

N.K BAGRODIA PUBLIC SCHOOL, SEC-4, DWARKA

CLASS: XI

MID TERM EXAMINATION

SESSION: 2025-26

TIME: 3HRS

SUB: MATHEMATICS

MAX. MARKS: 80

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 (4 marks each) with sub parts.

64
x4
6

SECTION A

Each question carries 1 mark

- Q.1. If $n(A - B) = 10$, $n(B - A) = 23$ and $n(A \cup B) = 50$ then $n(A \cap B)$ is
 (a) 7 (b) 17 (c) 27 (d) 33 1
- Q.2. Let $U = \{1, 2, 3, \dots, 40\}$, $A = \{x : x \text{ is divisible by 2 and 3}\}$ and $B = \{x : x = n^2, n \in N\}$ then $n(A) - n(B)$ is
 (a) 0 (b) 1 (c) 2 (d) 3 1
- Q.3. If $f(z) = \frac{7-z}{1-z^2}$, where $z = 1 + 2i$, then $|f(z)|$ is
 (a) 1 (b) $|z|$ (c) $2|z|$ (d) $\frac{|z|}{2}$ 1
- Q.4. The number of words which can be formed out of the letters of the word ARTICLE so that vowels occupy the even place is
 (a) 1440 (b) 144 (c) 7! (d) 56 1
- Q.5. If $\sin x = \frac{1}{3}$ then the value of $\sin 3x$ is
 (a) 1 (b) 0 (c) $\frac{23}{27}$ (d) $\frac{-23}{27}$ 1
- Q.6. Given that x, y, b are real numbers and $x < y, b < 0$ then
 (a) $\frac{x}{b} < \frac{y}{b}$ (b) $\frac{x}{b} > \frac{y}{b}$ (c) $\frac{x}{b} \leq \frac{y}{b}$ (d) $\frac{x}{b} \geq \frac{y}{b}$ 1
- Q.7. The number of proper subsets of a set containing 4 elements is
 (a) 4^2 (b) $4^2 - 1$ (c) 2^4 (d) $2^4 - 1$ 1

- Q.8. The conjugate of $\frac{4}{i^5}$ is 1
 (a) i (b) 4i (c) -i (d) -4i
- Q.9. If $(n + 1)! = 20(n - 1)!$ then the value of n is 1
 (a) 3 (b) 2 (c) 4 (d) 5
- Q.10. The number of terms in the expansion of $(x + a)^{46} - (x - a)^{46}$ after simplification is 1
 (a) 23 (b) 24 (c) 46 (d) 92
- Q.11. If $A = \{a, b\}$ and $B = \{x, y, z\}$ then number of non- empty relations from B to A are 1
 (a) 8 (b) 16 (c) 32 (d) 63
- Q.12. A wheel makes 450 revolutions per hour . The number of radians through which it turns in one second is 1
 (a) $\frac{\pi}{4}$ (b) $\frac{\pi}{2}$ (c) $\frac{\pi}{6}$ (d) $\frac{\pi}{3}$
- Q.13. The values of x for which the functions defined by $f(x) = 6x^2 + 1$ and $g(x) = 11 - 7x$ are equal to 1
 (a) $\{-1, \frac{2}{3}\}$ (b) $\{-2, \frac{5}{6}\}$ (c) $\{3, \frac{5}{6}\}$ (d) $\{2, \frac{2}{3}\}$
- Q.14. The number of six digits numbers that can be formed by using the digits 1, 2, 1, 2, 0, 2 ? 1
 (a) 60 (b) 50 (c) 110 (d) 10
- Q.15. For any two sets X and Y , $X \cap (X \cup Y)'$ is equal to 1
 (a) X (b) Y (c) $X \cap Y$ (d) \emptyset
- Q.16. If $A = \{(x, y) : y = \frac{1}{x}, x \neq 0 \text{ and } x \in R\}$, $B = \{(x, y) : y = -x \text{ and } x \in R\}$ then $A \cap B$ is 1
 (a) B (b) A (c) U (d) \emptyset
- Q.17. If $P(10, r) = 5040$ then value of r is 1
 (a) 2 (b) 1 (c) 5 (d) 4
- Q.18. If $f(x) = px + q$, where p and q are integers $f(-1) = 1$ and $f(2) = 13$, then p and q are 1
 (a) $p = 4, q = 5$ (b) $p = -4, q = 5$ (c) $p = 4, q = -5$ (d) $p = -4, q = -5$

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 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.

Q.19. Assertion (A) : If $p > 0$ and $q < 0$, then $q + p < p$. 1

Reason (R) : If $p > 0$ and $q < 0$, then $p - q > p$.

Q.20. Assertion (A) : The number of terms in the expansion of $(1 - 3x + 3x^2 - x^3)^{12}$ is 37. 1

Reason (R) : The number of terms in the expansion of $(x + a)^n$ is $n + 1$

SECTION - B (2 × 5 = 10 marks)

Q.21. If $(\frac{1-i}{1+i})^{100} = a + ib$, then find (a , b) 2

Q.22. Prove that : $\tan 71^\circ = \frac{\cos 26^\circ + \sin 26^\circ}{\cos 26^\circ - \sin 26^\circ}$ 2

OR

Prove that : $\tan x \tan (\frac{\pi}{3} - x) \tan (\frac{\pi}{3} + x) = \tan 3x$

Q.23. Let $R = \{ (x, y) : x, y \in Z, y = 2x - 4 \}$ and if $(a, -2)$ and $(4, b^2)$ belong to R then find the values of a and b. 2

Q.24. Using Binomial theorem , which one is larger $(1.2)^{4000}$ or 800 ? 2

OR

Prove that : $\sum_{r=0}^n 3^r C(n, r) = 4^n$

Q.25. Draw the graph of the following function and hence find its domain and range : $f(x) = \begin{cases} 1-x, & x < 0 \\ 1, & x = 0 \\ 1+x, & x > 0 \end{cases}$ 2

SECTION - C (3 × 6 = 18 marks)

Q.26. Let A and B be two finite sets and $n(A) + n(B) = 9$. The ratio of number of subsets of A is to number of subsets of B is 8 : 1 . Then

- (i) find $n(A)$ 1
- (ii) find $n(B)$ 1
- (iii) find the number of proper subsets of $(n(A) + n(B))$ 1

Q.27. Find the number of words with or without meaning that can be formed from the letters of word EQUATION if

- (i) all the letters of the word used at a time. 1
 (ii) all vowels occur together . 2

OR

The words which can be made using all the letters of the word AGAIN If these words are written in a dictionary order , then

- (i) find the 50th word . 2
 (ii) find the 52nd word . 1

Q.28. By using Binomial Theorem , prove that : $6^n - 5n$ always leaves the remainder 1 when divided by 25 for all $n \in N$. 3

Q.29. If $\sec x + \tan x = p$, obtain the values of $\sec x$, $\tan x$ and $\sin x$ in terms of p . 3

OR

Prove that : $\frac{\sin 5x - 2 \sin 3x + \sin x}{\cos 5x - \cos x} = \tan x$

Q.30. Prove that : $C(n, r) + C(n, r-1) = C(n+1, r)$ 3

OR

In how many of the distinct permutations of the letters in MISSISSIPPI do the four I's not come together ?

Q.31. Let R be a relation from N to N defined by $R = \{ (a, b) : a, b \in N \text{ and } a = b^2 \}$. Are the following true ? 3

- (i) $(a, a) \in R$, for all $a \in N$.
 (ii) $(a, b) \in R$ implies $(b, a) \in R$
 (iii) $(a, b) \in R$, $(b, c) \in R$ implies $(a, c) \in R$.

SECTION - D (4 × 5 = 20 marks)

Q.32. (i) Prove that : $\cot 4x (\sin 5x + \sin 3x) = \cot x (\sin 5x - \sin 3x)$ 2
 (ii) Prove that : $\cos^2 x + \cos^2 (x + \frac{2\pi}{3}) + \cos^2 (x - \frac{2\pi}{3}) = \frac{3}{2}$ 3

Q.33 Prove that : $\cos 20^\circ \cos 40^\circ \cos 80^\circ = \frac{1}{8}$ 5

OR

- (i) Prove that : $\tan 20^\circ \tan 40^\circ \tan 80^\circ = \tan 60^\circ$ 3
 (ii) Prove that : $\sin^2 (\frac{\pi}{8} + \frac{A}{2}) - \sin^2 (\frac{\pi}{8} - \frac{A}{2}) = \frac{1}{\sqrt{2}} \sin A$ 2

Q.34. 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 ? 5

Q.35. If α and β are two different complex numbers with $|\beta| = 1$ then find 5
 $\left| \frac{\beta - \alpha}{1 - \bar{\alpha}\beta} \right|$

OR

(i) If $(x + iy)^{1/3} = a + ib$ where $x, y, a, b \in R$, show that

$$\frac{x}{a} - \frac{y}{b} = -2(a^2 + b^2)$$

(ii) Find the least positive integral value of n for which $\left(\frac{1+i}{1-i}\right)^n$ is purely imaginary. 3

2

SECTION- E (3 x 4 = 12 marks)

This section comprises of 3 case-study based questions.

Q.36. The three sides of a triangle are given by $(2x + 3)$ cm, $(4x - 1)$ cm and 14 cm .

Based on the above information, answer the following questions :

- (i) Find the minimum value of x , if the perimeter of triangle is at least 34 cm . 1
- (ii) Find the maximum value of x , if the perimeter of triangle is at most 82 cm . 1
- (iii) Find x if sum of first two sides of triangle is more than the third side atleast by 6 cm . 2

Q.37. Out of 7 boys and 5 girls , a team of 7 students is to be formed .

Based on the above information, answer the following questions:

- (i) Find the number of ways , if team contains at least 3 girls. 1
- (ii) Find the number of ways , if team contains at most 3 girls. 1
- (iii) If exactly 3 girls are selected and are arranged in a row for a photograph . Find the number of ways if all the girls and all the boys will stand together. 2

Q.38. $\tan x = \frac{5}{12}$ and x lies in third quadrant .

Based on the above information, answer the following questions:

- (i) Find the value of $\sin 2x$ 1
- (ii) Find the value of $\cos 2x$ 1
- (iii) Find the value of $\sin \frac{x}{2}$ 2

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