

**Instructions**

The question paper has five parts namely A, B, C, D, and E

Answer all parts, write question numbers correctly

Use the graph sheet wherever necessary.

PART-A**I Answer all the questions:****10 x 1 = 10**

1. If $\left(\frac{x}{3} + 1, y - \frac{2}{3}\right) = \left(\frac{5}{3}, \frac{1}{3}\right)$, find the value of x
2. Write the interval $[-23, 5)$ in set builder form
3. Express 15° into radian measure
4. Find the modulus of $6 - 3i$
5. Find the value of x if, $\frac{1}{8!} + \frac{1}{9!} = \frac{x}{10!}$
6. Find the 10th term, $a_n = \frac{n-3}{4}$
7. Find the equation of a line passing through the point $(-4, 3)$ with slope 1
8. Evaluate $\lim_{x \rightarrow 1} \frac{x^2 + 1}{x + 100}$
9. Write the negation of the statement "2 is a prime number"
10. Write the sample space of the experiment "A coin is tossed three times"

PART-B**II Answer any Ten questions****10 x 2 = 20**

11. If X and Y are two sets such that $X \cup Y$ Has 18 elements, X has 8 elements and Y has 15 elements. How many does $X \cap Y$ has?
12. Let $A = \{1, 2\}$ and $B = \{3, 4\}$. Find $A \times B$ and also find the number of relations from A to B?
13. Find the range of $f(x) = 2 - 3x$, $x \in \mathbb{R}$, $x > 0$
14. In a circle of diameter 40 cm, the length of a chord is 20cm. find the length of the minor arc of the chord.
15. Prove that $\sin^2 \frac{\pi}{6} + \cos^2 \frac{\pi}{3} - \tan^2 \frac{\pi}{4} = \frac{1}{2}$
16. Express $-i + 1$ in polar form.
17. If $\left(\frac{1+i}{1-i}\right)^m = 1$, then find the least positive integral value of m.
18. Solve $3x - 5 < 2x + 1$ and show the graph of the solution on number line.
19. How many 4 digit numbers are there with no digit repeated?
20. Find the equation of the line with x and y intercept are given by 2 and 3 respectively.
21. Show that the points $(-2, 3, 5)$, $(1, 2, 3)$ and $(7, 0, -1)$ are collinear.

22. Evaluate $\lim_{(x-\pi)\rightarrow 0} \frac{\sin(\pi-x)}{\pi(\pi-x)}$
23. Write the converse and contrapositive for the statement “Something is cold implies it has low temperature”
24. If $\frac{2}{11}$ is the probability of an event, what is the probability of the event “not A”

PART-C

III Answer any TEN questions **10 x 3 = 30**

25. In a committee, 50 speak French, 20 speak Spanish and 10 speak both Spanish and French. How many speak at least one of these two languages?
26. If $f(x) = x^2$ and $g(x) = 2x + 1$ be two real functions, find $(f+g)(x)$, $(f-g)(x)$ and $(fg)(x)$
27. If $\cos x = \frac{-3}{5}$, x lie in 3rd quadrant, find the value of $\sin x$ and $\tan x$.
28. If $x - iy = \sqrt{\frac{a-ib}{c-id}}$, prove that $(x^2 + y^2)^2 = \frac{a^2 + b^2}{c^2 + d^2}$
29. Convert $-1 - i\sqrt{3}$ into polar form.
30. Find the value of n such that $nP_5 = 42 nP_3$, $n > 4$
31. Find the coefficient of $x^6 y^3$ in the expansion of $(x + 2y)^9$
32. Insert three numbers between 1 and 256 so that the resulting sequence is a G.P.
33. If the sum of a certain number of terms of the A.P. 25, 22, 19, is 116, find the last term.
34. Find the coordinates of focus, equation of directrix and latus rectum of parabola $x^2 = -6y$.
35. Find the derivative of $\sin x$ with respect to x from first principles.
36. Prove by method of contradiction that “ $\sqrt{2}$ is irrational”
37. One card is drawn from a well shuffled pack of 52 cards. If each outcome is equally likely, find the probability that the card will be a) not a diamond, b) not a black card.
38. Coefficient of variation of two distributions are 60 and 70, and their standard deviations are 21 and 16 respectively. What are their arithmetic means?

PART-D

IV Answer any SIX questions **6 x 5 = 30**

39. Define Greatest integer 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. Prove by Mathematical induction for all $n \in \mathbb{N}$, $1^3 + 2^3 + 3^3 + \dots + n^3 = \frac{n^2(n+1)^2}{4}$
42. Solve the following system of inequalities graphically, $x + 2y \leq 10$, $x + y \geq 1$, $x - y \leq 0$, $x, y \geq 0$

- 43. In an examination , a question paper consists of 12 questions divided into two parts that is Part A and Part B containing 5 and 7 questions respectively. A student is required to attempt 8 questions in all, selecting atleast 3 from each Part. In how many ways can a student select the questions?
- 44. State and prove binomial theorem for positive integers.
- 45. Derive the expression for angle between two lines in terms of their slopes.
- 46. Derive section formula for internal division in three dimensions
- 47. Prove geometrically that $\lim_{x \rightarrow 0} \left(\frac{\tan x}{x} \right) = 1$, where x is in radians.
- 48. Find the mean deviation about median for the following data.

x_i	10	30	50	70	90
f_i	4	24	28	16	8

PART-E

- V Answer any ONE question** **1 x 10 = 10**
- 49. (a) Prove geometrically that $\cos (x + y) = \cos x \cos y - \sin x \sin y$ and hence deduce $\cos 2x = 2\cos^2 x - 1$ **(6M)**
 - (b) Find the sum to n terms of the series, whose n^{th} term is $n(n + 1)(n + 4)$ **(4M)**
 - 50. (a) Define ellipse as a set of points. Derive its equation in the form $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ **(6M)**
 - (b) Find the derivative of $\frac{2}{x + 1} - \frac{x^2}{3x - 1}$ with respect to x **(4M)**
