

Venkateshwar Global School, Rohini
Mid Term Examination (2025-26)
Mathematics



Time: 3 Hours

M.M: 80

Subject Code: 041

Date: 25-08-2025

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Class: XI

Section: COLUMBA

Roll No.: 8

General instructions:

- This question paper contains five sections **A, B, C, D and E**. Each section is compulsory. However there are internal choices in some questions.
- **Section A** has 18 MCQs and 2 Assertion – Reason based questions of 1 mark each.
- **Section B** has 5 Very Short Answer (VSA) type questions of 2 marks each.
- **Section C** has 6 Short Answer (SA) type questions of 3 marks each.
- **Section D** has 4 Long Answer (LA) type questions of 5 marks each.
- **Section E** has 3 source based / case based / integrated units of assessment (4 marks each) with sub parts.

Section A

1. If a set A contains 3 elements, then its power set contains
 - a) 9 elements
 - b) 8 elements
 - c) 3 elements
 - d) None of these
2. The value of $\sin(45^\circ + \theta) - \cos(45^\circ - \theta)$ is
 - a) 0
 - b) 1
 - c) -1
 - d) None of these
3. If $A = \{2, 3, 4, 5, 6\}$ and R is a relation on set A defined by $R = \{(x, y) : y = x + 2, x, y \in A\}$, then R is
 - a) $\{(2, 4), (3, 5), (4, 6)\}$
 - b) $\{(4, 2), (5, 3), (6, 4)\}$
 - c) $\{(2, 4), (5, 3), (4, 6)\}$
 - d) $\{(4, 2), (3, 5), (4, 6)\}$
4. The centroid of a triangle is (2, 7) and two of its vertices are (4, 8) and (-2, 6). The third vertex is
 - a) (0, 0)
 - b) (4, 7)
 - c) (7, 4)
 - d) (7, 7)

5. If $A = \{a, b\}$ and $B = \{x, y, z\}$, then the number of relations from B to A is
 a) 8 b) 16 c) 32 d) 64
6. The value of $\sin\left(\frac{-11\pi}{3}\right)$ is
 a) $\sqrt{3}/2$ b) $2/\sqrt{3}$ c) $-1/\sqrt{3}$ d) $\sqrt{3}$
7. In a G.P. if first term is $3/4$, common ratio is 2 and the last term is 384, then the number of terms of G.P. is
 a) 8 b) 9 c) 10 d) 11
8. The two lines $a_1x + b_1y = c_1$ and $a_2x + b_2y = c_2$ are perpendicular if
 a) $a_1a_2 + b_1b_2 = 0$ b) $a_1b_2 = a_2b_1$
 c) $a_1b_1 + a_2b_2 = 0$ d) $a_1b_2 + a_2b_1 = 0$
9. The domain for which the functions defined by $f(x) = 6x^2 + 1$ and $g(x) = 11 - 7x$ are equal is
 a) $\left\{-1, \frac{2}{3}\right\}$ b) $\left\{3, \frac{5}{6}\right\}$ c) $\left\{-2, \frac{5}{6}\right\}$ d) $\left\{2, \frac{2}{3}\right\}$
10. If $z = \cos \frac{\pi}{4} + i \sin \frac{\pi}{6}$, then the value of $|z|$ is
 a) 1 b) $1/2$ c) $\sqrt{3}/2$ d) None of these
11. The angle subtended by an arc of length 20 cm at the centre of circle when radius is 14 cm is
 a) $5/7$ radians b) $10/7$ radians
 c) $5/14$ radians d) $7/10$ radians
12. The real value of a for which $3i^3 - 2ai^2 + (1-a)i + 5$ is real is
 a) $a = -2$ b) $a = 2$ c) $a = 5/2$ d) $a = -5/2$
13. The inclination of the line $x - y + 3 = 0$ with positive direction of x-axis is
 a) 45° b) 135° c) -45° d) -135°
14. The value of $3 \sin \frac{\pi}{6} \cdot \sec \frac{\pi}{3} - 4 \sin \frac{5\pi}{6} \cdot \cot \frac{\pi}{4}$ is
 a) -1 b) 0 c) 1 d) 2
15. If $z = \bar{z}$, then z lies on
 a) x-axis b) y-axis c) origin d) None of these
16. If $x, 2y, 3z$ are in A.P., where the distinct numbers x, y, z are in G.P., then the common ratio of G.P. is
 a) 3 b) $1/3$ c) 2 d) $1/2$
17. If $\sin x = 1/3$, then the value of $\sin 3x$ is
 a) 1 b) 0 c) $23/27$ d) $-\frac{23}{27}$
18. The solution set of $6 \leq -3(2x - 4) < 12$, $x \in \mathbb{R}$ is
 a) $(0, 1]$ b) $[1, 0)$ c) $(0, 1)$ d) $[0, 1]$

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):** The value of $\sin 5\theta - \sin 7\theta + \sin 11\theta = 0$.

Reason (R): $\sin x - \sin y = 2 \cos \frac{x+y}{2} \sin \frac{y-x}{2}$

20. **Assertion (A):** The equation of the line passing through the point (1, 4) and parallel to the line

$$4x + y - 7 = 0 \text{ is } 4x + y - 8 = 0.$$

Reason (R): Lines with slopes m_1 and m_2 are perpendicular iff $m_1 m_2 = -1$.

Section B

21. A and B are two sets such that $n(A - B) = 14 + x$, $n(B - A) = 3x$ and $n(A \cap B) = x$. Draw a Venn diagram to illustrate this information. If $n(A) = n(B)$, find the value of x .

22. If $A = \{2, 4, 6, 9\}$, $B = \{4, 6, 18, 27, 54\}$ and a relation R from A to B is defined by $R = \{(a, b); a \in A, b \in B, a \text{ is a factor of } b \text{ and } a < b\}$, then find R in roster form. Also find its domain and range.

23. If $z = \frac{1+i}{\sqrt{2}}$, then find the value of $z^6 + z^4 + z^2 + 1$.

24. If $a = \frac{2 \sin x}{1 + \cos x + \sin x}$, then prove that $\frac{1 - \cos x + \sin x}{1 + \sin x}$ is also equal to a .

25. If one geometric mean G and two arithmetic means p and q are inserted between two numbers, show that $G^2 = (2p - q)(2q - p)$.

Section C

26. If A, B and C are three sets such that $A \cup B = C$ and $A \cap B = \phi$, then show that $A = C - B$ (using properties of sets).

27. Find the domain and range of the function $f(x) = \frac{x^2 - x + 1}{x^2 + x + 1}$.

28. Prove that $\cos^2 x + \cos^2\left(x + \frac{\pi}{3}\right) + \cos^2\left(x - \frac{\pi}{3}\right) = \frac{3}{2}$.

29. Find the real values of x and y for which the complex numbers $-3 + ix^2y$ and $x^2 + y + 4i$ are conjugate of each other.

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

31. Find the angle between the lines $y = (2 - \sqrt{3})(x + 5)$ and $y = (2 + \sqrt{3})(x - 7)$.

Section D

32. a) If $P = \{x \mid x^2 + 14x + 40 = 0\}$, $Q = \{x \mid x^2 - 5x + 6 = 0\}$ and $R = \{x \mid x^2 + 17x - 60 = 0\}$, then find $P \cap (Q \cup R)$ and $P \cup (Q \cap R)$.
- b) Find the quotient of the identity function by the modulus function.
33. If $\tan \frac{\theta}{2} = \sqrt{\frac{a-b}{a+b}} \tan \frac{\phi}{2}$, prove that $\cos \theta = \frac{a \cos \phi + b}{a + b \cos \phi}$.
34. Show that the sum and product of two complex numbers are real iff they are conjugates of each other.
35. If b is the least value of the product of the roots of the equation $(m^2 + 1)x^2 - 3x + (m^2 + 1)^2 = 0$ and c is the greatest value of the sum of its roots, then find the sum of first five terms of the G.P. whose first term is $(b + 2)$ and the common ratio is $2c^{-1}$.

Section E

Case Study 1:

36. Tanya wants to cut three lengths from a single piece of rod of length 91 cm to play a game. The length of the second piece should be 3 cm longer than the shortest and the length of third piece should be twice as long as the shortest.

Based on the above information answer the following questions.

- Find the maximum possible length of the shortest piece.
- Find the possible lengths of the shortest piece if the third piece is to be at least 5 cm longer than the second piece.

Case Study 2:

37. A company introduced a battery powered home décor product at a price of ₹ 100. From the following year onward, the company redesigned the product and increased its price by 10% compared to the previous year.

Based on the above information answer the following questions.

- What will be the price of the product in the 2nd year?
- Check whether the prices in four consecutive years form a Geometric progression.
- Find the sum of first four years' prices using the appropriate formula.

Case Study 3:

38. Three students of Class 11 named A, B, C are standing in a playground at positions $(1, 4)$, $(2, -3)$ and $(-1, -2)$ with respect to two mutually perpendicular lines drawn in the playground. AM is the altitude from vertex A on side BC and AD is the median meeting side BC at D.

Based on the above information answer the following questions.

- Find the coordinates of mid-point D of side BC.
- Find the distance between A and B.
- Find the equation of the median AD through A.