



THE CATHOLIC UNIVERSITY OF EASTERN AFRICA

A. M. E. C. E. A

MAIN EXAMINATION

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SEPTEMBER - DECEMBER 2020 TRIMESTER

FACULTY OF SCIENCE

DEPARTMENT OF MATHEMATICS AND ACTUARIAL SCIENCE

REGULAR PROGRAMME

MAT 100: BASIC MATHEMATICS

Date: DECEMBER 2020

Duration: 2 Hours

INSTRUCTIONS: Answer Question ONE and any other TWO Questions

QUESTION ONE (30MARKS)

- a) If $f(x) = 2 - 3x$ and $g(x) = 5x^2 + x$ find: $(g \circ f^{-1})(x)$ (3marks)
- b) By using the remainder theorem, determine the remainder when $3x^3 - x^2 - 20x + 5$ is divided by $(x + 4)$ (3marks)
- c) UCC class of 42 students, 30 students play football while 25 students play volleyball. Use Venn diagrams to determine the number of students who play both games. (3marks)
- d) Evaluate $(3 + i)(2 + 4i)$ and hence write your answer in polar form. (3marks)
- e) Evaluate $\tan 75^\circ$ using surd angles on 30° and 45° (3marks)
- f) Evaluate $\sum_{i=1}^4 (5x_i + 2)$ $x_1 = 2, x_2 = 3, x_3 = 4, x_4 = 6$ (2marks)
- g) Find the number of permutations of the letters of the word GOOGLE (1 MARK)
- h) The 2nd term of an A.P is 11 and the 11th term is -7 find the sum of the first 40 terms (3marks)
- i) Write $\log \frac{8 \times \sqrt[3]{5^2}}{81}$ in term of $\log 2, \log 3$ and $\log 5$ (3marks)
- j) Evaluate (2marks)

$$\frac{x^4 \times x^{1/3} \times x}{\sqrt[5]{x} \times x^9}$$

k) Show whether the functions below are even, odd or neither:

i. $f(x) = -3x^2 + 4$ (2 mark)

ii. $h(x) = \frac{x^3}{1+x^4+x^2}$ (2mark)

QUESTION TWO

- a. If $\tan \theta = \frac{7}{24}$ and θ is reflex, without using tables or calculators find the values of $\sec \theta$ and $\sin \theta$ (3 marks)
- b. The third fourth and fifth term of G.P is given by $(x + 4)$, $(4x - 5)$, and $(2x + 1)$ respectively, show that one of the possible value of x is $\frac{1}{2}$, find the other possible value and common ration (5marks)
- c. If $A=(1,2,3)$ $B=(2,3,4)$ and $U=(1,2,3,4,5,6)$, verify that:
- i) $(A \cup B)' = A' \cap B'$ (3marks)
- ii) $(A \cap B)' = A' \cup B'$ (3marks)
- d. What do you understand by: (3marks)
- i. A function $f: A \rightarrow B$
- ii. Onto function
- iii. Many to one function
- e. Simplify $\frac{\sin^2\theta + \sin \theta - 3}{1 - \cos^2\theta - \sin \theta}$ (3marks)

QUESTION THREE

- a. Find the inverse of the function of $f(x) = \frac{2x+1}{x-3}$ hence verify that $(f \circ f^{-1})(x) = x$ (6marks)
- b. Safaricom Kenya surveyed 400 of its customers to determine the way they learned about the new jimbabie tariff. The survey shows that 180 learned about the tariff from radio, 190 from television, 190 from newspaper, 80 from radio and newspaper, 50 from television and newspaper and 30 from all the three forms of media 10mks
- i. Draw a venn diagram to represent this information
- ii. Determine the number of customers who learned of the tariff from at least two of the three media
- iii. The number of customers who learned of the tariff from exactly one of the three media

- iv. The number of customers who did not learner of the tariff of the three media
- c. Solve for $0^\circ \leq \theta \leq 360^\circ$ $\cos^2\theta + \sin\theta + 1 = 0$ (4marks)

QUESTION FOUR

- a. Solve the equation $\log_3 x - 4 \log_x 3 + 3 = 0$ (4marks)
- b. Out of a group of 87 ladies, 43 can play hockey, 42 can play football and 47 can play badminton; 15 can play badminton and hockey 17 badminton and football and 21 hockey and football. Each lady can play at least one of the three games. How many ladies can play all the three games (6 marks)
- c. Consider the series 0.3232323232..... Hence determine the;
- Common ratio
 - 20th term
 - Sum of first 10 terms
- (6 marks)
- d. Find the value of a and b if $\frac{x^5+4x^3+ax+b}{x^2-1}$ the remainder is $2x + 3$ (4 marks)

QUESTION FIVE

- a) Without fully expanding determine the sixth term given by $(3p + \frac{q}{3})^{13}$ (3marks)
- b) Given $f(x) = 2x - 1, g(x) = x^2 + 2$ and $h(x) = 3x + 1$; find
- $(f \circ h^{-1})(2)$ (4marks)
 - $(g \circ h \circ f)(-1)$ (3 marks)
 - $(g \circ f^{-1})x$ (3marks)
- c) Given $\cos \theta = \frac{3}{4}$ find the value of $\sin 3\theta$ (3marks)
- d) Find the remainder when $x^3 - 2x^2 - 5x + 6$ is divided by $(x + 2)$ (3marks)

END