



विद्या सर्वार्थ साधिका

ANANDALAYA  
PERIODIC TEST -2  
Class : XI

Subject: Mathematics  
Date : 23-09-2022

M.M: 80  
Time: 3Hours

General Instructions:

1. This question paper contains two parts A and B. Each part is compulsory. Part A carries 24 marks and Part B carries 56 marks.

2. Part-A has Objective Type Questions and Part -B has Descriptive Type Questions

3. Both Part A and Part B have choices.

Part – A:

1. It consists of two sections- I and II.

2. Section I comprises of 16 very short answer- type questions.

3. Section II contains 2 case studies. Each case study comprises of 5 case-based MCQs. An examinee is to attempt any 4 out of 5 MCQs.

Part – B:

1. Question No 19 to 28 are Very short answer Type questions

2. Question No 29 to 35 are Short Answer Type questions of 3 marks each

3. Question No 36 to 38 are Long Answer Type questions of 5 marks each.

PART A

SECTION -I

All questions are compulsory. In case of internal choices attempt any one.

1 a) Find the union of the following pair of sets : (1)

$P = \{x : x \in N \text{ and } 1 < x \leq 5\}$ ,  $Q = \{x : x \in N \text{ and } 3 < x \leq 7\}$

(A)  $\{x \in N : 2 \leq x \leq 7\}$

(B)  $\{x \in N : 1 < x \leq 7\}$

(C)  $\{x \in N : 1 \leq x < 7\}$

(D)  $\{x \in N : 2 \leq x < 7\}$

OR

b) Which one of the following is an empty set?

(A)  $\{\phi\}$

(B)  $\{x: x \text{ is even prime number}\}$

(C)  $\{x: x \in R, \text{ and } x^2 = -1\}$

(D)  $\{x: x \in Z \text{ and } -1 < x < 1\}$

2 a) 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 \_\_\_\_\_ (1)

(A)  $2^{mn}$

(B)  $n^m - 1$

(C)  $mn - 1$

(D)  $2^{mn} - 1$

OR

b) Consider the function  $y = f(x)$  given by  $\{(x, y): x = 10y\}$ , find the image of  $x = 0.1$ .

(A) -10

(B) 0.01

(C)  $\frac{1}{10}$

(D) 100

3 Find the real values of  $x$  and  $y$ , if  $(1 - i)x + (1 + i)y = 1 - 3i$ . (1)

(A)  $x = 2, y = 1$

(B)  $x = 2, y = -1$

(C)  $x = -2, y = -1$

(D)  $x = -2, y = 1$

4 Solve for  $x : \frac{5-2x}{3} \leq \frac{x}{6} - 5$ . (1)

(A)  $x \geq 8$

(B)  $x \leq 8$

(C)  $x > 8$

(D)  $x \geq 40$

5 The value of  $\sin 15^\circ =$  \_\_\_\_\_ (1)

(A)  $\frac{\sqrt{3}-1}{4}$

(B)  $\frac{\sqrt{3}+1}{2\sqrt{2}}$

(C)  $\frac{\sqrt{3}-1}{2\sqrt{2}}$

(D)  $\frac{\sqrt{3}-1}{\sqrt{2}}$

6 Find the value of  $\tan 720^\circ - \sin 270^\circ - \sin 150^\circ \cos 120^\circ$  (1)

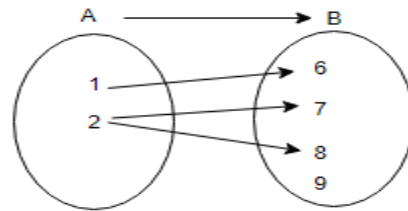
(A)  $-\frac{5}{4}$

(B)  $\frac{5}{4}$

(C)  $\frac{1}{4}$

(D)  $\frac{3}{2}$

- 7 a) Find the value of  $\sin^2 \frac{5\pi}{6} + \cos^2 \frac{\pi}{3} - \tan^2 \frac{\pi}{4}$  (1)  
 (A)  $-\frac{1}{2}$  (B) 1 (C)  $\frac{1}{2}$  (D)  $-\frac{1}{4}$   
**OR**  
 b) If  $\sin\theta + \cos\theta = 0$  and  $\theta$  lies in the fourth quadrant, find  $\sec^2\theta$ .  
 (A)  $\frac{1}{2}$  (B) 1 (C) 2 (D) 4
- 8 Simplify  $z = i^{107} + i^{112} + i^{117} + i^{122}$ , where  $i = \sqrt{-1}$ . (1)  
 (A) 1 (B) -1 (C) 0 (D)  $i$
- 9 If  $\frac{1}{6!} + \frac{1}{7!} = \frac{k}{8!}$ , find k. (1)
- 10 a) List all the elements of the set  $\{x : x \in Z, |x| < 3\}$ . (1)  
**OR**  
 b) Express the following set in roster form.  $A = \left\{x : x = \frac{n^2-1}{n^2+1}, n \in N \text{ and } n < 5\right\}$
- 11 a) Let  $A = \{-2, -1, 0, 1, 2\}$  and  $B = \{0, 1, 3\}$  Find the subset of  $A \times B$  corresponding to the relation  $R : x > y$ . (1)  
**OR**  
 b) Range of the function  $f(x) = \frac{x}{x+2}$  is \_\_\_\_\_
- 12 How many three digit numbers can be formed without using the digits 0, 3, 5, 7, 9. The repetition of digits is not allowed. (1)
- 13 Solve the in-equation:  $5x - 3 < 7$ , when  $x \in W$ . (1)
- 14 From the given arrow diagram, find whether the relation from A to B is a function or not? Justify. (1)



- 15 Find the conjugate of  $\frac{1}{3+4i}$  in the standard form. (1)
- 16 If  $4P_2 = n \times 4C_2$ , find n. (1)

### SECTION -II

Both the Case study based questions are compulsory. Attempt any 4 sub parts from each question (17 and 18). Each question carries 1 mark.

- 17 **Azadi Ka Amrit Mahotsav** is an initiative of the Government of India to celebrate and commemorate 75 years of independence of **INDIA** and the glorious history of its people, culture and achievements. After the school programme, Mathematics teacher gave a task to the students of Class XI.



- i) How many different words can be formed with the letters of the word **INDIA**? (1)  
 (A) 50 (B) 60 (C) 40 (D) 120

- ii) Of all permutations of the letters of the word **INDIA** are arranged as in dictionary, 13<sup>th</sup> word is (1)
- \_\_\_\_\_ (A) DAIIN (B) INDIA (C) DIAIN (D) DAINI
- iii) How many words can be formed starting with the letter D? (1)
- (A) 13 (B) 15 (C) 12 (D) 25
- iv) 49<sup>th</sup> word will be \_\_\_\_\_ (1)
- (A) NIADI (B) NIDIA (C) NAIDI (D) NADII
- v) 60<sup>th</sup> word will be \_\_\_\_\_ (1)
- (A) NDIAI (B) NIDIA (C) NIIDA (D) NDAII

18.

In a survey of 100 students in a music school the number of students learning different music instruments was found to be: Guitar 28, Violin 30, Flute 42, Guitar and Violin 8, Guitar and Flute 10, Violin and Flute 5, all musical instruments 3. Based on the above information, answer the following.



- i) How many students were learning Guitar and Violin? (1)
- (A) 10 (B) 8 (C) 5 (D) 3
- ii) How many students were learning at least one of the instruments? ie  $n(A \cup B \cup C)$  (1)
- (A) 20 (B) 100 (C) 80 (D) 70
- iii) How many students were learning Guitar only? (1)
- (A) 16 (B) 10 (C) 15 (D) 13
- iv) How many students were learning Flute only? (1)
- (A) 32 (B) 30 (C) 25 (D) 27
- v) How many students were not learning any of the instruments? (1)
- (A) 20 (B) 18 (C) 22 (D) 27

### PART B

All questions are compulsory. In case of internal choices attempt any one.

- 19 If  $z_1 = 1 - i$  and  $z_2 = -2 + 4i$  then find  $im\left(\frac{z_1 z_2}{z_1}\right)$  (2)
- 20 If  $R = \left\{(x, y) : x, y \in N, y = \frac{1}{1+x}, x \text{ is odd natural number}\right\}$ , write  $R$  in Roster form and find the range of  $R$ . (2)
- 21 a) Show that :  $\frac{\sin 135^\circ - \cos 120^\circ}{\sin 135^\circ + \cos 120^\circ} = 3 + 2\sqrt{2}$ . (2)
- OR**
- b) Prove that :  $\cos\theta + \cos\left(\frac{2\pi}{3} + \theta\right) + \cos\left(\frac{4\pi}{3} + \theta\right) = 0$
- 22 a) Let  $f = \{(1,1), (2,3), (0,-1), (-1,-3)\}$  be a function from  $Z \rightarrow Z$  defined by  $f(x) = ax + b$ , for some integers  $a, b$ . Determine  $a$  and  $b$ . (2)
- OR**
- b) If  $A = \{x : x \in W, x < 2\}$ ,  $B = \{x : x \in N, 1 < x < 5\}$ ,  $C = \{3, 5\}$  find  
 (i)  $A \times (B \cap C)$  (ii)  $A \times (B \cup C)$
- 23 The letters of the word HARYANA are arranged in a line, How many different arrangements are possible? How many of these start with H and end with N? (2)

- 24 If  $U = \{1,2,3,4,\dots,12\}$ ,  $A = \{x: x = 2n + 1, n \leq 5, n \in N\}$  and  $B = \{x: x \text{ is a prime number}, 3 \leq x \leq 10\}$ . Find  $A^c$ ,  $B^c$ ,  $(A^c \cap B^c)$  (2)
- 25 a) A and B are two sets such that  $n(A) = 4$  and  $n(B) = 7$ . Find  
(i) minimum value of  $n(A \cup B)$  (ii) Maximum value of  $n(A \cup B)$ . (2)
- OR**
- b) If X and Y are two sets such that X has 50 elements,  $X \cup Y$  has 70 elements and  $X \cap Y$  has 15 elements. How many elements does Y has? (2)
26. Show that :  $\frac{\sin 85^\circ + \sin 35^\circ}{\cos 85^\circ + \cos 35^\circ} = \sqrt{3}$  (2)
- 27 Find the multiplicative inverse of  $-1 + \sqrt{3}i$  in the  $x + iy$  form. (2)
28. Find the number of different 8-letter arrangements that can be made from the letters of the word DAUGHTER so that:  
(i) all vowels occur together. (ii) beginning with D and ending with R (2)
- 29 a) If  $\left(\frac{1+i}{1-i}\right)^3 - \left(\frac{1-i}{1+i}\right)^3 = a + ib$ . Find  $a - b$ . (3)
- OR**
- b) Show that:  $(x + 1 + i)(x + 1 - i)(x - 1 + i)(x - 1 - i) = x^4 + 4$
- 30 Prove that :  $\left[1 + \cot\alpha - \sec\left(\frac{\pi}{2} + \alpha\right)\right]\left[1 + \cot\alpha + \sec\left(\frac{\pi}{2} + \alpha\right)\right] = 2 \cot\alpha$  (3)
- 31 a) Let  $A = \{-2, -1, 0, 1, 2\}$  and  $f: A \rightarrow Z$  given by  $f(x) = x^2 - 2x - 3$ .  
(i) Find the range of  $f$   
(ii) pre- images of 6, -3 and 5. (3)
- OR**
- b) If the function  $f: R \rightarrow R$  defined by  $f(x) = \begin{cases} x + 2, & x < 1 \\ 0, & x = 1 \\ x - 2, & x > 1 \end{cases}$   
Find the value of  $\frac{f(3) - f(-3) + f(1) + f(\sqrt{2})}{f(0)}$ .
- 32 Solve the system of in-equations:  $3x - 7 < 5 + x$ ,  $11 - 5x \leq 1$ . (3)
- 33 Prove that :  $\frac{\sin(\alpha + \beta) - 2 \sin \alpha + \sin(\alpha - \beta)}{\cos(\alpha + \beta) - 2 \cos \alpha + \cos(\alpha - \beta)} = \tan \alpha$ . (3)
- 34 How many of the natural numbers from 1 to 1000 have none of their digits repeated? (3)
- 35 If  $U = \{x: x \in Z \text{ and } -3 \leq x \leq 5\}$ ,  $A = \{x: x \in W \text{ and } x^2 - 4x + 3 = 0\}$ ,  
 $B = \{x: x \in Z \text{ and } -1 < x \leq 4\}$ ,  $C = \{x: x \in Z \text{ and } x^2 \leq 4\}$ .  
Find i)  $(A \cup B)^c$  ii)  $(A \cup C)^c$  iii) Verify  $(A \cup B)^c = A^c \cap B^c$  (3)
- 36 a) Find the values of  $\sin \frac{x}{2}$ ,  $\cos \frac{x}{2}$  and  $\tan \frac{x}{2}$ , if  $\sin x = -\frac{1}{2}$ , where  $x$  lies in IV<sup>th</sup> quadrant. (5)
- OR**
- If  $\cos \theta = \frac{-3}{5}$ , when  $\theta$  lies in the third quadrant, evaluate:  $\frac{\operatorname{cosec} \theta + \cot \theta}{\sec \theta - \tan \theta}$
- 37 A committee of 12 is to be formed from 9 women and 8 men. In how many ways this can be done if at least five women have to be included in a committee? In how many of these committees (i) the women are in majority (ii) the men are in majority? (5)
- 38 If  $f = \left\{ \left( x, \frac{x^2}{1+x^2} \right) \right\}$  be a function from R into R. Determine the domain and range of  $f$ . (5)