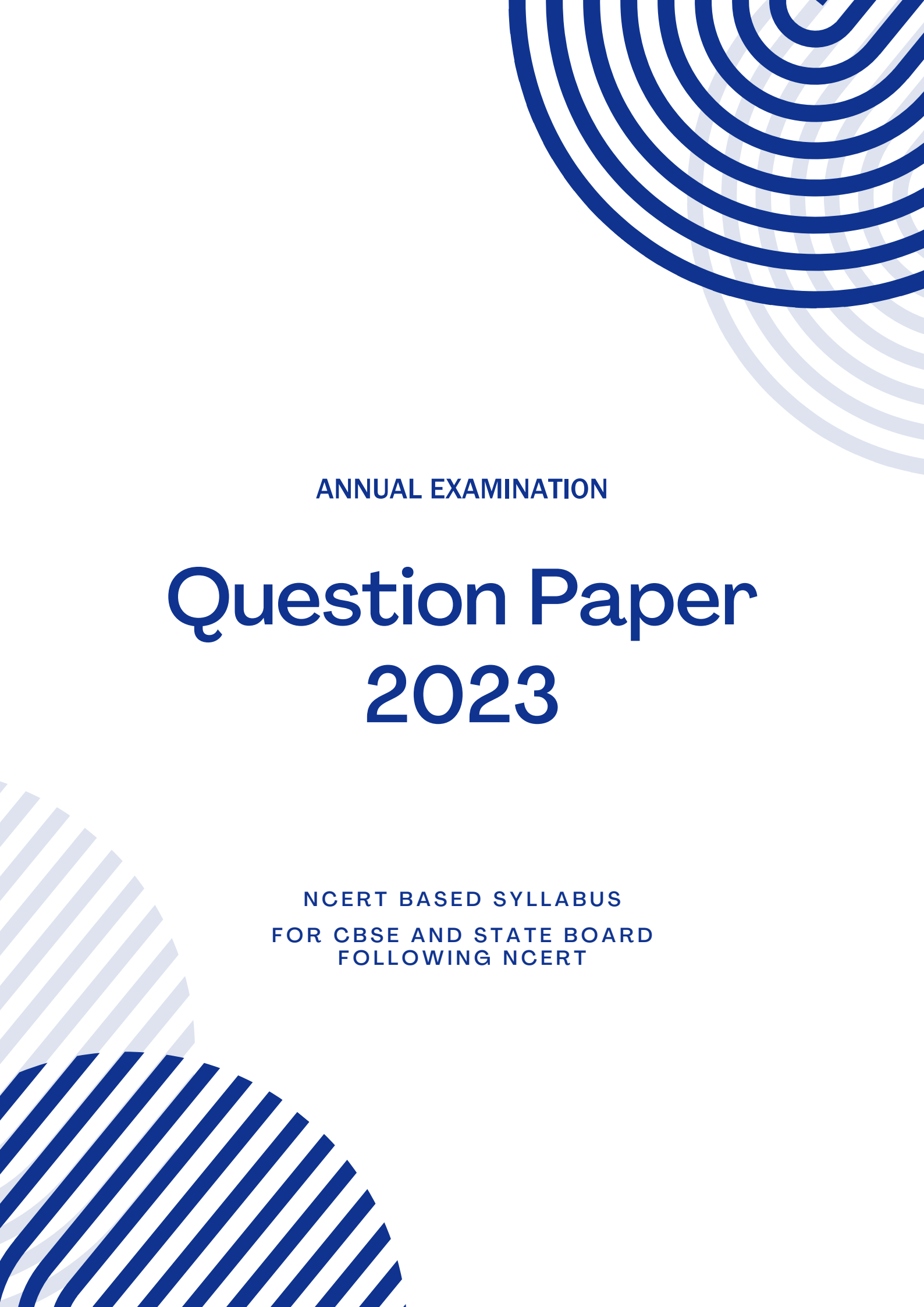




ANNUAL EXAMINATION

Question Paper 2023

NCERT BASED SYLLABUS
FOR CBSE AND STATE BOARD
FOLLOWING NCERT

Class - XI
Time - 3 Hours

Subject - Mathematics
Maximum Marks - 80

General Instructions:

1. This question paper contains - five sections A, B, C, D and E. Each section is compulsory. However, there are internal choices in some questions.
2. Section A has 18 MCQ's and 2 Assertion Reason based questions of 1 mark each.
3. Section B has 5 Very Short Answer (VSA) type questions of 2 marks each.
4. Section C has 6 Short Answer (SA) type questions of 3 marks each.
5. Section D has 4 long answer (LA) type questions of five marks each.
6. Section E has 3 source based / case based / passage-based / integrated units of assessment (4 marks each) with sub-parts.

SECTION - A

(Multiple Choice Questions)

Each question carries 1 mark

1. Two finite sets have m and n elements. The number of elements in the power set of first set is 56 more than the total number of elements in the power set of second set. then the values of 'm' and 'n' are respectively :
(a) 6 and 3 (b) 3 and 6 (c) 4 and 5 (d) 5 and 4
2. Let F_1 be the set of all parallelograms, F_2 be the set of all rectangles, F_3 be the set of all rhombuses, F_4 be the set of all squares and F_5 be the set of all trapeziums in a plane. Then F_1 may be equal to :
(a) $F_2 \cap F_3$ (b) $F_3 \cap F_4$ (c) $F_2 \cup F_3$ (d) $F_2 \cup F_3 \cup F_4 \cup F_1$
3. A relation R is defined from set $\{2, 3, 4, 5\}$ to set $\{3, 6, 7, 10\}$ by :
 $(x, y) \in R \Leftrightarrow x$ is relatively prime to y then the domain of R is :
(a) $\{2, 3, 5\}$ (b) $\{3, 5\}$ (c) $\{2, 3, 4, 5\}$ (d) $\{2, 3, 4\}$
4. Let $R = \{(x, y) : x, y \in Z, y = 2x - 4\}$. If $(a, -2)$ and $(4, b^2) \in R$ then find the values of a and b .
(a) $a = 1, b = 2$ (b) $a = -1, b = -2$ (c) $a = 2, b = \pm 1$ (d) $a = 1, b = \pm 2$
5. If $f(x) = \frac{x-1}{x+1}, x \neq -1$, then find the value of $f(f(x))$.
(a) $\frac{1}{x}$ (b) $-\frac{1}{x}$ (c) 0 (d) None of the above
6. Find the range of the real valued function $f(x) = \frac{4-x}{x-4}$
(a) $R - \{4\}$ (b) $\{4\}$ (c) $\{-1\}$ (d) $R - \{-1\}$

7. The radian measure corresponding to the degree measure $-37^{\circ}30'$ is :

- (a) $\left(\frac{5\pi}{24}\right)^c$ (b) $-\left(\frac{5\pi}{24}\right)^c$ (c) $\left(\frac{8\pi}{22}\right)^c$ (d) $-\left(\frac{8\pi}{22}\right)^c$

8. A horse is tied to a post by a rope . If the horse moves along a circular path always keeping the rope tight and describes 88metres when it has traced out 72° at the centre , then the length of the rope is :

- (a) 70metres (b) 80metres (c) 75metres (d) 65metres

9. If $a \cos x + b \sin x = m$ and $a \sin x - b \cos x = n$, then :

- (a) $a^2 - b^2 = m^2 + n^2$ (b) $a^2 - b^2 = m^2 - n^2$ (c) $a^2 + b^2 = m^2 - n^2$ (d) $a^2 + b^2 = m^2 + n^2$

10. If α and β are acute angles such that $\tan \alpha = \frac{m}{m+1}$ and $\tan \beta = \frac{1}{2m+1}$, then :

- (a) $\alpha + \beta = \frac{\pi}{3}$ (b) $\alpha + \beta = \frac{\pi}{6}$ (c) $\alpha + \beta = \frac{\pi}{4}$ (d) $\alpha + \beta = \frac{\pi}{2}$

11. The solution of the quadratic equation $25x^2 - 30x + 11 = 0$ is :

- (a) $\frac{3}{5} \pm \frac{\sqrt{2}}{5}i$ (b) $\frac{2}{5} \pm \frac{\sqrt{3}}{5}i$ (c) $\frac{2}{5} \pm \frac{\sqrt{2}}{5}i$ (d) $\frac{3}{5} \pm \frac{\sqrt{3}}{5}i$

12. The solution of the inequality : $1 \leq |x-2| \leq 3$ is :

- (a) $x \in [-2,1] \cup [2,5]$ (b) $x \in [-1,1] \cup [3,5]$ (c) $x \in [-1,2] \cup [3,6]$ (d) $x \in [-2,0] \cup [2,5]$

13. A solution is to be kept between $30^{\circ}C$ and $35^{\circ}C$, then the range of temperature in degree Fahrenheit is :

- (a) Between $82^{\circ}F$ and $96^{\circ}F$ (b) Between $84^{\circ}F$ and $92^{\circ}F$
(c) Between $86^{\circ}F$ and $95^{\circ}F$ (d) Between $84^{\circ}F$ and $98^{\circ}F$

14. The total number of terms in the expansion of $(x+a)^{100} + (x-a)^{100}$ after simplification is :

- (a) 100 (b) 50 (c) 51 (d) 202

15. If the points $(a,0)$, $(0,b)$ and (x,y) are collinear , then :

- (a) $\frac{x}{a} + \frac{y}{b} = 0$ (b) $\frac{x}{a} - \frac{y}{b} = 0$ (c) $\frac{x}{a} - \frac{y}{b} = 1$ (d) $\frac{x}{a} + \frac{y}{b} = 1$

16. The distance between the parallel lines : $3x - 4y + 9 = 0$ and $6x - 8y - 15 = 0$ is :

- (a) $\frac{11}{10}$ units (b) $\frac{22}{10}$ units (c) $\frac{33}{10}$ units (d) $\frac{44}{10}$ units

17. The image of the point $(-5,4,-3)$ along xz plane is :

- (a) $(-5,4,-3)$ (b) $(-5,-4,-3)$ (c) $(5,-4,3)$ (d) $(5,4,3)$

18. If a plane is parallel to yz plane, then it is perpendicular to :

- (a) x - axis (b) y - axis (c) z - axis (d) None of the above

(ASSERTION - REASON BASED QUESTIONS)

In the following questions a statement of **Assertion (A)** is followed by a statement of **Reason (R)**. Choose the correct answer out of the following choices.

- Both A and R** are true and **R** is the correct explanation of **A**.
- Both A and R** are true, but **R** is not the correct explanation of **A**.
- A** is true, but **R** is false.
- A** is false, but **R** is true.

19. **Assertion (A)** : $33!$ is divisible by 2^{15} .

Reason (R) : 15 is the largest integer n such that $33!$ is divisible by 2^n .

20. **Assertion (A)** : A and B are two events associated with the random experiment, then the probability of occurrence of neither A nor B is $1 - P(A \cup B)$.

Reason (R) : $P(A' \cap B') = 1 - P(A \cup B)$.

SECTION - B

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

21. If $5({}^4P_r) = 6({}^5P_{r-1})$, then find the value of ' r '.

22. Find the value of $(0.99)^5$ by using the first three terms of its expansion.

OR

If a and b are distinct integers, then prove that $a^n - b^n$ is divisible by $a - b$, where $n \in \mathbb{N}$

23. If p is the length of the perpendicular from the origin to the line $\frac{x}{a} + \frac{y}{b} = 1$, then prove that $\frac{1}{p^2} = \frac{1}{a^2} + \frac{1}{b^2}$.

OR

Transform the equation of the line : $\sqrt{3}x + y - 8 = 0$

(I) to intercept form and find intercepts on the coordinate axes.

(II) to slope intercept form and find its slope.

24. Determine the point in XY plane which is equidistant from three points $A(2, 0, 3)$, $B(0, 3, 2)$ and $C(0, 0, 1)$.

25. Differentiate the given function with respect to x : $f(x) = \frac{ax^2 + bx + c}{\sqrt{x}}$.

SECTION - C

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

26. Prove that : $\tan\left(\frac{\pi}{3} + x\right) \tan\left(\frac{\pi}{3} - x\right) = \frac{2 \cos 2x + 1}{2 \cos 2x - 1}$.

OR

Prove that : $\frac{\sec 8x - 1}{\sec 4x - 1} = \frac{\tan 8x}{\tan 2x}$.

27. Solve the system of inequalities :

$$\frac{x}{2x+1} \geq \frac{1}{4} \text{ and } \frac{6x}{4x-1} < \frac{1}{2}$$

28. If α and β are different complex numbers with $|\beta|=1$, then find the value of : $\left| \frac{\beta - \alpha}{1 - \overline{\alpha}\beta} \right|$

OR

If $a + ib = \frac{c+i}{c-i}$, where c is real, then prove that : $a^2 + b^2 = 1$ and $\frac{b}{a} = \frac{2c}{c^2 - 1}$.

29. If one geometric mean G and two arithmetic means A_1 and A_2 be inserted between two given quantities, then prove that $G^2 = (2A_1 - A_2)(2A_2 - A_1)$.

30. For the curve : $16x^2 + 25y^2 = 400$, find : $(\frac{1}{2} \times 6 = 3)$

- (i) the coordinates of foci.
- (ii) the coordinates of vertices.
- (iii) the length of major axis.
- (iv) the length of minor axis.
- (v) the eccentricity.
- (vi) the length of latus rectum.

31. Calculate the mean deviation about the median for the following distribution :

x_i	10	15	20	25	30	35	40	45
f_i	7	3	8	5	6	8	4	9

SECTION - D

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

32. The sum of three numbers in G.P. is 56. If we subtract 1, 7, 21 from these numbers in that order we obtain an arithmetic progression. Find the numbers.

OR

If in an A.P. the sum of ' m ' terms is equal to n and the sum of ' n ' terms is equal to m , then prove that the sum of $(m+n)$ terms is $-(m+n)$. Also find the sum of first $(m-n)$ terms ($m > n$).

33. (i) An equilateral triangle is inscribed in the parabola $y^2 = 4ax$ whose vertex is at the vertex of the parabola. Find the length of its side. (3)

(ii) Find the centre and radius of the circle: $x^2 + y^2 + 6x - 4y + 4 = 0$ (2)

34. (i) If $\lim_{x \rightarrow -a} \left[\frac{x^9 + a^9}{x + a} \right] = 9$, then find the real values of ' a '. (2)

(ii) Using the First principle, prove that the differentiation of $\operatorname{cosec} x$ with respect to x is: $-\operatorname{cosec} x \cot x$ (3)

35. (i) Find the probability that the birth days of six different persons will fall in exactly two calendar months.

(ii) Three letters are dictated to three persons and an envelope is addressed to each of them, the letters are inserted into the envelopes at random so that each envelope contains one letter. Find the probability that at least one letter is in its proper envelope. (3+2=5)

OR

Four cards are drawn at random from a pack of 52 playing cards.

Find the probability of getting:

(1 × 5 = 5)

- (i) all the four cards of the same suit .
- (ii) all the four cards of the same number .
- (iii) two red cards and two black cards .
- (iv) all the four cards of the same color .
- (v) all are face cards .

SECTION - E

This section comprises of 3 case - study / passage-based questions of 4 marks each with sub - parts. Marks allotted for each sub questions are indicated.

Case - Study 1: Read the following passage and answer the questions given below.

36. In a town of 10,000 families, it was found that 40% families buy newspaper A, 20% families buy newspaper B and 10% families buy newspaper C. 5% families buy newspapers A and B, 3% families buy newspapers B and C and 4% families buy newspapers A and C. If 2 % families buy all the three newspapers, then:

- (i) Find the number of families that who buy newspaper B only? (2)
- (ii) Find the number of families that who buy atleast two newspapers? (1)
- (iii) Find the number of families that who buy exactly one newspaper? (1)

37. **Case - Study 2:** Read the following passage and answer the questions given below.

Suppose that you are a representative of your class comprising of 9 girls and 8 boys (including you also). Your class teacher has assigned you a task of forming a team of 12 students for conducting morning assembly. In how many ways you can form a team such that:

- (i) the girl are in majority . (2)
- (ii) the boy are in majority . (2)

38. **Case - Study 3:**

The following table represents the marks obtained by the students of class X in half yearly examination. Study the following table and answer the questions given below:

Marks obtained	20-30	30-40	40-50	50-60	60-70	70-80	80-90
Number of students	3	6	13	15	14	5	4

- (i) Calculate the mean marks obtained by the students. (1)
- (ii) Using nearest integral value of mean, calculate the variance for the given data. (2)
- (iii) Calculate the standard deviation for the given data. (1)

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