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TAGORE INTERNATIONAL SCHOOL
VASANT VIHAR, NEW DELHI
MID TERM EXAMINATION (2024-25)
MATHEMATICS
CLASS – XI

Date: 18.09.2024
No of Pages: 6

Time: 3 Hours
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 **MCQs** and 02 **Assertion-Reason** based questions of **1 mark** each.
   Section B has 05 **Very Short Answer (VSA)-type** questions of 2 marks each.
   Section C has 06 **Short Answer (SA)-type** questions of 3 marks each.
   Section D has 04**Long Answer (LA)-type** questions of 5 marks each.
   Section E has 03 **Case-study / Source-based / passage based/integrated units of assessment** (4 marks each) with sub-parts.
3. All questions are compulsory.
4. If you want to answer any question again, cancel the previous answer.

SECTION A

Choose the correct option for Q1 to Q20

Q1. Which of the following is a null set? (1 Mark)

a) $\{x: x \in N, 2x - 1 = 3\}$

b) $\{x: x$ is an even prime greater than $2\}$

c) $\{x: x \in N, x^2 < 20\}$

d) $\{x: x \in Z, 3x + 7 = 1\}$

Q2. The domain of the function f defined by $f(x) = \frac{1}{\sqrt{|x|-x}}$ is: (1 Mark)

a) $(-\infty, 0)$

b) $(0, \infty)$

c) $(-\infty, 0]$

d) $\emptyset$

Q3. The value of $cosec(-750°)$ is: (1 Mark)

a) $\frac{2}{\sqrt{3}}$

b) 2

c) -2

d) $-\frac{2}{\sqrt{3}}$

Q4. If $|2x+3|<7, x \in R$, then (1 Mark)

a) $x \in (-5,2)$.

b) $x \in (-5,2]$

c) $x \in (-\infty,-5] \cup (2,\infty)$

d) $x \in (-\infty,-5) \cup [2,\infty)$

Q5. If $\left\{\frac{(1+i)}{(1-i)}\right\}^x = 1$, then for all $n \in N$: (1 Mark)

a) $x = 2n+1$

b) $x = 2n$

c) $x = 4n$

d) $x = 4n+1$

Q6. The inclination of the line $x - y + 3 = 0$ with positive direction of x −axis is: (1 Mark)

a) $45°$

b) $135°$

c) $-45°$

d) $-135°$

Q7. The interval in which $f(x) = \frac{2x-1}{x-3}$ is negative is (1 Mark)

a) $(-2,3)$

b) $\left(\frac{1}{2},3\right)$

c) $\left(-\infty,\frac{1}{2}\right)$

d) $(3,\infty)$

Q8. If $A = \{1,2,3,4,5\}$ then which of the following is not true? (1 Mark)

a) $0 \notin A$

b) $\{3\} \in A$

c) $3 \in A$

d) $\{3\} \subset A$

Q9. The domain of the function f defined by $f(x) = \frac{x}{x^2+3x+2}$ is (1 Mark)

a) $R - [1,-2]$

b) $R - \{1,-2\}$

c) $R - \{-1,-2\}$

d) $R - (-2,1)$

Q10. The range of $f(x) = 4 + 5\cos x$ is (1 Mark)

a) $[-1,9]$

b) $(-1,9]$

c) $(-1,9)$

d) $[-1,9)$

Q11. The equation of parabola with focus at $(-3,0)$ and directrix $x = 3$ is: (1 Mark)

a) $x^2 = 12y$

b) $x^2 = -12y$

c) $y^2 = 12x$

d) $y^2 = -12x$

Q12. The equation of line for which $\tan\theta = \frac{1}{2}$, where θ is the inclination of the line and $y-intercept$ as $\frac{-3}{2}$ is: (1 Mark)

a) $2y - x + 3 = 0$

b) $2x + 3y - 1 = 0$

c) $2x - y + 3 = 0$

d) $3x + 2y + 5 = 0$

(1 Mark)

Q13. The value of $1 + i + i^2 + \cdots + i^n$ is: (1 Mark)

a) positive
c) negative
b) 0
d) cannot be determined

Q14. The length of latus rectum for the conic section $9y^2 - 4x^2 = 36$ is: (1 Mark)

a) $\frac{4}{3}$
c) 9
b) 4
d) $2\sqrt{3}$

Q15. If $(1 + 2i)(2 + 3i)(3 + 4i) = x + iy;\ x, y \in R, then\ x^2 + y^2$ is: (1 Mark)

a) 1450
c) 1575
b) 1625
d) 1725

Q16. The area of triangle with vertices A (-4,-1), B (1,2) and C (1,-2) is: (1 Mark)

a) 17
c) 13
b) 2
d) 10

Q17. The value of $2sin^2\frac{\pi}{6} + cosec^2\frac{7\pi}{6}.\ cos^2\frac{\pi}{3}$ is equal to: (1 Mark)

a) 1
c) $\frac{3}{2}$
b) -1
d) 2

Q18. Which of the following interval is a correct representation of the set
$A = \{x: -3 < x \leq 0, x \in R\}$ (1 Mark)

a) $(-3, 0)$
c) $[-3, 0)$
b) $[-3, 0]$
d) $(-3, 0]$

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.

Q19. **Assertion (A) :** Conjugate of $-3 + 4i$ lies in the second quadrant. (1 Mark)

Reason (R) : $x + iy$ lies in the second quadrant if $x < 0$ and $y > 0$.

Q20. **Assertion (A) :** If the line passing through $(4, -5)$ and $(7, -2)$ is parallel to the line joining $(-2,3)$ and $(\alpha, 7), then\ \alpha = 2$.

Reason (R) : Two non-vertical lines are parallel if the product of their slopes is -1. (1 Mark)

SECTION B

Q21. Let f be the subset of $Q \times Z$ defined by $f = \{\left(\frac{a}{b}, a\right) : a, b \in Z, b \neq 0\}$. Is f a function from Q to Z? Justify your answer. (2 Marks)

Q22. Let $A = \{1,2,4,5\}, B = \{2,3,5,6\}, C = \{4,5,6,7\}$, verify the identity: (2 Marks)
$A \cap (B - C) = (A \cap B) - (A \cap C)$

Q23. A and B are two sets such that $n(A - B) = 14 + x, n(B - A) = 3x$ and $n(A \cap B) = x$. If $n(A \cup B) = 49$, find the value of x. (2 Marks)

Q24. Solve the system of inequalities: $3 \leq |2x - 1| < 7$ (2 Marks)

OR

Solve the system of inequalities: $5x - 7 < 3(x + 3), \quad 1 - \frac{3x}{2} > x - 4$ (2 Marks)

Q25. Using slopes, find the value of x for which the points $(x, -1), (2,1)$ and $(4,5)$ are collinear. (2 Marks)

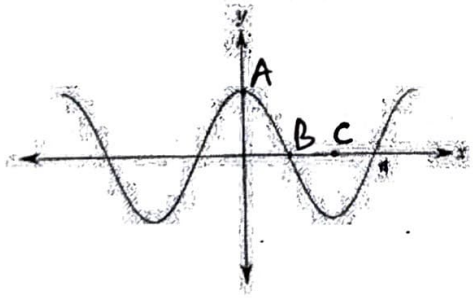
SECTION C

Q26. Express the following complex number in standard form: $\frac{\sqrt{7+3i}+\sqrt{7-3i}}{\sqrt{7+3i}-\sqrt{7-3i}}$.

Also, find its conjugate. (3 Marks)

Q27. Solve the system of inequality and represent the solution on number line : (3 Marks)
$\frac{x}{2x+1} \geq \frac{1}{4}$

Q28. Here is part of the curve $y = cos(x)$, where x is in radian measure. Write the coordinates of points A, B and C. (3 Marks)



Q29. Two lines passing through the point (4,3) intersect each other at an angle of $45°$. If the slope of one line is 2, find the equation of the other line. (3 Marks)

OR

Find the equation of the straight line passing through the point $(5,2)$ and perpendicular to the line joining the points $(2,3)$ and $(3,-1)$ (3 Marks)

Q30. Prove that: $\frac{sin5x+2sin8x+sin11x}{sin8x+2sin11x+sin14x} = \frac{sin8x}{sin11x}$ (3 Marks)

Q31. Find the coordinates of focus, the vertex, the equation of directrix and latus-rectum of the conic section represented by the equation $y^2 = 36x$ (3 Marks)

OR

Find the equation of hyperbola whose vertices are $(\pm 7,0)$ and eccentricity is $\frac{4}{3}$. (3 Marks)

SECTION D

Q32. Prove that : $cos20°cos40°cos60°cos80° = \frac{1}{16}$ (5 Marks)

OR

If $cosx = \frac{-1}{7}$, x lies in third quadrant. Find $sin\frac{x}{2}, cos\frac{x}{2}$ and $tan\frac{x}{2}$. (5 Marks)

Q33. (i) Find the domain and range of the following function: $f(x) = 2 - |x - 5|$ (3 Marks)

(ii) Given a relation $R = \left\{(x, y): y = x + \frac{6}{x}, where\ x, y \in N, x < 6\right\}$. Write R in roster form and also represent it using an arrow diagram. (2 Marks)

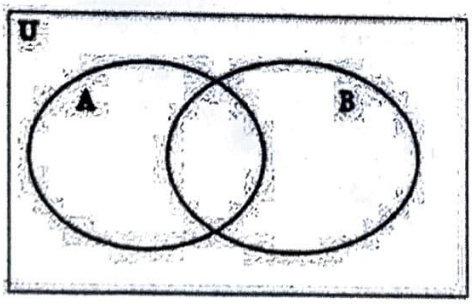
Q34. Find the equation of circle which passes through the points $(2,3)$ and $(4,5)$ and the center lies on the line $y - 4x + 3 = 0$. (5 Marks)

Q35. Solve the equation $|z + 1| = z + 2(1 + i)$. (5 Marks)

SECTION E

(Case study-based questions)

Q36. A survey among 800 people was conducted to know about the transportation used by them in an area. It was observed that 420 go to work by Car and 360 go to work by bicycle and 140 use both modes of transportation. The information collected was put into a Venn diagram as given below, where A denotes the number of people travelling by Car and B denotes the number of people travelling by Bicycle



Answer the following based on the given information:

a) How many people use at least one of both transportation types? (1 Mark)

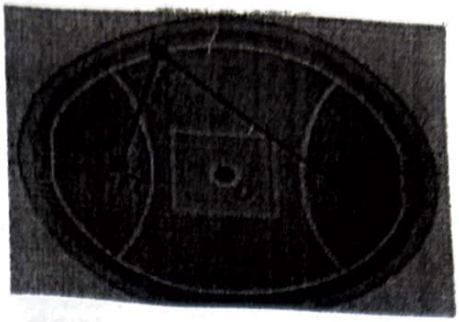
b) How many people go neither by car nor by bicycle? (1 Mark)

c) How many people go to work by Car only? (2 Marks)

OR

How many people go to work by bicycle only? (2 Marks)

Q37. Rohan is playing with his friend in an elliptical park. The park has ends of major axis as $(\pm 10,0)$ and ends of minor axis as $(0, \pm 5)$. Rohan wants to throw the ball from the center of the park to the edge.



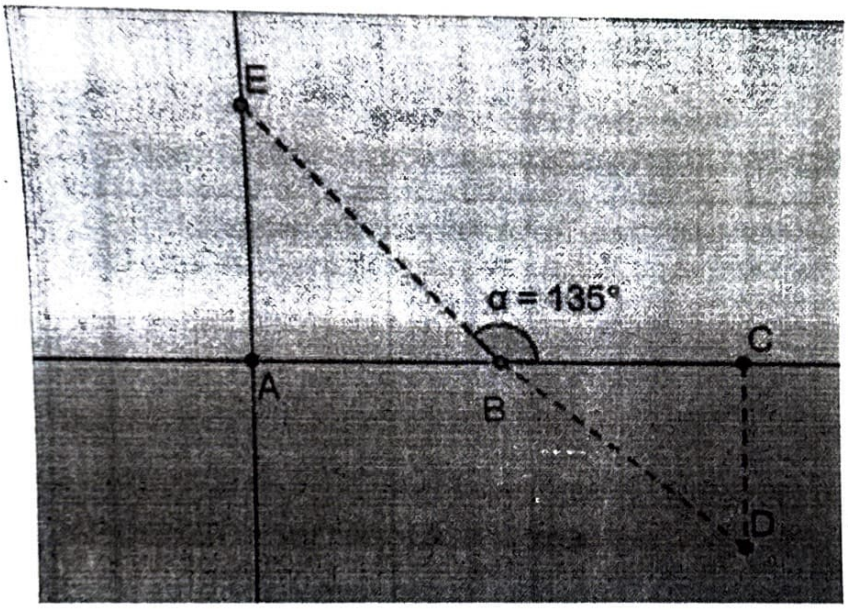
Based on the given information answer the following questions:

a) Find the equation of ellipse. (1 Mark)
b) Find the latus rectum of ellipse. (1 Mark)
c) Find the eccentricity of ellipse. (2 Marks)

OR

Find the coordinates of foci. (2 Marks)

Q38. Five friends Chetan, Ela, Danish, Anita and Bob have their homes respectively situated at points A, B, C, D and E. Assuming A is the origin, B, C are on the $x-axis$ and E is on the $y-axis$.



Based on the given information answer the following:

a) If $AB = BC = AE = 4m$, then what would be the equation of line BE? (2 Marks)

b) What would be the distance of A from the line BE? (2 Marks)