

UNIVERSITY EXAMINATIONS

1ST SEMESTER 2022/2023 ACADEMIC YEAR

**FIRST YEAR EXAMINATION FOR THE DEGREES OF
BACHELOR OF SCIENCE (BIOMED)/BACHELOR OF
SCIENCE (BIOCHEMISTRY)/BACHELOR OF
EDUCATION(SCIENCE)/BACHELOR OF SCIENCE
(AGED)/BACHELOR OF AGRIBUSINESS
MANAGEMENT**

MATH 111: GENERAL MATHEMATICS

STREAM: R

TIME: 2 HRS

DAY: TUESDAY [8.30AM – 10.30M] DATE: 13/12/2022

THIS QUESTION PAPER CONSISTS OF FOUR (4) PAGES

PLEASE DO NOT OPEN UNTIL THE INVIGILATOR SAYS SO.

INSTRUCTIONS: - Answer Question **ONE** and any **OTHER TWO**

QUESTION ONE (30 MKS) COMPULSORY

- (a) If $f(x) = 2x + 12$ and $g(x) = x^2 + 3x + 1$
- (i) Find $f \circ g(x)$ (2 marks)
- (ii) $f \circ g(1)$ (2 marks)
- (iii) $g \circ f(1)$ (2 marks)
- (b) Given that data;
- 23, 27, 32, 38, 40 (3 marks)
- Find the:
- (i) Mean square deviation (variance)
- (ii) Coefficient of variation
- (c) Solve the equation $\frac{2x}{7} - \frac{1-2x}{3} = \frac{4}{7}$ (3 marks)
- (d) The sum of the first 8 terms of an arithmetic progression (A.P) is 220 the 3rd term is 17; find the sum of first 6 terms (5 marks)
- (e) Show that $\frac{2 \times (3^{n+1}) + 7(3^{n-1})}{3^{(n+2)} - 2 \times (1/3)^{1-n}} = 1$ (5 marks)
- (g) Solve $9^{(x+2)} + 3^{(2x+3)} = 27$ (4 marks)
- (h) Name the properties of real numbers that justify each statement:
- (i) $4(50) = 4(50)$ (1 mark)
- (ii) $3(10 + 7) = (3 \times 10) + (3 \times 7)$ (1 mark)
- (iii) $a + (-a) = 0$ (1 mark)
- (iv) $-22 - (4 + 6) = (-22 - 4) - 6$ (1 mark)

QUESTION TWO (OPTIONAL) (20Mks)

- (a) Find $\frac{dy}{dx}$ given that $y = \frac{x^4 - 6}{3x + 4}$ (5 marks)
- (b) Solve the inequality $\frac{2x-1}{3x+5} \leq \frac{5}{1}$ (4 marks)

- (c) Solve the quadratic equation $2x^2 + 3x - 4 = 0$ using completing square method. (4 marks)

- (d) Simplify the following expression of polynomials.

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

- (e) Factorize each of the following expression.

$$3px - qy + 3qx - py \quad (1 \text{ mark})$$

$$a^2 - 4ap - 4p + a \quad (1 \text{ mark})$$

QUESTION THREE OPTIONAL

- (a) Use the binomial theorem to expand $(x + y)^4$, hence evaluate $(1.1)^4$ correct to 3 decimal places (5 marks)

- (b) Express into partial $\frac{2x+3}{(x+1)(2x+1)}$ fraction (4 marks)

- (c) Solve for x in the expression

$$3^2(x+2) + 9(x-1) = 27 \quad (3 \text{ marks})$$

- (d) The expression $x^3 + kx^2 - 2x - 4$ is fully divisible by $(x + 1)$. (4 marks)

Find the value of k

- (e) Solve for x in the following equation: (4 marks)

$$4^{x+1} \cdot (1/32)^{2-x} = 16^{x-\frac{1}{2}}$$

QUESTION FOUR - OPTIONAL (20MKS)

- (a) Prove that the functions f and g are inverses to each other (5 marks)

$$f(x) = 8 + 3x \quad \text{and} \quad g(x) = \frac{x-8}{3}$$

- (b) From the 1st principles differentiate the function $f(x) = (2x^2 + 4x)$ (5 marks)

- (c) Find the value of n given that when $f(x) = x^5 + 4x^4 - 6x^2 + nx + 2$ is divided by $(x + 2)$ the remainder is 6. (4 marks)
- (d) Solve the equation $\log_x 16 - \log_x 2 = \frac{1}{2}$ (4 marks)
- (e) For the following function, determine the nature of the turning points: (2 marks)
- $$2x + 4 - 3x^2$$

QUESTION FIVE - OPTIONAL (20MKS)

- (a) The weights of fifty cartons of cooking fat are given below:

34 38 30 31 37 43 38 37 32 40
 41 34 37 36 32 38 41 35 37 38
 35 37 32 40 39 31 33 37 37 43
 34 35 39 41 37 38 38 41 43 30
 32 36 32 35 38 34 38 37 34 36

- (i) Write down a grouped frequency table (beginning with class 30-32) (2 marks)
- (ii) Calculate: Median, 60th percentile and quartile deviation. (5 marks)
- (iii) Draw a histogram and a frequency polygon on the same axes. (4 Mks)
- (b) Evaluate the integral $\int (8x^2 + 16x) dx$ (4 marks)
- (c) (i) State the Factor Theorem (1 mark)
- (ii) Use the long division method to show that $x^3 + 4x^2 + x - 6$ is divisible by $(x + 2)$ (2 marks)
- (iii) Confirm your results in (i) above using the Factor Theorem (2 marks)

