SWAMY VIVEKANANDA PRE UNIVERSITY COLLEGE

CHANDAPURA-99

II PUC SECOND MONTHLY TEST JULY-2019

TIME: 1 hr MATHEMATICS MARKS:25

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I ANSWER ALL THE QUESTIONS: $1 \times 3 = 3$

1. If $A=\begin{bmatrix}1 & 1 & -2\\ 2 & 1 & -3\\ 5 & 4 & -9\end{bmatrix}$, find $|A|$.
2. Prove that the function f(x) = 5x-3 is continuous at x = -3.
3. Find $\frac{dy}{dx}$, if $y = \cos(\sqrt{x})$.

II ANSWER ANY 3 OF THE FOLLOWING : $2 \times 3 = 6$

4. If $A = \begin{bmatrix}1 & 2\\ 4 & 2\end{bmatrix}$, then show that $|2A| = 4|A|$.
5. Find equation of line joining (3, 1) and (9,3) using determinants.
6. Find y′, if $x^2+xy+y^2 = 100$.
7. Find $\frac{dy}{dx}$, if $x = 4t$ and $y = \frac{4}{t}$.

III ANSWER ANY 2 OF THE FOLLOWING: $3 \times 2 = 6$

8. Verify $A\,adj(A) = adj(A)A = |A|I$, $A=\begin{bmatrix}2 & 3\\ -4 & -6\end{bmatrix}$ and I is Identity matrix.
9. Find $\frac{dy}{dx}$ of the function $x^{\sin x} + (\sin x)^{\cos x}$.
10. Differentiate $\sin^{-1}\left(\sqrt{1-x^2}\right)$ with respect to $\cos^{-1} x$.

IV ANSWEER ANY 2 OF THE FOLLOWING: $5 \times 2 = 10$

11. Prove that $\begin{vmatrix}x+4 & 2x & 2x\\ 2x & x+4 & 2x\\ 2x & 2x & x+4\end{vmatrix} = (5x+4)(4-x)^2$
12. Solve the system of linear equation using matrix method $x - y + z = 4$, $2x + y - 3z = 0$, $x + y + z = 2$.
13. Find value of K so that the function f is defined by $f(x) = \begin{cases}\frac{K\cos x}{\pi - 2x}, & if\ x \neq \frac{\pi}{2}\\ 3, & if\ x = \frac{\pi}{2}\end{cases}$ is continuous at $x = \frac{\pi}{2}$.

SWAMY VIVEKANANDA RURAL PRE-UNIVERSITY COLLEGE

CHANDAPURA-99, ANEKAL (TQ), BANGALORE-99

II PUC - QUARTERLY EXAMINATION AUGUST-2019

TIME: 1:40 min **SUB: MATHEMATICS** **MARKS: 50**

I ANSWER THE FOLLWING QUESTIONS: **1X5=5**

1. Give an example of a Relation which is symmetric and transitive but not reflexive.
2. Find the principal value of $\sin^{-1}\left(\frac{-1}{2}\right)$.
3. Find the value of $a\,\&\,b$ if $\begin{bmatrix} a-b & 5 \\ 2a-b & 13 \end{bmatrix} = \begin{bmatrix} -1 & 5 \\ 0 & 13 \end{bmatrix}$.
4. Find $\frac{d^2y}{dx^2}$ of x^{20}.
5. Find the rate of change of the area of Circle with respect to its radius $'r'$ when $r = 3cm$.

II ANSWER ANY 5 OF THE FOLLOWING: **2X5=10**

6. Check injective and surjective of the function $f : N \to N$ given by $f(x) = x^2$.
7. If $\sin\left(\sin^{-1}\frac{1}{5} + \cos^{-1} x\right) = 1$, then find the value of $'x'$.
8. If $A = \begin{bmatrix} \cos\alpha & \sin\alpha \\ -\sin\alpha & \cos\alpha \end{bmatrix}$, then verify $A'A = I$.
9. Find the value of k, if area of triangle is $35\,sq\,units$ with vertices $(2,-6),(5,4)\,\&\,(k,4)$.
10. Differentiate $(\log x)^{\cos x}$ with respect of $'x'$.
11. Find the approximate value of function $f(x) = \sqrt{0.6}$ upto 3 decimal places.

III ANSWER ANY 5 OF THE FOLLOWING: **3X5=15**

12. Check whether the relation R in $\mathbf{R}$ of real numbers defined by $R = \{(a,b) : a \le b^3\}$ is reflexive, symmetric or transitive.
13. By using elementary transformation, find the inverse of matrix $A = \begin{bmatrix} 1 & 2 \\ 2 & -1 \end{bmatrix}$.
14. If $x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}$. Show that $\frac{dy}{dx} = -\sqrt[3]{\frac{y}{x}}$.
15. Verify Mean value theorem, if $f(x) = x^3 - 5x^2 - 3x$ in the interval $[1,3]$.
16. If $A = \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$. Show that $A^2 - 5A + 7I = 0$. Hence find A^{-1}.
17. Prove that $\tan^{-1}\left(\frac{63}{16}\right) = \sin^{-1}\frac{5}{13} + \cos^{-1}\frac{3}{5}$.

IV ANSWER ANY 4 OF THE FOLLWING: 5X4=20

18. If $A=\begin{bmatrix}0 & 6 & 7\\ -6 & 0 & 8\\ 7 & -8 & 0\end{bmatrix}, B=\begin{bmatrix}0 & 1 & 1\\ 1 & 0 & 2\\ 1 & 2 & 0\end{bmatrix} \& C=\begin{bmatrix}2\\ -2\\ 3\end{bmatrix}$. Calculate $AC, BC \& (A+B)C$. Also verify $(A+B)C = AC+BC$.

19. Solve the system of linear equations using matrix method.

$$2x+y+z=1$$
$$x-2y-z=\frac{3}{2}$$
$$3y-5z=9$$

20. Prove that $\begin{vmatrix}a^2 & bc & ac+c^2\\ a^2+ab & b^2 & ac\\ ab & b^2+bc & c^2\end{vmatrix}=4a^2b^2c^2$.

21. If $y=e^{a\cos^{-1}x}, -1\le x\le 1$. Show that $(1-x^2)\frac{d^2y}{dx^2}-x\frac{dy}{dx}-a^2y=0$.

22. Sand is pouring from a pipe at the rate of $12cm^3/\sec$. The falling sand forms a cone on the ground in such a way that the height of the cone is always one-sixth of the radius of the base. How fast is the height of the sand cone increasing when the height is $4cm$?

SWAMY VIVEKANANDA RURAL PRE UNIVERSITY COLLEGE

CHANDAPURA, ANEKAL (TQ)

MIDTERM EXAMINATION OCT - 2019

TIME : 3: 15 mins | II PUC MATHEMATICS | MARKS : 100

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PART-A

I ANSWER THE FOLLOWING QUESTIONS: 10X 1=10

1. Let *be a binary operation on N given by a*b = LCM of a and b, find 20*16.
2. Define the composition function.
3. Write the principal value of $\text{cosec}^{-1}(2)$.
4. Write the range of $\tan^{-1} x$ function other than principal value branch.
5. Find the product of $\begin{bmatrix} 2 & 1 \\ 3 & 2 \\ -1 & 1 \end{bmatrix}\begin{bmatrix} 1 & 0 & 1 \\ -1 & 2 & 1 \end{bmatrix}$
6. Find the value of x, A= $\begin{bmatrix} 3 & 3 \\ 4 & x \end{bmatrix}$ if A is a singular matrix.
7. Check the continuity of the function f given by $f(x) = 2x + 3$ at $x = 1$.
8. Find $\frac{dy}{dx}$ of x^y.
9. Find the slope of the tangent to the curve $y = 3x^4 - 4x$ at $x = 4$.
10. Find the minimum value of $f(x) = (2x - 1)^2 + 3$.

PART-B

II ANSWER ANY 10 OF THE FOLLOWING QUESTIONS: 10X 2=20

11. Show that the function $f: R \to R$ defined by $f(x) = \frac{1}{x}$ is one-one and onto.
12. If $f: R \to R$ is defined as$f(x) = x^2 - 3x + 2$ find $f \circ f(x)$ and $f \circ f(-1)$.
13. Show that points A(a, b+c), B(b, c+a), C(c, a+b) are collinear.
14. Write the simplest form of $\tan^{-1}\left[\frac{x}{\sqrt{a^2-x^2}}\right]$, $|x| < a$.
15. Find the value of $\tan\frac{1}{2}\left[\sin^{-1}\frac{2x}{1+x^2} + \cos^{-1}\frac{1-y^2}{1+y^2}\right]$ $|x| < 1$, $y > 0$ and $xy < 1$.
16. Find x, if Y= $\begin{bmatrix} 3 & 2 \\ 1 & 4 \end{bmatrix}$ and 2X+Y = $\begin{bmatrix} 1 & 0 \\ -3 & 2 \end{bmatrix}$.
17. Prove that if any two rows (or columns) of a determinant are interchanged, then sign of determinant changes.
18. Find $\frac{dy}{dx}$ for Y=$\sin^{-1}\left[2x\sqrt{1-x^2}\right]$, $-\frac{1}{\sqrt{2}} < x < \frac{1}{\sqrt{2}}$.
19. Verify the Rolle's theorem for the function f(x)= $y^2 + 2$ a = -2 and b = 2.
20. Find the intervals in which the function f given by $f(x) = 2x^3 - 3x^2 - 36x + 7$ is
    a) Strictly increasing b) Strictly decreasing
21. Use differentials to approximate $(82)^{\frac{1}{4}}$.

PART-C

III ANSWER ANY 10 OF THE FOLLOWING QUESTIONS: 10 X 3=30

22. Determine whether relation R in the set A ={1,2,3,4,5,6} as R = {(x ,y) / y is divisible by x } is equivalence relation or not.
23. Let * be the binary operation on set Q of rational numbers defined as a* b = $\frac{ab}{4}$. Determine * is Commutative, Associative and find Identity element.

24. Find the value of $\tan^{-1}\frac{1}{5}+\tan^{-1}\frac{1}{7}+\tan^{-1}\frac{1}{3}+\tan^{-1}\frac{1}{8}=\frac{\pi}{4}$.

25. Solve by elementary operation to find inverse of B = $\begin{bmatrix}3 & 10\\5 & 7\end{bmatrix}$.

26. Prove that , if A and B are invertible matrices of the same order, then $(AB)^{-1} = B^{-1}A^{-1}$.

27. If A=$\begin{bmatrix}2 & 3\\1 & -4\end{bmatrix}$ and B = $\begin{bmatrix}1 & -2\\-1 & 3\end{bmatrix}$, then verify $(AB)^{-1} = B^{-1}A^{-1}$.

28. Examine the continuity of function $f(x)=\begin{cases}2x+3, & if\ x\le 2\\ 2x-3, & if\ x>2\end{cases}$ at x=2.

29. Find $\frac{dy}{dx}$ if $y^x+x^y+x^x=a^b$.

30. Verify Mean Value theorem, if $f(x)=x^2-4x-3$ in interval [a, b], where a=1, b=4.

31. Find the point at which the tangent to the curve$y=\sqrt{4x-3}$ -1 has its slope $\frac{2}{3}$.

32. Find the Local Maxima and Local Minima of the function $f(x)=x^3-6x^2+9x+15$.

PART-D

IV ANSWER ANY 6 OF THE FOLLOWING QUESTIONS: 6 X 5=30

33. Consider $f: R_+ \to [-5,\infty)$ given by $f(x)=9x^2+6x-5$. show that f is invertible with $f^{-1}(y)=\frac{\sqrt{y+6}\ -1}{3}$.

34. Solve the system of linear equations, using Matrix Method $x-y+2z=7, 3x+4y-5z=-5$ $2x-Y+3z=12$.

35. If $y=3\cos(logx)+4\sin(logx)$. Show that $x^2y_2+xy_1+y=0$.

36. The length x of a rectangle is decreasing at the rate of 5 cm/min and the width y is increasing at the rate of 4 cm/min. when x=8cm and y= 6 cm. Find the rate of change of a) The perimeter and b) The area of the rectangle.

37. Find two positive numbers x and y such that their sum is 35 and the product x^2y^5.

38. If $A=\begin{bmatrix}1 & 0 & 2\\0 & 2 & 1\\2 & 0 & 3\end{bmatrix}$, prove that $A^3-6A^2+7A+2I=0$.

39. If $A=\begin{bmatrix}1 & 3 & 3\\1 & 4 & 3\\1 & 3 & 4\end{bmatrix}$, then verify that $A\ adjA=|A|I$. Also find A^{-1}.

PART-E

V ANSWER THE FOLLOWING QUESTION: 1 x 10=10

40. A) Find the values of a and b such that the function defined by , $\begin{cases}5 & ,if\ x\le 2\\ ax+b, & if\ 2<x<10\\ 21 & ,if\ \ge 10\end{cases}$

B) Prove that $\begin{vmatrix}a-b-c & 2a & 2a\\ 2b & b-c-a & 2b\\ 2c & 2c & c-a-b\end{vmatrix}=(a+b+c)^3$.

Swamy Vivekananda Rural Pre-University College

SWAMY VIVEKANANDA RURAL PRE-UNIVERSITY COLLEGE

CHANDAPURA-99, ANEKAL (TQ), BANGALORE-99

FIRST PREPARETORY EXAMINATION DEC-2019

TIME: 3hr 15 mins **II PUC - MATHEMATICS** **MARKS: 100**

PART- A

I ANSWER THE FOLLOWING: **1 X 10 =10**

1. Give an example of a relation which is reflexive, symmetric but not transitive in the set A={1,2,3}.
2. Write the set of values of$x$, for which $2\tan^{-1}x = \tan^{-1}\left(\frac{2x}{1-x^2}\right)$.
3. If A=$\begin{bmatrix} cos\alpha & sin\alpha \\ -sin\alpha & cos\alpha \end{bmatrix}$, verify that A'A=$I$.
4. If A is a square matrix with $|A|$=6, find the value of$|AA'|$.
5. Differentiate e^{3logx} with respect to x.
6. Define continuous function.
7. Evaluate:$\int(2x - 3cosx + e^x)\,dx$.
8. Define collinear vectors.
9. If a line has direction ratios 2,-1,-2. Determine its direction cosines.
10. Define feasible solution in Linear programing problem.

PART- B

II ANSWER ANY TEN OF THE FOLLOWING: **2 X 10 =20**

11. Prove that the greatest integer function $f: R \rightarrow R$ defined by $f(x)$=$[x]$ is neither one-one nor onto, where $[x]$ indicates greatest integer.
12. If $f: R \rightarrow R$ given by $(x) = (3 - x^3)^{\frac{1}{3}}$, then find $f \circ f(x)$.
13. Prove that $\tan^{-1}(-x) = -\tan^{-1}x$.
14. Find the value of $\sin^{-1}\left(\sin\frac{3\pi}{5}\right)$.
15. Find the equation of the line joining (1,2) and (3,6) using determinants.
16. If $y = \cos^{-1}(\sin x)$. Then prove that $\frac{dy}{dx} = -1$.
17. Differentiate $\sin^2 x$ with respect to e^{cosx}.
18. Show that the function $f(x) = x^2 - 4x + 6$ is, a) straightly increasing b)straightlydecreasing.
19. Find the approximate change in the volume V of a cube of side x meters caused by increasing the side by 1% .
20. Evaluate$\int e^x secx\,(1 + tanx)\,dx$.
21. Find the area of the parallelogram whose adjacent sides are the vectors $3\hat{i} + \hat{j} + 4\hat{k}$ and $\hat{i} - \hat{j} + \hat{k}$.
22. If $\vec{a}$ is a unit vector such that $(\vec{x} - \vec{a}) \cdot (\vec{x} + \vec{a})$=8 find$|\vec{x}|$.
23. Find the angle between the pair of lines $\vec{r} = 3\hat{i} + 5\hat{j} - \hat{k} + \lambda(\hat{i} + \hat{j} + \hat{k})$ and $\vec{r} = 7\hat{i} + 4\hat{k} + \mu(2\hat{i} + 2\hat{j} + 2\hat{k})$.

PART- C

III ANSWER ANY TEN OF THE FOLLOWING: **3 X 10 =30**

24. Show that relation R in the set A={x: xez, 0 ≤ x ≤ 12} given by R={(a, b): |a-b| is a multiple of 4} is an equivalence relation.
25. Prove that $\cos^{-1}\frac{4}{5} + \cos^{-1}\frac{12}{13} = \cos^{-1}\frac{33}{65}$.
26. Find the simplest form of $\tan^{-1}\left(\sqrt{\frac{1-cosx}{1+cosx}}\right)$ where $< \pi$.
27. Using elementary transformation find the inverse of A=$\begin{bmatrix} 2 & 1 \\ 1 & 1 \end{bmatrix}$.
28. Verify Mean Value Theorem for $f(x) = x^2 - 4x - 3$ in the interval [a,b] , where a=1, b=4.

29. If $y = \tan^{-1}\left(\frac{3x-x^3}{1-3x^2}\right)$, $-\frac{1}{\sqrt{3}} < x < \frac{1}{\sqrt{3}}$. Find $\frac{dy}{dx}$.

30. Find two numbers whose sum is 24 and whose product is as large as possible.

31. Find absolute maximum value and absolute minimum value of the function $f(x) = 2x^3 - 24x + 107$ in the interval [1,3].

32. Evaluate : $\int_4^9 \frac{\sqrt{x}}{\left(30-x^{\frac{3}{2}}\right)^2}\, dx$.

33. Evaluate : $\int \frac{x}{(x+1)(x+2)}\, dx$.

34. Show that the four points A,B,C and D with position vectors $4\hat{i} + 8\hat{j} + 12\hat{k}$, $2\hat{i} + 4\hat{j} + 6\hat{k}$, $3\hat{i} + 5\hat{j} + 4\hat{k}$, $5\hat{i} + 8\hat{j} + 5\hat{k}$ respectively are coplanar.

35. For a unit vector perpendicular to the vectors $\vec{a} - \vec{b}$ and $\vec{a} + \vec{b}$, where $\vec{a} = \hat{i} + \hat{j} + \hat{k}$ and $\vec{b} = \hat{i} + 2\hat{j} + 3\hat{k}$.

36. Find the equation of the line which passes through the point (1,2,3) and is parallel to the vector $3\hat{i} + 2\hat{j} - 2\hat{k}$, both in Vector form and Cartesian form.

PART- D

IV ANSWER ANY SIX OF THE FOLLOWING: **5 X 6 =30**

37. If R_+ is the set of all non-negative real numbers. Prove that $f: R_+ \to [-5, \infty)$ defined by $f(x) = 9x^2 + 6x - 5$ is invertible and find $f^{-1}(x)$.

38. For the matrix $A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & -3 \\ 2 & -1 & 3 \end{bmatrix}$ show that $A^3 - 6A^2 + 5A + 11I = 0$ and hence find A^{-1}.

39. Solve the system of equations by Matrix Method $3x - 2y + 3z = 8$, $2x + y - z = 1$, $4x - 3y + 2z = 4$.

40. If $y = \cos^{-1} x$ prove that $(1 - x^2)\frac{d^2y}{dx^2} - x\frac{dy}{dx} = 0$.

41. A man of height 2 meters walks at a uniform speed of 5km/hr away from a lamp post which is 6 meters high. Find the rate at which the length of his shadow increases.

42. A square piece of tin of side 18 cm is to be made into a box without top, by cutting a square from each corner and folding up the flaps to form the box. What should be the side of the square to be cut off so that the volume of the box is the maximum possible?

43. Find the integral of $\frac{1}{\sqrt{x^2+a^2}}$ with respect to x and hence evaluate $\int \frac{1}{\sqrt{x^2+2x+2}}\, dx$.

44. Derive the equation of a line passing through two given points both in vector and Cartesian form.

PART- E

V ANSWER ONE FULL QUESTION OF THE FOLLOWING: **10 X 1 =10**

45. a) Prove that $\int_{-a}^{a} f(x)\, dx = \begin{cases} 2\int_0^a f(x)\, dx, & if\ f(x) is\ even \\ 0, & if\ f(x)\ is\ odd \end{cases}$ and evaluate $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \sin^{-1} x\, dx$. (6 M)

b) Prove that $\begin{vmatrix} 1 & x & x^2 \\ x^2 & 1 & x \\ x & x^2 & 1 \end{vmatrix} = (1 - x^3)^2$. (4 M)

46. a) Minimize and Maximize $z = x + 2y$

Subject to constraints $x + 2y \geq 100$

$2x - y \leq 0$

$2x + y \leq 200$, $x, y \geq 0$ by graphical method. (6 M)

b) Find the value of K so that the function given by $f(x) = \begin{cases} Kx^2, if & x \leq 2 \\ 3, & if\ x > 2 \end{cases}$ (4 M)

is continuous at $x = 0$.

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SWAMY VIVEKANANDA RURAL PRE-UNIVERSITY COLLEGE

CHANDAPURA, ANEKAL (TQ), BANGALORE-99

II PUC – II PREPARATORY EXAMINATION -JANUARY-2020

TIME: 3:15 mins **SUB: MATHEMATICS** **MARKS:1**

PART - A

I. Answer the following questions: $1\times10=10$

1. Let * be an operation defined on the set of rational numbers by $a*b=\dfrac{ab}{4}$, find the identity element.
2. Write the domain of $f(x)=\cos^{-1}x$.
3. Define a scalar matrix.
4. Find the value of $'x'$ if $\begin{vmatrix} x & 2 \\ 18 & x \end{vmatrix}=\begin{vmatrix} 6 & 2 \\ 18 & 6 \end{vmatrix}$.
5. Prove that the greatest integer function is not continuous at $x=0$.
6. Evaluate: $\int\dfrac{x^3-1}{x^2}dx$.
7. If the vectors $2\hat{i}+3\hat{i}-6\hat{k}$ and $4\hat{i}-m\hat{i}-12\hat{k}$ are parallel. Find $'m'$.
8. Find the direction cosines of the vector $\hat{i}+2\hat{j}+3\hat{k}$.
9. Define feasible solution of the constraints in LPP.
10. If $P(A)=\dfrac{3}{5}, P(B)=\dfrac{1}{5}$, find $P(A\cap B)$, if $A \& B$ are independent events.

PART – B

II. Answer any TEN of the following questions: $2\times10=20$

11. Show that if $f:A\to B$ and $g:B\to C$ are one – one, then $g\circ f:A\to C$ is also one –one.
12. Show that $\sin^{-1}\left(2x\sqrt{1-x^2}\right)=2\cos^{-1}x, \dfrac{1}{\sqrt{2}}\le x\le 1$.
13. Solve the equation $\tan^{-1}\left(\dfrac{1-x}{1+x}\right)=\dfrac{1}{2}\tan^{-1}(x),(x>0)$.
14. If area of the triangle with vertices $(-2,0),(0,4)$ and $(0,k)$ is 4 sq. units, find the values of $'k'$ using determinants.
15. If $ax+by^2=\cos y$, then find $\dfrac{dy}{dx}$.
16. Verify Rolle's theorem for the function $f(x)=x^2+2$ for $x\in[-2,2]$.
17. Using differentiation, find the approximate value of $\sqrt{49.5}$.
18. Evaluate $\int\dfrac{\sqrt{\tan x}}{\sin x\cos x}dx$.
19. Integrate $\dfrac{xe^x}{(1+x)^2}$ with respect to x.
20. Find the order and degree of the differential equation $\left(\dfrac{dy}{dx}\right)^2+\dfrac{dy}{dx}-\sin^2 y=0$.
21. Find the angle between the vector $\vec{a}=\hat{i}+\hat{j}-\hat{k}$ and $\vec{b}=\hat{i}+\hat{j}+\hat{k}$.

Find a vector in the direction of vector $5\hat{i}-\hat{j}+2\hat{k}$ which has magnitude 8 units.

Show that the lines $\frac{x-5}{7}=\frac{y+2}{-5}=\frac{z}{1}$ *and* $\frac{x}{1}=\frac{y}{2}=\frac{z}{3}$ are perpendicular to each other.

Find the probability distribution of number of heads in two tosses of a coin.

PART – C

Answer any TEN of the following questions: $3\times10=30$

Show that the relation R in the set Z of integers given by $R=\{(a,b): 2\, divides\ a-b\}$ is an equivalence relation.

6. Solve $\tan^{-1}(2x)+\tan^{-1}(3x)=\frac{\pi}{4}$. Find the value of '$x$'.

7. By using elementary operations, find the inverse of the matrix $A=\begin{bmatrix}3 & -1\\ -4 & 2\end{bmatrix}$.

8. Find the equations of tangent and normal to the curve $y=x^4-6x^3+13x^2-10x+5$ at the point $(1,3)$.

9. If $x=a(\theta-\sin\theta)$ *and* $y=a(1+\cos\theta)$, then Prove that $\frac{dy}{dx}=-\cot\left(\frac{\theta}{2}\right)$.

0. Find two positive number x and y such that $x+y=60$ *and* xy^3 is maximum.

1. Find $\int e^x\left[\frac{1-\sin x}{1+\cos x}\right]dx$.

2. Integrate $\frac{1}{x(x^2+1)}$ with respect to x.

3. Find the area lying between the curve $y^2=4x$ and the line $y=2x$.

4. Form the differential equation of the family of circles touching the x-axis at origin.

5. Show that the position vector of the point, which divides the line joining the points A and B having the position vectors $\vec{a}$ *and* $\vec{b}$ internally in ratio is $\frac{m\vec{b}+n\vec{a}}{n+n}$.

6. Prove that $\left[\vec{a}+\vec{b},\vec{b}+\vec{c},\vec{c}+\vec{a}\right]=2\left[\vec{a},\vec{b},\vec{c}\right]$.

7. Find the equation of the plane through the intersection of the planes $3x-y+3z-4=0$ & $x+y+z-2=0$ and the point $(2,2,1)$.

8. An insurance company insured 2000 scooter drivers, 4000 car drivers and 6000 truck drivers. The probability of an accidents are 0.01, 0.03 and 0.15 respectively. One of the insured person meets with an accid[illegible]. What is th[illegible] probability that he is a scooter driver?

PART – D

Answer any SIX of the following questions: $5\times6=30$

9. Let R_+ be the set of all non-negative real numbers. Show that the function $f:R_+\to[4,\infty)$ defined by $f(x)=x^2+4$ is invertible. Also write the inverse of $f(x)$.

0. If $A=\begin{bmatrix}1 & 2 & -3\\ 5 & 0 & 2\\ 1 & -1 & 1\end{bmatrix}, B=\begin{bmatrix}3 & -1 & 2\\ 4 & 2 & 5\\ 2 & 0 & 3\end{bmatrix}$ *and* $C=\begin{bmatrix}4 & 1 & 2\\ 0 & 3 & 2\\ 1 & -2 & 3\end{bmatrix}$, then compute $(A+B)$ *and* $(B-C)$, Also verify $A+(B-C)=(A+B)-C$.

1. Solve the following system of linear equations by matrix method
$x-y+2z=7;\ 3x+4y-5z=-5;\ 2x-y+3z=12.$

2. If $y=3e^{2x}+2e^{3x}$, prove that $\frac{d^2y}{dx^2}-5\frac{dy}{dx}+6y=0$.
3. A ladder 5 m long is leaning against a wall. The bottom of the ladder is pulled along the ground, away from the wall, at the rate of 2cm/s. How fast is its height on the wall decreasing when the foot of the ladder is 4m away from the wall?
4. Find the integral of $\frac{1}{x^2+a^2}$ w.r.t 'x' and hence find $\int\frac{1}{3+2x+x^2}dx$.
5. Using integration, find the area of region bounded by the triangle whose vertices are $(-1,0),(1,3)$ and $(3,2)$.
6. Solve the differential equation $\frac{dy}{dx}+y\sec x=\tan x,\ 0\le x<\frac{\pi}{2}$.
7. Derive the equation of the plane in normal form (both in the vector and Cartesian forms).
8. The probability that a bulb produced by a factory will fuse after 150 days of use is 0.05. Find the probability that out of 5 such bulbs
   i) none
   ii) not more than one
   iii) more than one

   will fuse after 150 days of use.

PART – E

Answer any ONE of the following questions: $1\times10=10$

. a) Minimize and Maximize: $Z=600x+400y$

Subject to the constraints: $x+2y\le12$,

$2x+y\le12,\ 4x+5y\le20\ and\ x\ge0, y\ge0$ by graphical method.

b) Determine the value of 'k' if $f(x)=\begin{cases}kx+1, & if\ x\le5\\ 3x-5, & if\ x>5\end{cases}$ is continuous at $x=5$.

. a) Prove that $\int_0^a f(x)dx=\int_0^a f(a-x)dx$ and hence evaluate $\int_0^{\frac{\pi}{4}}\log(1+\tan x)dx$.

b) Show that $\begin{vmatrix}x+y+2z & x & y\\ z & y+z+2x & y\\ z & x & z+x+2y\end{vmatrix}=2(x+y+z)^3$.