ST. MARGARET SR. SEC. SCHOOL
MID TERM EXAMINATION 2023-24
MATHEMATICS (041)
CLASS XI

Time: 3Hr   SAMPLE PAPER.   M.M: 80

GENERAL INSTRUCTIONS:

Read the following instructions very carefully and follow them:

i)   Question paper is divided into 5 sections-Section A, B,C,D and E.
ii)   In Section A- Question Number 1 to 18 are Multiple Choice Questions(MCQ) type and Question Number 19 to 20 are Assertion-Reason based questions of 1 mark each.
iii)   In Section B-Question Number 21 to 25 are Very Short Answer(VSA) type questions of 2 marks.
iv)   In Section C- Question Number 26 to 31 are Short Answer(SA) type questions carrying 3 marks each.
v)   In Section D-Question Number 32 to 35 are Long Answer(LA) type questions carrying 5 marks each.
vi)   In Section E-Question Number 36 to 38 are case study based questions carrying 4 marks each.
vii)   There is an internal choice in 2 questions in Section B, 3 questions in Section C, 2 questions in Section D and 2 questions in Section E.

SECTION- A

1. If $A \cap B = B$ then
   (a) $A \subseteq B$ (b) $B \subseteq A$ (c) $A = \varphi$ (d) $B = \varphi$

2. $f(x) = \frac{x}{|x|}$
   (a) $R - \{0\}$ (b) $R - \{-1,1\}$ (c) $[-1,1]$ (d) None of these.

3. $\frac{sin2x}{1-cos2x} =$
   (a)   tan2x   (b) cot2x   (c) tanx   (d) cotx

4. $i^9 + i^{19} =$
   (a)   0   (b) i   (c) –i   (d) 1

5. The multiplicative inverse of $3+2i =$
   (a) $-\frac{3}{13} - \frac{2i}{13}$ (b) $\frac{3}{13} - \frac{2i}{13}$ (c) $\frac{3}{13} + \frac{2i}{13}$ (d) $-\frac{3}{13} + \frac{2i}{13}$

6. Which of the following is not a function ?
   (a) $\{(x,y) : x, y \in R, x^2 = y\}$ (b) $\{x, y : x, y \in R, y^2 = x\}$
   (c) $\{(x, y) : x, y \in R, x = x^3\}$ (d) $\{(x, y) : x, y \in R, y = x^3\}$

7. For any two sets A and B $A \cap (A \cup B)^/ =$
   (a)   A   (b) $A \cup B$ (c) φ (d) $A \cap B$

8. The value of x so that the line passing through (3,4) and (x,5) makes 135^0 angle with the positive direction of x axis.
   (a)   1   (b) 2   (c) -1   (d) -2

9. The distance between 5x+3y-7=0 and 15x+9y+14=0 is
   (a) $\frac{35}{\sqrt{14}}$ (b) $\frac{35}{3\sqrt{34}}$ (c) $\frac{35}{2\sqrt{34}}$ (d) $\frac{1}{3\sqrt{34}}$

10. The value of $(1+i)(1+ i^2)(1+i^3)(1+i^4)$ is
    (a)   2   (b) 0   (c) 1   (d) i

11. If $\frac{1-ix}{1+ix} = a+ib$ then $a^2+ b^2 =$
    (a)   1   (b) -1   (c) 0   (d) None of these.

12. Two finite sets have m and n elements. The number of elements in the power set of first set is 48 more than the total number of elements in power set of second set. Then values of m and n are
   (a)   7,6   (b) 6,3   (c) 6,4   (d) 7,4

13. If R is a relation on a finite set having n elements , then the number of relation on A
   (a) 2^n (b) 2^{n^2} (c) n^2 (d) n^n

14. The LCM of 4! , 5! And 6! Is
    (a)   720   (b) 360   (c) 120   (d) 20

15. The equation of a line which is parallel to x axis and passes through (3,-5) is
   (a)   X= -5   (b) y=-5   (c) x=3   (d) y=-3

16. The value of $\sin(-1125^0)$ is
   (b) $\frac{-1}{\sqrt{2}}$ (b) $\frac{1}{\sqrt{2}}$ (c) $\frac{1}{2}$ (d)- $\frac{1}{2}$

17. Total number of words formed by 2 vowels and 3 consonants taken from 4 vowels and 5 consonants is equal to
   (a)   60   (b) 120   (c) 7200   (c) 240

18. The value of $\sin 50^0 - \sin 70^0 + \sin 10^0$ is equal to
   (a)   1   (b) 0   (c) ½   (d) 2

Assertion-Reason Based Questions

In the following questions 19 and 20, a statement of Assertion(A) is followed by a statement of a 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 and (R) is false.
(d)   (A) is false and (R) is true.

19. Assertion: 2 sin5A cosA = sin6A+sin4A
    Reason: 2sinAcosB= sin(A+B)- cos(A+B).

20. Assertion: The solution of $|1-i|^x = 2^x$ is x=0.
    Reason: $|a-ib| = \sqrt{a^2 + b^2}$.

SECTION- B

21. Show that if A $\subset B$ then C −B $\subset$ C-A .

22. Find the value of $\frac{13\pi}{12}$.

23. Find the value of $(-\frac{1}{3} + 3i)^3$.

24. If the lines 2x+3y-3 =0 , 5x+ky-3=0 and 3x-y-2=0 . Find k.

OR

   Find the distance of the point (-1,1) from the line 12(x+6)=5(y-2).

25. Let A= {a,b} . List all relations on A and find their number.

OR

   Find proper subset of A= { a, b, c, d}.

SECTION – C

26. Find the equation of the line passing through the point (2 , 2) and cutting off intercepts on the axis whose sum is 9.

27. Let A and B are two sets then prove that $(A \cap B)' = A' \cup B'$.

28. Show that a real value of x will satisfy the equation $\frac{1-ix}{1+ix}$ = a-ib if $a^2 + b^2 =1$ where a and b are real.

OR

If z= x+iy and w= $\frac{1-iz}{z-i}$ show that $|w| = 1 \Rightarrow z$ is purely real.

29. Using Binomial theorem expand $(1-x+x^2)^4$.

OR

Using binomial theorem prove that $6^n - 5n$ always leaves remainder 1 when divided by 25.

30. Draw the graph of f (x)= cosecx .

31. If f is a real function defined by $f(x) = \frac{x-1}{x+1}$ then prove that $f(2x) = \frac{3f(x)+1}{f(x)+3}$.

OR

Find the domain and range of $f(x) = \frac{3}{2-x^2}$.

SECTION- D

32. Prove that $\frac{sec8x-1}{sec4x-1} = \frac{tan8x}{tan2x}$.

OR

Prove that $sinA \; sin(\frac{\pi}{3} - A) \; sin(\frac{\pi}{3} + A) = \frac{1}{4} sin3A$

33. In how many ways can a cricket eleven be chosen out of a batch of 15 players if
    (i) There is no restriction on selection   (ii) a particular player is always chosen.
   (iii) a particular player is never chosen.

OR

If $^nC_{r-1} = 36$, $^nC_{r+1} = 126$ then find $^rC_2$.

34. Find the equation of the lines through the point (3,2) which make an angle of 45^0 with the line x-2y= 3.

35. Find the coefficient of $\mathbf{a^4}$ in the product $(1+2a)^4 (2-a)^5$ using binomial theorem.

SECTION- E

36. Villages of Shanu and Arun's are 50km apart and are situated on Delhi Agra highway as shown in the following picture. Another highway YY' crosses Agra Delhi highway at O(0,0). A small local road PQ crosses both the highways at pints A and B such that OA=10 km and OB =12 km. Also, the villages of Barun and Jeetu are on the smaller high way YY'. Barun's village B is 12km from O and that of Jeetu is 15 km from O.
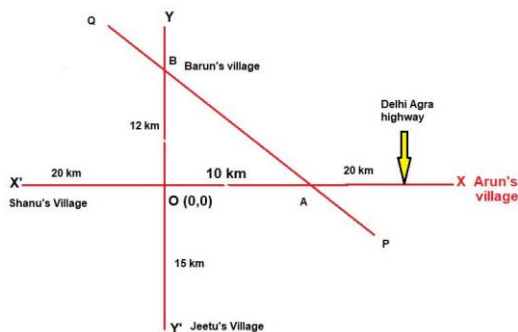
Now answer the following questions:
    (i) What are the coordinates of A?   (1)
    (ii) What is the equation of AB?   (1)
    (iii) What is the slope of AB?
                    OR
        Find the distance from AB from origin?   (2)

37. The ordered pair of two elements a and b is denoted by (a,b): a is first element and b is second element. Two ordered pairs are equal if their corresponding elements are equal ,i.e (a, b) = (c,d)=>a=c and b=d. For two non-empty sets A and B, the cartesian product AxB is the set of all ordered pairs of elements from sets A and B. In symbolic form we say it as A x B={(a, b); a €A, b €B}.

Answer the following:

(i) If (a-3,b+7)=(3,7), then find the value of a and b.   (1)

(ii) Let A and B be two sets such that A x B be consists 6 elements three of them are (1,4),(2,6) and (3,6) then find AxB. (2)

(iii) If n(AxB)=45,, then find n(A) if n(B)= 5 (1)

38. In how many ways can the letters of the word **INTERMEDIATE** be arranged so that

    (i)   The vowels always occupy even places ?

    (ii)   The relative order of vowels and consonants do not alter ?