



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 - B

Time allowed : 3 hours
Date : 09-08-2026

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 Let $A = \{1, 2, 3\}$ and $B = \{3, 4\}$. Then $n(A \times B)$ is : 1
- (A) 5
(B) 6
(C) 7
(D) 12
- Q.2 If $n(A) = 5$, then the number of proper subsets of A is : 1
- (A) 32
(B) 31
(C) 16
(D) 10
- Q.3 In a group of 150 people, 92 like tea and 63 like coffee, while 25 like both. The number of people who like neither is : 1
- (A) 15
(B) 20
(C) 25
(D) 10

- Q.4 A store codes items as $U = \{x : x \in N, x \leq 25\}$. The set of codes divisible by both 3 and 5 is : 1
- (A) {15}
 (B) {3, 5, 15}
 (C) {5, 10, 15, 20}
 (D) {15, 30}
- Q.5 For two sets, $n(A) = 20$, $n(B) = 28$ and $n(A \cap B) = 8$. Then $n(A \cup B)$ is : 1
- (A) 56
 (B) 48
 (C) 40
 (D) 36
- Q.6 On the set $A = \{1, 2, 3\}$, the relation $R = \{(1, 1), (2, 2), (3, 3), (1, 2), (2, 1)\}$ is : 1
- (A) reflexive and symmetric only
 (B) symmetric and transitive only
 (C) reflexive and transitive only
 (D) an equivalence relation
- Q.7 If $n(A) = 4$ and $n(B) = 3$, then the total number of relations from A to B is : 1
- (A) 7
 (B) 12
 (C) 2^7
 (D) 2^{12}
- Q.8 A hotel booking app records $R = \{(x, y) : x \text{ is a guest, } y \text{ is a room and } x \text{ is assigned } y\}$ with $n(R) = 12$ over 12 guests, each assigned exactly one room. Then : 1
- (A) the domain of R has at most 12 elements
 (B) the range of R has exactly 12 elements
 (C) R is not a function
 (D) the domain has fewer than 12 elements
- Q.9 The domain of the real function $f(x) = \frac{1}{x^2 - 9}$ is : 1
- (A) R
 (B) $R - \{3\}$
 (C) $R - \{-3, 3\}$
 (D) $R - \{0\}$
- Q.10 A tutor charges a fixed fee of ₹ 200 plus ₹ 150 per hour of tuition. If $f(x)$ is the fee for x hours, then $f(4)$ is : 1
- (A) ₹ 600
 (B) ₹ 750
 (C) ₹ 800
 (D) ₹ 950
- Q.11 The range of the real function $f(x) = 5 - |x + 1|$ is : 1
- (A) $[5, \infty)$
 (B) $(-\infty, 5]$
 (C) $[0, 5]$
 (D) R
- Q.12 The 3rd and the 7th terms of an AP are 9 and 21 respectively. Its first term is : 1
- (A) 3

- (B) 4
- (C) 5
- (D) 6

Q.13 A person invests ₹ 2,00,000 in a scheme that grows by 10% every year. The values at the ends of successive years form : 1

- (A) an AP with common difference ₹ 20,000
- (B) a GP with common ratio 1.1
- (C) a GP with common ratio 0.1
- (D) an AP with common difference ₹ 2,00,000

Q.14 The sum of the first 20 terms of the AP 4, 9, 14, ... is : 1

- (A) 990
- (B) 980
- (C) 1030
- (D) 950

Q.15 A password consists of 3 distinct letters from A, B, C, D, E followed by 2 distinct digits from 1 to 4. The number of passwords possible is : 1

- (A) 360
- (B) 480
- (C) 600
- (D) 720

Q.16 The number of ways of arranging 5 different books on a shelf so that 2 particular books are always together is : 1

- (A) 24
- (B) 48
- (C) 120
- (D) 60

Q.17 The number of distinct arrangements of all the letters of the word *COMMITTEE* is : 1

- (A) $\frac{9!}{2!}$
- (B) $\frac{9!}{2! \times 2! \times 2!}$
- (C) $\frac{9!}{3!}$
- (D) $9!$

Q.18 The number of ways in which 4 letters can be posted into 3 letter-boxes (each letter in exactly one box) is : 1

- (A) 4P_3
- (B) 3^4
- (C) 4^3
- (D) $\frac{4!}{3!}$

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) : The number of 3-digit numbers with no digit repeated, formed from 1, 2, 3, 4, 5, is 60.

Reason (R) : The number of ways of arranging r objects out of n distinct objects is ${}^nP_r = \frac{n!}{(n-r)!}$.

- (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) : If the first term of a GP is 5 and the common ratio is 2, then its 6th term is 160.

Reason (R) : In a GP with first term a and common ratio r , the n th term is $a_n = ar^{n-1}$.

- (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 Let $A = \{1, 2\}$ and $B = \{a, b, c\}$. Write $A \times B$ and hence write the number of relations from A to B . 2

OR

A gift shop stocks greeting cards in the set G of 6 designs and gift bags in the set H of 3 sizes. Find $n(G \times H)$ and interpret what one element of $G \times H$ represents in this situation.

Q.22 A survey of 100 gym members found that 62 use the treadmill and 45 use the weight section, while 20 use both. Find the number of members who use exactly one of the two facilities. 2

Q.23 An intern's monthly stipend starts at ₹ 6,000 and rises by ₹ 500 every month. Find her stipend in the 10th month. 2

Q.24 In how many distinct ways can all the letters of the word *BASKETBALL* be arranged ? 2

Q.25 A three-digit code is formed using the digits 0, 1, 2, 3, 4, 5 with no digit repeated. In how many ways can this be done if the code must not begin with 0 ? 2

OR

Five friends are to be seated in a row for a photograph. In how many ways can this be done if two particular friends must always sit together ?

SECTION C

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

Q.26 Let $A = \{2, 4, 6\}$ and $B = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$. Let $R = \{(a, b) : a \in A, b \in B \text{ and } b \text{ is a multiple of } a\}$. 3

- (a) Write R in roster form.
 (b) Write the domain and the range of R .
 (c) Find $n(A \times B)$ and hence the total number of relations possible from A to B .

OR

A parking lot issues tickets numbered $A = \{1, 2, 3, 4, 5\}$ and slots numbered $B = \{2, 4, 6, 8, 10\}$. 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.27 In a survey of 70 readers of a magazine, 30 read fiction, 32 read non-fiction and 28 read poetry ; 10 read fiction and non-fiction, 12 read non-fiction and poetry, 8 read fiction and poetry, and 4 read all three. Using a Venn diagram, find the number of readers who read none of the three genres. 3

Q.28 A taxi service charges ₹ 50 for the first 2 km and ₹ 15 for every additional km (or part of it). If $f(x)$ is the fare for a journey of x km, $x \in N$: 3

- Express $f(x)$ as a function of x .
- Find the fare for a journey of 11 km.
- A passenger paid ₹ 185. Find the distance travelled.

Q.29 The 4th term of a GP is 24 and its 7th term is 192. Find the first term and the common ratio of the GP, and hence find the sum of its first five terms. 3

Q.30 How many words, with or without meaning, can be formed using all the letters of the word *EQUATION* so that all the vowels always occur together ? Also state how many of them begin with a vowel. 3

Q.31 Find the value of r if ${}^5P_r = 2 \times {}^6P_{r-1}$. 3

OR

How many 4-digit numbers can be formed using the digits 0, 1, 2, 3, 4, 5, 6 without repetition ?
How many of these are even ?

SECTION D

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

Q.32 A survey of 180 visitors to a fair found that 100 visited the food stalls, 85 visited the game zone and 60 visited the exhibition ; 40 visited both food stalls and the game zone, 25 visited both the game zone and the exhibition, 30 visited both food stalls and the exhibition, and 12 visited all three. 5

- Represent the data by a Venn diagram.
- Find the number of visitors who visited at least one of the three attractions.
- Find the number who visited only the game zone.
- Find the number who visited none of the three attractions, and state what this figure means for the fair organisers.

Q.33 A coaching institute allots seat numbers $U = \{x : x \in N, x \leq 24\}$. Seats that are multiples of 3 are given to the morning batch M , and seats that are multiples of 8 are given to the evening batch E . 5

- Write M and E in roster form.
- Find $M \cap E$ and $M \cup E$, and state what each represents here.
- Find $M - E$ and E' .
- Verify that $(M \cup E)' = M' \cap E'$.

OR

A warehouse numbers its trucks $A = \{1, 2, 3\}$ and its docks $B = \{1, 2, 3, 4\}$. A relation is defined as $R = \{(a, b) : a \in A, b \in B \text{ and } a + b \text{ is odd}\}$.

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

Q.34 A water park charges its visitors as follows : an entry fee of ₹ 150, plus ₹ 10 per ride for the first 8 rides and ₹ 15 per ride for every ride beyond 8. Let $f(x)$ be the total charge (in ₹) for a visitor taking x rides. 5

- (a) Express $f(x)$ as a piecewise-defined function.
- (b) Find the charge for a visitor taking 5 rides.
- (c) Find the charge for a visitor taking 15 rides.
- (d) A visitor paid ₹ 335. Find the number of rides taken.
- (e) If no visitor takes more than 20 rides in a day, write the range of f .

Q.35 A person takes a loan of ₹ 84,000 and agrees to repay it in monthly instalments, paying ₹ 2,000 in the first month and increasing every instalment by ₹ 200. 5

- (a) Find the amount of the 15th instalment.
- (b) Find the total amount repaid in 15 instalments.
- (c) Examine whether the loan is cleared in 15 instalments and, if not, find the amount still due.

OR

A company purchases a vehicle for ₹ 6,00,000. Its value depreciates by 20% of the value at the beginning of each year.

- (a) Show that the values of the vehicle at the ends of successive years form a GP and write its first term and common ratio.
- (b) Find the value of the vehicle at the end of 3 years.
- (c) The company plans to sell the vehicle when its value first falls below one-third of its purchase price. Examine whether this happens by the end of the 5th year.

SECTION E

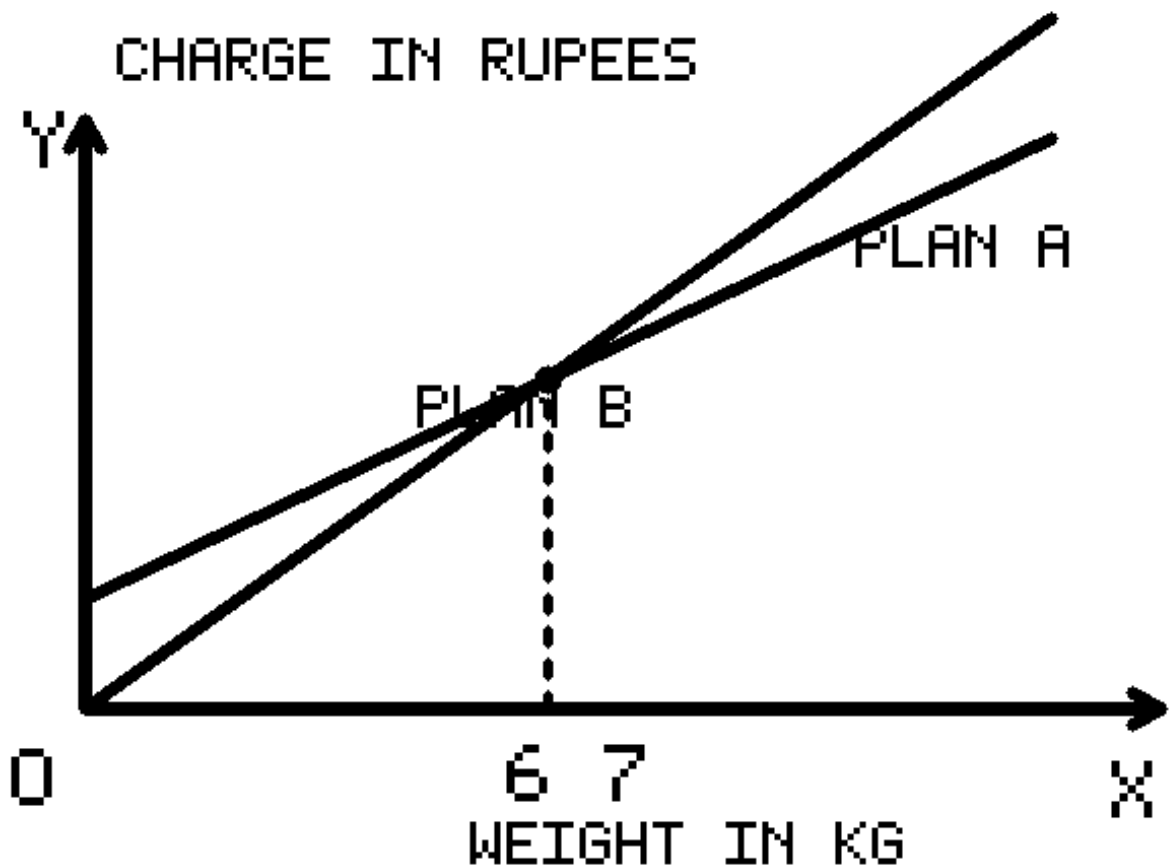
This section comprises 3 case study based questions of 4 marks each.

Q.36 Case Study – 1 : A courier company offers two pricing plans for a parcel. 4

Plan A : a fixed charge of ₹ 40 plus ₹ 12 per kg.

Plan B : no fixed charge, but ₹ 18 per kg.

Let x be the weight of the parcel (in kg) and let $f(x)$ and $g(x)$ be the charges (in ₹) under Plan A and Plan B respectively.



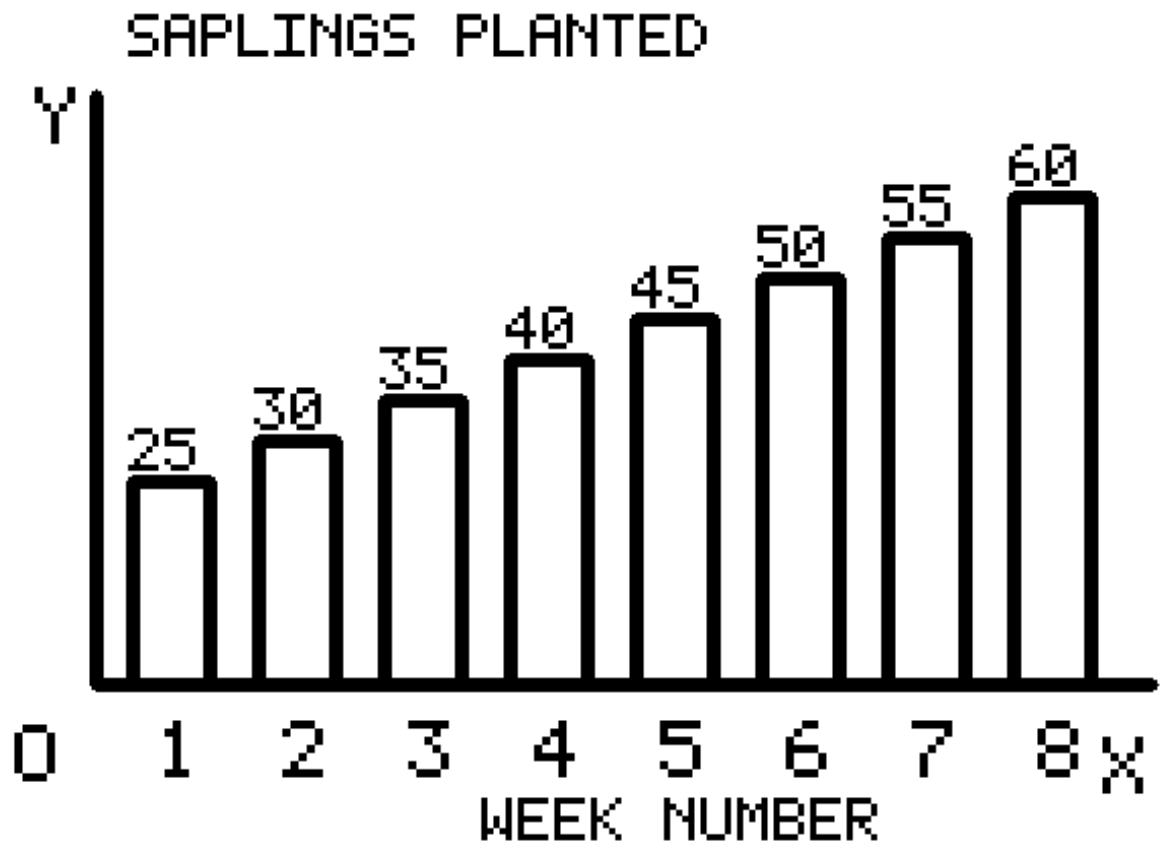
On the basis of the above information, answer the following questions :

- (i) Write $f(x)$ and $g(x)$ as functions of x .
- (ii) Find the charge under each plan for a parcel of 5 kg.
- (iii) Find the weight for which both plans cost the same, and state which plan is cheaper for a 10 kg parcel.

OR

- (iii) A customer's monthly budget for sending one parcel is ₹ 160. Using Plan A, find the greatest whole number of kilograms she can send, and write the range of f for $0 \leq x \leq 15$.

Q.37 Case Study – 2 : A tree plantation drive records the number of saplings planted every week. In the first week 25 saplings were planted, and thereafter the number planted each week increased by 5 every week. In the same drive, the cost of maintaining each sapling was ₹ 40 in the first month, and it is revised upwards by 5% at the start of every month. 4



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

- (i) Write the number of saplings planted in the 8th week.
- (ii) Find the total number of saplings planted during the first 8 weeks.
- (iii) Find the maintenance cost per sapling in the 4th month, correct to the nearest rupee, and state whether the costs form an AP or a GP with reason.

OR

- (iii) The drive wants the number of saplings planted in a week to first exceed 80. Find the week in which this happens.

Q.38 Case Study – 3 : A college is preparing registration codes and a felicitation seating plan for its annual fest. 4

Each registration code consists of 3 distinct letters chosen from the letters of the word *FESTIVAL*, followed by 2 distinct digits chosen from 1 to 5.

REGISTRATION CODE



3 LETTERS



2 DIGITS

SEATING ON STAGE



1

2

3

4

5

6

SEATED TOGETHER

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

- (i) Find the number of ways in which the 3 distinct letters can be arranged in the code.
- (ii) Find the total number of registration codes that can be formed.
- (iii) Six chief guests are to be seated in a row on the stage. Find the number of seating arrangements in which two particular guests are always seated together.

OR

- (iii) Find the number of distinct arrangements of all the letters of the word *COMMITTEE*, and state why this number is smaller than $9!$.
