



# APEEJAY SCHOOL PANCHSHEEL PARK

Class XI

Subject- Mathematics

MIDTERM EXAMINATION (2024-25)

Name of the student

Date

Time Allowed: 3 hrs

M.M. 80

## General Instructions:

- Section A has 20 questions carrying 1 mark each.
- Section B has 5 questions carrying 02 marks each.
- Section C has 6 questions carrying 03 marks each.
- Section D has 4 questions carrying 05 marks each.
- Section E has 3 case-based questions (04 marks each) with subparts.
- All Questions are compulsory.
- Draw neat figures wherever required.

## SECTION A (1 × 20)

- The value of  $\left(\frac{2}{1+i}\right)^2$  is  
a)  $-2i$                       b) 2                      c)  $-4i$                       d)  $2i$
- The minute hand of a watch is 3cm long. How far does its tip move in 20 minutes  
a) 12.56 cm                      b) 3.14 cm                      c) 9.56 cm                      d) 6.28 cm
- The value of  $\sin\left(-\frac{41\pi}{3}\right)$  is  
a)  $\frac{\sqrt{3}}{2}$                       b)  $-\frac{1}{2}$                       c)  $-\frac{\sqrt{3}}{2}$                       d)  $\frac{1}{2}$
- The solution of inequalities  $3x - 7 > 2(x - 6)$  and  $6 - x > 11 - 2x$  is  
a)  $x > 5$                       b)  $x > -5$                       c)  $-5 < x < 5$                       d)  $x < -5$ ,  
 $x > 5$
- The imaginary part of the complex number  $i^9 + i^{19} + i^{29}$  is  
a) 0                      b) -1                      c)  $i$                       d)  $-i$
- The set of real  $x$  satisfying the inequality  $\frac{5-2x}{3} \leq \frac{x}{6} - 5$  is  
a)  $(8, \infty)$                       b)  $[8, \infty)$                       c)  $(-\infty, 8)$                       d)  $[-8, 6)$



7. If  $A = \{1, 2, 3\}$  and  $B = \{x, y\}$  then the number of non-empty relations that can be defined from A to B is

a) 63

b) 64

c) 32

d) 6

**Direction:** In question numbers 8 and 9, two statements are given, one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer from the following options:

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

8. **Assertion (A):** The number of terms in the expansion of  $(x - y)^{10} + (x + y)^{10}$  is 6

**Reason (R):** The number of terms in the expansion of  $(a + b)^n$  is n

9. **Assertion (A):** The number of ways can a bowler take 4 wickets in a single over of 6 balls is 30

**Reason (R):** The number of arrangements of r objects out of n distinct objects is  ${}^n P_r$

10. If  $z_1 = \sqrt{3} + i\sqrt{3}$  and  $z_2 = \sqrt{3} + i$ , then in which quadrant  $\left(\frac{z_1}{z_2}\right)$  lies?

a) I

b) II

c) III

d) IV

11. Convert  $40^\circ 20'$  into radian measure.

12. Find the value of  $\tan \frac{19\pi}{3}$ .

13. How many chords can be drawn through 21 points on a circle?

14. If  ${}^n C_9 = {}^n C_8$ , find  ${}^n C_{17}$ .

15. Find the multiplicative inverse of  $2-3i$ .

16. Taking the set of natural numbers as the universal set, write down the complement of  $\{x: x \text{ is a natural number divisible by } 3\}$

17. Express  $(5 - 3i)^3$  in the form  $a + ib$ .

18. Expand  $(1 - 2x)^5$  using the binomial theorem.

19. How many two-digit even numbers can be formed from the digits 1, 2, 3, 4, 5 if the digits can be repeated?

20. Find the number of permutations of n objects, where p objects are of the same kind and the rest all are different.

### SECTION B (2 × 5)

21. Show that  $A \cup B = A \cap B$  implies  $A = B$ .

22. Find the domain and the range of the function  $f(x) = -|x|$ .

23. A wheel makes 360 revolutions in one minute. Through how many radians does it turn in one second?

24. Prove that  $3 \sin \frac{\pi}{6} \sec \frac{\pi}{3} - 4 \sin \frac{5\pi}{6} \cot \frac{\pi}{4} = 1$

25. Solve  $\frac{3x-4}{2} \leq \frac{x+1}{4} - 1$ .



**SECTION C (3 × 6)**

26. 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?
27. Prove that  $\cos 2x \cos \frac{x}{2} - \cos 3x \cos \frac{9x}{2} = \sin 5x \sin \frac{5x}{2}$ .
28. Find the number of non-zero integral solutions of the equation  $|1 - i|^x = 2^x$ .
29. Prove that  $\cos 6x = 32 \cos^6 x - 48 \cos^4 x + 18 \cos^2 x - 1$ .
30. Let A and B be sets. If  $A \cap X = B \cap X = \emptyset$  and  $A \cup X = B \cup X$  for some set X, show that  $A = B$ .
31. Find the value of  $\tan \frac{\pi}{8}$ .

**SECTION D (5 × 4)**

32. If  $\tan x = \frac{3}{4}$ ,  $\pi < x < \frac{3\pi}{2}$ , find the value of  $\sin \frac{x}{2}$ ,  $\cos \frac{x}{2}$  and  $\tan \frac{x}{2}$ .
33. 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) at least one boy and one girl (iii) at least 3 girls?
34. Evaluate
- $(\sqrt{3} + \sqrt{2})^6 - (\sqrt{3} - \sqrt{2})^6$
  - $(a^2 + \sqrt{a^2 - 1})^4 + (a^2 - \sqrt{a^2 - 1})^4$
35. Find the value(s) of  $\theta$  for which the complex number  $\frac{1+i \cos \theta}{1-2i \cos \theta}$  is purely real.

**SECTION E (4 × 3)**

36. Rani is playing with scramble word cubes. She needs to form words using all the letters of the word 'ORGANIC' without repetition of letters.



In how many of these words:

- Vowels and consonants are alternate with each other
  - All vowels are together
  - Vowels and consonants occur together
  - Words begin with a vowel
37. In an experiment, a solution of 8% boric acid is to be diluted by adding a 2% boric acid solution to it. The resulting mixture is to be more than 4% but less than 6% boric acid.





- a) If we have 640 litres of the 8% solution, how many litres of the 2% solution will have to be added?
- b) In a different experiment a solution of hydrochloric acid is to be kept between  $30^\circ$  and  $35^\circ$  Celsius. What is the range of temperature in degree Fahrenheit if the conversion formula is given by  $C = \frac{5}{9}(F - 32)$ , where C and F represent temperature in degree Celsius and degree Fahrenheit, respectively.
38. A committee wants to select a cricket team of eleven players from 17 players in which only 5 players can bowl.



- a) In how many ways this can be done if each cricket team of 11 includes exactly 4 bowlers?
- b) If a support team of 3 persons is to be constituted from a group of 2 men and 3 women. In how many ways can this be done? How many of these teams would consist of 1 man and 2 women?