

Spring Semester Examination 2018
Paro College of Education
Royal University of Bhutan
Paro

Module : MAT 101 (Elementary Algebra) **Programme:** B.Ed(S) **Level :** I
Writing Time: Three Hours **Full Marks:** 100

Instructions : Do not write during the first 15 minutes. Use this time for reading the questions. You will get full three hours for answering the questions. Write the answers to all the questions in the answer sheets provided by the college. Read the directions to each section and to each question carefully before answering the questions. You are allowed to carry a scientific calculator *fx-82 or fx-100* beside other writing materials. You will be provided with graph sheets.

SECTION A
One Question - 20 Marks

Question 1

Instructions : Answer all the sub-questions numbered a to j. Choose only one answer for each sub-question and write in the answer script against the question number.

- a. Let $A = \{a, b, c, d\}$ and $B = \{x, y, z\}$. Which is a relation from A to B?
- A** $\{(a, x), (b, y), (z, c), (c, x)\}$
- B** $\{(x, a), (y, b), (z, c), (x, b)\}$
- C** $\{(a, x), (b, y), (a, y), (c, x)\}$
- D** $\{(a, a), (b, b), (d, c), (x, y)\}$
- b. Which relation is a function?
- A** $\{(a, x), (b, y), (c, z), (a, y)\}$
- B** $\{(a, x), (b, y), (c, z), (d, p)\}$
- C** $\{(a, x), (a, y), (a, z), (a, p)\}$
- D** $\{(a, x), (b, y), (b, z), (c, x)\}$
- c. Let $A = \{1, 2, 3\}$. The subset $R = \{(1, 1), (2, 2), (1, 2), (2, 1), (1, 3), (2, 3)\}$ of $A \times A$ is
- A** transitive.
- B** reflexive.
- C** symmetric.
- D** anti-symmetric.

- d. If x is a non-zero rational number and xy is irrational, then y must be
- A an integer.
 - B a rational number.
 - C an imaginary number.
 - D an irrational number.
- e. If $f(x) = 2x^3 + mx^2 - 13x + n$ and 2, 3 are roots of the equation $f(x) = 0$, then
- A $m = 5$ and $n = 30$.
 - B $m = -5$ and $n = 30$.
 - C $m = 5$ and $n = -30$.
 - D $m = -5$ and $n = -30$.
- f. The value of x and y in the system of linear equations $6x - 8y = 3$ and $2x + 4y = 6$ are
- A $x = \frac{3}{4}$ and $y = \frac{3}{2}$
 - B $x = -\frac{3}{2}$ and $y = \frac{3}{4}$
 - C $x = \frac{3}{2}$ and $y = \frac{3}{4}$
 - D $x = -\frac{3}{4}$ and $y = \frac{3}{2}$
- g. The next term of the sequence 2, 6, 12, 20, ... is
- A 24
 - B 28
 - C 30
 - D 40
- h. All are true about the graph of a quadratics equation $f(x) = x^2 + 2x - 8$, EXCEPT
- A it is open upward.
 - B the coordinates of vertex are $(1, -9)$.
 - C the coordinates of y-intercept are $(0, 8)$.
 - D the coordinates of one of the x-intercept are $(0, -4)$.

- i. Which one is NOT a factor of the expression $3x^3 - 7x^2 - 2x + 8$?
- A $x + 1$
 B $x + 2$
 C $x - 2$
 D $3x - 4$
- j. The remainder of the expression $3x^3 + 8x^2 - 6x + 1$, when divided by $x + 3$ is
- A 4
 B 5
 C 6
 D 7

SECTION B
 Five Questions- 80 Marks

Instructions: There are SIX questions in this section. Answer any FIVE questions. Sub-questions must be answered in order and completely for every question attempted. Marks for each question or sub-question are given in the brackets.

Question 2

- a. Prove that $(A \times B) \cap (C \times D) = (A \cap C) \times (B \cap D)$ for any sets A, B, C and D. Give an example to verify the proved relation. (8)
- b. Simplify $\frac{6\sqrt{2}}{\sqrt{3} + \sqrt{6}} - \frac{4\sqrt{3}}{\sqrt{6} + \sqrt{2}} + \frac{2\sqrt{6}}{\sqrt{3} + \sqrt{2}}$ (8)

Question 3

- a. Sonam wants to fence a playground next to the school and build a dividing fence to make separate play areas for younger and older students. The budget allows for 210 m of fencing. (9)
- i. Write a function that represents the total area of the playground as a function of its width.
- ii. Determine the width that will result in the maximum total area that can be enclosed using 210 m of fencing. Sketch the graph of the function to see if your answer is reasonable.

b. Let $A = \{2, 3, 4, 5, 6\}$. (7)

i. Find $A \times A$.

ii. Find the solution set of R , where $R = \{(x, y) \in A \times A : x > y, \frac{x}{y} \notin \mathbb{W}\}$.

iii. Plot R on the co-ordinate and arrow diagram of $A \times A$.

iv. Write the domain, range and co-domain of the relation R .

Question 4

a. The expression $x^3 + x^2 + ax + b$ is exactly divisible by $x - 3$ and leaves the remainder 14 when divided by $x - 1$. Find the values of a and b , and the factors of the expression. (8)

b. Resolve $\frac{x}{(x-2)^2(x+1)}$ into partial fractions. (8)

Question 5

a. Lhamo is 5 years older than Choden. The sum of their ages is 29 years. (8)

i. Write equations to model the relationship.

ii. Solve the system of equations using the Elimination method to determine each person's age.

b. Resolve $\frac{x^3}{x^2 + 5x + 6}$ into partial fractions. (8)

Question 6

a. Let $A = \{4, 8, 12, 16\}$ and $B = \{3, 0, -3, -6\}$ be two sets and $f : A \rightarrow B$ be a function. (8)

i. Write f and f^{-1} as ordered pairs.

ii. Find the equation of the given function by showing all the procedures.

iii. What type of function is it? Justify your answer.

iv. If $28 \in B$, then what is its value in A ?

- b. The 6th and the 20th terms of an Arithmetic Progression are 13 and 41 respectively. Find its first term and the common difference. What is the sum of first 25 terms of the sequence? (8)

Question 7

- a. Find the three numbers in Geometric Progression whose sum is 26 and the product is 216. Find sum of the sequence to 8 terms by taking the least number as first term of the sequence. (8)
- b. Identify the vertex, axis of symmetry, maximum or minimum value, domain, range and opening of the parabola $f(x) = 2x^2 - 4x - 3$. Graph the equation. (8)