

CHUKA



UNIVERSITY

UNIVERSITY EXAMINATIONS

EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR
OF SCIENCE IN ACTUARIAL SCIENCE AND BACHELOR OF SCIENCE IN
ENGINEERING

MATH 203: INTRODUCTION TO ANALYSIS

STREAMS: BSC (ACMT & EENG)

TIME: 2 HOURS

DAY/DATE: FRIDAY 09/7/2021

11.30 A.M. – 1.30 P.M.

INSTRUCTIONS:

QUESTION ONE (30 MARKS)

- a. Differentiate between open sentence and a universal (2 marks)
- b. What are the requirements of a set (3 marks)
- c. The sets L , M and N in a universal set consisting of the first 10 lower case letters of the alphabet are $L = \{a, b, c\}$, $M = \{b, c, q, z\}$

$$N = \{a, d, e, f\}$$

Determine the numbers of the following sets.

- i. $M \cup N$
 - ii. $L \cup N$
 - iii. L
 - iv. $L \cap M \cap N$
 - v. $(L \cup M) \cap N$
 - vi. $M \cap N$ (6 marks)
- d. A salesman daily wages is composed of a fixed amount and a variable component, which is dependent on the number of office cream units sold. He finds out that when he sells 10 units on a given day, he earns Kshs. 600 whereas when he doubles his sales, his earnings increase only by Kshs. 100.

Determine;

- i. Fixed daily earnings
- ii. Level of commission per unit sold hence.
- iii. What are the salesman's earnings if he sells 30 units.

MATH 203

- iv. On a given day, the salesman is determined to earn Kshs. 3,500. Suppose on the previous day he had a guaranteed order of 20 units, how many more must he sell in order to achieve his target earnings (6 marks)
- e. List and explain six assumptions of C-V-P – cost volume analysis (3 marks)
- f. Prove that for $n \in \mathbb{N}$
 $1+4+9+ \dots +n^2 = \frac{1}{6} (2n^3 + 3n^2+n)$ (4 marks)
- g. Let x, y and $Z \in \mathbb{F}$
Proof that
- If $x \neq 0$ and $xy = xz$ then $y = z$
 - If $x \neq 0$ and $xy = x$ then $y = 1$
 - If $x \neq 0$ and $xy=1$ then $y = \frac{1}{x}$
 - If $x \neq 0$ then $\frac{1}{\frac{1}{x}} = x$ (6 marks)

QUESTION TWO (20 MARKS)

- Define the completeness of an axiom (2 marks)
- List four implications of Archimedean property a real numbers (4 marks)
- State the Bolzano –Weierstrass theorem (2 marks)
- Show that $\lim_{n \rightarrow \infty} \frac{1}{n\sqrt{n}} = 1$ (4 marks)
- Let P and Q be propositions construct the truth table for the proposition $(P \wedge Q) \Rightarrow ((P \wedge Q))$ (4 marks)
- Show that if $3n$ is an odd integer then n is an odd integer. (4 marks)

QUESTION THREE (20 MARKS)

- Prove that “7 is a divisor of $3^{2n}-2^n$ ” (3 marks)
- Let A, B and C be subjects of a universal set U. gone up with the below rules
 - Commutative law
 - Associative law
 - Idempotent law
 - Demorgan law
 - Distributive law (5 marks)
- A survey was conducted on the newspaper readership of 3 dailies, the mirror, the citizen and the times M, C, T respectively and the following data were obtained.
The number of people who read M, C and T are 55, 45 and 39 respectively.
The number that read M and T = 19
The number that read C and M =15
The number that read C and T = 14
Those who read all the 3 dailies were found to be 4 people only.

MATH 203

Required:

Determine the number of people who

- i. Read the Mirror only
- ii. Read Citizen or times but not the Mirror
- iii. Total number of people interviewed 45 people read none of the paper. (8 marks)
- d. Differentiate between a converging and diverging sequence (4 marks)

QUESTION FOUR (20 MARKS)

- a. Define what is a topological space and give three conditions of topology to be open (4 marks)
- b. Show that $\text{Lim } (1 - 1/2^n) = 1$
Using the Archimedean property $\lim_{n \rightarrow \infty} \left(1 - \frac{1}{2^n}\right) = 1$ (6 marks)
- c. Discuss the convergence and divergence of
 - i. Harmonic series (3 marks)
 - ii. P series with $P=2$ (3 marks)

QUESTION FIVE (20 MARKS)

- a. Differentiate between a multivariate function and a logarithmic function (4 marks)
 - b. What are the applications of linear functions in the business world and explain how linear functions are applied (6 marks)
 - c. Show that $\lim_{n \rightarrow \infty} \frac{\cos nx/2}{n^2} = 0$ (4 marks)
 - d. Differentiate between least upper bound (supremum) and greatest lower bound (infimum) (6 marks)
-