



B.K. BIRLA CENTRE FOR EDUCATION

SARALA BIRLA GROUP OF SCHOOLS
A CBSE DAY-CUM-BOYS' RESIDENTIAL SCHOOL



FIRST TERM EXAMINATION (2026-27)
APPLIED MATHEMATICS — CLASS XI — Subject Code: 241
SET - A

Time allowed : 3 hours
Date : 09-09-2026

Maximum Marks : 80
Roll No : _____

General Instructions :

Read the following instructions carefully and follow them :

- (i) This question paper contains 38 questions. All questions are compulsory.
- (ii) This question paper is divided into FIVE Sections — A, B, C, D and E.
- (iii) In Section A, Questions no. 1 to 18 are multiple choice questions (MCQs) and questions no. 19 and 20 are Assertion-Reason based questions of 1 mark each.
- (iv) In Section B, Questions no. 21 to 25 are very short answer (VSA) type questions, carrying 2 marks each.
- (v) In Section C, Questions no. 26 to 31 are short answer (SA) type questions, carrying 3 marks each.
- (vi) In Section D, Questions no. 32 to 35 are long answer (LA) type questions carrying 5 marks each.
- (vii) In Section E, Questions no. 36 to 38 are case study based questions carrying 4 marks each. Internal choice is provided in 2 marks questions in each case study.
- (viii) There is no overall choice. However, an internal choice has been provided in 2 questions in Section B, 2 questions in Section C, 2 questions in Section D and 3 questions in Section E.
- (ix) Draw neat Venn diagrams wherever required.
- (x) Use of calculator is NOT allowed.

SECTION A

This section comprises multiple choice questions (MCQs) of 1 mark each.

Q.1 In a colony of 120 households, 78 subscribe to a news app and 54 to a music app, while 22 subscribe to both. The number of households subscribing to neither app is : 1

- (A) 10
- (B) 12
- (C) 14
- (D) 16

Q.2 A store codes its stock as $U = \{x : x \in N, x \leq 30\}$. The set of codes divisible by both 4 and 6 is : 1

- (A) {12, 24}
- (B) {4, 6, 12, 24}
- (C) {12, 18, 24}
- (D) {6, 12, 18, 24}

Q.3 A set A has 6 elements. The number of subsets of A that contain at least one element is : 1

- (A) 32
- (B) 63
- (C) 64

- (D) 36
- Q.4 For two overlapping sets, $n(A) = 32$, $n(B) = 25$ and $n(A \cup B) = 45$. Then $n(A - B)$ is : 1
- (A) 7
(B) 12
(C) 20
(D) 13
- Q.5 A cafe offers 4 beverages and 3 snacks. Taking A as the set of beverages and B as the set of snacks, the number of distinct beverage–snack orders possible is : 1
- (A) 7
(B) 12
(C) 81
(D) 64
- Q.6 If $n(A) = 3$ and $n(B) = 4$, then the number of relations from A to B that are NOT the empty relation is : 1
- (A) 2^{12}
(B) $2^{12} - 1$
(C) 2^7
(D) 12
- Q.7 A delivery app records $R = \{(x, y) : x \text{ is a rider, } y \text{ is an order and } x \text{ delivered } y\}$ with $n(R) = 15$ over 5 riders. Then R is best described as a relation whose : 1
- (A) domain has at most 5 elements
(B) domain has exactly 15 elements
(C) range has exactly 5 elements
(D) domain and range are equal
- Q.8 Let $A = \{1, 2, 3, 4\}$ and let $R = \{(a, b) : a \in A, b \in A \text{ and } a + b = 5\}$. Then R in roster form is : 1
- (A) $\{(1, 4), (2, 3)\}$
(B) $\{(1, 4), (2, 3), (3, 2), (4, 1)\}$
(C) $\{(1, 4), (4, 1)\}$
(D) $\{(2, 3), (3, 2), (5, 0)\}$
- Q.9 A factory's daily cost (in ₹) of producing x units is $C(x) = 4500 + 130x$. The cost of producing the 26th unit alone is : 1
- (A) ₹ 130
(B) ₹ 3380
(C) ₹ 7880
(D) ₹ 4630
- Q.10 The domain of the real function $f(x) = \frac{1}{\sqrt{9-x^2}}$ is : 1
- (A) $[-3, 3]$
(B) $(-3, 3)$
(C) $R - \{-3, 3\}$
(D) $(-\infty, 3)$
- Q.11 A parking fee is ₹ 30 for the first hour and ₹ 20 for each additional hour. If $f(x)$ is the fee for x hours, $x \in N$, then $f(x)$ is : 1
- (A) $30 + 20x$

- (B) $10 + 20x$
 (C) $50x$
 (D) $30x + 20$
- Q.12 The range of the real function $f(x) = 7 - |x - 2|$ is : 1
 (A) $[7, \infty)$
 (B) $(-\infty, 7]$
 (C) $[0, 7]$
 (D) R
- Q.13 A trainee's monthly stipend starts at ₹ 8,000 and rises by ₹ 750 every month. His stipend in the 12th month is : 1
 (A) ₹ 16,250
 (B) ₹ 17,000
 (C) ₹ 15,500
 (D) ₹ 16,750
- Q.14 A machine bought for ₹ 5,00,000 loses 20% of its value at the end of every year. The values at the ends of successive years form : 1
 (A) an AP with common difference $-1,00,000$
 (B) a GP with common ratio 0.8
 (C) a GP with common ratio 0.2
 (D) an AP with common difference -20
- Q.15 The sum of the first 25 terms of the AP 6, 11, 16, ... is : 1
 (A) 1650
 (B) 1500
 (C) 1725
 (D) 1875
- Q.16 A shop assigns each product a code consisting of 2 distinct letters from A, B, C, D followed by a digit from 1 to 5. The number of codes possible is : 1
 (A) 60
 (B) 40
 (C) 80
 (D) 120
- Q.17 The number of 4-digit numbers, with no digit repeated, that can be formed using the digits 1, 2, 3, 4, 5, 6 is : 1
 (A) 360
 (B) 1296
 (C) 720
 (D) 240
- Q.18 The number of distinct arrangements of all the letters of the word *ANNUAL* is : 1
 (A) 720
 (B) 360
 (C) 180
 (D) 120
- Q.19 Directions : In the question below, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option. 1
 Assertion (A) : If the 4th and the 9th terms of an AP are 17 and 37 respectively, then its common difference is 4.

Reason (R) : In an AP with first term a and common difference d , $a_n = a + (n - 1)d$.

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of Assertion (A).

(C) Assertion (A) is true, but Reason (R) is false.

(D) Assertion (A) is false, but Reason (R) is true.

Q.20 Directions : In the question below, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option. 1

Assertion (A) : The number of ways in which 7 students can be seated in a row of 7 chairs so that two particular students always sit together is $2 \times 6!$.

Reason (R) : When two objects must always occur together, they are treated as a single object and the arrangements within that object are also counted.

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of Assertion (A).

(C) Assertion (A) is true, but Reason (R) is false.

(D) Assertion (A) is false, but Reason (R) is true.

SECTION B

This section comprises very short answer (VSA) type questions of 2 marks each.

Q.21 In a survey of 90 employees of a firm, 55 use the metro and 48 use the office bus, while 21 use both. Find the number of employees who use exactly one of the two modes. 2

OR

A showroom stocks cars in the set C of 5 models and bikes in the set B of 4 models. Find $n(C \times B)$ and interpret what one element of $C \times B$ represents in this situation.

Q.22 Let $A = \{2, 3, 5\}$ and $B = \{4, 6, 9, 10\}$. A relation is defined as $R = \{(a, b) : a \in A, b \in B \text{ and } a \text{ divides } b\}$. Write R in roster form and hence write its range. 2

Q.23 A start-up's monthly revenue in its first month is ₹ 2,40,000 and it increases by ₹ 18,000 every month. Find its revenue in the 15th month. 2

Q.24 A four-digit PIN is to be formed using the digits 1, 2, 3, 4, 5, 6, 7 with no digit repeated. In how many ways can this be done if the PIN must begin with an odd digit ? 2

Q.25 In how many distinct ways can all the letters of the word *LOGISTICS* be arranged ? 2

OR

Six delegates are to be seated in a row for a photograph. In how many ways can this be done if two particular delegates refuse to sit next to each other ?

SECTION C

This section comprises short answer (SA) type questions of 3 marks each.

Q.26 In a survey of 60 customers of a cafe, 25 ordered coffee, 26 ordered tea and 26 ordered juice ; 9 ordered coffee and tea, 11 ordered tea and juice, 8 ordered coffee and juice, and 3 ordered all the three. Using a Venn diagram, find the number of customers who ordered none of these three drinks. 3

Q.27 Let $A = \{1, 2, 3, 4, 6\}$ and let $R = \{(a, b) : a, b \in A \text{ and } b \text{ is exactly divisible by } a\}$. 3

(a) Write R in roster form.

(b) Write the domain and the range of R .

(c) Find $n(A \times A)$ and hence the total number of relations possible from A to A .

OR

A library issues cards numbered $A = \{1, 2, 3, 4\}$ and shelves numbered $B = \{2, 4, 6, 8\}$. A relation is defined as $R = \{(a, b) : b = 2a\}$.

- (a) Write R in roster form and write its domain and range.
- (b) State whether R is a function from A to B and justify your answer.
- (c) Find the total number of relations possible from A to B .

Q.28 A courier company charges ₹ 60 for the first kg and ₹ 22 for every additional kg (or part of it). If $f(x)$ is the charge for a parcel of x kg, $x \in N$:

- (a) Express $f(x)$ as a function of x .
- (b) Find the charge for a parcel of 9 kg.
- (c) A customer paid ₹ 258. Find the weight of the parcel.

Q.29 The 5th term of a GP is 81 and its 2nd term is 3. Find the first term and the common ratio of the GP, and hence find the sum of its first six terms.

Q.30 How many words, with or without meaning, can be formed using all the letters of the word *ARTICLE* so that all the vowels always occur together ? Also state how many of them begin with a consonant.

Q.31 Find the value of n if ${}^nP_4 = 20 \times {}^nP_2$

OR

How many 5-digit numbers can be formed using the digits 0, 1, 2, 3, 4, 5 without repetition ? How many of these are divisible by 5 ?

SECTION D

This section comprises long answer (LA) type questions of 5 marks each.

Q.32 A market research team surveyed 200 shoppers of a mall. It was found that 120 visited the food court, 95 visited the cinema and 70 visited the book store ; 45 visited both the food court and the cinema, 30 visited both the cinema and the book store, 35 visited both the food court and the book store, and 15 visited all the three.

- (a) Represent the data by a Venn diagram.
- (b) Find the number of shoppers who visited at least one of the three places.
- (c) Find the number who visited only the food court.
- (d) Find the number who visited none of the three places, and state what this figure means for the mall management.

Q.33 A sports academy allots training slots $U = \{x : x \in N, x \leq 20\}$. Slots that are multiples of 4 are given to the swimming batch S , and slots that are multiples of 6 are given to the gym batch G .

- (a) Write S and G in roster form.
- (b) Find $S \cap G$ and $S \cup G$, and state what each represents here.
- (c) Find $S - G$ and G' .
- (d) Verify that $(S \cap G)' = S' \cup G'$.

OR

A transport office numbers its buses $A = \{1, 2, 3, 4\}$ and its routes $B = \{1, 2, 3\}$. A relation is defined as $R = \{(a, b) : a \in A, b \in B \text{ and } a + b \text{ is even}\}$.

- (a) Write R in roster form.
- (b) Write the domain and the range of R .
- (c) Find the total number of relations possible from A to B .
- (d) State, with reason, whether R is a function from A to B .

Q.34 An electricity board charges its domestic consumers as follows : a fixed rental of ₹ 120 per month, plus ₹ 5 per unit for the first 100 units and ₹ 8 per unit for every unit above 100. Let $f(x)$ be the monthly bill (in ₹) for x units consumed. 5

- Express $f(x)$ as a piecewise-defined function.
- Find the bill for a consumer using 80 units.
- Find the bill for a consumer using 250 units.
- A consumer paid ₹ 1,340. Find the number of units consumed.
- If no household in the colony uses more than 400 units, write the range of f .

Q.35 A person takes a loan of ₹ 1,18,000 from a self-help group and agrees to repay it in monthly instalments, paying ₹ 1,000 in the first month and increasing every instalment by ₹ 100. 5

- Find the amount of the 30th instalment.
- Find the total amount repaid in 30 instalments.
- Examine whether the loan is cleared in 30 instalments and, if not, find the amount still due.

OR

A company purchases a machine for ₹ 8,00,000. Its value depreciates by 15% of the value at the beginning of each year.

- Show that the values of the machine at the ends of successive years form a GP and write its first term and common ratio.
- Find the value of the machine at the end of 3 years.
- The company plans to replace the machine when its value first falls below half of its purchase price. Examine whether this happens by the end of the 4th year.

SECTION E

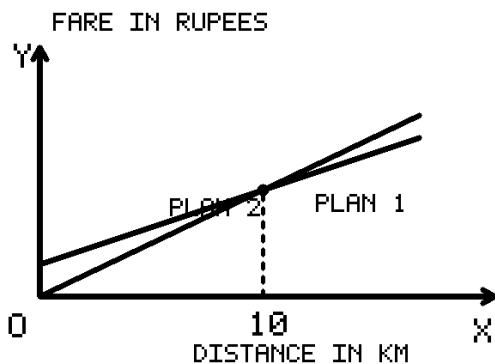
This section comprises 3 case study based questions of 4 marks each.

Q.36 Case Study – 1 : A cab aggregator offers two plans for a city ride. 4

Plan I : a fixed charge of ₹ 60 plus ₹ 14 per km.

Plan II : no fixed charge, but ₹ 20 per km.

Let x be the distance travelled (in km) and let $f(x)$ and $g(x)$ be the fares (in ₹) under Plan I and Plan II respectively.



On the basis of the above information, answer the following questions :

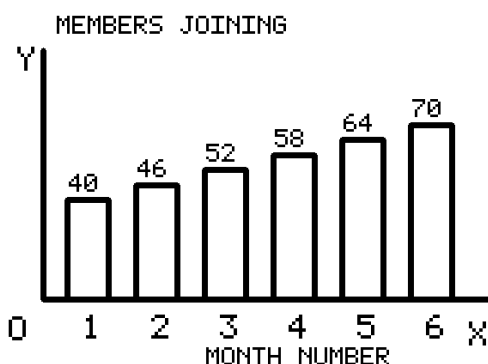
- Write $f(x)$ and $g(x)$ as functions of x .
- Find the fare under each plan for a ride of 8 km.
- Find the distance for which both plans cost the same, and state which plan is cheaper for a 15 km ride.

OR

- (iii) A commuter's monthly budget for one daily ride is ₹ 300. Using Plan I, find the greatest whole number of kilometres she can travel in one ride, and write the range of f for $0 \leq x \leq 20$.

Q.37 Case Study – 2 : A fitness centre records the number of members joining every month. In January 40 members joined, and thereafter the number joining each month increased by 6 every month. In the same centre, the monthly subscription fee was ₹ 1,000 in January and it is revised upwards by 10% at the beginning of every month.

4



On the basis of the above information, answer the following questions :

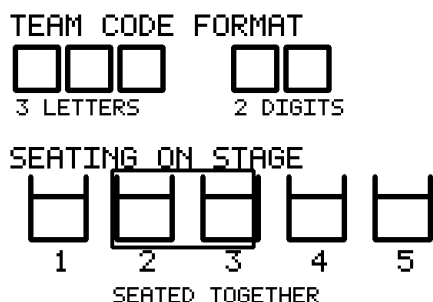
- Write the number of members joining in the 10th month.
- Find the total number of members who joined during the first 10 months.
- Find the subscription fee in the 4th month, correct to the nearest rupee, and state whether the fees form an AP or a GP with reason.

OR

- The centre wants the number of members joining in a month to first exceed 100. Find the month in which this happens.

Q.38 Case Study – 3 : A school is preparing identity codes and seating plans for its annual quiz. Each team code consists of 3 distinct letters chosen from the letters of the word *QUIZTEAM*, followed by 2 distinct digits chosen from 1 to 6.

4



On the basis of the above information, answer the following questions :

- Find the number of ways in which the 3 distinct letters can be arranged in the code.
- Find the total number of team codes that can be formed.
- Five finalists are to be seated in a row on the stage. Find the number of seating arrangements in which two particular finalists are always seated together.

OR

- Find the number of distinct arrangements of all the letters of the word *ASSESS*, and state why this number is smaller than $6!$.
