



**BK BIRLA CENTRE FOR EDUCATION**  
SARALA BIRLA GROUP OF SCHOOLS  
SENIOR SECONDARY CO-ED DAY CUM BOYS' RESIDENTIAL SCHOOL



**MID TERM EXAMINATION (2024-25)**

**MATHEMATICS (041)**

Class: XI Science  
Date: 14/09/24  
Admission Number: \_\_\_\_\_

Duration: 3 Hour  
Max. Marks: 80  
Roll number: \_\_\_\_\_

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 02 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 5 marks each.
6. Section E has 3 source based/case based/passage based/integrated units of assessment of 4 marks each with sub-parts.

**Section –A (Multiple Choice Questions)**

Each question carries 1 mark

- 1 Let  $Z$  denote the set of all integers and  $A = \{(a, b) : a^2 + 3b^2 = 28, a, b \in Z\}$ ,  
 $B = \{(a, b) : a > b, a, ab \in Z\}$ , then the number of elements in  $A \cap B$   
(A) 2 (B) 3 (C) 6 (D) 5
- 2 If  $A - B = B - A$ , then,  
(A)  $A \subseteq B$  (B)  $B \subseteq A$  (C)  $A = B$  (D) None of these
- 3 The length of interval  $(-\infty, \infty)$  is  
(A) 0 (B)  $-\infty$  (C)  $\infty$  (D) none of these
- 4 If  $(3a+5, 5-b) = (8, -2)$ , then  
(A)  $a=1, b=3$  (B)  $a=1, b=4$  (C)  $a=1, b=\frac{3}{2}$  (D)  $a=1, b=7$
- 5 If  $A = \{1, 2, 4\}$ ,  $B = \{2, 4, 5\}$ ,  $C = \{2, 5\}$  then  $(A - B) \times (B - C)$   
(A)  $\{(1, 2), (1, 5), (2, 5)\}$  (B)  $\{(1, 4)\}$  (C)  $\{(1, 5)\}$  (D) none of these
- 6 Let  $n(A) = m$  and  $n(B) = n$ , then the total number of non-empty relations that can be defined from  $A$  to  $B$  is  
(A)  $m^n$  (B)  $n^m - 1$  (C)  $mn - 1$  (D)  $2^{mn} - 1$
- 7 Find the radian of given degree measure  $330^\circ$

- (A)  $\frac{13\pi}{6}$                       (B)  $\frac{7\pi}{6}$                       (C)  $\frac{5\pi}{6}$                       (D)  $\frac{11\pi}{6}$
- 8 Find the degree measure of given radian  $-\frac{5\pi}{2}$   
 (A)  $-430^\circ$                       (B)  $-450^\circ$                       (C)  $-420^\circ$                       (D)  $-470^\circ$
- 9 If  $\tan\theta = -\frac{4}{3}$ , then  $\sin\theta$  is  
 (A)  $-\frac{4}{5}$  but not  $\frac{4}{5}$                       (B)  $-\frac{4}{5}$  or  $\frac{4}{5}$                       (C)  $\frac{4}{5}$  but not  $-\frac{4}{5}$                       (D)  $-\frac{3}{4}$  or  $\frac{3}{4}$
- 10 If  $x, y \in R$  then  $x+iy$  is a non-real complex number, if  
 (A)  $x=0$                       (B)  $y=0$                       (C)  $x \neq 0$                       (D)  $y \neq 0$
- 11 Write the additive inverse of  $-5+4i$ .  
 (A)  $5-4i$                       (B)  $5+4i$                       (C)  $-5-4i$                       (D)  $-5+4i$
- 12 If  $a+ib = c+id$ , then  
 (A)  $a^2+c^2=0$                       (B)  $b^2+c^2=0$                       (C)  $b^2+d^2=0$                       (D)  $a^2+b^2 = c^2+d^2$
- 13 If  $-3x+17 < -13$ , then  
 (A)  $x \in (10, \infty)$                       (B)  $x \in [10, \infty)$                       (C)  $x \in (-\infty, 10]$                       (D)  $x \in [-10, 10)$
- 14 If  $|x| > 5$ , then  $x$  belongs to  
 (A)  $(-\infty, -5)$                       (B)  $(5, \infty)$                       (C)  $(-\infty, -5) \cup (5, \infty)$                       (D) none of these
- 15 The set of all values of  $x$  satisfying  $-\frac{2}{3} < 1 - \frac{x}{3} \leq \frac{2}{3}$   
 (A)  $\{x: -1 \leq x < 3, x \in R\}$                       (B)  $\{x: 1 \leq x < 5, x \in R\}$   
 (C)  $\{x: -1 \leq x < 5, x \in R\}$                       (D) none of these
- 16  $n!(n+2)$  is equal to  
 (A)  $(n+3)!$                       (B)  $(n+1)!$                       (C)  $n!+(n+1)!$                       (D) None of these
- 17  $(2 \times 3)!$  Is equal to  
 (A)  $2!+3!$                       (B)  $2! \div 3!$                       (C)  $2! \times 3!$                       (D) None of these
- 18 If  $(n+2)! = 2550xn!$  Then the value of  $n$  is  
 (A) 48                      (B) 49                      (C) 50                      (D) 51

**Assertion and Reasoning questions: In the following two questions, 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 but R is false.  
 (D) A is false but R is true.

- 19 Assertion (A): The relation R in a set  $A = \{1,2,3,4,5\}$  defined by  $R = \{(x, y) : 5x = y\}$  have the domain =  $\{1,2,3,4,5\}$  and range =  $\{5,10,15,20,25\}$   
Reason (R): Domain and range of relation (R) is respectively the set of all first and second entries of the distinct ordered pair of the relation.
- 20 Assertion (A): If  $a, b, c \in R - \{0\}$ , then at least one  $ax^2+bx+c=0$ ,  $bx^2+cx+a=0$  and  $cx^2+ax+b=0$  has imaginary roots.  
Reason (R): If  $a, b, c \in R$ ,  $a \neq 0$ , then imaginary roots of the equation  $ax^2+bx+c=0$  occurs in conjugate pair.

### Section – B

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

- 21 On the real line, if  $A = [0,2]$  and  $B = [1,3]$ , then find  $A \cup B$  and  $A \cap B$ .
- 22 Let  $R = \{(x, y) : x \text{ and } y \text{ are integers and } xy = 6\}$ , then write R in roster form.
- 23 Prove that  $2\sin^2\frac{\pi}{6} + \operatorname{cosec}^2\frac{7\pi}{6} \cos^2\frac{\pi}{3} = \frac{3}{2}$

**OR**

Find the value of  $\sin 75^\circ$

- 24 If  $(a+b) - i(3a+2b) = 5 + 2i$ , then find a and b.

**OR**

Convert  $\frac{1+7i}{(2-i)^2}$  into standard form

- 25 Solve :  $\frac{5-2x}{3} \leq \frac{x}{6} - 5$ .

### Section – C

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

- 26 Two finite sets have m and n elements. The total number of subsets of first set is 112 more than the total number of subsets of the second set. Find the value of m and n.
- 27 If  $A = \{2,3,4\}$ ,  $B = \{3,4,5\}$ ,  $C = \{2,4,5\}$  and  $D = \{3,5,6\}$  then verify that  $(A \times B) \cap (C \times D) = (A \cap C) \times (B \cap D)$ .
- 28 If  $5\sin x = -3$ , x lies in 3<sup>rd</sup> quadrant, then find the value of  $\frac{\sec x - \tan x}{\sec x + \tan x}$ .

**OR**

Find the degree measure of  $\frac{11}{15}$  radians.

- 29 If  $\frac{(a^2+1)^2}{2a-i} = x+iy$ , then find the value of  $x^2+y^2$ .

**OR**

Find the value of x and y, if  $\frac{(1+i)x-2i}{3+i} + \frac{(2-3i)y+i}{3-i} = i$

- 30 Solve for real values of  $x$ :  $\frac{2x-3}{4} + 9 \geq 3 + \frac{4x}{3}$
- 31 In how many ways can 5 people be seated in a car with two people in front seat and three in the rear, if two particular persons out of the five cannot drive.

**Section –D**

**[This section comprises of long answer type questions (LA) of 5 marks each]**

- 32 Draw the Venn diagrams to illustrate the following relationship among sets, E, M and U, where E is the set of students studying English in a school, M is the set of students studying Mathematics in the same school, U is the set of all students in that school.
- i) All the students who study Mathematics study English, but some students who study English do not study Mathematics.
- ii) There is no students who studies both Mathematics and English.
- 33 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 88m, when it has traced out  $54^\circ$  at the centre. Find the length of the rope.

**OR**

Prove that  $\tan 75^\circ + \cot 75^\circ = 4$ .

- 34 The longest side of a triangle is twice the shortest side and the third side is 2cm longer than the shortest side. If the perimeter of the triangle is more than 166cm, then find the minimum length of the shortest side.
- 35 How many non-zero numbers can be formed using the digits 0, 1,2,3,4 and 5 if repetition of digits is not allowed?

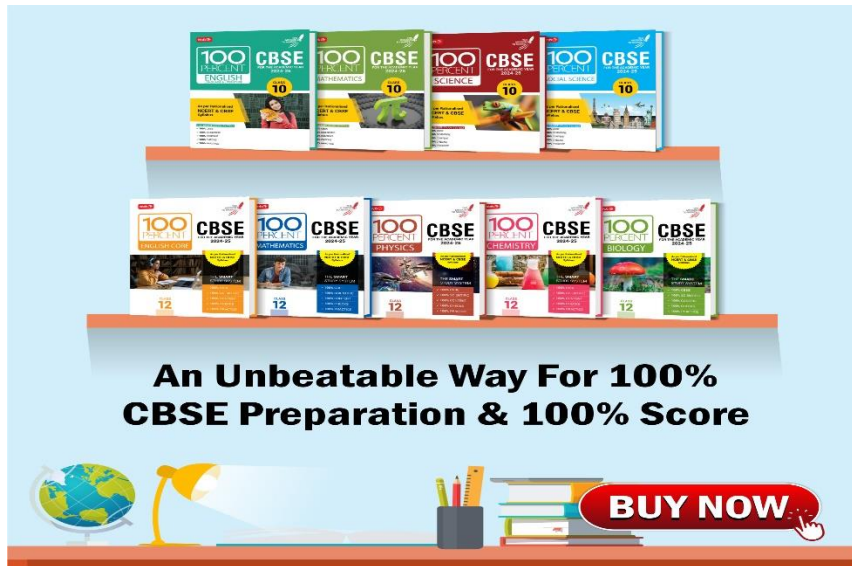
**OR**

Find  $n$ , if  $\frac{(2n)!}{7!(2n-7)!} : \frac{n!}{4!(n-4)!} = 24:1$ .

**Section –E**

**[This section comprises of 3 case- study/passage based questions of 4 marks each with sub parts. The all three case study questions have three sub parts (i), (ii), (iii) of marks 1, 1, 2 respectively.**

- 36 There are 60 employees who work for MTG Learning Media Pvt. Ltd., out of which 25 are women. Also: i) 28 employees are married, ii) 26 employees are graduate, iii) 20 married employees are graduate of which are men, iv) 15 are graduates, v) 15 are married. On the basis of above information answer the following questions.



- A) How many unmarried women are graduate?
- B) How many unmarried women work in the company?
- C) How many graduate men are unmarried?

37 Ram made a cubical box by folding metal sheet, the side of cubical box is  $x$  cm. Let  $y$  be the volume of the box. Then, based on the given information, answer the following questions.



- A) Write the function represents the given situation?
- B) Domain of the given function?
- C) Range of the given function?

38 Two complex numbers  $Z_1 = a+ib$  and  $Z_2 = c+id$  are said to be equal, if  $a=c$  and  $b=d$ . On the basis of above information answer the following questions.

## Complex number

$$z = \underbrace{a}_{\substack{\text{Real} \\ \text{part}}} + \underbrace{ib}_{\substack{\text{Imaginary} \\ \text{part}}}$$

- A) If  $(3a-6)+2ib = -6b + (6+a)i$  then what is the value of  $a$  and  $b$ .
- B) If  $(2a+2b)+i(b-a) = i4$ , then find the values  $a$  and  $b$ .
- C) If  $\left(\frac{1-i}{1+i}\right)^{100} = a+ib$ , then find the values of  $a$  and  $b$ .

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