

General instructions:

- a) All questions are compulsory.
b) Paper is divided into 5 sections:
SECTION-A (18 Multiple Choice Questions and 2 Assertion-Reasoning Questions.
Each question carry one mark)
SECTION-B (5 Very Short Answer (VSA)-type questions of 2 marks each)
SECTION-C (6 Short Answer (SA)-type questions of 3 marks each)
SECTION-D (4 Long Answer (LA)-type questions of 5 marks each)
SECTION-E (Case Based Questions. Each question carry four marks)
c) There is no overall choice. However internal choice has been provided in 2 questions of section B, 3 questions of Section C, 2 questions of Section D, 1 part of two questions of Section E. You have to attempt any one of the two options.

SECTION-A (Each question carry one mark)

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1. If A and B are two sets such that $n(A \cap B) = 8$ and $n(A) = 12$, then $n(A \cap B)$ is:
A) 4 B) 5 C) 6 D) 8
 2. The additive inverse of $\frac{5+\sqrt{2}i}{1-\sqrt{2}i}$ is:
A) $1-2\sqrt{2}i$ B) $-1-2\sqrt{2}i$ C) $-1+2\sqrt{2}i$ D) $1+2\sqrt{2}i$
 3. The value of $\frac{\sin 15^\circ - \cos 15^\circ}{\cos 15^\circ + \sin 15^\circ}$ is:
A) 0 B) $-\frac{1}{\sqrt{3}}$ C) $\frac{\sqrt{3}}{2}$ D) $-\sqrt{3}$
 4. Let $A = \{0, 1, 9\}$, $B = \{2, 0, 5\}$ and $C = \{0, -2, 6\}$, then the number of elements in $A \times (B - C)$ is:
A) 5 B) 6 C) 12 D) 8
 5. If 5, x, y, z, 405 are in G.P., then the common ratio of the G.P. is:
A) 3 B) $1/3$ C) 2 D) $1/2$
 6. Given set $A = \{x : x \in \mathbb{Z}, 0 \leq x < 7\}$, then the solution of the inequality $-2x + 6 \leq x + 2$ in set A is:
A) $\{0, 1, 2, 3, 4, 5\}$ B) A C) $\{2, 3, 4, 5, 6\}$ D) $\{2, 3, 4, 5\}$
 7. Let $A = \{-1, 0, 1, 2, \{3, 7\}, 4, 5, 6\}$ then which of the following statement is incorrect:
A) $\{3, 7\} \in A$ B) $\{3, 7\} \subset A$ C) $\{1, 4\} \subset A$ D) $\{\{3, 7\}\} \subset A$
 8. If ${}^nC_{10} = {}^nC_2$, then ${}^nC_{11}$ is:
A) 11 B) 12 C) 10 D) 121

9. The conjugate of the Complex number $i^{2001} - 26$ is:
 A) $i - 26$ B) $-i - 26$ C) $i + 26$ D) $-i + 26$
10. A wheel makes 270 revolutions in one minute. Through how many radians does it turn in 1 second?
 A) 9π B) 7π C) 5π D) 10π
11. If $f(x) = (\sin x + \cos x)^2$, then $f(\frac{\pi}{2})$ is:
 A) 0 B) 1 C) -1 D) 8
12. Multiplicative inverse of $4 - 3i$ is:
 A) $\frac{4}{5} - \frac{3}{5}i$ B) $\frac{4}{5} + \frac{3}{5}i$ C) $-\frac{4}{5} + \frac{3}{5}i$ D) $-\frac{4}{5} - \frac{3}{5}i$
13. How many terms are there in the expansion of $(a^2 - 2ab + b^2)^5$.
 A) 6 B) 5 C) 10 D) 11
14. Let $A = \{2, 3\}$, $B = \{3, 4, 5\}$ and $U = \{1, 2, 3, 4, 5, 6\}$ then $(A \cup B)'$ is:
 A) $\emptyset$ B) $\{1, 5\}$ C) $\{1, 6\}$ D) $\{6, 2\}$
15. Which term of the G.P. 2, 8, 32 up to n terms is 512?
 A) 4 B) 5 C) 6 D) 9
16. Domain of the function $f(x) = \frac{x^2 + 3x + 5}{x^2 - 5x + 4}$ is:
 A) R B) $\emptyset$ C) $R - \{1, 4\}$ D) $\{1, 4\}$
17. A function $f(x) = \begin{cases} 2x - 3, & 0 \leq x < 4 \\ x^2 - 5, & x \geq 4 \end{cases}$, then $f(4)$ is:
 A) 5 B) 11 C) 12 D) 9
18. The degree measure corresponding to $-\frac{5\pi}{3}$ is:
 A) -270° B) -300° C) -120° D) -240°

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 number of non-empty subsets of the set containing letters of the word 'SECTION' is 127.
 Reason (R): The number of subsets of a set having n elements is 2^n .
20. Assertion (A): The maximum value of $3\sin x - 4\sin^2 x + 2$ is 4.
 Reason (R): For real x , $-1 \leq \sin x \leq 1$

SECTION-B (Each question carries two marks)

21. Find $x + y$, if x and y are real numbers and $(x - iy)(3 - 5i)$ is conjugate of $-3 + 4i$.

22. Find the value of n if ${}^nP_5 = 42 \cdot {}^nP_3, n > 4$.

OR

How many numbers lying between 100 and 1000 can be formed with the digits 0, 1, 2, 3, 4, 5 if the repetition of digits is not allowed.

23. Let $R = \{(x, y) : y = x + 1 \text{ and } x, y \in \{0, 1, 2, 4, 5\}\}$. Write R in roster form. Write its domain and range.
24. If all letters of the word "WEST" are arranged as in dictionary, what will be 21st word?
25. Draw graph of the function : $f(x) = \begin{cases} -x, & x < 0 \\ x^2, & x \geq 0 \end{cases}$

OR

Let $f = \{(1, 1), (2, 3)\}$ be a function from Z to Z defined by $f(x) = ax + b$. Find the function.

SECTION-C (Each question carry three marks)

26. Let A be set of all letters of the word "TAMILNADU",
 $X = \{x : x \text{ is a vowel and } x \in A\}$ and $Y = \{y : y \text{ is a consonant and } y \in A\}$
 Write X and Y in roster form and find the following:
 i) $A - X$ ii) $A - Y$ iii) $X \cup Y$ iv) $X \cap Y$

OR

If $n(U) = 50, n(A) = 3x, n(B) = 2x$ and $n(A \cap B) = x = n(A \cup B)$, find
 i) x ii) $n(A - B)$ iii) $n(A \cup B)$

27. A solution is to be kept between 68°F and 77°F . What is the range of temperature in degree Celsius, if Celsius/Fahrenheit(F) conversion formula is given by :

$F = \frac{9}{5}C + 32$. Taking temperature in degree Celsius as x , represent its value on number line.

28. If $a + ib = \frac{c+i}{c-i}$, where a, b, c are real, prove that $\frac{b}{a} = \frac{2c}{c^2 - 1}$ and find $a^2 + b^2$.

OR

Express $\frac{3-4i}{(4-2i)(1+i)}$ in the standard form and find its modulus.

29. Verify $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$, using Venn diagram.

30. Simplify : $\frac{\cos(\pi+x)\cos(-x)}{\sin(\pi-x)\cos(\frac{\pi}{2}+x)} - \frac{\tan(\pi-x)\tan(\frac{\pi}{2}+x)}{\cos(\frac{3\pi}{2}+x)\cos(\frac{5\pi}{2}+x)}$

OR

Prove that : $(\cos x + \cos y)^2 + (\sin x - \sin y)^2 = 4 \cos^2 \frac{x+y}{2}$

31. Find the range of the following functions:

i) $-|2x-3| + 5$ ii) $2 - 3 \sin x$ iii) $\sqrt{25-x^2}$

SECTION-D (Each question carry five marks)

32. Prove that : $\sin 10^\circ \sin 30^\circ \sin 50^\circ \sin 70^\circ = \frac{1}{16}$.

33. The ratio of the A.M. and G.M. of two positive numbers a and b is $m:n$. Show that :

$$a:b = (m + \sqrt{m^2 - n^2}) : (m - \sqrt{m^2 - n^2})$$

OR

Find the sum to first n terms of the series: $0.7 + 0.77 + 0.777 + \dots$

34. Find $(a+b)^4 - (a-b)^4$ and hence evaluate : $(\sqrt{5} + \sqrt{3})^4 - (\sqrt{5} - \sqrt{3})^4$.

35. How many words can be formed by taking four letters at a time from the letters of the word "MATHEMATICS".

OR

In how many ways can the letters of the word "SISTER" be arranged if:

- i) Words start with R and end with S.
- ii) All S's occur together
- iii) There are always 3 letters between S and E.

SECTION-E CASE BASED QUESTIONS (Each question carry four marks)

36. In a competitive examination paper consists of 10 questions divided into two sections I and II, each containing 5 questions. A student is required to attempt 7 questions. In how many ways the student select the questions if :

- i) The student selects exactly 4 questions from the section I.
- ii) The student selects all questions from the section I.
- iii) The student selects at least 3 questions from the section I.

OR

The student selects at most 4 questions from the section I.

37. During tree plantation drive, a rectangular park is used for planting saplings. Length of the park is three times its width. Width of the park is x metres.

Based on the above information, answer the following questions:

- i) Find the least value of x if the minimum perimeter of the park is 160m.
- ii) If the perimeter of the triangle is at most 200 m, then what is the maximum value of x ?

38. Some students decided to save some portion of pocket money and their savings form a geometric progression. The savings of the 5th and 3rd students are Rs. 2025 and Rs.225 respectively.

Based on the above information, answer the following questions:

- i) Find the common ratio of the progression.
- ii) Find the amount saved by the first student.
- iii) Find the ratio of the savings of 4th student to 2nd student.

OR

Find the total saving of first 5 students.