

Subject - Mathematics

Sample Question Paper - 6

Time Allowed: 3 hours

Maximum Marks: 80

General Instructions:

1. This Question paper contains 38 questions. All questions are compulsory.
2. This Question paper is divided into five Sections - A, B, C, D and E.
3. In Section A, Questions no. 1 to 18 are multiple choice questions (MCQs) and Questions no. 19 and 20 are Assertion-Reason based questions of 1 mark each.
4. In Section B, Questions no. 21 to 25 are Very Short Answer (VSA)-type questions, carrying 2 marks each.
5. In Section C, Questions no. 26 to 31 are Short Answer (SA)-type questions, carrying 3 marks each.
6. In Section D, Questions no. 32 to 35 are Long Answer (LA)-type questions, carrying 5 marks each.
7. In Section E, Questions no. 36 to 38 are Case study-based questions, carrying 4 marks each.

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- c) $\sqrt{13}$ d) $\frac{7}{13}\sqrt{13}$
6. If A and B are two sets then $A \cap (A \cap B^c) = \dots$ [1]
 a) \in b) ϕ
 c) B d) A
7. Mark the correct answer for $\left(\frac{1-i}{1+i}\right)^2 = ?$ [1]
 a) 1 b) $\frac{1}{\sqrt{2}}$
 c) $\frac{-1}{2}$ d) -1
8. If $A = \{x \in \mathbb{Z} : 0 \leq x \leq 12\}$ and R is the relation in A given by $R = \{(a, b) : |a - b| \text{ is a multiple of } 4\}$. Then, the set of all elements related to 1 is [1]
 a) {1, 3, 9} b) {1, 4, 6}
 c) {1, 5, 9} d) {2, 4, 6}
9. If $|x + 2| \leq 9$, then [1]
 a) $x \in (-\infty, -7) \cup (11, \infty)$ b) $x \in (-7, 11)$
 c) $x \in [-11, 7]$ d) $x \in (-7, -\infty) \cup [\infty, 11)$
10. The value of $\sin 78^\circ - \sin 66^\circ - \sin 42^\circ + \sin 60^\circ$ is [1]
 a) -1 b) $\frac{1}{2}$
 c) $\frac{-1}{2}$ d) None of these
11. Two finite sets have m and n elements respectively. The total number of subsets of first set is 56 more than the total number of subsets of the second set. The values of m and n respectively are. [1]

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17. If z is any complex number, then $\frac{z-\bar{z}}{2i}$ is [1]
- a) purely real b) purely imaginary
 c) either 0 or purely imaginary d) either 0 or purely real
18. If ${}^{15}P_{r-1} : {}^{16}P_{r-2} = 3 : 4$, then $r = ?$ [1]
- a) 10 b) 12
 c) 14 d) 8
19. **Assertion(A):** In the expansion $(x + x^{-2})^n$ the coefficient of eighth term and nineteenth term are equal, then $n = 25$. [1]
- Reason (R):** Middle term in the expansion of $(x + a)^n$ has the greatest binomial coefficient.
- 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.
20. **Assertion (A):** The mean deviation about the mean for the data 4, 7, 8, 9, 10, 12, 13, 17 is 3. [1]
- Reason (R):** The mean deviation about the mean for the data 38, 70, 48, 40, 42, 55, 63, 46, 54, 44 is 8.5.
- 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.
- Section B**
21. if $A = \{1, 3, 5\}$ and $B = \{2, 3\}$, then show that $A \times B \neq B \times A$. [2]
- OR

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22. Differentiate $\left(\frac{x^2+5x-6}{4x^2-x+3}\right)$. [2]

23. Find the equation of the ellipse in the cases: eccentricity $e = \frac{1}{2}$ and major axis = 12. [2]

OR

Find the vertex, focus, axis, directrix and latus-rectum of the following parabolas $4x^2 + y = 0$.

24. If $A = \{a, b, c, d, e\}$, $B = \{a, c, e, g\}$ and $C = \{b, e, f, g\}$, verify that: $B \cup C = C \cup B$ [2]

25. State whether the two lines are parallel, perpendicular or neither: Through (3, 15) and (16, 6); through (-5, 3) and (8, 2) [2]

Section C

26. Let $f : \mathbb{R} \rightarrow \mathbb{R}$: $f(x) = x^3$ for all $x \in \mathbb{R}$. Find its domain and range. Also, draw its graph. [3]

27. Solve the system of linear inequation: $3x - x > x + \frac{4-x}{3} > 3$ [3]

28. Verify that (-1, 2, 1), (1, -2, 5), (4, -7, 8) and (2, -3, 4) are the vertices of a parallelogram. [3]

OR

Show that the points (-2, 3, 5), (1, 2, 3) and (7, 0, -1) are collinear.

29. The coefficient of $\frac{1}{x^{17}}$ in the expansion of $\left(x^4 - \frac{1}{x^2}\right)^{15}$ is [3]

OR

$$\{(\sqrt{2} + 1)^5 + (\sqrt{2} - 1)^5\}$$

30. Write the argument of $(1 + \sqrt{3})(1 + i)(\cos \theta + i \sin \theta)$. [3]

OR

Find the square root of $-15 - 8i$.

31. Using the properties of sets and their complements prove that: $A - (B \cup C) = (A - B) \cap (A - C)$ [3]

Section D

32. A bag contains 8 red and 5 white balls. Three balls are drawn at random. Find the probability that all the three balls are red. [5]

33. Evaluate the following limits: $\lim_{x \rightarrow \sqrt{10}} \frac{\sqrt{7+2x} - (\sqrt{5} + \sqrt{2})}{x^2 - 10}$. [5]

OR

Differentiate $\frac{\sin x}{x}$ from first principle.

34. If S be the sum, P be the product and R be the sum of reciprocals of n terms in a G.P, prove that $P^2 = \left(\frac{S}{R}\right)^n$. [5]

35. Prove that: $\tan 20^\circ \tan 30^\circ \tan 40^\circ \tan 80^\circ = 1$ [5]

OR

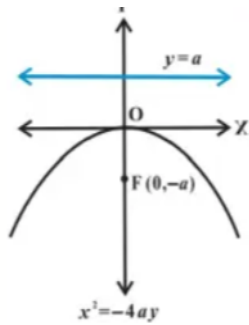
Prove that: $\sin 20^\circ \sin 40^\circ \sin 80^\circ = \frac{\sqrt{3}}{8}$

Section E

36. **Read the following text carefully and answer the questions that follow:** [4]

Indian track and field athlete Neeraj Chopra, who competes in the Javelin throw, won a gold medal at Tokyo Olympics. He is the first track and field athlete to win a gold medal for India at the Olympics.

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- i. Name the shape of path followed by a javelin. If equation of such a curve is given by $x^2 = -16y$, then find the coordinates of foci. (1)
- ii. Find the equation of directrix and length of latus rectum of parabola $x^2 = -16y$. (1)
- iii. Find the equation of parabola with Vertex $(0,0)$, passing through $(5,2)$ and symmetric with respect to y-axis and also find equation of directrix. (2)

OR

Find the equation of the parabola with focus $(2, 0)$ and directrix $x = -2$ and also length of latus rectum. (2)

37. **Read the following text carefully and answer the questions that follow:**

[4]

A teacher conducted a surprise test of Mathematics, Physics and Chemistry for class XI on Monday.

The mean and standard deviation of marks obtained by 50 students of the class in three subjects are given below:

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