I

3166 (N)

Total No. of Questions - **40**
Total No. of Printed Pages - **4**

Regd. No.

Part - III
MATHEMATICS - Paper - I
(NEW)
Core
(English Version)

Time : 3 Hours **Max. Marks : 100**

SECTION - A

I. **Answer ALL the questions.** **12×1=12**
Each question carries 1 mark.

1. The domain of the function $\frac{1}{\sqrt{x^2-25}}$ is -
(1) $(-\infty, -5) \cup (5, \infty)$ (2) $(-\infty, -5] \cup [5, \infty)$
(3) $(-\infty, -5] \cup (5, \infty)$ (4) $(-\infty, -5) \cup [5, \infty)$

2. The value of $\sqrt{-25} \times \sqrt{-9}$ is -
(1) 15 (2) −15
(3) 15i (4) None of these

3. If ${}^{12}C_{s+1} = {}^{12}C_{2s-5}$, then the value of s is -
(1) 4 (2) 8
(3) 12 (4) 6

4. The coefficient of $x^8 y^{10}$ in the expansion of $(x + y)^{18}$ is -
(1) ${}^{18}C_8$ (2) ${}^{18}P_{10}$
(3) 2^{18} (4) None of these

5. XOZ-plane divides the line joining the points (2, 3, 1) and (6, 7, 1) in the ratio -
(1) 3 : 7 (2) 2 : 7
(3) −3 : 7 (4) −2 : 4

6. If P(A) = 0.5, P(B) = 0.3 (given that A and B are mutually exclusive), then $P(A' \cap B') =$
(1) 0.6 (2) 0.5
(3) 0.7 (4) 0.2

7. List all the elements of the set C = {x : x is an integer, $x^2 \leq 4$}.

8. Find the value of the $\sin\left(-\frac{11\pi}{3}\right)$.

9. Find the sum to infinity in Geometric Progression $1, \frac{1}{3}, \frac{1}{9}, \ldots\ldots$

10. Find the equation of the line which is passing through the point (–4, 3) with slope $\frac{1}{2}$.

11. Find the length of transverse axis of hyperbola $x^2 - 4y^2 = 4$.

12. Find the derivative of $x^2 - 2$ at x = 10.

SECTION - B

II. Answer ALL the questions. **10×2=20**

Each question carries 2 marks.

13. Let A = {1, 2, {3, 4}, 5}. Is the statement {3, 4} ∈ A incorrect? And why?

14. If P = {a, b, c} and Q = {r} form the sets P × Q and Q × P. Are these two products equal?

15. A wheel makes 360 revolutions in one minute. Through how many radians does it turn in one second?

16. Express the complex number $\left(\frac{1}{3} + 3i\right)^3$ in the form a + ib.

17. How many 4-digit numbers can be formed by using the digits 1 to 9 if repetition of digits is not allowed?

18. Expand $\left(\frac{2p}{5} \frac{3q}{7}\right)^6$

19. Find the equation of the parabola with vertex (0, 0) and passing through (2, 3) and axis is along x-axis.

20. Find 'x' if the distance between (5, –1, 7) and (x, 5, 1) is 9 units.

21. Evaluate $\lim_{x \to 0} \frac{\sqrt{1+x}-1}{x}$

22. Find the mean deviation about the mean for the following data -

4, 7, 8, 9, 10, 12, 13, 17

SECTION - C

III. Answer ANY SEVEN questions. **7×4=28**

Each question carries 4 marks.

23. $U = \{1, 2, 3, 4, 5, 6\}$, $A = \{2, 3\}$ and $B = \{3, 4, 5\}$. Find A', B', $A' \cap B'$, $A \cup B$ and hence show that $(A \cup B)' = A' \cap B'$.

24. $A = \{1, 2, 3, 4, 5, 6\}$. Define a relation R from A to A by $R = \{(x, y) : y = x + 1\}$

(i) Depict this relation using an arrow diagram.

(ii) Write down the domain, codomain and range of R.

25. Show that the four points in the Argand plane represented by the complex numbers $2 + i$, $4 + 3i$, $2 + 5i$, $3i$ are the vertices of a square.

26. A solution is to be kept between 68° F and 77° F. What is the range in temperature in degree Celsius (C) if the Celsius/Fahrenheit (F) conversion formula is given by $F = \frac{9}{5}C + 32$?

27. Prove that for $3 \leq r \leq n$,

$^{(n-3)}C_r + 3.\,^{(n-3)}C_{(r-1)} + 3.\,^{(n-3)}C_{(r-2)} + {}^{(n-3)}C_{(r-3)} = {}^{n}C_r$.

28. Show that the middle term in the expansion of $(1 + x)^{2n}$ is $\frac{1.3.5...(2n-1)}{n!}.\,2n.x^n$, where n is a positive integer. 3

29. Find the equations of the straight lines passing through (1, 3) and (i) parallel to (ii) perpendicular to the line passing through the points (3, –5) and (–6, 1). https://www.apboardonline.com

30. Find the coordinates of the foci, the vertices, the length of major axis, the minor axis, the eccentricity and the length of the latus rectum of the ellipse $\frac{x^2}{100} + \frac{y^2}{400} = 1$.

31. Compute the derivative of sin 2x from the first principle.

32. A and B are two events such that $P(A) = 0.54$, $P(B) = 0.69$ and $P(A \cap B) = 0.35$. 4

Find (i) $P(A \cup B)$ (ii) $P(A' \cap B')$ (iii) $P(A \cap B')$ (iv) $P(B \cap A')$

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SECTION - D

IV. Answer ANY FIVE questions. **5×8=40**

Each question carries 8 marks.

33. If f and g are real-valued functions defined by $f(x) = 2x - 1$ and $g(x) = x^2$, then find -

(i) $(3f - 2g)(x)$ (ii) $(fg)(x)$ (iii) $(f/g)(x)$

(iv) $(f + g + 2)(x)$ (v) $2f(x)$ (vi) $2 + f(x)$

34. Prove that $\sin 2x + 2 \sin 4x + \sin 6x = 4 \cos^2 x \sin 4x$.

35. A man deposited ₹ 10,000 in a bank at the rate of 5% simple interest annually. Find the amount in 15th year since he deposited the amount and also calculate the total amount after 20 years. 8

36. A straight line through Q(2, 3) makes an angle $\frac{3\pi}{4}$ with the negative direction of the X-axis. If the straight line intersects the line $x + y - 7 = 0$ at P, then find the distance $\overline{PQ}$. 8

37. Find the equation of the circle passing through points (3, 4), (3, 2), (1, 4). 8

38. If $f(x) = \begin{cases} mx^2 + n, & x < 0 \\ nx + m, & 0 \le x \le 1 \\ nx^3 + m, & x > 1 \end{cases}$ For what integers m and n does both $\lim_{x \to 0} f(x)$ and $\lim_{x \to 1} f(x)$ exist?

39. Find the mean, variance and standard deviation using shortcut method.

Height in cms	70-75	75-80	80-85	85-90	90-95	95-100	100-105	105-110	110-115
Number of Children	3	4	7		15	9	6	6	3

40. (a) In Class XI of a school 40% of the students study Mathematics and 30% study Biology. 10% of the class study both Mathematics and Biology. If a student is selected at random from the class, find the probability that he will be studying Mathematics or Biology.

(b) There are four men and six women on the city council. If one council member is selected for a committee at random, how likely is it that it is a woman?