

Time: 2:45 Hrs.

Max. Marks: 80

Instructions:

- 1) The question paper has five parts namely A, B, C, D and E. Answer all the parts.
- 2) PART A has 15 MCQ's, 5 Fill in the blanks of 1 mark each.
- 3) Use the graph sheet for question on linear programming in PART E.

PART A

I. Answer ALL the Multiple-Choice Questions

15 x 1 = 15

1. The interval form of $\{x : x \in \mathbb{R}, -5 < x \leq 7\}$ is _____

- A. $(-5, 7)$ B. $[-5, 7]$ C. $\cancel{(-5, 7]}$ D. $\cancel{(-5, 7)}$

2. Let $A = \{1, 2, \{3, 4\}, 5\}$ which of the following statement is correct?

- A. $\{3, 4\} \subset A$ B. $\cancel{\{3, 4\} \in A}$ C. $3 \in A$ D. $4 \in A$

3. Match the List I with List II

List I

List II

- | | |
|-----------------------|--|
| a. Domain of $\sin x$ | i) $(-\infty, \infty) \cup \{n\pi, n \in \mathbb{Z}\}$ |
| b. Domain of $\cot x$ | ii) $[-1, 1]$ |
| c. Range of $\cos x$ | iii) $(-\infty, \infty)$ |

Choose the correct answer from the option given below.

- A. a-i, b-ii, c-iii B. a-iii, b-ii, c-i C. a-ii, b-i, c-iii D. ~~a-iii, b-i, c-ii~~

4. The additive identity of $\sqrt{6} + 2i$ is _____

- A. $0+1i$ B. $0+0i$ C. $\sqrt{6} - 2i$ D. $\frac{\sqrt{6}-2i}{\sqrt{10}}$

5. The solution of $3x+8>2$ when 'x' is a real number is _____

- A. $\cancel{(-2, \infty)}$ B. $(-\infty, -2]$ C. $(-\infty, -2)$ D. $(-\infty, -1)$

6. If $\frac{1}{6!} + \frac{1}{7!} = \frac{x}{8!}$ then $x =$ _____

- A. 56 B. 49 C. ~~64~~ D. 81

7. The fifth term whose n^{th} term is $a_n = n(n+2)$ is _____

- A. 30 B. 35 C. ~~40~~ D. 45

8. Equation of the line parallel to x-axis, passing through $(-2, 3)$ is _____

- A. $X=3$ B. ~~$X=2$~~ C. $Y=-2$ D. $Y=3$

9. The equation of the line which has slope 2 and y-intercept -5 is _____

- A. $2x-y-5=0$ B. ~~$2x+y-5=0$~~ C. $2x-y+5=0$ D. $2x+y+5=0$

10. The axis in which $(0, 5, 0)$ lies is _____

- A. x-axis B. y-axis C. ~~z-axis~~ D. ~~$x+y=0$~~

11. The derivative of $f(x) = 1 + x + x^2 + x^3 + \dots + x^{50}$ at $x=1$ is _____
 A. 1275 B. 1200 C. 1326 D. 1542
12. The length of the latus rectum of the parabola $y^2 = -9x$ is _____
 A. 9 B. -9 C. $\frac{9}{4}$ D. $\frac{9}{2}$
13. The eccentricity of the ~~hyper~~ parabola $\frac{x^2}{9} - \frac{y^2}{16} = 1$ is _____
 A. $\frac{5}{4}$ B. $\frac{5}{3}$ C. $\frac{16}{4}$ D. $\frac{32}{3}$
14. Mean deviation about the median for first 5 natural numbers is _____
 A. 5 B. $\frac{6}{5}$ C. 6 D. $\frac{5}{6}$
15. The probability of getting exactly two heads on tossing a coin thrice is _____
 A. $\frac{2}{3}$ B. $\frac{2}{5}$ C. $\frac{3}{8}$ D. $\frac{1}{2}$

II Fill in the blanks

5 x 1 = 5

$(-2, -1, 0, 1, 2, 3)$

16. If $A = \{2, 4, 6, 8\}$, $B = \{6, 8, 10\}$, then number of elements in $A \cap B = \underline{2}$
17. The slope of the line passing through $(4, 0)$ and $(6, -4)$ is $\underline{-2}$
18. The value of $\sin 4\pi = \underline{0}$
19. $\lim_{x \rightarrow -1} x^3 - x^2 + 1$ is $\underline{1}$
20. If ${}^{15}C_{3r} = {}^{15}C_{3+r}$, then r is $\underline{1}$

Part B

Answer any SIX of the following

6 x 2 = 12

21. If $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$, $A = \{3, 4, 5, 6\}$, $B = \{2, 4, 6, 8\}$ Find $(A \cap B)'$
22. In a circle of diameter 40cm, the length of the chord is 20cm. Find the length of minor arc of the chord.
23. If $x + iy = \frac{a+ib}{a-ib}$, Prove that $x^2 + y^2 = 1$
24. Find the multiplicative inverse of $2-3i$
25. Solve the inequality $5x-3 \geq 3x-5$ and show the graph of the solution on number line.
26. Ravi obtained 70 and 75 marks in first two tests. Find the minimum marks he should get in third test to have an average of at least 60 marks.
27. A.M and G.M of roots of a quadratic equation are 8 and 5 respectively. Find the quadratic equation.
28. Evaluate $\lim_{x \rightarrow 2} \frac{3x^2 - x - 10}{x^2 - 4}$
29. A coin is tossed twice. What is the probability that at least one tail occurs.

Part C

Answer any SIX of the following

6 x 3 = 18

30. If $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$, $A = \{2, 4, 6, 8\}$, $B = \{2, 3, 5, 7\}$. Verify $(A \cup B)^c = A^c \cap B^c$.
31. Determine the domain, range of the relation R defined by: $R = \{(x, x-5), x \in \{0, 1, 2, 3, 4, 5\}\}$
32. Prove that $\sin^2 6x - \sin^2 4x = \sin 2x \sin 10x$
33. Find the values of other 5 trigonometric function if $\cot x = \frac{-5}{12}$, x lies in 2nd quadrant.
34. Find $(a+b)^4 - (a-b)^4$ and hence evaluate $(\sqrt{3} + \sqrt{2})^4 - (\sqrt{3} - \sqrt{2})^4$
35. Find the equation of the set of points P such that its distance from the points $A(5, 4, -5)$ and $B(-2, 1, 4)$ are equal.
36. How many words with or without meaning can be formed using all the letters of the word EQUATION at a time so that the vowels and consonants occur together.
37. The slope of a line is double the slope of another line. If tangent angle between them is $\frac{\pi}{3}$. Find the slopes of the lines.
38. Find the derivative of $\tan x$ using first principle.

Part D

Answer any FOUR questions

4 x 5 = 20

39. Define signum function. Draw the graph of it. Also write its domain and range.
40. Prove that $\frac{\cos 4x + \cos 3x + \cos 2x}{\sin 4x + \sin 3x + \sin 2x} = \cot 3x$
41. A group consists of 7 boys and 5 girls. Find the number of ways in which a team 5 members can be selected so as to have at least one boy and one girl.
42. Derive an expression for the perpendicular distance between a point (x_0, y_0) and a line $Ax + By + C = 0$
43. Prove geometrically that $\lim_{x \rightarrow 0} \frac{\sin x}{x} = 1$, x being measured in radians.
44. Find the mean deviation about the mean for the following data

Marks obtained	10 - 20	20 - 30	30 - 40	40 - 50	50 - 60	60 - 70	70 - 80
No. of students	2	3	8	14	8	3	2

45. Three coins are tossed once. Find the probability of getting

- | | | |
|--------------|------------------------|------------------------|
| (i) 3 Heads | (iii) No tail | (v) At least two heads |
| (ii) 2 Heads | (iv) At most two tails | |

Part E

Answer the following questions

46. Prove geometrically $\cos(x + y) = \cos x \cos y - \sin x \sin y$ and hence prove that $\cos 2x = \cos^2 x - \sin^2 x$

OR

6 Marks

Define hyperbola. Derive its equation in the form $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$

47. Find the derivative of $f(x) = \frac{x + \cos x}{\tan x}$ with respect to x

OR

4 Marks

Find the sum of the series up to n term $7 + 77 + 777 + \dots$

