



MACHAKOS UNIVERSITY

University Examinations 2020/2021 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

FIRST YEAR FIRST SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (PUBLIC HEALTH)

HPH 100: APPLIED TECHNICAL MATHEMATICS

DATE: 23/2/2021

TIME: 2.00-4.00 PM

INSTRUCTIONS:

Answer Question One and Any Other Two Questions

QUESTION ONE (30 MARKS) (COMPULSORY)

- a) Define (3 marks)
- i. Sets
 - ii. Subset
 - iii. Power set
- b) Find the power set of the set $A = \{1,2,3\}$ (2 marks)
- c) Let set $A = \{1,3,5,7,9,11\}$, $B = \{2,3,5,7,11\}$, $C = \{2,3,6,7,9,11\}$, $D = \{2,4,8\}$
Determine (3 marks)
- i. $A \cup B$
 - ii. $A \cap B$
 - iii. $(C \cup A) \cap B$
- d) Determine the coefficient of x^3 in the binomial expansion of $(2 - x)^8$ (3 marks)
- e) Differentiate between a Tautology and a contradiction, hence determine whether the following is a Tautology, Contradiction or neither. $(P \Rightarrow Q) \wedge (\sim P \vee Q)$ (4 marks)
- f) Compute the value of the following limit $\lim_{x \rightarrow 2} (3x^2 + 5x - 9)$ (5 marks)
- g) Find a_6 for an arithmetic sequence where $a_1 = 3x - 1$ and $d = 2x + 6$ (4 marks)
- h) Solve by factorization method $2x^2 - 5x - 3 = 0$ (3 marks)
- i) Expand $\left(10 + \frac{2}{x}\right)^4$ (3 marks)

QUESTION TWO (20 MARKS)

- a) Find the equation for the line that has a slope of $\frac{2}{3}$ and passes through (6,2) (4 marks)
- b) Evaluate the indefinite integral defined by $\int (2x^2 + 3) dx$ (4 marks)
- c) The fourth term of a geometric progression is 27 and the seventh term is 729. Find
- The first term (4 marks)
 - The common difference (4 marks)
- d) Evaluate $\frac{\log 125 - \log 25}{\log 25 + \log 5}$ (4 marks)

QUESTION THREE (20 MARKS)

- a) A rectangular field has an area of 75 m^2 . The width of the field is 3 m longer than the length of the rectangle. What are the dimensions of the field? (8 marks)
- b) Differentiate $f(t) = \frac{3t+9}{2-t}$ with respect to t (6 marks)
- c) Determine the points where the function below is not continuous
- $$h(t) = \frac{4t+10}{t^2-2t-15} \quad (6 \text{ marks})$$

QUESTION FOUR (20 MARKS)

- a) The first term of an arithmetic sequence is equal to 6 and the common difference is equal to 3.
- Find the formula of the n^{th} term (3 marks)
 - Find the 50^{th} term (3 marks)
- b) Given that the fourth and the eight terms of the arithmetic sequence are $a_4=93$ and $a_8=65$
- Find the common differences d and the first term a (4 marks)
 - Find the n^{th} term (2 marks)
- c) Find S_{10} for 250, 100, 40, 16,.... (4 marks)
- d) Find the 9^{th} term of the sequence
- $$1, \sqrt{2}, 2, \dots \quad (4 \text{ marks})$$

QUESTION FIVE (20 MARKS)

- a) Use truth table to determine the validity of the argument: $[(P \rightarrow Q) \wedge \neg Q] \rightarrow \neg P$ (7 marks)
- b) Evaluate the derivative of the following function using the definition of derivatives
- $$f(x) = 2x^2 - 16 + 35 \quad (7 \text{ marks})$$
- c) Obtain the first four terms of the expansion $\left(1 + \frac{1}{2}x\right)^{10}$ in ascending powers of x and estimate the value of $(1.005)^{10}$ correct to four decimal places (6 marks)