P—2 PERIODIC TEST :- 1(2024-25)

Class :- XI (MATHS)

Time :- 90 minutes M.M :-40

SECTION -A(12marks)

1. Let A= {x:x∈R,x>6} and B={ x:x∈R,x<9} then A∩B=
   (a) (7, 8] (b) (7 , 8) (c) [7, 8) (d) [7,8]
2. For any set A , $(A^c)^c$ is equal to
   (a) A^c (b) A (c) Φ (d) U
3. For any two sts A an B , A∩(AUB) =
   (a) A (b) B (c) Φ (d) U
4. If A= {1,2,3,4,5} then the number of subsets of A is
   (a)25 (b) 5 (c) 31 (d) 32
5. If A = {1,2,4} , B={2,4,5} , C={2,5} then (A – B) x(B - C) is

   (a) { (1,2),(1,5), (2,5)} (b) {(1,4)} (c) (1,4) (d) { (2,5),(1,4)}
6. If R = {(x,y): x,y ∈ Z, x^2+y^2 =4 } is a relation on Z then domain of R is

   (a) {0,1,2} (b) {0,-1,-2} (c) {-2,-1,0,1,2} (d) [-2,2]
7. Let f(x) = $f(x) = \begin{cases} 3-2x, & x<1 \\ 3x+5, & 1 \le x \le 2 \\ 5x-2, & x>3 \end{cases}$ then 2f(0) + f(3) =

   (a) 17 (b) 19 (c) 24 (d) 31
8. The domain of f(x)= $\sqrt{4x-x^2}$ is

   (a) R- [0,4] (b) R – (0,4) (c) (0,4) (d) [0,4]

Question number 9 and 10 are assertion(A) – reason(R) type questions of 2 marks each. Choose the correct answer out of the following options

(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

9. Assertion (A) : The set D ={ x: x is even prime number} in roster form is {2,3}

   Reason(R) : The set E= {the set of all letters in the word SCHOOL } in the roster form is {S,C , H,O,L}

10. Let A { 1,2,3,4,5,6} if R is a relation on A defined by {(a,b): b=a^2 and a,b ∈A}

Assertion (A): The relation R in the roster form is {(1,1), (2,4),(3,9),(4,16),(5,25),(6,36)}

Reason(R): The domain and range of R is { 1,2,3,4,5,6}

Section:-B (Case/ Source Based) (1x4=4)

11. Natasha is doing a designing course. She is working on Cartesian art now a days. For it sh wants to to take x coordinate from the set A = {0,1,2,3,5} and y coordinate from the set B= {-3,-2,-1,0,1,2,3}. Based on this information answer the following questions.

(i) How many ordered pairs Natasha can make from A to B ?

(ii) How many relations can be defined from A to B?

(iii) If a relation R from A to B is defined as R = { (a,b) : a<b, a ϵ A , b ϵ B} then how many elements are there in the relation R?

(iv) Draw the arrow diagram of the relation R described in the question no (iii).

Section :- C (2x3=6)

12. Write the intervals (-3,0) and [-23,5) in set builder forms.

13. If U ={ 1,2,3,4,5,6,7,8,9} , A = {2,4,6,8} and B = { 2,3,5,7} then verify $(A \cup B)^c = A^c \cap B^c$

14. If $f(x) = y = \frac{ax-b}{cx-b}$, then prove that f(y) =x

Section :- D (3x2 =6)

15. If for any two sets AUB = A ∩ B then prove that A=B.

16. Find the range of the function $f(x) = 1 - |x - 4|$.

Section :- E (4x3= 12)

17. Show that for any sets A and B ,

A= (A ∩ B) U(A – B) and A U (B – A) = (A U B)

18. If $f : R \to R$ be a function defined by $f(x) = \frac{x^2}{1+x^2}$ then find the range of f.

19. If f and g are real functions defined by $f(x) = x^2 + 7$ and $g(x) = 3x + 5$ then find

(i) $\frac{f(t)-f(5)}{t-5}$, $t \neq 5$ (ii) $f(\frac{1}{2}) \times g(14)$

KVS(DR)/2024/AA

11130

KENDRIYA VIDYALAYA SANGATHAN, DELHI REGION

HALF YEARLY EXAMINATION 2024-25

CLASS: XI **SUBJECT: MATHEMATICS**

M.M. 80 **TIME : 3 HOURS**

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.

SECTION A

1) If $A \cap B = \Phi$ then A and B are called

A) Equal Set B) Finite set C) Disjoint Set D) Empty set

2) Let A = (a, {b, c}, d, e, f}. Insert the appropriate symbol $\in$ or $\notin$, $\subset$ in the blank space.

{d} __ A , {b} __ A , a __ A , {b,c} __ A which of the following option is correct

A) $\in, \notin, \notin, \subset$ B) $\in, \notin, \in, \subset$ C) $\subset, \notin, \in, \in$ D) $\subset, \in, \in, \notin$

3) The value of $A \cap A'$ is

A) U' B) U C) A D) A'

4) Find x + y if (3x-2,13) = (13,2x+3y)

A) 5 B) 6 C) 7 D) 8

5) The number of relations from A to B If n(A) = 5 and n(B) = 2 is

A) 256 B) 512 C) 1024 D) 128

6) The value of $\cos\frac{5\pi}{12}$ is

A) $\frac{\sqrt{3}+1}{2\sqrt{2}}$ B) $\frac{\sqrt{3}-1}{2\sqrt{2}}$ C) $\sqrt{3}+1$ D) $\sqrt{3}-2$

7) The value of $\cot^2\frac{\pi}{6}+\operatorname{cosec}\frac{5\pi}{6}+3\tan^2\frac{\pi}{6}$

A) 6 B) 5 C) 4 D) 7

8) Solve $7<\frac{3x+11}{2}\leq 11$ x is an integer

A) {1,2,3} B) {2,3} C) (1,11/3] D) {1,2}

9) Solve: $2<3x-4<5$ when x is a natural number

A) [2,3) B) {2} C) {2,3} D) Φ

10) How many lines can be formed using ten points in a plane.

A) 45 B) 90 C) 10 D) ∞

11) $\frac{1}{4!}+\frac{1}{5!}=\frac{x}{6!}$ then value of x is

A) 36 B) 24 C) 12 D) 30

12) Fourth term in the expansion of $\left(x+\frac{1}{x}\right)^6$

A) $20x^2$ B) $20x^4$ C) 20 D) $20/x^2$

13) Which term of sequence $\sqrt{3}$, 3 , $3\sqrt{3}$, ... is 729 ?

A) 10^{th} B) 11^{th} C) 12^{th} D) 13^{th}

14) The value of x, for which -1, x, $-\frac{3}{2}$ are in G.P are

A) 0 B) ±1 C) $\pm\sqrt{3}$ D) $\pm\sqrt{\frac{3}{2}}$

15) Fifth term of the series $a_1=a_2=1$ and $a_n=a_{n-1}+a_{n-2}$, $n>2$. is

A) 2 B) 3 C) 5 D) 8

16) The equation of the line passing through the point (2,2) and cutting off equal intercepts on the axes is

A) $x+y=2$ B) $x+y=4$ C) $x-y=2$ D) $x-y=4$

17) The slope of the line, which makes an angle of 30° with the positive direction of y-axis measured anticlockwise is

A) $\sqrt{3}$ B) $-\sqrt{3}$ C) $\frac{1}{\sqrt{3}}$ D) $-\frac{1}{\sqrt{3}}$

18) The slope of the line perpendicular to the line through the points (2, 5) and (–3, 6) is

A) -5 B) $-\frac{1}{5}$ C) $\frac{1}{5}$ D) 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 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) : Range of $f(x) = \frac{1}{2+\sin x}$ is , $[\frac{1}{3}, 1]$

Reason (R) Range of sin x is [-1,1] (a)

20) Assertion (A) : If $x + (3x - y)i = 3 + 4i$, where x and y are real numbers, then $x = 3$ and $y = 4$

Reason (R) : Two complex numbers $z_1 = a + ib$ and $z_2 = c + id$ are equal if $a = c$ and $b = d$.

SECTION B

21) In a right angled triangle, the difference between two acute angles is $(\pi/18)^c$. Express the angles in radian measure.

22) Find the value of $\cos 50° \cos 10° - \cos 40° \sin 10°$

23) Find the value of $1 + i + i^{-1} + i^{-2} + i^{-3}$

OR

Find the value of $i^{64} + i^{65} + i^{66} + i^{67}$

24) In a G.P., the 3rd term is 24 and the 6th term is 192.Find the 10th term.

25) Find the equation of a line passing through the points (0,1) and parallel to the line passing through points (1,2) and midpoint of (-1,2) and (5,6).

OR

The vertices of a triangle are A (-2, -1), B (6, -2) and C (4, 2). Find the equation of median through the vertex A.

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}. Find A′, B′, AUB, and A∩B , verify that i) $(A \cup B)' = A' \cap B'$ (ii) $(A \cap B)' = A' \cup B'$

OR

If U = {1,2,3,4,5,6,7,8,9} , A = {1,2,3,4} and B = {3,4,8,9} Find A - B , B - A , AUB and A∩B , verify that i) $A - B = A \cap B'$ (ii) $(A - B) \cup (B - A) = (AUB) - (A \cap B)$

27. $f = \{(1,1), (2,3), (0,-1), (-1,-3)\}$ and f is defined as $f(x) = mx + c$. Find f(x), Domain and Range of the function f.

OR

Find domain of the following functions.

(i) $f(x) = -|x-1|$ ii) $f(x) = \sqrt{x-1}$ iii) $f(x) = \frac{1}{x-1}$

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

29. Using Binomial Theorem Show that $3^{2n+2} - 8n - 9$ is divisible by 64.

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

31. If the angle between two lines is $\frac{\pi}{4}$ and slope of one of the lines is $\frac{1}{2}$, find the slope of the other line.

OR

If P (a, b) is the mid-point of a line segment between axes. Show that equation of the line is $\frac{x}{a} + \frac{y}{b} = 2$

SECTION D

32. Using properties of sets prove the followings.

i) $(A \cap B) \cup (A - B) = A$ [2]

ii) Let A, B and C are sets such that $A \cup B = A \cup C$ and $A \cap B = A \cap C$. Show that $B = C$ [3]

33. Find $\sin\frac{x}{2}$, $\cos\frac{x}{2}$ and $\tan\frac{x}{2}$ where $\tan x = -\frac{4}{3}$ x lies in second quadrant.

OR

Prove that $\frac{\sec 8\theta - 1}{\sec 4\theta - 1} = \frac{\tan 8\theta}{\tan 2\theta}$

34. Find the sum of the sequence 7, 77, 777, 7777, ... to n terms.

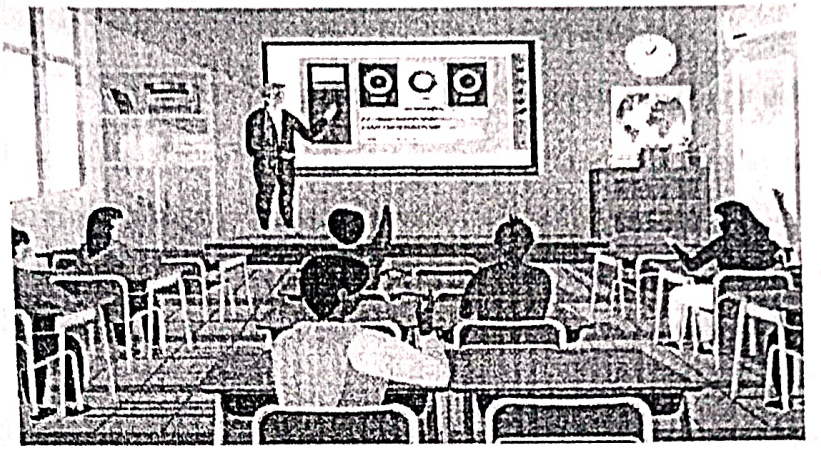
OR

The sum of two numbers is 6 times their geometric mean, show that numbers are in the ratio $(3 + 2\sqrt{2}) : (3 - 2\sqrt{2})$

35. Find the coordinates of the foot of the perpendicular from the point (-1, 3) to the line 3x - 4y- 16 =0. Also find the image of the point (-1,3) with respect to the given line.

SECTION E

36. **CASE STUDY 1**: Read the following passage and answer the questions given below.



A teacher teaching Relations and functions in the class read a statement **"Every function is a relation but every relation is not a function"**. After that he wrote two relations

The relation f is defined by $f(x)=\begin{cases} x^2, 0\le x\le 3 \\ 3x, 3\le x\le 10 \end{cases}$

The relation g is defined by $g(x)=\begin{cases} x^2, 0\le x\le 2 \\ 3x, 2\le x\le 10 \end{cases}$

i) Which of the above relation is a function. Justify your answer.

ii) Which of the above relation is not a function. Justify your answer.

iii) Let A = {1,2,3,4}, B = {1,5,9,11,15,16} and f = {(1,5), (2,9), (3,1), (4,5), (2,11)} which of the following is true or false.

(a) f is a relation from A to B (b) f is a function from A to B.

Justify your answer in both the cases.

OR

Let f be the subset of Z × Z defined by f = {(ab, a + b): a, b ∈ Z}. Is f a function from Z to Z? Justify your answer.

37. **CASE STUDY 2:**

Read the following passage and answer the questions given below.

Sachin Tendulkar is an Indian former international cricketer. He is regarded as one of the greatest batter in the history of cricket. You can observe an interesting pattern in his name. All the letters in the word **SACHIN** after S are in alphabetical order.

i) How many words with or without meaning can be formed using all the letters of the word **SACHIN**

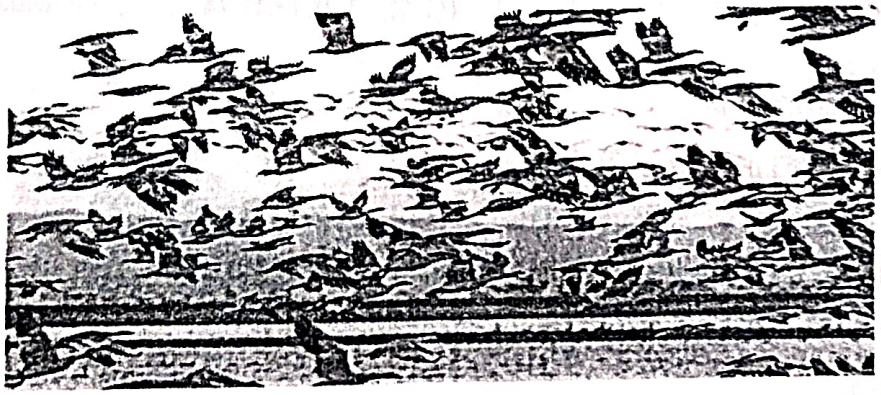
ii) How many words with or without meaning can be formed using all the letters of the word **TENDULKAR** in which vowel comes together.

iii) If all the word with or without meaning which can be formed using all the letters of the word SACHIN are arranged and listed as in dictionary.

OR

If all the word with or without meaning which can be formed using all the letters of the word PRACHI are arranged and listed as in dictionary. Find 481ST word of this list.

38.CASE STUDY 3: Read the following passage and answer the questions given below.



Normal body temperatures for **Mammals** range from 97° F to 104° F. Most **Birds** have a normal body temperature between 102° F to109° F. Birds' higher body temperatures make it difficult for them to obtain enough food when the colder weather arrives in the winter,

therefore most of them move to warmer climates where their bodies do not have to work as hard to keep warm. This type of birds are called migrant birds.

The formula to convert temperature in degree Celsius, Fahrenheit and Kelvin is given by

$$\frac{5(F-32)}{9} = C = K - 273$$

i) What is the range of temperature of mammals in degree Celsius.

ii) What is the range of temperature of birds in kelvin.

ARMY PUBLIC SCHOOL DHAULA KUAN
ANNUAL EXAMINATION 2023-24
MATHEMATICS
CLASS XI

TIME ALLOWED – 3 HRS

MM -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 of 4 marks each with sub-parts.

SECTION A

1. If U ={x: x≤ 10, $x \in N$} , $A = \{x: x \in N, x \text{ is prime}\}, B = \{x: x \in N, x \text{ is even}\}$

Find number of elements in $A \cap B'$

(a) infinite (b) 0 (c)2 (d) 3

2. Find the value of $\cos 1° \cos 2° \cos 3° \ldots\ldots\ldots\ldots\ldots\ldots\ldots \cos 179°$

(a) $\frac{1}{\sqrt{2}}$ (b)1 (c)0 (d)-1

3. Find cos 2x if tanx $= \frac{1}{2}$

(a) $\frac{4}{3}$ (b)$\frac{3}{5}$ (c)1 (d)$\frac{5}{4}$

4. Imaginary part of $\frac{(1+i)^2}{2-i}$ is-

(a)$\frac{1}{5}$ (b)$\frac{4}{5}$ (c)$\frac{3}{5}$ (d)$\frac{2}{5}$

5. If f(x)= x sinx ,then $f'(\pi/2)$ *is*

(a)0 (b)1 (c) -1 (d) ½

6. Distance between the lines 5x+3y-7=0 and 15x+9y+14=0 is

(a)$\frac{35}{\sqrt{34}}$ (b)$\frac{1}{3\sqrt{34}}$ (c)$\frac{35}{3\sqrt{34}}$ (d)$\frac{35}{2\sqrt{34}}$

7. In which Quadrant does $\frac{1+2i}{1-i}$ lie?

(a) first (b) second (c) third (d) fourth

8. If y = $\sqrt{x} + \frac{1}{\sqrt{x}}$, *then* $\frac{dy}{dx}$ *at* $x = 1$ *is* –

(a)1 (b)$\frac{1}{2}$ (c)$\frac{1}{\sqrt{2}}$ (d)0

9. $\lim_{x \to 0} \frac{\sin x^\circ}{x}$ is equal to -

(a) 1 (b) π (c)x (d)$\frac{\pi}{180}$

10.The length of perpendicular drawn from the point (3,4,5) to Y- axis is

(a) 10 (b) $\sqrt{34}$ (c)$\sqrt{113}$ (d)$5\sqrt{2}$

11.Three vertices of parallelogram taken in order are (-1,-6),(2,-5) and (7,2).

The fourth vertex is-

(a) (1,4) (b) (4,1) (c) (1,1) (d)(4,4)

12.The equation of hyperbola whose vertices lie at $(0,\pm3)$ *and foci at* $(0,\pm5)$ *is*

(a) $\frac{x^2}{39}-\frac{y^2}{25}=-1$ (b) $\frac{y^2}{16}-\frac{x^2}{9}=1$ (c) $\frac{x^2}{16}-\frac{y^2}{9}=-1$ (d)*none of these*

13.Value of i^{4k+3} is

(a) i (b) -1 (c) -i (d) -2

14.The line segment joining the points (1,2) and (-2,1) is divided by the line 3x+4y=7 in the ratio

(a) 3:4 (b)4:3 (c) 9:4 (d)4:9

15. $\lim_{x\to1}\frac{x^m-1}{x^n-1}$ is

(a) 1 (b) m/n (c) -m/n (d)$\frac{m^2}{n^2}$

16. Value of $\sin(45°+\emptyset)-\cos(45°-\emptyset)$ *is*

(a) 2cos$\emptyset$ (b)$2sin\emptyset$ (c)1 (d)0

17.If Coefficient of x^2 *and* x^3 *in the expansion of* $(3+ax)^9$ are equal, then a =

(a) 9/7 (b) 7/9 (c) 1 (d)none of these

18.Number of terms in the expansion of$(1-2x+x^2)^7$ are

(a) 8 (b) 16 (c) 14 (d)15

Following are **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)Ais false but R is true.

19.Assertion(A):The point (1,-2,3) lies in OXY'Z octant.

Reason (R) :The three planes XY,YZ & ZX determined by pair of axes divide the space into eight octants and every point in space corresponds to a particular octant.

20. Assertion (A):

In the binomial expansion of $(1+a)^{m+n}$, the coefficients of a^m and a^n are equal

Reason(R) : The coefficients of terms equidistant from the beginning and end are equal.

SECTION B

21.Let f={(1,1),(2,3),(0,-1),(-1,-3)} be a function described by the formula f(x)=ax+b for Some integer a and b. Find f(x)

OR

What is the total number of proper subsets of a set consisting of n elements? Write the proper subsets of {1,2,Ø}

22.There are 5 girls and 3 boys who are to be seated in a row. In how many way can they be seated such that-

(i) no two boys are together?

(i) boys are always together?

23. Differentiate $\frac{px^2+qx+r}{ax+b}$ w.r.t to 'x'

24. Find the equation of line parallel to Y -axis and drawn through the point of intersection of x-7y+5=0 and 3x+y=0

OR

Find the equation of the straight line whose intercepts on X -axis and Y-axis are respectively twice and thrice of those by the line 3x+4y=12

25.One number is chosen from numbers 1 to 200. Find the probability that the number is divisible by 4 or 6.

SECTION C

26.Evaluate

$$\frac{\sin(\pi+x)\cos\left(\frac{\pi}{2}+x\right)\tan\left(\frac{3\pi}{2}-x\right)\cot(2\pi-x)}{\sin(2\pi-x)\cos(2\pi+x)\operatorname{cosec}(-x)\sin\left(\frac{3\pi}{2}-x\right)}$$

OR

Prove that - $\tan 8x-\tan 6x-\tan 2x = \tan 8x \tan 6x \tan 2x$

27. If the first and the nth terms of a GP are a and b respectively and if P is the product of first n terms , prove that $P^2 = (ab)^n$

28.Find the eccentricity, coordinates of foci, vertices, length of minor and major axis, length of the latus rectum of the ellipse- $9x^2 + 25y^2 = 225$

29.Determine the point in the XY plane which is equidistant from the three points A (2,0,3) ,B(0,3,2) and C(0,0,1)

30. Solve the following inequation $\frac{x+3}{x-2} \leq 2$

OR

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. If there are 640 litres of the 8% solution, how many litres of 2% solution will have to be added?

31. Find the foot of perpendicular from (-1,3) to the line 3x -4y-16 = 0

OR

Find the distance of the line 4x+7y+5=0 from the point (1,2) along the line 2x-y=0

SECTION D

32. Find mean, Variance and Standard Deviation of the following distribution-

Classes	30-40	40-50	50-60	60-70	70-80	80-90	90-100
Frequency	3	7	12	15	8	3	2

33. (i) Evaluate $\lim_{x\to\frac{\pi}{2}} \frac{1-\sin x}{\left(\frac{\pi}{2}-x\right)^2}$ (3+2)

(ii) If $y = \frac{2-3\cos x}{\sin x}$, $find\ \frac{dy}{dx}\ at\ x = \frac{\pi}{4}$

34. Find the domain and range of the real function f(x)= $\sqrt{25-x^2}$

OR

The function f is defined by f(x)= $\begin{cases} 1-x, & x<0 \\ 1, & x=0 \\ x+1, & x>0 \end{cases}$ (3+2)

Draw graph of f(x)

(ii) Prove using Venn Diagram, $(A \cup B)' = A' \cap B'$

35.The sum of three numbers in a GP is 56. If we subtract 1,7,21 from these numbers in that order, we obtain an AP. Find the numbers.

OR

If the AM and GM between two numbers are in the ratio m:n, then prove that the numbers are in the ratio $m+\sqrt{m^2-n^2} : m-\sqrt{m^2-n^2}$

SECTION E

Case -Based questions

36. Trigonometry (from Greek," trigon"is triangle " and metron is "measure") is a branch of mathematics that studies relationship between side lengths and angles of triangles. Measurement of angles can be done in degrees (English System), Grades(French system) And Radians (Circular system).

Based on the concepts of trigonometry, answer the following questions- (2+2)

(i)The minute hand of a clock is 2cm long. How far does it move in 20 minutes?

(ii) If $\cos A = \frac{4}{5}$, $\sec B = \frac{13}{12}$ *such that* $A, B \in \left(\frac{3\pi}{2}, 2\pi\right)$, *find the value of* $\sin(A - B)$

OR

If $\sin\theta = -\frac{4}{5}$, θ lies in third quadrant, find $\cos\frac{\theta}{2}$

37.Class XI of a school offers Home Science and Fine arts as optional subjects in one of its sections. In the section consisting of 60 students,30 opted for Home Science and 32 opted for Fine Arts while 24 opted for both. If one of the students is selected at random, find the probability that - (2+2)

(i) the student opted for Home Science or Fine Arts

(ii)the student opted for Fine Arts but not Home Science

38. Collinear points are the points that lie on the same straight line or in a single line. In Euclidean geometry ,If two or more than two points lie on a line close to or far from each other, then they are said to be collinear.

It is given that there are 10 points in a plane, no three of which are in the same straight line, excepting 4 points, which are collinear. Find- (2+2)

(i) Number of straight lines obtained from the pairs of these points.

(ii)Number of triangles that can be formed with the vertices as these points.

P-8

Annual Examination – 2024
Class – XI
Subject -Mathematics

M.M. – 80 **Time – 3 Hours**

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 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 sources based/case based/passage based (4 marks each) with sub parts.

SECTION-A

1) If $A = \{1,2,3,4,5\}$, then the number of proper subsets of A are –

a) 120 b) 30

c) 31 d) 32

2) 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 the values of m and n are –

a) 7,6 b) 6,3

c) 6,4 d) 7,4

3) The value of $\cos\cos 1° \cos\cos 2° \cos\cos 3° \ldots \cos\cos 179°$ is

a) $\frac{1}{\sqrt{2}}$ b) 0

c) 1 d) –1

4) If $\tan\theta = \frac{a}{b}$, then $b\cos 2\theta + a\sin 2\theta =$

a) a b) b

c) b/a d) none of these

5) If the arcs of the same length of two circles subtend 75^0 *and* 140^0 at the centre, then the ratio of the radii of the circles is

a) 3/4 b) 4/3

c) $\sqrt{3}/2$ d) 9/16

6) The value of θ for which $z = \cos\theta + i\sin\theta$ is purely imaginary is

a) 0 b) $\pi/2$

c) π d) 2π

7) Find the value of $\sqrt{-25} + 3\sqrt{-4} + 2\sqrt{-9}$

a) 17i b) 18i

c) -17 d) -18

8) The value of $(0.99)^3$ up to four decimal places is

(a) 0.9011 (b) 0.9702

(c) 0.9013 (d) 0.9014

9) How many ancestors i.e. parents, grandparents, great- grand parents and so on does a person has during the ten generations preceding his own.

(a) 1024 (b) 2066

(c) 2046 (d) 1566

10) If the sum of first two terms of an infinite G.P. is 1 and every term is twice the sum of all the successive terms, then the first term is

(a) $\frac{1}{3}$ (b) $\frac{2}{3}$

(c) $\frac{3}{4}$ (d) $\frac{1}{4}$

11) The area of the circle centered at (1, 2) and passing through (4, 6) is

(a) 5π (b) 10π

(c) 25π (d) 20π

12) The mean deviation of the data 2, 9, 9, 3, 6, 9, 4 from the mean is:

(a) 2.23 (b) 2.57

(c) 3.23 (d) 3.57

13) The domain and range of the real function f defined by f(x) = $\frac{4-x}{x-4}$ is given by

(a)Domain= R, Range= {-1, 1} (b) Domain=R-{1}, Range= R

(c) Domain=R-{4} Range= {-1} (d) Domain = R-{-4} Range={-1,1}

14) If f(x) = ax +b where a and b are integers, f (-1) =-5 and f (3) =3, then a and b are equal to

a) a= -3 , b =-1 b) a=2 b= -3

c) a=0, b =2 d) a=2 , b = 3

15) In an examination there are three multiple choice questions and each has 4 choices. Number of ways in which a student can fail to get all answer correct is

a) 11 b) 12

c) 27 d) 63

16) The number of ways 10 digit numbers can be written using the digits 1 and 2 is

a) 2^{10} b) 10_{C_2}

c) 10! d) $10_{C_1} + 19_{C_2}$

17) All letters of the word EAMCOT are arranged in different possible ways. The number of such arrangements in which no two vowels are adjacent to each other is

a) 360 b) 144

c) 72 d) 54

18) There are four bus routes between A and B and three bus routes between B and C.A man can travel round trip in number of ways by bus from A to C via B. If he does not want to use a bus route more than once, in how many ways can he make round trip?

a) 72 b) 144

c) 14 d) 19

ASSERTION-REASON BASED QUESTIONS (Q19 & Q20)

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 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: The total number of terms in expansion of $(x^5 + y^5)^5$ is 6.

REASON: The total number of terms in expansion of $(x + y)^n$ is n+1.

20) ASSERTION: If (x+1, y-2) = (3, 1) then x = 2 and y = 3

REASON: Two ordered pairs are equal, if their corresponding elements are equal.

SECTION-B

21) Find the modulus of $z = \frac{1+i}{1-i}$

OR

Find the conjugate of $\frac{(3-i)^2}{2+i}$.

22) How many numbers are there between 99 and 1000 having at least one of their digits 7?

23) Find the vertex of triangle whose centroid is origin and two vertices are (2, 4, 6) and (0, -2, 5).

OR

Find the point on x axis which is equidistant from the points A (3, 2, 2) and B (5, 5, 4).

24) If $\lim_{x \to 1} \frac{x^4 - 1}{x - 1} = \lim_{x \to k} \frac{x^3 - k^3}{x^2 - k^2}$, then find the value of k.

25) Differentiate $\left(\sqrt{x} + \frac{1}{\sqrt{x}}\right)^2$ with respect to x.

SECTION-C

26) Let $f = \{(x, \frac{x^2}{1+x^2}) : x \in R\}$ be a function from R into R. Determine the range of f

OR

Find the range of the function given by $f(x) = \frac{3}{2 - x^2}$

27) Draw the graph of $f(x) = \sin x$. Write the domain and range.

28) A man wants to cut three lengths from a single piece of board of length 91cm. The second length is to be 3cm longer than the shortest and the third length is to be twice as long as the shortest.

(i) If x is the length of shortest piece ,write the perimeter as inequality form.

(ii) Use **part (i)** find the length of shortest piece as inequality form.

(iii) What are the possible lengths of the shortest board if the third piece is to be at least 1cm longer than the second?

OR

Rishi is aiming for a seat in prestigious institution which admits students scoring above 90% in class XII. Class XII marks are calculated in weightage system where each PA carries 10% weightage, half yearly marks carry 20% weightage and remaining weightage is that of final exam. Rishi got 45/50, 49/50 and 40/50 in three PA s and 96/100 in half yearly. How many minimum marks should he get out of 100 in his final exam to get admission in the institute?

29) Prove by using binomial theorem that $6^n - 5n - 1$ is divisible by 25, for all natural number n.

30) The mean and standard deviation of a group of 100 observations were found to be 20 and 3, respectively. Later on it was found that three observations were incorrect, which were recorded as 21, 21 and 18. Find the mean and standard deviation if the incorrect observations are omitted.

31) A committee of two persons is selected from two men and two women. What is the probability that the committee will have (a) no man? (b) One man? (c) Two men?

OR

If A, B, C are three events associated with a random experiment, prove that $P(A \cup B \cup C) = P(A)+P(B)+P(C)-P(A \cap B)-P(A \cap C)-P(B \cap C) + P(A \cap B \cap C)$

SECTION -D

32) Prove that $2\cos\frac{\pi}{13}\cos\frac{9\pi}{13} + \cos\frac{3\pi}{13} + \cos\frac{5\pi}{13} = 0$

OR

Find $\sin\frac{x}{2}$, $\cos\frac{x}{2}$ and $\tan\frac{x}{2}$ if $\sin x=\frac{1}{4}$, x lies in quadrant II

33) Let S be the sum, P the product and R the sum of reciprocals of n terms in a G.P. prove that $P^2 \times R^n = S^n$

OR

The ratio of A.M. and G.M. of two positive numbers a and b is m: n. Show that a: b = $(m+\sqrt{m^2-n^2}) : (m-\sqrt{m^2-n^2})$

34) A beam is supported at its ends by supports which are 12 meters apart. Since the load is concentrated at its center, there is a deflection of 3 cm at the center and the deflected beam is in the shape of a parabola. How far from the center is the deflection 1 cm?

35) An urn contains twenty white slips of paper numbered from 1 to 20, ten red slips of paper numbered from 1 through 10, forty yellow slips of paper numbered from 1 through 40 and ten blue slips of paper numbered from 1 to 10. If these 80 slips of paper are thoroughly shuffled so that each slips has the same probability of being drawn. Find the probabilities of drawing a slip of paper that is

(a) Blue or white
(b) Numbered 1, 2, 3, 4, 5
(c) Red or yellow numbered 1, 2, 3 or 4
(d) Numbered 5, 15, 25 or 35
(e) White and numbered higher than 12 OR yellow and numbered higher than 26.

SECTION – E

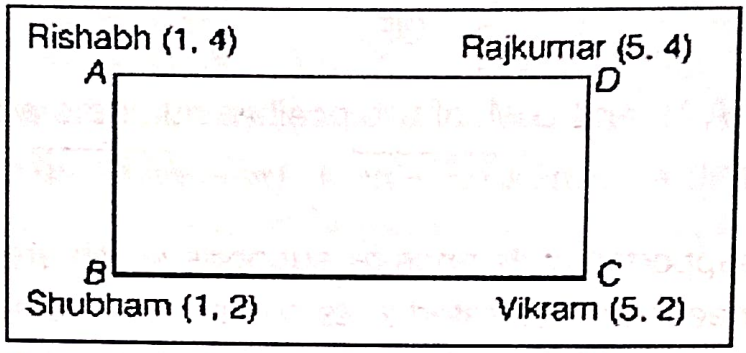
36) Two non-empty sets A and B are given by A= {x: x is a letter in 'I LOVE MATHEMATICS'} and B={x: x is a letter in 'I LOVE STATISTICS}. Based on the above information answer the following questions

a) What is $A \cup B$?
b) What is $A \cap B$?
c) What is $A \cap B - A \cup B$?

OR

Find the number of proper subsets of set B.

37) Four friends Rishab, Shubham, Vikram and Raj Kumar are sitting on the vertices of a rectangle, whose coordinates are given.



Based on the above information solve the following questions.

(i) Find the equation formed by Shubham and Rajkumar.

(ii) Which is the pair of students having the same slope?

(iii) Find the slope of the line formed by Shubham and Raj kumar

OR

Find the distance between Rishab and Shubham .

38) In class XI science, the teacher is explaining the concept of derivative and he defined the derivative of a real function $f(x)$ as $f'(x)=\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$ and said that this is called the first principle of derivative. But one of the students asked that this is looking like a limit and what they used to call the left-hand and right-hand limits of the above limit. Then the teacher replied that the left-hand limit of $\frac{f(x+h)-f(x)}{h}$ at $h=0$ is called left derivative $Lf'(x)$ and the right-hand limit is called right derivative $Rf'(x)$.

Based on the above information, answer the following questions.

(i)) Find the derivative of $\sin x$ at x = 0

(ii) Find the derivative of f(x) = x^2 by using first principle.