UNIVERSITY OF EDUCATION, WINNEBA
INSTITUTE FOR TEACHER EDUCATION AND CONTINUING PROFESSIONAL DEVELOPMENT
(ITECPD)
END-OF-FIRST-SEMESTER EXAMINATIONS, JUNE, 2023

LEVEL 200
COURSE CODE: JBM 232
COURSE TITLE: TEACHING, LEARNING, AND APPLYING FURTHER ALGEBRA

TIME ALLOWED: 2 HRS

STUDENT'S INDEX NUMBER:

GENERAL INSTRUCTIONS:

- This paper is made up of ONE SECTION.
- *The Section is made up of six essay type questions.*
- *Answer any FOUR questions in your answer booklet.*
- ***Each question carries equal marks. You are expected to start each question on a new page.***
- ***You are expected to hand over your answer booklet to the invigilator*** *before you leave the examination hall.*

Instruction: *Answer any four (4) questions in the answer booklet provided.*

Question 1

a) If $m * n = mn + m + n$, show that the operation $*$ is associative on the set of real numbers. [6 Marks]

b) Find the term that contains x^5 in the expansion of $(2x + y)^{20}$. [5 Marks]

c) If $log_5 3 = 0.6820$, find the value of $\log_5 \left(\frac{3}{8}\right) + \log_5 15 + 2\log_5 \left(\frac{4}{5}\right) - \log_5 \left(\frac{2}{5}\right)$ [6 Marks]

d) When $(1 + kx)^{\frac{3}{2}}$ is expanded in ascending powers of x, the first four terms are $A + Bx + \frac{27}{8}x^2 + Cx^3 + \ldots$. Find the possible values of K, A, B and C. [8 Marks]

Question 2

a) Given the set $E = \{1,3\}; F = \{1\}; G = \{3\}; H = \{\ \}$.

i. Copy and complete the table below for the operation $\cup$,

$\cup$	E	F	G	H
E	E			
F			E	

G				G
H				H

ii. Determine with reason, the identity element for the operation inverse of the element G. [7 Marks]

b) In a classroom, there are eight students. Out of these eight students, at least five are girls. How many possible groups of boys and girls can be formed with at least five girls? [4 Marks]

c) Find the value of $\frac{\sqrt{0.04}+(0.1)^2}{0.5}$, give details. [5 Marks]

d) Given the system $\begin{matrix} 2x-3y=1 \\ 4x-5y=2 \end{matrix}$,

i. Write the system as a matrix equation of the form $AX = B$

ii. Calculate the determinant of the coefficient matrix

iii. Using matrix approach, solve the system. [9 Marks]

Question 3

a) The first n terms of a geometric sequence are $a_1, a_1r, a_1r^2, a_1r^3, a_1r^4, \ldots\ldots\ldots a_1r^{n-1}$

Show that the sum of all terms of the geometric series $S_\infty = \frac{a_1}{1-r}$ for all $-1 < r < 1$.

Hence, find the values of the common ratio and the first term of the exponential sequence whose second term is 20 and the sum to infinity is 90. [12 Marks]

b) Find the constant term in the expansion of $\left(3x + \frac{1}{4x}\right)^{10}$. [6 Marks]

c) If $3^m \times 3^n = 243$ and $3^m \div 3^n = 27$, write down two equations connecting m and n. Hence, find the values of m and n. [7 Marks]

Question 4

a) A conference room has rows of chairs for attendees. In the first row, there are 10 chairs, and each subsequent row has 2 more chairs than the previous row. If there are a total of 8 rows in the conference room, how many chairs are there in total? [4 Marks]

b) Evaluate $(1-x)^{\frac{-1}{2}}$ in ascending powers of x up to the fourth term. Hence evaluate $\left(\frac{100}{99}\right)^{\frac{1}{2}}$, correct to two decimal places. [7 Marks]

c) Find the truth set of the simultaneous equations $\left(\frac{1}{3}\right)^{2x} = \left(\frac{1}{9}\right)^{y+2}$ and $3^{x-1} = 27^{y-1}$ [14 Marks]

Question 5

a) A shop sells two types of pens: regular pens and premium pens. The shop sold a total of 100 pens, and the revenue from selling regular pens was \$150, while the revenue from selling premium pens was \$300. If the regular pens cost \$2 each and the premium pens cost \$5 each, how many regular and premium pens were sold? [4 Marks]

b) Find the number of terms of the arithmetic progression (A.P) $4 + 6\frac{1}{2} + 9 + 11\frac{1}{2}$..... needed to make a total of 126. [6 Marks]

c) Tom invested $GHc5,000.00$ in a mutual fund that has been consistently growing at a rate of 8% per year. Sarah invested $GHc3,000.00$ in a different mutual fund that has been growing at a rate of 12% per year. After how many years will Sarah's investment be worth more than twice the value of Tom's investment? [10 Marks]

d) If $2^{5x} = \frac{16}{2^{1-x}}$, find x [5 Marks]

Question 6

a) In an AP, the sum of the first ten terms is 50 and the fifth term is three times the second term. Find the first term and the sum of the first 20 terms. [10 Marks]

b) A binary operation Δ is defined on the set of real numbers R by $p\Delta q = p + q - 2pq$, where p and q are real.

i. Show that Δ is commutative.

ii. Find the identity element under the operation Δ.

iii. Which element in R has no inverse under the operation? [9 Marks]

c) Find the value of x if $3^{3x-4} = 243(3\sqrt{3})$ [6 Marks]