



UNIVERSITY OF GHANA

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DEPARTMENT OF TEACHER EDUCATION
 SCHOOL OF EDUCATION AND LEADERSHIP
 COLLEGES OF EDUCATION
 END OF SEMESTER ONE EXAMINATION FOR LEVEL 200, 2023
 B.ED. PROGRAMME

COURSE CODE: TEJS 245
 COURSE TITLE: LEARNING TEACHING AND APPLYING FURTHER ALGEBRA

Instruction: Answer all questions in Section A and any three questions in Section B.

Time: 2 hours

SECTION A

[25 Marks]

Answer all the questions in this section.

1. Which of the following is NOT a binary operation?
 - A. Subtracting from 100
 - B. Finding the square root
 - C. Finding the product
 - D. Finding the quotient
2. A binary operation * is defined over the set of real numbers as $a * b = \frac{a+b}{a}$. Find the value of $2a * (-2b)$.
 - A. $\frac{a+b}{a}$
 - B. $\frac{a-b}{a}$
 - C. 0
 - D. $\frac{b-a}{a}$
3. Let '*' and \wedge be two binary operations such that $a * b = a^2b$ and $a \wedge b = 2a + b$.
 - b. find $(2 * 3) \wedge (6 * 7)$.
 - A. 256
 - B. 275
 - C. 276
 - D. 286

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4. Find the sum of all the numbers from 1000 to 2000 which are divisible by 5.
- A. 200000
 - B. 201000
 - C. 221100
 - D. 301500

5. How many roots has the quadratic equation $x^2 - 6x + 9 = 0$?
- A. 0
 - B. 1
 - C. 2
 - D. 3

6. What is the discriminant of the quadratic equation $3x^2 - 8x + 2 = 0$?
- A. -88
 - B. -40
 - C. 40
 - D. 88

7. Given the quadratic function, $f(x) = x^2 - x - 6$. Determine the turning point of its graph.

- A. $\left(\frac{1}{2}, -\frac{25}{4}\right)$
- B. $\left(\frac{1}{2}, \frac{25}{4}\right)$
- C. $\left(-\frac{1}{2}, \frac{25}{4}\right)$
- D. $\left(-\frac{1}{2}, -\frac{25}{4}\right)$

8. Given that $\begin{bmatrix} x & y \\ 3y & x \end{bmatrix} \begin{bmatrix} 1 \\ 2 \end{bmatrix} = \begin{bmatrix} 3 \\ 5 \end{bmatrix}$, find the values of x and y .
- A. $x = 1, y = 2$
 - B. $x = 2, y = 1$
 - C. $x = 1, y = 1$
 - D. $x = 3, y = 5$

9. If A and B are symmetric matrices of the same order, then $(AB - BA)$ is always _____?
- A. A symmetric matrix
 - B. A skew-symmetric matrix
 - C. A zero matrix
 - D. An identity matrix

10. Which of these functions is a polynomial?

- A. $f(x) = 4x^3 + \sqrt{x} - 1$
- B. $f(x) = 5x^4 - 2x^2 + \frac{3}{x}$
- C. $f(x) = 0$
- D. $f(x) = x^2 + \sin x$

11. If $a = \sqrt{5} + 2$ and $b = \sqrt{5} - 2$, find the value of $a^2 - b^2$.

- A. $2\sqrt{5}$
- B. $4\sqrt{5}$
- C. $8\sqrt{5}$
- D. $16\sqrt{5}$

12. Subtract $2x^2 - x + 2$ from $x^2 + 3x + 5$.

- A. $-x^2 + 4x + 3$
- B. $x^2 - 4x - 3$
- C. $x^2 + 2x + 7$
- D. $-x^2 + 2x + 7$

13. Find the coefficient of x^6 in the binomial expansion $(2 + x)^{10}$.

- A. 16
- B. 64
- C. 210
- D. 3360

14. Which of the following statements best differentiate between series and sequence?

- A. Numbers in a series have a common ratio while numbers in a sequence have a common difference.
- B. Numbers in sequence have a common ratio while numbers in a series have a common difference.
- C. Sequence is a list of numbers in a definite order while series is the sum of the numbers in a definite order.
- D. Series is the list of numbers in a definite order while sequence is the sum of the series.

15. Find the remainder of the polynomial $f(x) = x^3 + 12x^2 - 3x + 4$ when divided by the expression $(x - 2)$.

- A. 4
- B. -28
- C. 50
- D. 54

16. Which of these is a factor of the equation $x^3 - 2x^2 - 7x + 12 = 0$?
- A. $(x - 1)$
 - B. $(x - 2)$
 - C. $(x - 3)$
 - D. $(x - 4)$
17. If the points A(3, -2), B(k , 2) and C(8, 8) are collinear then the value of k is ____?
- A. -4
 - B. -3
 - C. 2
 - D. 5
18. The sequence $\frac{1}{5}, \frac{1}{10}, \frac{1}{15}, \frac{1}{20}, \frac{1}{25}, \dots$ can best be described as a _____ sequence.
- A. Arithmetic
 - B. Fibonacci
 - C. Geometric
 - D. Harmonic
19. Find the values of x and y respectively for which $\begin{pmatrix} x & -3 \\ 0 & 3 \end{pmatrix} = \begin{pmatrix} 2 & 4 \\ y+1 & 3 \end{pmatrix}$
- A. 5 and 1
 - B. 5 and -1
 - C. -1 and 5
 - D. 1 and 5
20. Find the values of x for which the determinant of the matrix $\begin{pmatrix} x & -2 & 1 \\ 2 & x & -3 \end{pmatrix}$ is zero.
- A. $x = 2, 3$
 - B. $x = 1, -6$
 - C. $x = -1, -4$
 - D. $x = 1, 4$
21. The axis of the symmetry of a parabola always passes through the
- A. vertex
 - B. x-intercepts
 - C. origin
 - D. y-intercept
22. Find the first term of the given sequence $a_n = 68, d = 3$
- A. 14
 - B. 20
 - C. 26
 - D. 29

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23. Create the explicit formula for the arithmetic sequence 2,8,14, ...

- A. $a_n = -6 + 6n$
- B. $a_n = 6n - 4$
- C. $a_n = 4 - 6n$
- D. $a_n = 2 + 6n$

24. Kamali has 6 unique bracelets and is trying to decide which 3 to wear on a date. Use Pascal's Triangle to find the number of different combinations of 3 bracelets that Kamali could choose from the 6 she owns.

- A. 1
- B. 3
- C. 6
- D. 20

25. Find the value of n if $\frac{\log_{10} n}{\log_{10} 64} = \frac{1}{2}$

- A. 8
- B. 12
- C. 16
- D. 24

SECTION B

[75 Marks]

Answer any three questions in this section.

13marks

- 1a. Your parents have assets of GH¢500,000.00. One option that they are considering involves an adult residential community facility for a six-year period beginning in 2023. The model $T_n = 1800n + 64,130$ describes yearly adult residential community facility costs in n years after 2022. Calculate what the cost of the residential facility will be and state if your parents will have enough to pay for the facility? 12marks
- 1b. The accumulated value, A , of a sum of money with principal, P , after t years at annual percentage rate r compound n times a year is given by: $A = P \left(1 + \frac{r}{n}\right)^{nt}$. How long will it take GH¢25,000.00 to grow to GH¢500,000 at 9% annual interest compounded monthly? 15marks

- 2a. A binary operation Δ is defined on the set $S = \{0, 1, 2, 3\}$ by; $a \Delta b = a + b - ab$, where $a, b \in S$
- Draw and complete a binary table for the operation.
Use the table to
 - Show that Δ is commutative.
 - Find the neutral element.
 - Find the inverse of the element 3.
- 15marks

- 2b. The roots of the equation $2x^2 - 3x + 4 = 0$ are α and β . Find an equation whose roots are $\frac{\alpha}{\beta}$ and $\frac{\beta}{\alpha}$. 10marks

- 3a. When the polynomial $f(x) = 2x^3 - x^2 - mx - 2$ is divided by $x - 1$ the remainder is -6 .
- Determine the value of m .
 - Find the truth set of the equation $f(x) = 0$.
- 15marks

- 3b. If $M = \begin{pmatrix} 2 & 1 \\ 3 & -1 \end{pmatrix}$, show that $M^2 - M - 5I$ is a zero matrix, where I is a 2×2 unit matrix. 10marks

- 4a. i. Write down the first four terms of the binomial expansion $\left(2 + \frac{x}{2}\right)^{10}$. 15marks
- ii. Using your expansion in (i) to find the value of $(2.025)^{10}$.

- 4b. Find the value(s) of x for which $10^x - 4(10^{-x}) = 3$. 10marks

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- 5a. A marathon runner begins his first day of training by running 2km. He 13marks
then increases this distance by $\frac{1}{2}$ km more each day from the distance
he ran the previous day.
i. On what day would he first cover 15km?
ii. What is the total distance covered after 30 days?
- 5b. If $\begin{vmatrix} t+1 & t-1 \\ t-3 & t+2 \end{vmatrix} = \begin{vmatrix} 4 & -1 \\ 1 & 3 \end{vmatrix}$, find the value of t 7marks
- 5c. Given that $A = \begin{bmatrix} 5 & -2 \\ 3 & 0 \end{bmatrix}$ and $B = \begin{bmatrix} 5 & -1 \\ 1 & 3 \end{bmatrix}$, find $C = 3A - B$ 5marks