



JAIN COLLEGE, v v puram
For Reduced Syllabus

Test / Exam:	MOCK 1	Month & Year :	2020-2021
Class:	II PUC	Subject:	Mathematics
Duration:	3:15	Max. Marks:	100

PART-A

Answer all the questions

10x1=10

1. Examine whether the operation $*$: $z^+ \rightarrow z^+$ defined by $a * b = |a - b|$, where z^+ is the set of all positive integers, is a binary operation or not.
2. Find the domain of $\sec^{-1}x$.
3. If a matrix has 5 elements, what are the possible orders it can have?
4. If A is a square matrix and $\text{adj}(A) = \begin{bmatrix} 5 & 0 \\ 0 & 5 \end{bmatrix}$, then find $|A|$.
5. Differentiate $\tan(x^3)$ with respect to x .
6. Evaluate $\int \sqrt{ax + b} dx$.
7. Find the vector components of the vector with initial point (2, 1) and the terminal point (-5,7).
8. Find the direction cosines of the line which makes equal angles with the coordinate axes.
9. Define Feasible region.
10. If $P(A) = \frac{7}{13}$, $P(B) = \frac{9}{13}$ and $P(A \cap B) = \frac{4}{13}$, Evaluate $P(A/B)$.

PART B

Answer any TEN questions:

10x2=20

11. On R $*$ is defined by $a * b = \frac{a+b}{2}$, verify whether $*$ is associative.
12. Find the principal value of $\cot^{-1}\left(\frac{-1}{\sqrt{3}}\right)$
13. Find the value of k if area of triangle is 4sq. units and vertices are $(k,0), (4,0), (0,2)$ using determinants.
14. Find $\frac{dy}{dx}$, if $2x + 3y = \sin y$.
15. Differentiate $\sin^{-1}\left(\frac{2x}{1+x^2}\right)$ with respect to x .
16. If $y = e^{6x} + \cos 3x$ find $\frac{d^2y}{dx^2}$

17. Find the intervals in which the function is strictly increasing or decreasing
 $x^2 + 2x - 5$.
18. Evaluate $\int x \sec^2 x \cdot dx$
19. Evaluate $\int_2^3 \frac{dx}{x^2-1}$
20. Find the order and degree of differential equation $y''' + 2y'' + y' = 0$.
21. Find a vector in the direction of vector $\vec{a} = \hat{i} - 2\hat{j}$ that has magnitude 7 units.
22. Find the area of the parallelogram whose adjacent sides are determined by the vectors $\vec{a} = \hat{i} - \hat{j} + 3\hat{k}$ and $\vec{b} = 2\hat{i} - 7\hat{j} + \hat{k}$.
23. Find the Cartesian equation of the line that passes through the points (3,-2,-5) and (3,-2, 6).
24. Assume that each child born in a family is equally likely to be a boy or girl. If a family has two children, what is the conditional probability that both are girls, given that a youngest is a girl.

PART C

Answer any TEN questions:

10x3=30

25. Show that the relation R defined in the set A of all triangles as
 $R = \{(T_1, T_2) : T_1 \text{ is similar to } T_2\}$, is equivalence relation.
26. If A and B are symmetric matrices of the same order, then show that AB is symmetric if and only if A and B commute that is $AB=BA$.
27. If $x = 2at^2, y = at^4$, then find $\frac{dy}{dx}$.
28. Differentiate $(\log x)^{\cos x}$ with respect to x
29. Find the point at which the tangent to the curve $y = \sqrt{4x - 3} - 1$ has its slope $\frac{2}{3}$
30. Evaluate $\int \frac{\sin^3 x + \cos^3 x}{\sin^2 x \cdot \cos^2 x} dx$
31. Evaluate $\int \frac{x}{(x-1)(x-2)(x-3)} dx$
32. $\int_0^{\frac{\pi}{4}} \sin^3 2t \cos 2t dt$
33. Find the area of the region bounded by the curve $y = x^2$ and the line $y = 2$.
34. Solve, $\frac{dy}{dx} = e^{x+y}$.
35. Show that the position vectors of the point P which divides the line joining the points A and B having position vectors \vec{a} and \vec{b} internally in the ratio m:n is $\frac{m\vec{b} + n\vec{a}}{m+n}$
36. Show that the points $A(-2\hat{i} + 3\hat{j} + 5\hat{k}), B(\hat{i} + 2\hat{j} + 3\hat{k})$ and $C(7\hat{i} - \hat{k})$ are collinear.
37. Find the equation of the plane through the intersection of the planes
 $3x - y + 2z - 4 = 0, x + y + z - 2 = 0$ and the point (2, 2, 1).
38. A man is known to speak truth 3 out of 4 times. He throws a die and reports that it is a six. Find the probability that it is actually a six.

PART D**Answer any SIX questions:****6x5=30**39. Check the injectivity and surjectivity of the function $f: R \rightarrow R$ defined by

$$f(x) = 1 + x^2. \text{ Is it a bijective function?}$$

40. If $A = \begin{bmatrix} 0 & 6 & 7 \\ -6 & 0 & 8 \\ 7 & -8 & 0 \end{bmatrix}$, $B = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 2 \\ 1 & 2 & 0 \end{bmatrix}$, $C = \begin{bmatrix} 2 \\ -2 \\ 3 \end{bmatrix}$ Verify that

$$(A + B)C = AC + BC$$

41. Solve the system of linear equations, using matrix method,

$$x - y + 2z = 7$$

$$3x + 4y - 5z = -5$$

$$2x - y + 3z = 12$$

42. If $y = e^{a \cos^{-1} x}$, $-1 \leq x \leq 1$, then prove that $(1 - x^2)y_2 - xy_1 - a^2y = 0$.

43. A ladder 5m long is leaning against a wall. The bottom of the ladder is pulled along the ground, away from the wall, at the rate of 2m/sec. How fast is its height on the wall decreasing when the foot of the ladder is 4m away from the wall?

44. Find the integral of $\frac{1}{x^2 - a^2}$ and hence evaluate $\int \frac{1}{x^2 - 16} dx$.45. Find the area bounded by the curve $x^2 = 4y$ and the line $x = 4y - 2$.46. Solve the differential equation $x \frac{dy}{dx} + 2y = x^2$ ($x \neq 0$).

47. Derive the equation of the plane passing through three non collinear points both in vector and Cartesian form.

48. Probability of solving specific problem independently by A and B are $\frac{1}{2}$ and $\frac{1}{3}$ respectively. If both try to solve the problem independently, find the probability that (i) the problem is solved (ii) exactly one of them solves the problem.**PART E****Answer any ONE question:****1x10=10**49. (a) Prove that $\int_0^a f(x) dx = \int_0^a f(a - x) dx$ and hence evaluate $\int_0^{\frac{\pi}{2}} \frac{\sin^4 x}{\sin^4 x + \cos^4 x} dx$.(b) Find the values of a and b such that $f(x) = \begin{cases} 5, & \text{if } x \leq 2 \\ ax + b, & \text{if } 2 < x < 10 \\ 21, & \text{if } x \geq 10 \end{cases}$

is a continuous function.

50.(a) Solve the linear programming problem graphically:

Minimize $Z = -3x + 4y$,

Subject to constraints: $x + 2y \leq 8, 3x + 2y \leq 12, x \geq 0, y \geq 0$.

(b) If the matrix $A = \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$ satisfies the equation $A^2 - 5A + 7I = 0$, then find the inverse of A using this equation, where I is identity matrix of order 2 and O is zero matrix of order 2.
