
SCIENCE IN MATHEMATICS AND COMPUTER SCIENCE, INDUSTRIAL
MATHEMATICS, PHYSICAL SCIENCE, ACTUARIAL SCIENCE, FINANCIAL
ENGINEERING, STATISTICS, BIOSTATISTICS, OPERATIONS RESEARCH, ANIMAL
SCIENCE, AGRICULTURE, BOTANY, COMPUTER SCIENCE, INFORMATION
TECHNOLOGY, COMMUNITY HEALTH, CONTROL & INSTRUMENTATION,
GEOPHYSICS, RENEWABLE ENERGY, INDUSTRIAL CHEMISTRY, ANALYTICAL
CHEMISTRY, APPLIED BIO-ENGINEERING (AB), INDUSTRIAL BIO-TECHNOLOGY
(IB), MEDICAL BIOCHEMISTRY (MB), BIOCHEMISTRY AND MOLECULAR BIOLOGY
(BMB)

SMA 2104: MATHEMATICS FOR SCIENCES

DATE: DECEMBER 2021

TIME: 2 HOURS

INSTRUCTIONS:

- ❖ **ANSWER QUESTION ONE and ANY OTHER TWO QUESTIONS**
- ❖ **You MUST only use PAPER handed out at the Examination venue. Other paper or notebooks are not permitted.**
- ❖ **ALL WORKINGS must be done inside the ANSWER BOOKLET.**

QUESTION ONE (30 MARKS) – COMPULSORY

- a) Define the following terms
(i) Permutation
(ii) Statistics [3 marks]
- b) Solve the following equation using completing square method $5x^2 - 6x - 2 = 0$ [3 marks]
- c) Given that $\sqrt{35} = 5.9160798$. Evaluate without using tables or a calculator
$$\frac{\sqrt{7} + \sqrt{5}}{\sqrt{7} - \sqrt{5}}$$
 [4 marks]
- d) Find the remainder and quotient when $3x^5 - 4x^3 + 2x + 3$ is divided by $2x - 1$ [3 marks]
- e) Twelve students in a chemistry practical obtained readings from a practical as shown below:
50.4, 47.9, 53, 50, 49.9, 52, 48.9, 52, 55, 50.1, 50, 50. Determine the mean, median and the semi-inter quartile range all correct to 1 decimal place. [4 marks]
- f) The third term of a GP is α and the 5th term is 16. Find
i. The Common Ratio and First term [2 marks]
ii. Sum of the First six terms [3 marks]
- g) A factory produces a large output of bulbs every day. If a sample of 30 bulbs is taken at the end of the day, what is the probability that exactly two bulbs are faulty given that one in every five bulbs is always faulty? [3 marks]
- h) Find y in the range $0 \leq y \leq 2\pi$ given that $6 \cos y - 2.5 \sin y + 1.5 = 0$ [5 marks]

QUESTION TWO (20 MARKS)

- a) Rationalize the denominator of $\frac{3}{\sqrt[3]{2}}$ [2 marks]
- b) Factorize completely the expression $x^4 + 5x^3 + 5x^2 - 5x - 6$ hence solve the equation
 $x^4 + 5x^3 + 5x^2 - 5x - 6 = 0$ [4 marks]
- c) The roots of the equation $2x^2 - 4x + 1 = 0$ are α and β . Find an equation with integral coefficient whose roots are $2 - \alpha$ and $2 - \beta$. [4 marks]
- d) Show that $\log_{3^n} x = \frac{1}{n} \log_3 x$ Hence solve the equation
$$\log_{81} x + \log_3 x + \log_{\sqrt{3}} x = 13$$
 [6 marks]
- e) Determine the number of permutations of the letters of the word HALLUCINATIONS [4 marks]

QUESTION THREE (20MARKS)

- a) The second and fifth terms of an arithmetic series are 26 and 41 respectively.
- (i) Show that the common difference of the series is 5. [4 marks]
 - (ii) Find the 12th term of the series. [3 marks]
 - (iii) Another arithmetic series has first term -12 and common difference 7. Given that the sums of the first n terms of these two series are equal, find the value of n . [3 marks]
- b) Find the expansion of $\sqrt{1-2x}$ up to and including the term x^3 and find a suitable approximation to $\sqrt{2}$ using your expansion. [5 marks]
- c) When polynomial $f(x)$ is divided by $x-1$ the remainder is 3, when $f(x)$ is divided by $x+1$ the remainder is 5 and when $f(x)$ is divided by $x-2$ the remainder is 20. When $f(x)$ is divided by $(x^2 - 1)(x - 2)$ the remainder is $ax^2 + bx + c$. Determine the value of a, b and c . [5 marks]

QUESTION FOUR (20MARKS)

- a) In a school club of 14 members, 9 are boys and 5 girls. A committee of 5 is to be formed. In how many ways can this be done, if
- (i) At least one girl must be a member of the committee. [2 marks]
 - (ii) One boy is a chairman and one girl must be secretary of the club. [2 marks]
- b) Given that $\sin A = \frac{-3}{5}$ and $180^\circ < A < 270^\circ$, and that $\cos B = -\frac{12}{13}$ and B is obtuse. Find the value of
- (i) $\cos(A - B)$ [3 marks]
 - (ii) $\tan(A + B)$ [3 marks]

- c) The table below shows the distribution of marks scored in a test by students in an examination

46-50	51-55	56-60	61-65	66-70	71-75	76-80	81-85	86-90
42	72	104	220	108	93	62	48	31

Compute the Mode, Mean, Median mark, 74th percentile and Standard deviation

[10 marks]