

**Directorate of Education, GNCT of Delhi**  
**Practice Paper**  
**(Mid Term )**  
**(2026-27)**  
**Class – XI**  
**Mathematics (Code: 041)**

**Time: 3 Hours**

**Maximum Marks: 80**

**General Instructions :**

- This Question paper contains - Five sections A,B,C,D,E. Each section is compulsory. However, there are internal choices in some questions.
- Section A has 18 MCQ's and 02 Assertion-Reason based questions of 1 mark each(20 Marks )
- Section B has 5 Very Short Answer (VSA)-type questions of 2 marks each(10 Marks )
- Section C has 6 Short Answer (SA)-type questions of 3 marks each(18 Marks )
- Section D has 4 Long Answer (LA)-type questions of 5 marks each(20 Marks )
- Section E has 3 Source based/Case based/passage based/integrated units of assessment (4 marks each) with sub parts(12 Marks )

**Section A**

(Question number 1 – 18 are of MCQ type questions of one mark each.)

1. If  $A \cap B = B$ , then

|                   |                   |
|-------------------|-------------------|
| (a) $A \subset B$ | (b) $B \subset A$ |
| (c) $A = \phi$    | (d) $B = \phi$    |

2. Let  $n(A) = 3$  and  $n(B) = 2$ , then the total number of non-empty relations that can be defined from set A to set B is:

|       |        |
|-------|--------|
| (a) 7 | (b) 15 |
| (c) 3 | (d) 63 |

**3: The value of  $\sin(45^\circ + \theta) - \cos(45^\circ - \theta)$  is:**

|                            |                            |
|----------------------------|----------------------------|
| (a) $\sqrt{2} \cos \theta$ | (b) $\sqrt{2} \sin \theta$ |
| (c) 1                      | (d) 0                      |

**4: If X and Y are two sets and  $X'$  denote the complement of X, then  $X \cap (X \cup Y)'$  is equal to:**

|            |                |
|------------|----------------|
| (a) X      | (b) Y          |
| (c) $\phi$ | (d) $X \cap Y$ |

**5: Value of  $1 + i^2 + i^4 + i^6 + \dots + i^{2026}$  is:**

|        |       |
|--------|-------|
| (a) 0  | (b) 1 |
| (c) -1 | (d) i |

**6: If x is a real number and  $|x - 2| < 5$ , then**

|                 |                  |
|-----------------|------------------|
| (a) $7 < x < 3$ | (b) $-7 < x < 3$ |
| (c) $3 < x < 7$ | (d) $-3 < x < 7$ |

**7. If domain of a function  $f(x) = \sqrt{7 - x}$  is restricted to real numbers, then what is the maximum value x can take?**

|        |                |
|--------|----------------|
| (a) -7 | (b) $\sqrt{7}$ |
| (c) 7  | (d) 0          |

**8. A convex polygon has 44 diagonals. What is the number of its sides?**

|       |        |
|-------|--------|
| (a) 9 | (b) 10 |
| (c)   | (d)    |

**9. The value of  $\cos 120^\circ + \sin 210^\circ$  is:**

|         |        |
|---------|--------|
| (a) 0.5 | (b) 0  |
| (c) 1   | (d) -1 |

**10. If  ${}^nC_{25} = {}^nC_{14}$  then  ${}^nC_1$  is equal to:**

|        |        |
|--------|--------|
| (a) 11 | (b) 14 |
| (c) 25 | (d) 39 |

**11. If  $-3x + 17 < -13$  then**

|                           |                          |
|---------------------------|--------------------------|
| (a) $x \in (10, \infty)$  | (b) $x \in [10, \infty)$ |
| (c) $x \in (-\infty, 10]$ | (d) $x \in [-10, 10)$    |

**12.  $2\sqrt{-9} \times \sqrt{-16}$  is equal to:**

|        |         |
|--------|---------|
| (a) 24 | (b) -24 |
| (c) 48 | (d) -48 |

**13. The maximum value of  $5(\cos x) + 7$  is:**

|       |       |
|-------|-------|
| (a) 5 | (b) 9 |
| (c) 7 | (d) 3 |

**14. If  $x$  is a natural number and  $5 - x > 2$ , then  $x \in$ :**

|                          |                   |
|--------------------------|-------------------|
| (a) $\{3, 4, 5, \dots\}$ | (b) $\{4, 2, 3\}$ |
| (c) $\{3\}$              | (d) $\{1, 2\}$    |

**15. The multiplicative inverse of  $4 + 3i$  is:**

|                                      |                                     |
|--------------------------------------|-------------------------------------|
| (a) $\frac{4}{25} + \frac{3}{25}i$   | (b) $\frac{-4}{25} + \frac{3}{25}i$ |
| (c) $\frac{-4}{25} + \frac{-3}{25}i$ | (d) $\frac{4}{5} - \frac{3i}{25}$   |

**16. If  $[x]^2 - 5[x] + 6 = 0$  where  $[.]$  denote the greatest integer function, then**

|                    |                    |
|--------------------|--------------------|
| (a) $x \in [3, 4]$ | (b) $x \in (2, 3]$ |
| (c) $x \in [2, 3]$ | (d) $x \in [2, 4)$ |

**17. Which of the following set builder form represents the set  $A = \{3, 6, 9, 12\}$ ?**

|                                          |                                                  |
|------------------------------------------|--------------------------------------------------|
| (a) $A = \{x : x = 3n, x \in N\}$        | (b) $A = \{x : x = 3(n-1), n \in N\}$            |
| (c) $A = \{x : x = 3n, n \in N, n < 4\}$ | (d) $A = \{x : x = 3(n-1), n \in N, 1 < n < 6\}$ |

**18. The number of possible outcomes when a coin is tossed 6 times is:**

|        |        |
|--------|--------|
| (a) 36 | (b) 64 |
| (c) 12 | (d) 32 |

### Assertion-Reason Based Questions

**Note:** For questions 19 and 20, 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. Assertion (A):** The range of function  $f(x) = \sin 5x + \cos 5x$  is  $[-\sqrt{2}, \sqrt{2}]$ .

**Reason (R):** for all  $\theta \in R$ ,  $-1 \leq \sin \theta \leq 1$ .

|                                                                  |                                                                      |
|------------------------------------------------------------------|----------------------------------------------------------------------|
| (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.                                        |

**20. Assertion (A):** Set  $\{1,2,3,4\}$  and  $\{3,2,5,1\}$  are equal sets.

**Reason (R):** Two sets A and B are said to be equal if they have exactly the same elements.

|                                                                  |                                                                      |
|------------------------------------------------------------------|----------------------------------------------------------------------|
| (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.                                        |

### **Section B**

**(This section contains 5 very short answer (VSA) type questions of 2 marks each.)**

**21. (a)** For any two sets A and B, prove that  $(A \cap B) \cup (A - B) = A$

**OR**

**(b)** Write set  $A = \{x : x^2 + 7|x| + 6 = 0, x \in \mathbb{R}\}$  in roaster form and list all the subsets of set A.

**22. Prove that:**  $(\cos x + \cos y)^2 + (\sin x - \sin y)^2 = 4 \cos^2 \left( \frac{x+y}{2} \right)$ .

**23. (a)** If  $x + iy = \frac{a+ib}{a-ib}$  prove that  $x^2 + y^2 = 1$

**OR**

**(b)** Express  $\left( \frac{1}{3} + 3i \right)^3$  in the form  $a + ib$ .

**24. How many 3-digit numbers can be formed from the digits 1, 2, 3, 4 and 5 assuming that:**

**(i)** repetition of the digits is allowed?

**(ii)** repetition of the digits is not allowed?

**25. If in two circles, arcs of the same length subtend  $75^\circ$  and  $90^\circ$  at the centre, find the ratio of their radii.**

## Section C

(This section contains 6 short answer (SA) type questions of 3 marks each.)

26. Define and sketch the graph of signum function. Write its domain and range.

27. (a) If  $x+iy=(u+iv)^{1/3}$  then show that  $\frac{u}{x}+\frac{v}{y}=4(x^2-y^2)$ .

OR

(a) If  $z_1=2-i$ ,  $z_2=1+i$ , then find the value of  $\left|\frac{z_1+z_2+1}{z_1-z_2+i}\right|$ .

28. (a) How many litres of water will have to be added to 1125 litres of the 45% solution of acid so that the resulting mixture will contain more than 25% but less than 30% acid content?

OR

(b) Solve  $5(2x-7)-3(2x+3)\leq 0, 2x+19\leq 6x+47$ .

29. Solve for real x:  $\frac{(2x-1)}{3}\geq\frac{(3x-2)}{4}-\frac{(2-x)}{5}$ .

30. (a) Prove that:  $\frac{4\tan x(1-\tan^2 x)}{1-6\tan^2 x+4\tan^4 x}$

OR

(b) Find the value of  $\tan\frac{\pi}{8}$ .

31. If  $U=\{1,2,3,4,5,6,7,8,9\}$ ,  $A=\{2,4,6,8\}$ ,  $B=\{2,3,5,7\}$ , then verify that:

(i)  $(A\cup B)'=A'\cap B'$

(ii)  $(A\cap B)'=A'\cup B'$ .

## Section D

(This section contains 4 Long answer (LA) type questions of 5 marks each.)

32. Find the value of  $\left(1+\cos\frac{\pi}{8}\right)\left(1+\cos\frac{3\pi}{8}\right)\left(1+\cos\frac{5\pi}{8}\right)\left(1+\cos\frac{7\pi}{8}\right)$ .

OR

Show that  $2\sin^2\beta+4\cos(\alpha+\beta)\sin\alpha\sin\beta+\cos 2(\alpha+\beta)=\cos 2\alpha$ .

33. Find the domain and range of the real function  $f(x) = \sqrt{2026 - x^2}$ .

34. A group consists of 4 girls and 7 boys. In how many ways can a team of 5 members be selected if the team has:

- (i) no girl?
- (ii) atleast one boy and one girl?
- (iii) atleast 3 girls?

OR

In how many ways can the letters of the word PERMUTATIONS be arranged if the:

- (i) words start with P and end with S.
- (ii) vowels are all together.
- (iii) there are always 4 letters between P and S.

35. Prove that  $\tan 5x - \tan 4x - \tan x = \tan x \cdot \tan 4x \cdot \tan 5x$  and hence use this result to find

the value of  $\frac{\tan 50^\circ}{2 \tan 10^\circ + \tan 40^\circ}$ .

### Section E (Case Study Based Questions)

36. landscaping architect is designing a park featuring a square central raised platform, denoted as

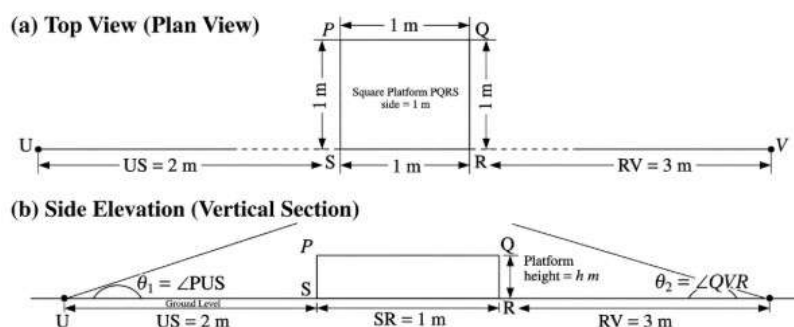
PQRS, with a side length of 1 m. Two specific viewing points, U and V, are located on the ground

on opposite sides of the platform along the extended straight line SR.

The distances from the base of the platform to the viewing points are measured as  $US = 2$  m

and  $RV = 3$  m. Let  $\theta_1$  be the angle of elevation to the top of the platform from point U (angle

PUS), and  $\theta_2$  be the angle of elevation from point V (angle QVR).



Based on the geometric information provided above, answer the following questions:

(i) Evaluate the sum of the tangents of the two angles:  $\tan \theta_1 + \tan \theta_2$ . 1

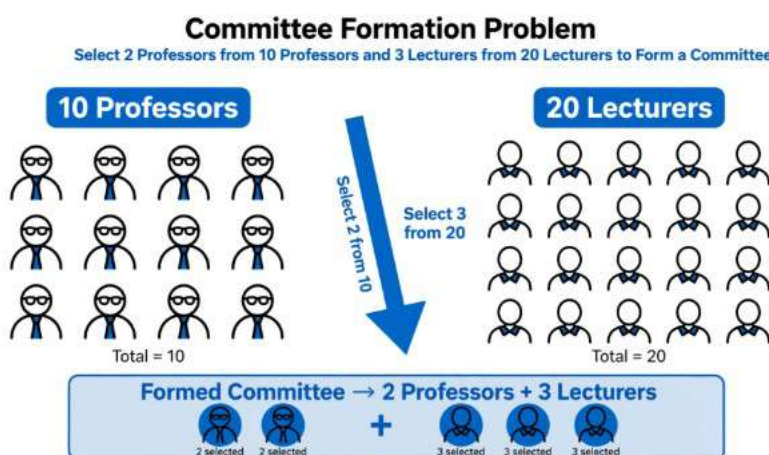
(ii) Evaluate the product of the tangents of the two angles:  $\tan \theta_1 \cdot \tan \theta_2$ . 1

(iii) Using trigonometric identities, find the exact value of  $\tan(\theta_1 + \theta_2)$ . 2

OR

(iii) Determine the exact Radian measure of the combined angle  $(\theta_1 + \theta_2)$ . 2

37: The principal of a college wants to form a committee of 2 professors and 3 lecturers out of 10 professors and 20 lecturers of the college. He is thinking about different alternatives.



Based on the above information answer the following questions:

(i) In how many ways committee can be formed. 1

(ii) In how many ways a particular professor is always included. 1

(iii) In how many ways a particular lecturer is excluded? 2

OR

(iii) In how many ways a particular professor is excluded? 2

38. A numismatist (coin collector) has a small display box containing rare vintage coins of paisa denominations ranging from 1 paisa to 10 paisa, with exactly one coin of each value.

Mathematically, the set of coin values in the box can be represented as:

$$S = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$$

The collector likes to group these coins into different subsets to display them at exhibitions based on specific mathematical patterns.



$$S = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$$

Figure: Set  $S$  of vintage Indian paisa coins — one coin of each denomination from 1 paisa to 10 paisa

Based on the information above, answer the following questions:

(i) Find the total number of possible subsets that can be formed from the set  $S$ . Also, Write the smallest subset and the largest subset of set  $S$ . 2

(ii) How many specific subsets of exactly three coins,  $\{x, y, z\}$ , are possible such that their denominations  $x, y$ , and  $z$  form an Arithmetic Progression (where  $x < y < z$ )? 2