



Name:
 Class: XI^m D
 Subject: Mathematics
 Date:
 Invigilator's Sign:
 Session: 2023-24

SET - A
 SUBJECT CODE-041

Time allowed: 3 Hours

Maximum Marks: 80

- Please check that this question paper contains 7 printed pages.
- Code number given on the right hand side of the question paper should be written on the title page of the answer book by the candidate.
- Please check that this question paper contains 38 questions.
- Please write down the serial number of the question in the answer book before attempting it.
- 15 minutes time has been allotted to read this question paper. The candidates will read the question paper only and will not write any answer on the answer book during this period.

General Instructions:

Read the following instructions very carefully and follow them:

- i. This question paper contains 38 questions. All questions are compulsory.
- ii. Question paper divided into FIVE Sections – Section A, B, C, D and E.
- iii. In Section A – Question Number 1 to 18 are Multiple Choice Questions (MCQ) type and Question Number 19&20 are Assertion-Reason based questions of 1 mark each.
- iv. In Section B - Question Number 21 to 25 are Very Short Answer (VSA) type questions of 2 marks each.
- v. In Section C - Question Number 26 to 31 are Short Answer (SA) type questions carrying 3 marks each.
- vi. In Section D - Question Number 32 to 35 are Long Answer (LA) type questions carrying 5 marks each.
- vii. In Section E - Question Number 36 to 38 are case study based questions carrying 4 marks each where 2VSA type questions are of 1 mark each and 1 SA type question is of 2 marks. Internal choice is provided in 2 marks question in each case-study.
- viii. There is no overall choice. However, an internal choice has been provided in 2 questions in Section-B, 3 questions in Section-C, 2 questions in Section-D and 2 questions in Section-E.
- ix. Use of calculators is NOT allowed.

SECTION A

(Multiple Choice Questions)

Each question carries 1 mark.

Select the correct options out of the four given options:

1.

If $A = \{1, 2, 3, 4\}$, then the number of subsets of set A is

- (a) 8 (b) 15 (c) 16 (d) 20

2.

If $n(A - B) = 5$, $n(B - A) = 3$, $n(A \cap B) = 10$, then $n(B)$ is

- (a) 10 (b) 13 (c) 18 (d) 23.

3.

If $n \in \mathbb{N}$, then the value of $(-\sqrt{-1})^{4n+3}$ is equal to

- (a) -i (b) i (c) 0 (d) 1

4.

If $A = \{a, b\}$ and $B = \{x, y, z\}$, then the number of relations from A to B is

- (a) 8 (b) 16 (c) 32 (d) 64

5.

If $z = 3 - 4i$, then the modulus of z is equal to

- (a) 5 (b) 9 (c) 16 (d) 25

6.

The domain of the function $f(x) = \sqrt{x-1} + \sqrt{3-x}$ is

- (a) (1,3) (b) [1,3] (c) [1,3] (d) (1,3]

7.

The value of $\cot^2 \frac{\pi}{6} + \operatorname{cosec} \frac{5\pi}{6} + 3 \tan^2 \frac{\pi}{6}$ is equal to

- (a) 0 (b) 2 (c) 4 (d) 6

8.

The value of $\operatorname{cosec}(-1410^\circ)$ is equal to

- (a) -2 (b) -1 (c) 2 (d) 3

9.

If x is a real number and $|x| < 5$, then

- (a) $x \geq 5$ (b) $-5 < x < 5$ (c) $x \leq -5$ (d) $-5 \leq x \leq 5$

10.

The value of $9^{1/3} \times 9^{1/9} \times 9^{1/27} \times \dots$ to ∞ is equal to

- (a) 1 (b) 3 (c) 9 (d) 27.

11. If the line through $(3, y)$ and $(2, 7)$ is parallel to the line through $(-1, 4)$ and $(0, 6)$, then

The value of y is equal to

- (a) -10 (b) -9 (c) 9 (d) 10

12. If $(x - iy)(3 + 5i)$ is the conjugate of $-6 - 24i$, then the real values of x and y are

- (a) $x = 1, y = -3$ (b) $x = 3, y = -3$
 (c) $x = -1, y = -3$ (d) $x = -3, y = -3$

13. If $\lim_{x \rightarrow 3} \frac{x^n - 3^n}{x - 3} = 108$ and $n \in \mathbb{N}$, then the value of n is equal to

- (a) 4 (b) 6 (c) 8 (d) 10

14. If $f(x) = 2x^3 - 9x^2 + 12x + 9$, then the value of $f'(1)$ is equal to

- (a) -1 (b) 0 (c) 1 (d) 2

15. The number of 6-digit numbers that can be formed by using the digits 1, 2, 1, 2, 0, 2 is

- (a) 40 (b) 50 (c) 60 (d) 70

16. If $y = \frac{\cos x}{1 + \sin x}$, then the value of $\frac{dy}{dx}$ is equal to

- (a) $\frac{-1}{1 + \sin x}$ (b) $1 + \sin x$ (c) $\frac{-1}{1 + \cos x}$ (d) $1 + \cos x$

17. If seven persons are to be seated in a row, then the probability that two particular persons are seated next to each other is

- (a) $\frac{1}{7}$ (b) $\frac{2}{7}$ (c) $\frac{3}{7}$ (d) $\frac{4}{7}$

18. The mean deviation about median of the following data: 3, 6, 11, 12 and 18 is

- (a) 4.2 (b) 5.2 (c) 6.4 (d) 11

Assertion-Reason Based questions

In the following questions 19 and 20, a statement of Assertion(A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices:

- (a) Both (A) and (R) are true and (R) is the correct explanation of (A).
 (b) Both (A) and (R) are true and (R) is not the correct explanation of (A).
 (c) (A) is true and (R) is false.
 (d) (A) is false but (R) is true.

19. Assertion(A): Number of diagonals of a 11 sided polygon is 44.

Reason (R): Number of straight lines that can be drawn out of non-collinear points is ${}^n C_2 - n$.

20. Assertion (A): If 5th, 8th and 11th term of a G.P. are a, b and c respectively, then $b^2 = ac$.

Reason(R): In a G.P., $a_n = \sqrt{a_{n-k} \times a_{n+k}}$, $n, k \in N$. (a)

SECTION-B

This section comprises of Very Short Answer (VSA) type questions of 2 marks each.

21. Find the coordinates of points on y-axis which are at a distance of $5\sqrt{2}$ from the point P (3, -2, 5).

22. Prove that: $\sin^2 6x - \sin^2 4x = \sin 2x \sin 10x$.

Or

If $\alpha + \beta = \frac{\pi}{4}$, prove that: $\tan \alpha + \tan \beta + \tan \alpha \tan \beta = 1$.

23. Express the complex number $(1 + i)^6 + (1 - i)^3$ in the form $a + ib$.

24. Three dice are thrown simultaneously. Find the probability of getting a total of at least 6.

Or

A letter is chosen at random from the word 'ASSASSINATION'. Find the probability that letter is (i) a vowel (ii) a consonant.

25. If $y = \sqrt{x} + \frac{1}{\sqrt{x}}$, prove that $2x \frac{dy}{dx} + y = 2\sqrt{x}$.

SECTION - C

This section comprises of Short Answer (SA) type questions carrying 3 marks each.

26. For any sets A and B, show that: (i) $(A \cap B) \cup (A - B) = A$ (ii) $A \cup (B - A) = A \cup B$.

27. Prove that: $\sin x + \sin 3x + \sin 5x + \sin 7x = 4 \cos x \cos 2x \sin 4x$.

Or

Prove that: $\left(1 + \cos \frac{\pi}{8}\right) \left(1 + \cos \frac{3\pi}{8}\right) \left(1 + \cos \frac{5\pi}{8}\right) \left(1 + \cos \frac{7\pi}{8}\right) = \frac{1}{8}$.

28. How many words, with or without meaning, each of 2 vowels and 3 consonants can be formed from the letters of the word DAUGHTER?

29. How many litres of water will have to be added to 1125 litres of the 45% solution of acid so that the resulting mixture will contain more than 25% but less than 30% acid content?

Or

Find all pairs of consecutive odd natural numbers, both of which are larger than 10, such that their sum is less than 40.

30. Evaluate: (i) $\lim_{x \rightarrow 0} \frac{1 - \cos 5x}{1 - \cos 6x}$ (ii) $\lim_{x \rightarrow 2} \frac{x^3 - 4x^2 + 4x}{x^2 - 4}$.

Or

Evaluate: (i) $\lim_{x \rightarrow 0} \frac{2 \sin x - \sin 2x}{x^3}$ (ii) $\lim_{x \rightarrow 1} \frac{x-1}{\log x}$.

31. Two cards are drawn at random from a pack of 52 cards. What is probability that the cards are either both aces or both black cards?

SECTION - D

This section comprises of Long Answer (LA) type questions carrying 5 marks each.

32. Prove that: $\cos 6x = 32 \cos^6 x - 48 \cos^4 x + 18 \cos^2 x - 1$

Or

Prove that: $\tan x + \tan \left(\frac{\pi}{3} + x\right) - \tan \left(\frac{\pi}{3} - x\right) = 3 \tan 3x$.

33. Find the mean, variance and standard deviation for the following frequency distribution:

Classes	0-10	10-20	20-30	30-40	40-50
Frequencies	5	8	15	16	6

34. If A (1,4), B (2, -3) and C (-1, -2) are the vertices of a triangle ABC, find the equation of the median and the altitude through vertex A.

35. The ratio of the A.M. and G.M. of two positive numbers a and b , is $m:n$. Show that $a:b = (m + \sqrt{m^2 - n^2}) : (m - \sqrt{m^2 - n^2})$.

Or

Let S be the sum, P the product and R the sum of reciprocals of n terms in a G.P. Prove that

$$P^2 = \left(\frac{S}{R}\right)^n.$$

SECTION - E

This section comprises of 3 case study/passage-based questions of 4 marks each with two sub-parts. First two case study questions have three sub-parts (I), (II), (III) of marks 1, 1, 2 respectively. The third case study question has two sub-parts (I) and (II) of marks 2 each.

36. Given two non-empty sets $A = \{x: x < 4, x \in \mathbf{N}\}$ and $B = \{x: x \leq 2, x \in \mathbf{W}\}$

Based on the above information, answer the following questions:

- (I) Write $A \times B$ as a set of ordered pairs.
 (II) A relation R from A to B is defined by
 $R = \{(x, y): x - y = 1, x > y, x \in A, y \in B\}$. Find R .
 (III) Find $(A \cup B) \times (A \cap B)$.

Or

- (III) Find domain and range of R .

37. An arch in the form of a semi-ellipse. It is 8m wide and 2m high at the centre.
 Based on the above information, answer the following questions:

- (I) Find the length of major axis.
 (II) Find the length of minor axis.
 (III) Find the coordinates of the foci and the eccentricity.

Or

- (III) Find the equation of directrices and the length of latus rectum.

38. A mathematics teacher taught the topic Binomial Theorem in class XI of a School. She was explaining the concept of the relation of power and number of terms in a binomial expansion. She asked some questions to the students regarding the same.

Based on the concept of Binomial Theorem, answer the following questions:

- (I) Find the expansion of $(x^2 + 2y)^6$.
- (II) Using binomial theorem, evaluate $(98)^5$.