



B.K. BIRLA CENTRE FOR EDUCATION

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



ANNUAL EXAMINATION (2025-26) MATHEMATICS (041): SET 2

Class: XI
Date: 23-02-26
Admission no:

Time: 3hrs
Max Marks: 80
Roll no:

General instructions:

1. The 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 02 Assertion-Reason based questions of 1 mark each.
3. Section B has 5 very short (VSA)- type questions of 2 marks each.
4. Section C has 6 short (SA)- type questions of 3 marks each.
5. Section D has 4 long (LA)- type questions of 5 marks each.
6. Section E has 3 source based/case-based questions of 4 marks each

SECTION A (20 X 1= 20)

1. Value of $\cot 570^\circ$ is:

- (a) $\sqrt{3}$ (b) $\frac{1}{\sqrt{3}}$ (c) $-\sqrt{3}$ (d) None of these

2. The real value of θ for which $\frac{1+i\cos\theta}{1-2i\cos\theta}$ is a real number is:

- (a) $n\pi + \frac{\pi}{4}$ (b) $2n\pi + \frac{\pi}{2}$ (c) $n\pi + \frac{\pi}{2}$ (d) None of these

3. Let $A = \{x: x \in \mathbb{R}, x > 6\}$ and $B = \{x: x \in \mathbb{R}, x < 9\}$. Then $A \cap B =$:

- (a) $(7, 8]$ (b) $(7, 8)$ (c) $[7, 8)$ (d) None of these

4. A line passes through $(2, 2)$ and is perpendicular to the line $3x + y = 3$. Its intercept is:

- (a) $\frac{1}{3}$ (b) $\frac{2}{3}$ (c) 1 (d) None of these

5. The solution set of $2(2x + 3) - 10 < 6(x - 2)$ is:

- (a) $(4, \infty)$ (b) $(-\infty, 4)$ (c) $[4, \infty)$ (d) None of these

6. Latus rectum of the parabola $y^2 = 8x$ is:

- (a) 2 (b) 4 (c) 6 (d) None of these

7. If $f(x) = \frac{1}{2 - \sin 3x}$, then the range of f is:

- (a) $[-1, 1]$ (b) $[-\frac{1}{3}, \frac{1}{3}]$ (c) $[\frac{1}{3}, 1]$ (d) None of these

8. The angle in radians through which a pendulum swings if its length is 80 cm and the arc length is 20 cm is:

- (a) $\frac{1}{4}$ (b) $\frac{2}{25}$ (c) $\frac{3}{25}$ (d) None of these

9. The derivative of $\left(\frac{x}{2} + \frac{2}{x}\right)$ is:

- (a) $\frac{1}{2} + \frac{2}{x^2}$ (b) $\frac{1}{2} - \frac{2}{x^2}$ (c) $\frac{x}{2} - \frac{2}{x^2}$ (d) None of these

10. Find the sum of the digits in the unit place of all the numbers formed with the help of 3, 4, 5 and 6 taken all at a time is:

- (a) 432 (b) 108 (c) 36 (d) None of these

11. The mean deviation about the mean of the following distribution is:

Size	20	21	22	23	24
Frequency	6	4	5	1	4

- (a) 1.25 (b) 1 (c) 1.50 (d) None of these

12. Let $f(x) = |x - 2|$. Then,

- (a) $f(x^2) = [f(x)]^2$ (b) $f(x + y) = f(x)f(y)$ (c) $f(|x|) = |f(x)|$ (d) None of these

13. The probability that when a hand of 7 cards is drawn from a well-shuffled deck of 52 cards, it contains all kings is:

- (a) $\frac{2}{7735}$ (b) $\frac{1}{7735}$ (c) $\frac{3}{7753}$ (d) None of these

14. The number of terms in the expansion of $(4 + 4x + x^2)^{20}$, when expanded in descending powers of x , is:

- (a) 20 (b) 21 (c) 40 (d) None of these

15. The value of $\lim_{x \rightarrow 2} \frac{x^3 - 8}{x - 2}$ is equal to:

- (a) 10 (b) 11 (c) 12 (d) None of these

16. Four geometric means between 3 and 96 are:

- (a) 6, 12, 24, 48 (b) 6, 10, 24, 48 (c) 6, 10, 40, 48 (d) None of these

17. Let A, B, C be the feet of the perpendiculars drawn from a point $P(1, 2, 5)$ on the xy -, yz - and zx -planes respectively.

The distances of the points A, B and C from point P (in units) respectively are:

- (a) 5, 2, 4 (b) 3, 4, 5 (c) 5, 1, 4 (d) None of these

18. Mean and standard deviation of 100 items are 50 and 4, respectively.

The sum of the squares of the items is:

- (a) 25000 (b) 251600 (c) 26000 (d) None of these

ASSERTION-REASON BASED QUESTIONS

In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:

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

19.

Assertion (A): The set $\{x: x \text{ is a month of a year not having 30 days}\}$ in roster form is $\{\text{January, February, March, May, July, August, October, December}\}$.

Reason (R): A collection of objects is called a set.

20.

Assertion (A): If 5th and 8th terms of a G.P. are 48 and 384 respectively, then the common ratio of the G.P. is 2.

Reason (R): If 18, x , 14 are in A.P., then $x = 16$.

SECTION B (5 X 2 =10)

21. Evaluate: $\left[i^{18} + \left(\frac{1}{i} \right)^{25} \right]^3$

OR

For any two complex numbers z_1 and z_2 , prove that $\text{Re}(z_1 z_2) = \text{Re}(z_1)\text{Re}(z_2) - \text{Im}(z_1)\text{Im}(z_2)$.

22. The water acidity in a pool is considered normal when the average pH reading of three daily measurements is between 8.2 and 8.5.

If the first two pH readings are 8.48 and 8.35, find the range of pH value for the third reading that will result in the acidity level being normal.

23. Given that $N = \{1, 2, 3, \dots, 100\}$, then:

(a) Write the subset A of N, whose elements are odd numbers.

(b) Write the subset B of N, whose elements are represented by $x + 2$, where $x \in \mathbb{N}$.

24. Using the Binomial Theorem, find the value of $(0.98)^{14}$ correct to four decimal places.

OR

Expand the expression: $\left(\frac{2}{x} - \frac{x}{2} \right)^5$.

25. Define a relation R on the set N of natural numbers by

$$R = \{(x, y): y = x + 3, x \text{ is a prime number less than 8}, x, y \in \mathbb{N}\}.$$

Depict this relationship using roster form. Write down the domain and range.

SECTION C (6 X 3 =18)

26. Find the value of the expression:

$$3 \left[\sin^4 \left(\frac{3\pi}{2} - \alpha \right) + \sin^4(3\pi + \alpha) \right] - 2 \left[\sin^6 \left(\frac{\pi}{2} + \alpha \right) + \sin^6(5\pi - \alpha) \right].$$

27. A side of an equilateral triangle is 20 cm long second equilateral triangle is inscribed in it by joining the midpoints of the sides of the first triangle. Find the perimeter of the sixth inscribed equilateral triangle.

28 . Let

$A = \{1, 2\}, B = \{1, 2, 3, 4\}, C = \{5, 6\}$ and $D = \{5, 6, 7, 8\}$. Verify that : (i) $A \times (B \cap C) = (A \times B) \cap (A \times C)$.
 (ii) $A \times C \subseteq B \times D$.

29. Solve the inequality

$$\frac{3x - 4}{2} \geq \frac{x + 1}{4} - 1.$$

Also, represent the solution set on the number line.

OR

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

30. There are 230 students in a school.

80 play football, 42 play soccer, and 12 play rugby.

32 play exactly two sports and 4 play all three sports.

How many students play none of the sports?

31. Find the equation of the circle passing through the points $(4, 1)$ and $(6, 5)$, whose centre lies on the line $4x + y = 16$.

OR

Find the equation of the ellipse whose major axis lies along the x-axis and which passes through the points $(4, 3)$ and $(-1, 4)$.

SECTION D (4 X 5 =20)

32. Find the value of: (a) $\cot 105^\circ$, (b) $\cot 15^\circ$.

33. The mean and standard deviation of some data for the time taken to complete a test are calculated with the following results: Number of observations = 25, Mean = 18.2 seconds, Standard deviation = 3.25 seconds. Further, another set of 15 observations x_1, x_2, \dots, x_{15} is now available and it is given that:

$$\sum_{i=1}^{15} x_i = 279 \text{ and } \sum_{i=1}^{15} x_i^2 = 5524.$$

Calculate the standard deviation based on all 40 observations.

34. How many terms of the G.P. $\frac{3}{2}, \frac{3}{4}, \dots$ are required to obtain a sum of $\frac{3069}{512}$?

OR

Find the sum of the sequence 7, 77, 777, 7777, ...up to n terms.

35. Evaluate the following limits:

(i) $\lim_{x \rightarrow 1} \frac{x^{15} - 1}{x^{10} - 1}$ (ii) $\lim_{x \rightarrow 0} \frac{\sqrt{1+x} - 1}{x}$

OR

Evaluate the following limits:

(i) $\lim_{x \rightarrow 0} \frac{\sin 4x}{\sin 2x}$ (ii) $\lim_{x \rightarrow 0} \frac{\tan x}{x}$

SECTION E (3 X 4 =12)

36. Case-Study 1

One card is drawn from a well-shuffled deck of 52 cards. Each outcome is equally likely.

- (A) Find the probability that the card drawn is a heart.
- (B) Find the probability that the card drawn is a black card.
- (C) Find the probability that the card drawn is an ace of spades.

OR

If E and F are events such that $P(E) = \frac{7}{15}$, $P(F) = \frac{1}{2}$ and $P(E \cap F) = \frac{1}{8}$, find $P(E \cup F)$.

37. Case-Study 2

Truss bridges are formed with a structure of connected elements that form triangular structures to make up the bridge.

Trusses are the triangles that connect the top and bottom chord and two endpoints. Consider the $\triangle ABC$ with vertices $A(1, 4)$, $B(2, -3)$, and $C(-1, -2)$.

- (A) Find the slope of BC.
- (B) Find the slope of AC.
- (C) Find the distance between A and C.

OR

Find the distance of the point $(4, -6)$ from the line $4x - 5y - 32 = 0$.

38. Case-Study 3

The word MONDAY consists of 6 distinct letters. Such arrangements of letters are useful in forming different words, codes, and passwords. Based on this information, answer the following questions:

(A) How many words (with or without meaning) can be formed using 4 letters at a time from the letters of the word MONDAY, assuming no letter is repeated?

(B) How many words can be formed using all the letters of the word MONDAY, assuming no letter is repeated?

(C) How many words can be formed using all the letters of MONDAY, if the first letter must be a vowel?

OR

How many words can be formed using all the letters of MONDAY, if the first letter must be a consonant?

*******ALL THE BEST*******