

NORTH EX PUBLIC SCHOOL
(SENIOR SECONDARY, AFFILIATED TO CBSE)
SCHOOL BLOCK, JAIN NAGAR, SECTOR-38, ROHINI, DELHI-81
HALF YEARLY EXAMINATION, 2023-24
SUBJECT- MATHEMATICS
CLASS-XI

Time : 3 Hrs.

Maximum Marks: 80

General Instructions:

1. This Question Paper has 5 Sections A-E.
2. Section **A** has 20 MCQs carrying 1 mark each
3. Section **B** has 5 questions carrying 02 marks each.
4. Section **C** has 6 questions carrying 03 marks each.
5. Section **D** has 4 questions carrying 05 marks each.
6. Section **E** has 3 case based integrated units of assessment (04 marks each).
7. All Questions are compulsory. However, an internal choice has been provided.

SECTION-A

1. The set of all the points on the circumference of a circle.
A)infinite set b)finite set c)void set d) none.
2. What is the range of cos function?
a) [-1, 1] b) R c) n.d d) none
3. Find the value of $\tan 19\pi/3$.
a) $\sqrt{3}$ b) 1 c) 0 d) none.
4. If A and B are two sets such that $n(A) = 50$, $n(B) = 20$, $n(A \cap B) = 40$, then $n(A \cup B)$ is
a) 20 b)30 c)40 d)50
5. Shweta writes a complex number in her notebook $3-4i$,real and imaginary part of the complex number is:
a)3,4 b)3,-4 c)4,3 d)4,-3
6. Let $f(x) = -|x|$ then range of the function
a)(0,∞) b)(-∞,∞) c) (-∞,0) d) none
7. A function f is defined by $f(x) = 2x - 3$, find $f(5)$
a)5 b)6 c)7 d)8
8. If $-3 \leq \frac{5-3x}{2} \leq 4$,then x:
A) [-1,11/3] b) [-5,5] c) [-11/3,1] d) [-∞∞]
9. If a set has n elements then the total number of subsets of A is
a) n^2 b) 2^n c)2n d) n
10. Find the value of $(1+i)(1+i^2)(1+i^3)(1+i^4)$
a) 0 b) 1 c) -1 d) none
11. How many elements will be there in the Cartesian product of A and B ,if the number of elements in A and B are respectively 10 and 7
a) none b)17 c)70 d) 10^7
12. If a complex number coincide with its conjugate ,then the number must lie on
a) Real axis b)imaginary axis c)origin d)none
13. The total number of terms in the expansion of $(x+a)^{100} - (x-a)^{100}$ after simplification is:
a) 50 b)202 c)51 d)none
14. Find a and b , if $(2a + b , a-b) = (8,4)$

- a) 3,-1 b) 2, -2 c)4,0 d)none
15. Convert into factorial 2.4.6.8.10.12
a) $2^6 6!$ b) $12!$ C) $6!$ d) $2!$
16. Find the length of an arc of a circle of radius 5cm subtending a central angle measuring 15° .
a) $\pi/12$ cm b) $5\pi/12$ cm c) $6\pi/12$ d) $3\pi/12$
17. Evaluate ${}^n P_r$ when $n = 5$, $r = 2$.
a) 11 b) 10 c) 20 d) 12
18. Evaluate $i^n + i^{n+1} + i^{n+2} + i^{n+3}$
a) 1 b) -1 c) 2 d) 0

ASSERTION- REASONING

DIRECTION: In the question number 4 and 5, a statement of assertion (A) followed by a statement of Reason (R). Choose the correct option

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A)
(b) Both assertion (A) and reason (R) are true and reason (R) is not the correct explanation of assertion (A)
(c) Assertion (A) is true but reason (R) is false.
(d) Assertion (A) is false but reason (R) is true.
19. Assertion(A) : If $A = \{1, 2\}$ and $B = \{3, 4\}$. Then the number of relations from A to B is 16.
Reason(R) : If $n(A) = p$ and $n(B) = q$, the number of relations is 2^{pq}
20. Assertion (A): If $z = i^9 + i^{19}$, then z is equal to $0 + 0i$
Reason(R): The value of $i^2 = -1$

SECTION—B

21. If $a \cos \theta + b \sin \theta = m$ and $a \sin \theta - b \cos \theta = n$, then show that $a^2 + b^2 = m^2 + n^2$
OR
Prove : $\sin^2 \pi/6 + \cos^2 \pi/3 - \tan^2 \pi/4 = -1/2$
22. Describe the set in roster form $\{x : x \text{ is a two digit number such that the sum of its digit is } 8\}$.
23. Find the conjugate of $1/(2 - 3i)$.
24. If A and B are two given sets, Then represent the set $(A-B)'$ using venn diagram.
25. How many 3 digit even numbers can be made using the digits 1,2,3,4,6,7, if no digit is repeated.

SECTION C

26. If $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$, $A = \{2, 4, 6, 8\}$ and $B = \{2, 3, 5, 7\}$. Verify that $(A \cup B)' = A' \cap B'$
27. Solve $5x - 3 < 3x + 1$ when
i) x is a real number
ii) x is an integer.
iii) x is a natural number.
28. Let R be a relation defined by $R = \{(x, x+5) : x \in (0, 1, 2, 3, 4, 5)\}$
a) Write R in roster form.
b) Find the domain of R.
c) Find the range of R.
29. Solve the inequality $\frac{(2x-1)}{3} \geq \frac{(3x-2)}{4} - \frac{(2-x)}{5}$ for real x.
30. Show that $\sin(n+1)x \sin(n+2)x + \cos(n+1)x \cos(n+2)x = \cos x$.
OR
Show that $\sin 2x + 2 \sin 4x + \sin 6x = 4 \cos^2 x \sin 4x$.
31. Show that the $9^{n+1} - 8n - 9$ is divisible by 64, where n is a +ve integer (using binomial expansion).

SECTION-D

32. Find $(a + b)^4 - (a - b)^4$. Hence, evaluate $(\sqrt{3} + \sqrt{2})^4 - (\sqrt{3} - \sqrt{2})^4$.

33. Prove that $\frac{(\sin 7x + \sin 5x) + (\sin 9x + \sin 3x)}{(\cos 7x + \cos 5x) + (\cos 9x + \cos 3x)} = \tan 6x$

OR

Prove that

$$\cos 6x = 32\cos^6 x - 48\cos^4 x + 18\cos^2 x - 1.$$

34. In an examination, a question paper consists of 12 questions divided into two parts : part 1 and part 2 containing 5 and 7 questions respectively. A student is required to attempt 8 questions in all, selecting at least 3 from each part. In how many ways can a student select the questions?

35. Find the real numbers x and y if $(x - iy)(3 + 5i)$ is the conjugate of $-6 - 24i$.

SECTION E

36. **CASE STUDY-1** Read the given case study and answer questions

Schools do not take IQ tests of the majority of students anymore. IQ tests are mostly used for children who struggle in school in order to determine if they are eligible to receive special services. IQ of a person is given by the formula $IQ = \frac{MA}{CA} \times 100$ where MA is mental age and CA is the chronological age. If $80 \leq IQ \leq 140$ for a group of 12 years old children, find:



a) What is the range of their mental age?

b) Find all pairs of consecutive even positive integers, both of which are larger than 5 such that their sum is less than 23.

37. **CASE STUDY-2**

A locker in a bank has some digit lock system. Each place's digits may vary from 0 to 9. Mahesh has a locker in the bank where he can put all his property papers and important documents. Once he needs one of the document but he forgot his password and was trying all possible combinations.



a) How many 4 digit account number can be formed from

the digits 0,1,3,5,7 and 9 which are divisible by 10, no digit is repeated?

b) A bank has 6 digit account number with no repetition of digits within an account number. The first and last digit of the account numbers is fixed to be 4 and 7. How many such account numbers are possible?

38. **CASE STUDY-3**

Two friends Sumit and Pawan have just come to know about complex numbers. They themselves created a game, for which they have prepared a board having an argand plane drawn on it: (as shown in the figure). They have taken two dice of different colours i.e. red and blue. And they have decided to take the number on red die as real part and that on blue die as imaginary part. Both have thrown that pair of dice and marked the number by each resp. as A and B. Now they are asking each other some questions. Help them out to find the answers...

a) Which complex numbers are represented by the points A and B?

i. $4+i5, 2+i7$

ii. $4-i5, 2-i7$

iii. $5+i4, 7+i2$

iv. $5-i4, 7-i2$

b) Find the product of A and B.

c) Find the length OA and OB.

d) Find the conjugate of A and B,

