

Maximum Marks: 80

General Instructions:

Read the following instructions very carefully and strictly follow them:

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, Q 1 to 18 are multiple choice questions (MCQs) with only one correct option and Q 19 and 20 are Assertion-Reason based questions of 1 mark each.
4. In Section B, Q 21 to 25 are Very Short Answer (VSA)-type questions, carrying 2 marks each.
5. In Section C, Q 26 to 31 are Short Answer (SA)-type questions, carrying 3 marks each.
6. In Section D, Q 32 to 35 are Long Answer (LA)-type questions, carrying 5 marks each.
7. In Section E, Q 36 to 38 are Case study-based questions, carrying 4 marks each.
8. There is no overall choice. However, an internal choice has been provided in 2 questions in Section B, 3 questions in Section C, 2 questions in Section D and one subpart each in 2 questions of Section E.
9. Use of calculator is not allowed.

SECTION-A

Each question carries 1 mark

1. Which of the following sets are correctly represented in set-builder form?
 (i) $\{x : x \text{ is a prime number and } x < 20\}$
 (ii) $\{y : y \in \mathbb{R} \text{ \& } y = 0\}$
 (iii) $\{z : z = 2n + 1, n \in \mathbb{Z}\}$
 (iv) $\{x : x \text{ is a positive even integer}\}$
 Choose the correct option from the following:
 (a) (i) & (ii) only
 (b) (ii) & (iii) only
 (c) (i) & (iv)
 (d) (i), (ii), (iii) & (iv)
2. If $A = \{1, 2, 3, 4, 5\}$, then the number of proper subsets of A is:
 (a) 120
 (b) 30
 (c) 31
 (d) 32
3. If A & B are two given sets, then $A \cap (A \cap B)^c$ is equal to:
 (a) A
 (b) B^c
 (c) $\emptyset$
 (d) $A - B$
4. Let A & B be two sets such that $A \times B$ consists of 6 elements. If three elements of $A \times B$ are $(1, 4), (2, 6), \& (3, 6)$, then other three elements of $A \times B$ are:
 (a) $(1, 6), (4, 2), (3, 4)$
 (b) $(1, 6), (2, 4), (3, 4)$
 (c) $(1, 6), (2, 4), (4, 3)$
 (d) $(6, 1), (2, 4), (3, 4)$
5. Let $f(x) = \frac{(x+2)}{(x-2)}$, then which of the statements is/are true?
 (a) The domain of $f(x)$ is $\mathbb{R} - \{2\}$
 (b) Domain of $f(x)$ is $\mathbb{R} - \{1\}$
 (c) domain of $f(x) = (-\infty, \infty)$
 (d) Domain of $f(x) = \{1, \infty\}$
6. The value of $\tan\left(\frac{-15\pi}{4}\right)$ is:
 (a) -1
 (b) 1
 (c) $\frac{1}{\sqrt{3}}$
 (d) $-\frac{1}{\sqrt{3}}$
7. If $\alpha + \beta = \pi/4$, then the value of $(1 + \tan \alpha)(1 + \tan \beta)$ is:
 (a) 1
 (b) 2
 (c) -2
 (d) Not defined
8. If $\sin \alpha = -3/5$, where $\pi < \alpha < 3\pi/2$, then $\cos(\alpha/2)$ is equal to:
 (a) $-\frac{1}{\sqrt{10}}$
 (b) $\frac{1}{\sqrt{10}}$
 (c) $\frac{3}{\sqrt{10}}$
 (d) $-\frac{3}{\sqrt{10}}$

9. Value of $\tan 15^\circ$ is:
 (a) $\frac{\sqrt{3}+1}{\sqrt{3}-1}$ (b) $\frac{\sqrt{3}-1}{\sqrt{3}+1}$ (c) $\frac{1-\sqrt{3}}{1+\sqrt{3}}$ (d) None of these
10. If $\sin A = 3/5$ & $\pi/2 < A < \pi$, then the value of $\sin 2A$ is:
 (a) $24/25$ (b) $8/5$ (c) $-8/25$ (d) $-24/25$
11. Which of the following is not correct?
 (a) $\sin \theta = -1/5$ (b) $\cos \theta = 1$ (c) $\sec \theta = 3/5$ (d) $\tan \theta = 20$
12. The multiplicative inverse of $2 - 3i$ is:
 (a) $\frac{2}{13} - \frac{3}{13}i$ (b) $\frac{2}{13} + \frac{3}{13}i$ (c) $-\frac{2}{13} - \frac{3}{13}i$ (d) $-\frac{2}{13} + \frac{3}{13}i$
13. If $i = \sqrt{-1}$, then $1 + i^2 + i^3 - i^4 + i^5$ is equal to:
 (a) $2 - i$ (b) 1 (c) 3 (d) -1
14. The modulus of $\frac{1+i}{1-i}$ is:
 (a) 1 (b) 2 (c) -1 (d) -2
15. The number of combinations of 4 different objects A, B, C, D taken 2 at a time is:
 (a) 4 (b) 6 (c) 7 (d) 8
16. If $5P_r = 6P_{r-1}$, then the value of r is:
 (a) 2 (b) 4 (c) 3 (d) 5
17. In the expansion of $(4-x)^9$ which of the following is/are the correct coefficient for x^6 ?
 (a) ${}^9C_3 (4)^5$ (b) ${}^9C_6 (4)^3$ (c) $-{}^9C_3 (4)^6$ (d) 5376
18. $(\sqrt{3}+1)^6 + (\sqrt{3}-1)^6$ is a/an:
 (a) rational number (b) irrational number (c) Negative integer (d) None of these

ASSERTION-REASON BASED QUESTIONS

In the following questions statements of Assertion (A) is followed by a statement of Reason (R). Choose the correct option.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion.
 (b) Both assertion (A) and reason (R) are true, but reason (R) is not the correct explanation of assertion (A).
 (c) Assertion (A) is true, but reason (R) is false.
 (d) Assertion (A) is false, but reason (R) is true.
19. Assertion (A): The relation R in a set A = {1, 2, 3, 4, 5} defined by $R = \{(x, y) : 5x = y\}$ have the domain {1, 2, 3, 4, 5} & range = {5, 10, 15, 20, 25}.

Reason (R): Domain & range of the relation R is respectively the set of all first & second entries of the distinct ordered pairs of the relation.

20. Assertion (A): The value of $\frac{1 - \tan^2 15^\circ}{1 + \tan^2 15^\circ} = \frac{\sqrt{3}}{2}$

Reason (R): $\cos(2x) = \frac{1 - \tan^2 x}{1 + \tan^2 x}$

SECTION-B

Each question carries 2 marks

21. If X is a set of all letters of the word 'NEW DELHI' & Y is a set of all the letters in the word 'CHANDIGARH' then find: (i) $X \cup Y$ (ii) $X - Y$

✓ Find the domain & range of the relation R defined by: $R = \{(x+1, x+3) : x \in \{0, 1, 2, 3\}\}$.

OR

If $f(x) = \frac{x^2 + 2x + 3}{x^2 - 5x + 6}$, then find the domain of the function.

✓ 23. Seven athletes are participating in a race, in how many ways can the three prizes be won?

✓ 24. How many words can be made from the letters of the word 'DAUGHTER' so that vowels always come together?

OR

How many words can be formed from the letters of the word 'ORDINATE' so that vowels occupy odd places?

✓ 25. Find the number of terms in the expansion of $(\frac{4x}{5} - \frac{5}{2x})^9$, $x \neq 0$? Also, find the 3rd term.

SECTION-C

Each question carries 3 marks

✓ 26. In a survey of 450 people, it is found that 110 play cricket, 160 play tennis & 70 play both. How many play neither cricket nor tennis?

✓ 27. The function
$$f(x) = \begin{cases} 1-x, & x < 0 \\ 1, & x = 0 \\ x+1, & x > 0 \end{cases}$$

Draw the graph of $f(x)$

✓ 28. Prove that $\frac{\sin 5x + \sin x - 2\sin 3x}{\cos 5x - \cos x} = \tan x$

OR

Prove that $\tan \alpha \tan (60^\circ - \alpha) \tan (60^\circ + \alpha) = \tan 3\alpha$.

✓ 29. Find the conjugate of $\frac{(3-2i)(2+3i)}{(1+2i)(2-i)}$

✓ 30. Solve $\frac{2x+1}{3} \geq \frac{2x-2}{5}$, where $x \in \mathbb{R}$. Graph the solution on the number line.

OR

Solve $2x+1 < |2x+1|$, graph the solution on the number line.

✓ 31. 5 boys & 5 girls form a line with the boys & girls alternating. Find the number of ways of making line.

OR

If all the letters of the word 'MOTHER' are written in all possible orders and the words so formed are arranged in a dictionary order, then find the rank of the word 'MOTHER'?

SECTION-D

Each question carries 5 marks

✓ 32. (i) Find the value of $\tan \frac{\pi}{9}$

✗ (ii) Prove that $\tan 70^\circ = 2 \tan 50^\circ + \tan 20^\circ$.

✓ 33. Find the magnitude & conjugate of $(\frac{1}{1-i} - \frac{2}{1+i})(\frac{3-4i}{5+i})$

OR

If $z_1 = 2+i$ & $z_2 = 1-i$, find $|\frac{z_1 + z_2 + 1}{z_1 - z_2 + 1}|$

- ✓ 34. In how many ways can a football team of 11 players be selected from 16 players? How many of them will exclude 2 particular players?

OR

A candidate is required to answer 7 questions out of 12 questions, which are divided into two groups, each containing 6 questions. He is not permitted to attempt more than 5 questions from either group. Find the number of different ways of doing the questions.

- ✓ 35. The milkman has 80% milk in his stock of 800 litres of adulterated milk. How much 100% pure milk is to be added to it, so that purity is between 90% and 95%. How much pure milk he should add to his stock to obtain 99% pure milk?

SECTION-E

Each question carries 4 marks

- ✓ 36. Rohit is a student of class XI. He got an assignment from his tuition teacher. He tried to solve all questions but was unable to solve a few of them. If $\cot x = -5/12$ and $\cos y = -4/5$, where x and y both lie in the second quadrant.

Based on the above information, answer the following questions:

- What is the value of $\cos x$?
- What is the value of $\sin x$?
- What is the value of $\sin y$?

OR

- Find the value of $\sin(x+y)$.



- ✓ 37. Sarita works in a library. While arranging some books in the shelf, she observed that there are 6 distinct English books, 4 distinct Mathematics books and 3 distinct Science books which have to be arranged. Help her to arrange her library in a proper way.

Based on the above information, answer the following questions:

- In how many ways can she select either a English book or a Mathematics book?
- If she selects 2 English books, 1 Mathematics book and 1 Science book to arrange them, then find the number of ways in which selection can be done.
- Find the number of ways, if the books of same subjects are put together.



- ✓ 38. IQ of a person is given by the formula $IQ = \frac{MA}{CA} \times 100$, where MA is the mental age and CA is the chronological age.

Based on the above information, answer the following questions:

- For an individual, if $2MA \geq 3CA$, then what is his/her minimum IQ?
- If for an individual $MA \leq CA$, then find the maximum value of his/her IQ.
- If $80 \leq IQ \leq 140$ for a group of 12-year-old children, find the range of their mental age.

OR

- If $CA \leq 3MA \leq 2CA$ for a group of persons, then find the range of their IQ.

