



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 (AGRICULTURAL EDUCATION AND EXTENSION)

KCU 101: FUNDAMENTALS OF MATHEMATICS

DATE: 2/3/2021

TIME: 2:00 – 4:00 PM

INSTRUCTIONS:

Answer Question One and Any Other Two Questions

QUESTION ONE 30 MARKS (COMPULSORY)

a) Find the median of 7, 3, 2, 9, 8, 5, 1, 4, 6. (2 marks)

b) Find the inner product and the lengths of $\vec{a} = [1, 2, 3]$ and $\vec{a} = [0, -2, 1]$ as well as the angle between them. (3 marks)

c) Find the functions of which the following are the derived functions

$$\frac{5}{x^2} - \frac{6}{x^3} + \frac{6}{x^4} \quad (3 \text{ marks})$$

d) Solve the following pairs of equations simultaneously

$$\begin{aligned} 6h &= 2k + 9 \\ 3h + 4k &= 12 \end{aligned} \quad (4 \text{ marks})$$

e) A die was cast 55 times and the outcomes recorded in the distribution

No. on die	1	2	3	4	5	6
No. of times shown	5	7	13	15	10	5

Calculate, on average, the number that showed up and the mode. (5 marks)

f) Using the remainder theorem to solve the equation $2x^3 - 2x^2 - 7x + 6 = 0$. (5 marks)

g) A bird laid a certain number of eggs in a nest, and a collector took away two-thirds of them. The bird laid some more, and another took two-thirds of them. If the bird laid 12 eggs altogether and collectors took 10 altogether, how many eggs were laid to begin with?

(8 marks)

QUESTION TWO (20 MARKS)

- a) Find the components and the length of the vector $\vec{a}$ with initial point $P(6, 2, -1)$ and terminal point $Q(7, -1, 2)$ (2 marks)
- b) The velocity of a moving particle after t seconds is $v \text{ ms}^{-1}$, where $v = 30 - t^2$. find the acceleration of the particle after 1 second. (3 marks)
- c) The number of faults occurring on a production line in a nine-week period are as shown below. Determine the median and quartile values for the data: 30 27 25 24 27 37 31 27 35 (5 marks)
- d) Find the term that must be added to the expressions to make it perfect square $t^2 + 16t$ (5 marks)
- e) Explain why $\int x^n$ is not possible for $n = -1$. (5 marks)

QUESTION THREE (20 MARKS)

- a) In a single toss of two dice, calculate the probability that the numbers that show up
- Give a total of 3 (2 marks)
 - Give a total of 10 (2 marks)
 - Are the same (2 marks)
- b) Calculate the gradient of the curve $y = x^3 - 5x + 3$ at the point $x = 3$ (3 marks)
- c) If $\log_b M = 3$ and $\log_b P = 4$, determine $\log_b \frac{M^{1/3} P^{1/4}}{\sqrt{(M^2 P^3)}}$ (5 marks)
- d) The probability of a component failing in one year due to excessive temperature is $\frac{1}{20}$, due to excessive vibration is $\frac{1}{25}$ and due to excessive humidity is $\frac{1}{50}$. Determine the probabilities that during a one-year period a component:
- Fails due to excessive vibration
 - Fails due to excessive vibration or excessive humidity, and
 - Will not fail because of both excessive temperature and excessive humidity.
- (6 marks)

QUESTION FOUR (20 MARKS)

- a) In a single toss of a fair die calculate the probability that what show up is
- i. An even number (2 marks)
 - ii. At least 5 (2 marks)
 - iii. At most 4 (2 marks)
- b) Find the functions of which the following are the derived functions.
- $$\frac{5}{x^2} - \frac{6}{x^3} - \frac{6}{x^4} \quad (4 \text{ marks})$$
- c) A rectangle is 3 times as long as it is wide, and its perimeter is 56cm. find its length and width (5 marks)
- d) If $x = \log_9 5$ and $y = \log_3 5$ find y in terms of x (5 marks)

QUESTION FIVE (20 MARKS)

- a) Find the differential coefficient of the following functions with respect to x
- $$-y = 2x^3 - 3x^2 \quad (3 \text{ marks})$$
- b) The velocity of a moving particle after t seconds is $v \text{ ms}^{-1}$, where $v = 30 - t^2$. Find the acceleration of the particle after 2 second. (4 marks)
- c) The gradient of a curve at any point is $5 - 6x$. Find the equation of the curve if it passes through the point $(1, 2)$ (5 marks)
- d) Use the factor theorem to factorize $x^3 + 4x^2 + x - 6$ and hence solve the cubic equation $x^3 + 4x^2 + x - 6 = 0$. (8 marks)