BK BIRLA CENTRE FOR EDUCATION

SARALA BIRLA GROUP OF SCHOOLS
SENIOR SECONDARY CO-ED DAY CUM BOYS' RESIDENTIAL SCHOOL

MID-TERM EXAMINATION 2023-24

MATHEMATICS (041)

Class : 11 sc.   Duration: 3 Hrs
Date   : 11/10/23   Max. Marks: **80**
Admission No.:   Roll No.:

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. For any two sets A and B, $(A-B) \cup (B-A) =$
    a) $(A-B) \cup A$ b) $(B-A) \cup B$ c) $(A \cup B)-(A \cap B)$ d) $(A \cup B) \cap (A \cap B)$

2. If $A \cap B = B$, then
    a) $A \subseteq B$ b) $B \subseteq A$ c) $A = \emptyset$ d) $B = \emptyset$

3. For any two sets A and B, $A \cap (A \cup B)'$
    a) A   b) B   c) $\emptyset$ d) $A \cap B$

4. If $f(x) = \log(\frac{1+x}{1-x})$, then $f(\frac{2x}{1+x^2})$ is equal to:
    a) $\{f(x)\}^2$ b) $\{f(x)\}^3$ c) $2f(x)$ d) $3f(x)$

5. The range of the function $f(x) = \frac{x^2-x}{x^2+2x}$ is
    a) R   b) R-$\{1\}$ c) R-$\left\{-\frac{1}{2}, 1\right\}$ d) None of these

6. If $x \neq 1$ and $f(x) = \frac{x+1}{x-1}$ is a real function, then $f(f(f(2)))$ is
    a) 1   b) 2   c) 3   d) 4

7. The value of $\tan x \sin(\frac{\pi}{2}+x)\cos(\frac{\pi}{2}-x)$ is
    a) 1   b) -1   c) $\frac{1}{2}\sin 2x$ d) None of these

8. The value $\tan x \tan(\frac{\pi}{3}-x)\tan(\frac{\pi}{3}+x)$ is
    a) Cot3x   b) 2cot3x   c) tan3x   d) 3 tan3x

9. The value of $\frac{1-tan^2 15°}{1+tan^2 15°}$ is
    a) 1   b) $\sqrt{3}$ c) $\frac{\sqrt{3}}{2}$ d) 2

10. The value of $(1+i)(1+i^2)(1+i^3)(1+i^4)$ is
    a) 2   b) 0   c) 1   d) i

11. The principal value of the amplitude of $(1+i)$ is
    a) $\frac{\pi}{4}$ b) $\frac{\pi}{12}$ c) $\frac{3\pi}{4}$ d) π

12. If a= 1+i , then a^2 equals
    a) 1-i   b) 2i   c) (1+i)(1-i)   d) i-1
13. If x is a real number and $|x| < 5$, then
    a) x≥5   b) -5<x<5   c) x≤-5   d) -5≤x≤5
14. The number of five digit telephone numbers having at least one of their digits repeated is
    a) 90000   b) 100000   c) 30240   d) 69760
15. The number of different signals which can be given from 6 flags of different colours taking one or more at a time is
    a) 1958   b) 1956   c) 16   d) 64
16. Total number of words formed by 2 vowels and 3 consonants taken from 4 vowels and 5 consonants is equal to
    a) 60   b) 120   c) 7200   d) None of these
17. The term without x in the expansion of $(2x - \frac{1}{2x^2})^{12}$ is
    a) 495   b) -495   c) -7920   d) 7920
18. The coefficient of x^{-17} in the expansion $\left(x^4 - \frac{1}{x^3}\right)^{15}$ is
    a) 1365   b) -1365   c) 3003   d) -3003

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.

(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. Observe the following statements.

    Assertion: A: The general solution of **sinx=−1** is **nπ+ (−1)ⁿ** $\frac{3\pi}{2}$

    Reason: R: The principal value of **sinx=k** lies in **[−π/2,π/2].**

20. Observe the following statements.
    Assertion: 51 × 52 × 53 × 54 × 55 × 56 × 57 × 58 is divisible by 40320
    Reason: The product of r consecutive natural numbers is always divisible by r!

SECTION B

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

21. Let A = {3,6,12,15,18,21} and B= {4,8,12,16,20} find: A-B.
22. Find x and y, if (x+3, 5) = (6, 2x+y).

OR

    Let f: R→R be given by f(x) = x^2+3, find $\{x: f(x) = 28\}$
23. Find the value of $\sin\frac{\pi}{12}$.

OR

    Find the value of $\tan\frac{13\pi}{12}$.
24. In how many ways 5 rings of different types can be worn in four fingers?
25. Find the number of terms in the expansion of $(2x-3y)^9$?

SECTION C

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

26. If A and B are two sets and U is the universal set such that n(U)=700, n(A) = 200, n(B)=300 and n(A∩B)=100. Find n(A'∩B').

27. Find the range of f(x)= $|x - 3|$.

OR

If R is the relation "less than" from A={1,2,3,4,5} to B={1,4,5}, write down the set of ordered pairs corresponding to R.

28. Prove that: $\frac{sin5x+sin3x}{cos5x+cos3x}$ = tan4x

OR

Find the value of cot 570°.

29. Express i^9 +i^{19} in the form of a+ib.

OR

Find the real values of x and y, if: (x+iy)(2-3i)= 4+i

30. If $^9P_5$ +5. $^9P_4$ =$^{10}P_r$, find r.

31. Find a, if 17th and 18th terms in the expansion of $(2+a)^{50}$ are equal.

SECTION D

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

32. In an University, out of 100 students 15 offered Mathematics only: 12 offered Statistics only: 8 offered Physics only: 40 offered Physics and Mathematics; 20 offered Physics and Statistics: 10 offered Mathematics and statistics: 65 offered Physics. Find the number of the students who (i) offered Mathematics (ii) offered Statistics (iii) did not offer any of the above three subjects.

33. Prove that: (cosx+cosy)² + (sinx –siny)² = 4cos² ($\frac{x+y}{2}$).

OR

Prove that: cot4x (sin5x+sin3x) = cotx (sin5x-sin3x)

34. Solve the following in equation: $\frac{5x-2}{3}$ $\frac{7x-3}{5}$ > $\frac{x}{4}$.

OR

Solve 5x-3< 3x+1 when (i) x is a real, (ii) x is integer number, (iii) x is a natural number.

35. What is the number of ways of choosing 4 cards from a pack of 52 playing cards? In how many of these (i) four cards of the same suit? (ii) four cards belong to four different suit?

SECTION E

[This section comprises of 3 case- study/passage based questions of 4 marks each with sub parts. The 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 of 2 marks each.)

36. During the mathematics class, a teacher clears the concept of permutation and combination to the 11TH standard students. After the class he asks the students some questions, one of the question was in how many ways numbers between 99 and 1000 (both excluding) can be formed such that

1. Every digit is either 3 or 7

(a) 8 ways   (b) 2 ways   (c) 27 ways   (d) 16 ways

2. There is no restriction

(a) 1000 ways   (b) 900 ways   (c) 800 ways   (d) 700 ways

3. No digit is repeated

(a) 684 ways   (b) 600 ways   (c) 648 ways   (d) 720 ways

37. Ordered pairs the ordered pair of two elements a and b is ordered by (a, b); a is first element (or first component) and b is second element (or second component). Two ordered pair are equal if their corresponding elements are equal i.e. (a,b)=(c,d) implies that a=c and b=d. Cartesian product of two sets for two non-empty sets A and B, the Cartesian product AxB is the set of all ordered pairs of elements from sets A and B. In symbolic form it can be written as AxB= $\{a, b; a \in A \ and \ b \in B\}$. Based on the above information answers the following questions.
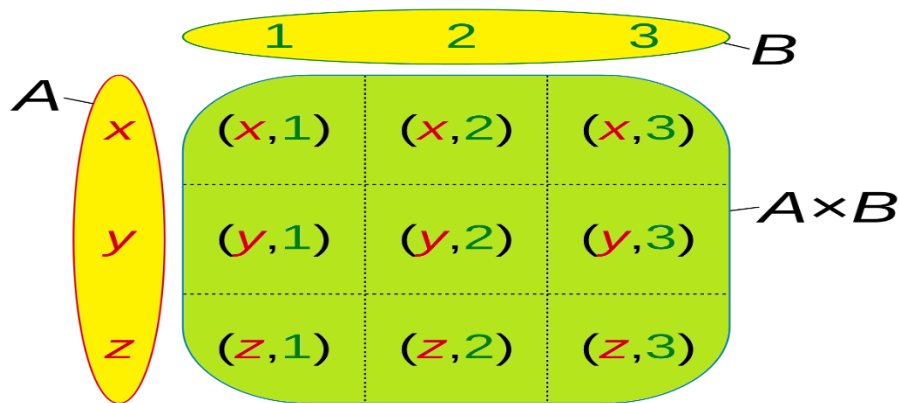
1. If (a-3,b+7) =(3,7) then the value of a and b are:

     a) 6,0   b) 3,7   c) 7,0   d) 3,-7

2. If (x+6,y-2) =(0,6), then the values of x and y are:

     a) 6,8   b) -6,-8   c) -6,8   d) 6,-8

3. Let a and B are two sets such that AxB consists of 6 elements. If three elements of AxB are (1,4);(2,6);(3,6) then :

     a) AxB =BxA   b) AxB= $\{(1,4); (1,6); (2,4)\}$ c) AxB≠BxA   d) None of these

38. In a survey of 100 students, the number of students studying the various languages were found to be: English only 18, English but not Hindi 23, English and German 8, English 26, German 48, German and Hindi 8, no languages 24. On the basis of above information find the following cases:

1. Find the number of students who were studying Hindi.
   a) 10   b) 15   c) 18   d)20
2. Find the number of students who were studying English and Hindi.
   a) 1   b) 2   c)3   d) 4
3. Find the number of studying who were studying English, Hindi and German.
   a) 1   b)3   c)2   d)4

_____ End of Paper_____