Mathematics Question Bank Class - 12th

Year(2026-2024)

Ch.1 :- Relations and Functions

M.C.Q. :-

1. Let R be the relation in the set {1,2,3,4} given by R = {(1,2),(2,2),(1,1),(4,4),(1,3),(3,3),(3,2)}. Then
   a) R is reflexive and symmetric but not transitive
   b) R is reflexive and transitive but not symmetric
   c) R is symmetric and transitive but not reflexive
   d) R is an equivalence relation (2022)
2. Let R be the relation in the set N given by R = {(a,b): a = b - 2, b> 6}. Then
   a) (2,4) ϵ R b) (3,8) ϵ R c) (6,8) ϵ R d) (8,7) ϵ R
3. Let f:R→R be defined as f(x) = x^4 . Then
   a) f is one-one onto b) f is many one onto c) f is one one but not onto
   d) f is neither one one nor onto
4. Let f:R→R be defined as f(x) = 3x. Then
   a) f is one-one onto b) f is many one onto c) f is one one but not onto
   d) f is neither one one nor onto
5. Let A = {1,2,3}. Then number of relations containing (1,2) and (1,3) which are reflexive and symmetric but not transitive is
   a) 1 b) 2 c) 3 d) 4
6. Let A = {1,2,3}. Then number of equivalence relations containing (1,2) is
   a) 1 b) 2 c) 3 d) 4
7. For the function, f:N→ N given by f(x) = x^2 . Choose the correct answer
   a) Both one-one and onto b) One-one, but not onto c) Onto, but not one-one
   d) Neither one-one nor onto (2022)
8. If a function f : {1,2,3,4} → {10} WITH F = {(1,10),(2,10),(3,10),(4,10)}. Choose the correct answer : (2022)
   a) f is one-one function b) f is many one function c) f is one-one onto d) None of these
9. Let R be the relation in the set Z of integer given by R = {(a,b): 2 divides a-b}. Choose the correct answer:
   a) Reflexive and Symmetric, but not Transitive
   b) Symmetric and Transitive, but not Reflexive
   c) R is an equivalence relation d) None of these (2021)
10. Let R be the relation in the set of real numbers 'R' given by R = {(a,b): a$\leq b$}.Choose the correct answer :
    a) Reflexive and Transitive, but not Symmetric
    b) Reflexive and Symmetric, but not Transitive
    c) Symmetric and Transitive, but not Reflexive d) None of these (2021) 11. Let f : R → defined by f(x) = 1 + x^2. Choose the correct answer :
    a) Both one - one and on - to b) One - one, but not on - to
    c) On - to, but not one - one d) Neither one - one nor on - to (2021)
12. Let S = {1,2,3}. Determine whether the functions f : S → S defined as f = {(1,1),(2,2),(3,3)}

then f^{-1} is :

a) {(1,2),(1,1),(1,3)} b) {(1,1),(2,2),(3,3)} c) {(1,1),(2,2),(2,3)} d) Does not exist (2021)

13. Let R be the relation in the set {1,2,3} given by R = {(1,1),(2,2),(3,3),(1,2),(2,3)}. Choose the correct answer :

a) R is Reflexive, but neither Symmetric nor Transitive

b) R is Symmetric and Transitive, but not Reflexive

c) R is Transitive and Reflexive, but not Symmetric d) None of these (2021)

14. Let R be the relation in the set A of human beings in a town at a particular time by R ={(x,y) : x is wife of y}. Choose the correct answer :

a) R is an equivalence relation b) Reflexive, Symmetric, but not Transitive

c) Neither Reflexive nor Symmetric nor Transitive d) None of these (2021)

15. Let A be the set of all 50 students of class X in a school. Let f : A → N be the function defined by f(x) = roll number of the student x. Choose the correct answer :

a) f is both one - one and onto b) f is one - one, but not onto

b) f is many one and onto d) None of these (2021)

16. Let S = {1,2,3}. Determine whether the functions f : S → S defined as f = {(1,3),(3,2),(2,1)} then f^{-1} is :

a) {(1,2),(2,2),(2,3)} b) {(1,1),(1,2),(3,3)} c) {(3,1),(3,2),(3,3)} d) {(3,1),(2,3),(1,2)} (2021)

17. Let R be the relation in the set {1,2,3,4,5,6} given by R = {(a,b): b = a + 1}.Choose the correct answer :

a) Reflexive and Symmetric, but not Transitive

b) Reflexive and Symmetric, but not Transitive

c) Symmetric and Transitive, but not Reflexive d) None of these (2021)

18. Let R be the relation in the set A of human beings in a town at a particular time by R ={(x,y) : x and y work at same place}. Choose the correct answer :

a) Reflexive and Transitive, but not Symmetric

b) Reflexive, Symmetric, but not Transitive

c) Transitive and Symmetric, but not Reflexive

d) Reflexive, Symmetric and Transitive (2021)

19. Let S = {1,2,3}. Determine whether the functions f : S → S defined as f = {(1,2),(2,1),(3,1)} then f^{-1} is :

a) {(1,2),(2,2),(2,3)} b) {(1,1),(1,2),(3,3)} c) {(1,1),(2,2),(3,3)} d) Does not exist (2021)

20. Let f : N → N given by f(1) = f(2) = 1 and f(x) = x - 1, for every x>2. Choose the correct answer :

a) f is one - one, but not onto b) f is many one and onto

c) f is onto, but not one - one d) f is one - one onto (2021)

Long Answer Type Question :-

1. Let L be the set of all lines in XY - plane and R be the relation in L defined as R = {(L_1, L_2) : L_1 is parallel to L_2}. Show that R is an equivalence relation. (2017)

2. Let T be the set of all triangles in a plane with R as a relation in T given by R = {(T_1, T_2) : $T_1 \cong T_2$}. Show that R is an equivalence relation. (2017)

3.Find gof and fog, if i) f(x) = IxI and g(x) = I5x-2I ii) f(x) = $8x^3$ and g(x) = $x^{\frac{1}{3}}$

(2016,18,19,20)

4. Check Whether the relation R in R defined by R = {(a,b) : a$\leq b^3$} is reflexive, symmetric or transitive. (2022)

5. Find fof(x), if f(x) = $(3-x^3)^{\frac{1}{3}}$ (2016,20)

6. Let T be the set of all triangles in a plane with R as a relation in T given by R = {(T_1, T_2) : $T_1 is\ congruent\ to\ T_2$}. Show that R is an equivalence relation. (2017)

7. Show that the relation R in the set A = {x ∈ Z : 0 ≤ x ≤ 12} is given by R = {(a,b) : a=b} is an equivalence relation. (2022)

8. Show that the relation R in the set A = {1,2,3,4,5} given by R = {(a,b) : $|a-b|$ is a multiple of 4} is an equivalence relation. (2022)

10. Find gof and fog, if f:R→ R and g:R→ R are given by f(x) = cos x and g(x) = $3x^2$ (2019)

11. If f:R→ R be defined by f(x) = x^2-3x+2, find f(f(x)). (2018)

Ch.2 - Inverse Trigonometric Function

M.C.Q. :-

1. The principal value of $\tan^{-1}(-1)$ is
   a) $\frac{\pi}{4}$ b) $\frac{-\pi}{6}$ c) $\frac{-\pi}{4}$ d) None of these
2. The principal value of $\sin^{-1}(\frac{-1}{2})$ is
   a) $\frac{-\pi}{6}$ b) $\frac{\pi}{6}$ c) $\frac{\pi}{3}$ d) $\frac{\pi}{3}$
3. If $\sin^{-1} x$ = y, then
   a) $0 \leq y \leq \pi$ b) $\frac{-\pi}{2} \leq y \leq \frac{\pi}{2}$ c) $0 < y < \pi$ d) $\frac{-\pi}{2} < y < \frac{\pi}{2}$ (2016)
4. If $\tan^{-1}(\sqrt{3}) - \sec^{-1}(-2)$ is equal to
   a) π b) $\frac{-\pi}{3}$ c) $\frac{\pi}{3}$ d) $\frac{2\pi}{3}$ (2020)
5. $\sin(\tan^{-1} x)$, $|x| < 1$is equal to
   a) $\frac{x}{\sqrt{1-x^2}}$ b) $\frac{1}{\sqrt{1-x^2}}$ c) $\frac{1}{\sqrt{1+x^2}}$ d) $\frac{x}{\sqrt{1+x^2}}$ (2015)
6. $\tan^{-1}(\frac{x}{y}) - \tan^{-1}(\frac{x-y}{x+y})$ is equal to
   a) $\frac{\pi}{2}$ b) $\frac{\pi}{3}$ c) $\frac{\pi}{4}$ d) $\frac{-3\pi}{4}$
7. The principal value of $\sin^{-1}(\sin\frac{3\pi}{5})$ is
   a) $\frac{3\pi}{5}$ b) $\frac{-3\pi}{5}$ c) $\frac{2\pi}{5}$ d) None of these (2016,21)
8. The principal value of $\tan^{-1}(-1)$ is
   a) $\frac{\pi}{4}$ b) $\frac{3\pi}{4}$ c) $\frac{-\pi}{4}$ d) $\frac{\pi}{3}$
9. The value of $\sin(\frac{\pi}{3} - \sin^{-1}(-\frac{1}{2}))$ is equal to
   a) $\frac{1}{2}$ b) $\frac{1}{3}$ c) $\frac{1}{4}$ d) 1 (2015,19,20,21)
10. The value of $\tan^{-1}\sqrt{3} - \cot^{-1}(-\sqrt{3})$ is equal to
    a) π b) $\frac{-\pi}{2}$ c) 0 d) $2\sqrt{3}$ (2015,19,20,21)
11. The principal value of $\sin^{-1}\left(\frac{1}{\sqrt{2}}\right)$ is :
    a) $\frac{\pi}{6}$ b) $\frac{\pi}{2}$ c) $\frac{\pi}{3}$ d) $\frac{\pi}{4}$ (2018)
12. The principal value of $\cos^{-1}\left(\frac{\sqrt{3}}{2}\right)$ is :
    a) $\frac{\pi}{6}$ b) $\frac{\pi}{3}$ c) $\frac{\pi}{4}$ d) $\frac{\pi}{2}$ (2017,18,21)
13. The principal value of $\tan^{-1}(-\sqrt{3})$ is :
    a) $\frac{\pi}{2}$ b) $\frac{\pi}{3}$ c) $\frac{-\pi}{3}$ d)$-\frac{\pi}{2}$ (2018)
14. $\cos^{-1}\left(\cos\frac{7\pi}{6}\right)$ is equal to
    a) $\frac{7\pi}{6}$ b) $\frac{5\pi}{6}$ c) $\frac{\pi}{3}$ d) $\frac{\pi}{6}$ (2019)
15. $\cos^{-1}\left(\cos\frac{13\pi}{6}\right)$ is equal to
    a) $\frac{13\pi}{6}$ b) $\frac{-\pi}{6}$ c) $\frac{\pi}{6}$ d) - $\frac{13\pi}{6}$ (2021)
16. $\pi - \cot^{-1} x, x \in R$ is equal to :
    a) $\cot^{-1}(-x)$ b) $\cot^{-1}(x)$ c) $\tan^{-1}(-x)$ d) $\tan^{-1}(x)$ (2021)
17. The principal value of $\sin^{-1}\left(-\frac{1}{2}\right)$ is :
    a) $\frac{\pi}{6}$ b) - $\frac{\pi}{6}$ c) $\frac{\pi}{4}$ d) $-\frac{\pi}{4}$ (2021)
18. $\tan^{-1}\{\tan\left(\frac{7\pi}{6}\right)\}$ is :

a) $\frac{7\pi}{6}$ c) $\frac{\pi}{6}$ c) $\frac{-\pi}{6}$ d) $-\frac{7\pi}{6}$ (2021)

19. If $\sin\left(\sin^{-1}\frac{1}{5}+\cos^{-1}x\right)=1$, then x is :

a) $\frac{1}{5}$ b) $\frac{2}{5}$ c) $\frac{3}{5}$ d) - $\frac{1}{5}$ (2021)

20. $\pi-\sec^{-1}(x)$, $|x|\geq 1$, is equal to :

a) $\sec^{-1}x$ b) $\text{cosec}^{-1}(-x)$ c) $\sec^{-1}(-x)$ d) $\text{cosec}^{-1}x$ (2021)

21. $\pi-\cos^{-1}x, x\in R$ is equal to :

a) $\cos^{-1}(-x)$ b) $\cos^{-1}(x)$ c) $\sin^{-1}(-x)$ d) $\sin^{-1}(x)$ (2021)

22. The principal value of $\cos^{-1}(\frac{-1}{2})$ is

a) $\frac{\pi}{6}$ b) $\frac{2\pi}{3}$ c) $-\frac{\pi}{3}$ d) $\frac{\pi}{3}$ (2017,21)

23. The principal value of $\cos^{-1}\left(\frac{1}{\sqrt{2}}\right)$ is :

a) $\frac{3\pi}{4}$ b) $\frac{5\pi}{4}$ c) $-\frac{\pi}{4}$ d) $\frac{\pi}{4}$ (2017)

24. $\tan^{-1}\{\tan\left(\frac{3\pi}{5}\right)\}$ is :

a) $\frac{3\pi}{4}$ c) $\frac{-\pi}{4}$ c) $\frac{\pi}{4}$ d) None of these (2016)

Long Answer Type Question :-

1. Prove that

i) $3\sin^{-1}x=\sin^{-1}(3x-4x^3)$

ii) $2\tan^{-1}\frac{1}{2}+\tan^{-1}\frac{1}{7}=\tan^{-1}\frac{31}{17}$

iii) $\tan^{-1}\frac{1}{2}+\tan^{-1}\frac{2}{11}=\tan^{-1}\frac{3}{4}$

iv) $\tan^{-1}\frac{2}{11}+\tan^{-1}\frac{7}{24}=\tan^{-1}\frac{1}{2}$ (2016)

v) $3\cos^{-1}x=\cos^{-1}(4x^3-3x)$

vi) $\sin^{-1}\frac{5}{13}+\cos^{-1}\frac{3}{5}=\tan^{-1}\frac{63}{16}$ (2016,21)

vii) $\sin^{-1}(2x\sqrt{1-x^2})=2\cos^{-1}x$

ix) $\tan^{-1}\left(\frac{\sqrt{1+x}-\sqrt{1-x}}{\sqrt{1+x}+\sqrt{1-x}}\right)=\frac{\pi}{4}-\frac{1}{2}\cos^{-1}x$ (2015,21)

x) $\cos^{-1}\frac{12}{13}+\sin^{-1}\frac{3}{5}=\sin^{-1}\frac{56}{64}$ (2015,17,21)

xi) $\cot^{-1}\left(\frac{\sqrt{1+\sin x}+\sqrt{1-\sin x}}{\sqrt{1+\sin x}-\sqrt{1-\sin x}}\right)=\frac{\pi}{2}$, $x\in(0,\frac{\pi}{4})$ (2021)

xii) $\sin^{-1}\frac{8}{17}+\sin^{-1}\frac{3}{5}=\tan^{-1}\frac{77}{36}$ (2017,21)

xiii) $\frac{9\pi}{8}-\frac{9}{4}\sin^{-1}\frac{1}{3}=\frac{9}{4}\sin^{-1}\frac{2\sqrt{2}}{3}$ (2021)

xiv) $\sin^{-1}\frac{3}{5}-\sin^{-1}\frac{8}{17}=\cos^{-1}\frac{84}{85}$ (2015,16)

xv) $\cos^{-1}\frac{4}{5}+\cos^{-1}\frac{12}{13}=\cos^{-1}\frac{33}{65}$ (2015,17)

2. Write the simplest form of :

i) $\tan^{-1}(\frac{3a^2x-x^3}{a^3-3ax^2})$ (2016)

ii) $\tan^{-1}(\frac{\cos x}{1-\sin x})$ (2016,19)

iii) $\tan^{-1}\sqrt{\frac{1-\cos x}{1+\cos x}}$, $0<x<\pi$ (2018,19,22)

iv) $\tan^{-1}\frac{x}{\sqrt{a^2-x^2}}$ (2017,18,20,22)

v) $\tan^{-1}(\frac{\sqrt{1+x^2}-1}{x})$ (2017,18,20,22)

vi) $\tan^{-1}(\frac{\cos x-\sin x}{\cos x+\sin x})$ (2016,17,19,20)

3. Solve for x if :

i) $\sin\left(\sin^{-1}\frac{1}{5}+\cos^{-1}x\right)=1$

ii) $\tan^{-1}(\frac{x-1}{x-2})+\tan^{-1}(\frac{x+1}{x+2})=\frac{\pi}{4}$

iii) $\tan^{-1}(\frac{1-x}{1+x})=\frac{1}{2}\tan^{-1}x$ (2018)

iv) $2\tan^{-1}(\cos x)=\tan^{-1}(2cosec\ x)$ (2018)

v) $\tan^{-1}2x+\tan^{-1}3x=\frac{\pi}{4}$ (2018)

4. Find the value of $\tan^{-1}[2\cos(2\sin^{-1}\frac{1}{2})]$ (2022)

Ch.3- Matrices

M.C.Q.

Refer to Q.1 and Q.2 :- Assume X,Y,Z,W and P are matrices of order 2xn, 3xk,2xp, nx3 and pxk respectively. Choose the correct answer in the following questions :

1. The restriction on n,k and p so that PY+WY will be defined are :
   a) k = 3, p = n b) k is arbitrary, p = 2 c) p is arbitrary, k = 3 d) k = 2, p = 3
2. If n = p, then the order of the matrix 7X - 5Z is
   a) p x 2 b) 2 x n c) n x 3 d) p x n (2015)
3. A = $[a_{ij}]_{mxn}$ is a square matrix, if
   a) m< n b) m> n c) m=n d) None of these (2019)
4. Which of the given values of x and y make the following pair of matrices equal
   $\begin{bmatrix} 3x+7 & 5 \\ y+1 & 2-3x \end{bmatrix} = \begin{bmatrix} 0 & y-2 \\ 8 & 4 \end{bmatrix}$ (2021)
   a) x = $\frac{-1}{3}$, y = 7 b) Not possible to find c) x = $\frac{-2}{3}$, y = 7 d) x = $\frac{-1}{3}$, y = $\frac{-2}{3}$
5. If A = $\begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix}$,then A + $A^{/}$ = I, if the value of α is
   a) $\frac{\pi}{6}$ b) $\frac{\pi}{3}$ c) π d) $\frac{3\pi}{2}$ (2019,21)
6. Matrices A and B will be inverse of each other only if
   a) AB = BA b) AB = BA = 0 c) AB = 0, BA = I d) AB = BA = I
7. If A = $\begin{bmatrix} \alpha & \beta \\ \gamma & -\alpha \end{bmatrix}$ is such that $A^2 = I$, then
   a) 1+ $\alpha^2 + \beta\gamma$ = 0 b) 1- $\alpha^2 + \beta\gamma$ = 0 c) 1- $\alpha^2 - \beta\gamma$ = 0 d) 1+ $\alpha^2 - \beta\gamma$ = 0
8. If the matrix A is both symmetric and skew- symmetric, then (2017,20)
   a) A is diagonal matrix b) A is a zero matrix c) A is a square matrix d) None of these
9. If A is square matrix such that $A^2 = A$, then $(I + A)^3 - 7A$ is equal to
   a) A b) I - A c) I d) 3A (2015,21)
10. A = $[a_{ij}]_{mxn}$ is a rectangular matrix, if
    a) m< n b) m> n c) m=n d) None of these (2021)
11. If A,B symmetric matrices of the same order then AB - BA is a (2016,17,18,20,21)
    a) Skew symmetric matrix b) Symmetric matrix c) Zero matrix d) Identity matrix
12. The number of all possible matrices of order 3x3 with each entry 0 or 1 is
    a) 27 b) 18 c) 81 d) 512 (2015,19,21)
13. If A is an invertible matrix of order 2 then det(A^{-1}) is equal to :
    a) 1 b) 0 c) det(A) d) $\frac{1}{\det(A)}$ (2018)
14. Let A be a nonsingular square matrix of order 3x3. Then $|adjA|$ is :
    a) $|A|$ b) $|A|^3$ c) $|A|^2$ d) $|3A|$ (2018)
15. If a matrix is symmetric as well as skew symmetric, then
    a) A is diagonal matrix b) A null matrix c) A unit matrix d) None of these
16. If A and B are invertible matrices of same order, then $(AB)^{-1}$ is equal to :
    a) BA b) $B^{-1}A$ c) $B^{-1}A^{-1}$ d) None of these (2016,17,20,21)
17. The matrix B = $[b_{ij}]_{1Xn}$, when n>1 is :
    a) Square matrix b) Column matrix c) Diagonal matrix d) Row matrix (2021)
18. If A = $\begin{bmatrix} 2 & 4 \\ 3 & 2 \end{bmatrix}$ and c = $\begin{bmatrix} -2 & 5 \\ 3 & 4 \end{bmatrix}$, THEN 3A - C is :
    a) $\begin{bmatrix} -8 & 7 \\ 6 & 2 \end{bmatrix}$ b) $\begin{bmatrix} -8 & -7 \\ 6 & 2 \end{bmatrix}$ c) $\begin{bmatrix} 8 & 7 \\ 6 & 2 \end{bmatrix}$ d) None of these (2021)

19. If $(A+B)^{/}$ is equal to :
a) $A^{/}+B$ b) $A^{/}+B^{/}$ c) A+$B^{/}$ d) None of these (2021)

20. A square matrix in which elements in the diagonal are all 1 and rest are zero is called :
a) Identity matrix b) Null matrix c) Row matrix d) Column matrix (2021)

21.If A is a non singular matrix of order n then IadjAI is equal to
a) IAI b) $|A|^n$ c) $|A|^{n-1}$ d) 3IAI (2016)

Long Answer Type Question :-

1. Construct a 3x2 matrix, whose elements are given by $a_{ij}=\frac{1}{2}|i-3j|$ (2016)

2. Construct a 2x3 matrix, whose elements are given by $a_{ij}=\frac{(i+j)^2}{2}$ (2016)

3. Construct a 2x2 matrix, whose elements are given by $a_{ij}=\frac{(i+2j)^2}{2}$ (2016)

4. Find the values of x,y and z from the equation : $\begin{bmatrix}4 & 3\\ x & 5\end{bmatrix}=\begin{bmatrix}y & z\\ 1 & 5\end{bmatrix}$

5. Find the values of x,y and z from the equation : $\begin{bmatrix}x+y+z\\ x+z\\ y+z\end{bmatrix}=\begin{bmatrix}9\\ 5\\ 7\end{bmatrix}$

6. Find X and Y, if 2X + 3Y = $\begin{bmatrix}2 & 3\\ 4 & 0\end{bmatrix}$ and 3X + 2Y = $\begin{bmatrix}2 & -2\\ -1 & 5\end{bmatrix}$

7. Find the values of x,y and z from the equation : $\begin{bmatrix}x+y & 2\\ -5+z & xy\end{bmatrix}=\begin{bmatrix}6 & 2\\ -5 & 8\end{bmatrix}$

8. For the matrices A and B, verify that $(AB)^{/}=B^{/}A^{/}$, where A = $\begin{bmatrix}-2\\ 4\\ 5\end{bmatrix}$ and B = $[1 \quad 3 \quad -6]$ (2018,20)

9. If A = $\begin{bmatrix}0\\ 1\\ 2\end{bmatrix}$, B = $[1 \quad 5 \quad 7]$, verify that $(AB)^{/}=B^{/}A^{/}$

10. If A = $\begin{bmatrix}\cos\alpha & \sin\alpha\\ -\sin\alpha & \cos\alpha\end{bmatrix}$, then verify that $A^{/}A=I$. (2015)

11. For the matrix A = $\begin{bmatrix}1 & 5\\ 6 & 7\end{bmatrix}$, verify that
i) (A+$A^{/}$) is a symmetric matrix. (2015,18)
ii) (A-$A^{/}$) is a symmetric matrix. (2018)

12. If A = $\begin{bmatrix}-1 & 2 & 3\\ 5 & 7 & 9\\ -2 & 1 & 1\end{bmatrix}$ and B = $\begin{bmatrix}-4 & 1 & -5\\ 1 & 2 & 0\\ 1 & 3 & 1\end{bmatrix}$, then verify that $(A+B)^{/}=A^{/}+B^{/}$ (2022)

13. If x$\begin{bmatrix}2\\ 3\end{bmatrix}+y\begin{bmatrix}-1\\ 1\end{bmatrix}=\begin{bmatrix}10\\ 5\end{bmatrix}$, then find the values of x and y. (2021)

14. Find x and y, if $2\begin{bmatrix}1 & 3\\ 0 & x\end{bmatrix}+\begin{bmatrix}y & 0\\ 1 & 2\end{bmatrix}=\begin{bmatrix}5 & 6\\ 1 & 8\end{bmatrix}$. (2021)

15. For the matrices A and B, verify that $(AB)^{/}=B^{/}A^{/}$, where A = $\begin{bmatrix}1\\ -4\\ 3\end{bmatrix}$ and B = $[-1 \quad 2 \quad 1]$ (2020)

16. For the matrices A and B, verify that $(AB)^{/}=B^{/}A^{/}$, where A = $\begin{bmatrix}0\\ 1\\ 2\end{bmatrix}$ and B = $[1 \quad 5 \quad 7]$ (2020)

17. If A = $\begin{bmatrix}-1 & 2 & 3\\ 5 & 7 & 9\\ -2 & 1 & 1\end{bmatrix}$ and B = $\begin{bmatrix}-4 & 1 & -5\\ 1 & 2 & 0\\ 1 & 3 & 1\end{bmatrix}$, then verify that $(A-B)^{/}=A^{/}-B^{/}$ (2022)

18. If $A^{/}$ = $\begin{bmatrix}-2 & 3\\ 1 & 2\end{bmatrix}$ and B = $\begin{bmatrix}-1 & 0\\ 1 & 2\end{bmatrix}$, then find $(A+2B)^{/}$. (2022)

19. Solve the equation for x, y, z and t, if $2\begin{bmatrix} x & z \\ y & t \end{bmatrix} + 3\begin{bmatrix} 1 & -1 \\ 0 & 2 \end{bmatrix} = 3\begin{bmatrix} 3 & 5 \\ 4 & 6 \end{bmatrix}$. (2021)

20. Express the matrix : A = $\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ as the sum of symmetric and a skew symmetric matrix. (2021)

21. Find $\frac{1}{2}(A + A')$ and $\frac{1}{2}(A - A')$ when A = $\begin{bmatrix} 0 & a & b \\ -a & 0 & c \\ -b & -c & 0 \end{bmatrix}$ (2019)

22. Construct a 3x4 matrix, whose elements are given by $a_{ij} = \frac{1}{2}|-3i + j|$ (2016)

23. If A = $\begin{bmatrix} 8 & 0 \\ 4 & -2 \\ 3 & 6 \end{bmatrix}$ and B = $\begin{bmatrix} 2 & -2 \\ 4 & 2 \\ -5 & 1 \end{bmatrix}$, then find the matrix X such that 2A+3X=5B. (2017)

24. Find X and Y, if X + Y = $\begin{bmatrix} 5 & 2 \\ 0 & 9 \end{bmatrix}$ and X - Y = $\begin{bmatrix} 3 & 6 \\ 0 & -1 \end{bmatrix}$ (2017)

25. Find the values of x and y from the equation $2\begin{bmatrix} x & 5 \\ 7 & y-3 \end{bmatrix} + \begin{bmatrix} 3 & -4 \\ 1 & 2 \end{bmatrix} = \begin{bmatrix} 7 & 6 \\ 15 & 14 \end{bmatrix}$ (2017)

Ch.4 :- Determinants

M.C.Q. :-

1. If $\begin{vmatrix} x & 2 \\ 18 & x \end{vmatrix} = \begin{vmatrix} 6 & 2 \\ 18 & 6 \end{vmatrix}$, then x is equal to
   a) 6 b) ± 6 c) -6 d) 0
2. Let A be a square matrix of order 3x3, then $|kA|$ is equal to
   a) k$|A|$ b) $k^2|A|$ c) $k^3|A|$ d) 3k$|A|$
3. If A is an invertible matrix of order n, then $|adj\ A| =$
   a) $|A|^n$ b) $|A|^{n+1}$ c) $|A|^{n-1}$ d) $|A|^{n+2}$ (2021)
4. If area of triangle is 35 sq. units with vertices (2,-6),(5,4) and (k,4). Then k is
   a) 12 b) -2 c) -12,-2 d) 12,-2
5. If $\Delta = \begin{vmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{vmatrix}$ and A_{ij} are cofactors of a_{ij}, then values of Δ is given by
   a) $a_{11}A_{31} + a_{12}A_{32} + a_{13}A_{33}$ b) $a_{11}A_{11} + a_{12}A_{21} + a_{13}A_{31}$
   c) $a_{21}A_{11} + a_{22}A_{12} + a_{23}A_{13}$ d) $a_{11}A_{11} + a_{21}A_{21} + a_{31}A_{31}$
6. Let A be a non-singular square matrix of order 3x3. Then $|adj\ A|$ is equal to
   a) $|A|$ b) $|A|^2$ c) $|A|^3$ d) 3$|A|$ (2018,21)
7. If A is an invertible matrix of order 2, then $|A^{-1}|$ is equal to
   a) $|A|$ b) $\frac{1}{|A|}$ c) 1 d) 0
8. If a,b,c are in A.P. then the determinant $\begin{vmatrix} x+2 & x+3 & x+2a \\ x+3 & x+4 & x+2b \\ x+4 & x+5 & x+2c \end{vmatrix}$ is
   a) 0 b) 1 c) x d) 2x
9. Let A be a non-singular square matrix of order 4x4. Then $|adj\ A|$ is equal to
   a) $|A|$ b) $|A|^2$ c) $|A|^3$ d) $|4A|$ (2021)

Long Answer Type Question :-

1. Find the area of the triangle with vertices (2,7),(1,1) and (10,8).
2. Find the area of the triangle with vertices (-2,-3),(3,2) and (-1,-8). (2021)
3. Find the inverse of $\begin{bmatrix} 1 & 0 & 0 \\ 3 & 3 & 0 \\ 5 & 2 & -1 \end{bmatrix}$.
4. Find the inverse of $\begin{bmatrix} 2 & 1 & 3 \\ 4 & -1 & 0 \\ -7 & 2 & 1 \end{bmatrix}$.
5. Find the area of the triangle with vertices (3,8), (-4,2) and (5,1). (2021)
6. Find the equation of the line joining A(1,3) and B(0,0) using determinants. (2021)
7. Solve the following system of equations by Matrix Method :
   i) 2x + 3y + 3z = 5, x - 2y + z = -4, 3x - y - 2z = 3 (2016,18,20,21)
   ii) x - y + z = 4, 2x + y - 3z = 0, x + y + z = 2 (2017,18,19,20,22)
   iii) x + 2y - 3z = -4, 2x + 3y + 2z = 2, 3x - 3y - 4z = 11
   iv) 2x + y + z = 1, x - 2y - z = $\frac{3}{2}$, 3y - 5z = 9 (2015,22)
   v) 3x - 2y + 3z = 8, 2x + y - z = 1, 4x - 3y + 2z = 4 (2015,17,19)
   vi) x + y + z = 6, x + 3z = 11, x + z = 2y (2021)
   vii) x - y + 2z = 7, 3x + 4y - 5z = -5, 2x - y + 3z = 12 (2016,18,19,20,21)
   viii) x- y + 2z = 1, 2y - 3z = 1, 3x - 2y + 4z = 2 (2017)

Ch.5- Continuity and Differentiability

M.C.Q. :-

1.The derivative of a^x is :

a) a^x b) $\frac{a^x}{\log a}$ c) $a^x \log a$ d) None of these (2018,21)

2. The derivative of 2^x is :

a) 2^x b) $\frac{2^x}{\log 2}$ c) $2^x \log 2$ d) None of these (2018)

3. The derivative of 5^x is :

a) 5^x b) $\frac{5^x}{\log 5}$ c) $5^x \log 5$ d) None of these (2018)

4. Derivative of $\cos \sqrt{x}$ is

a) $-\frac{\sin \sqrt{x}}{2\sqrt{x}}$ b) $\frac{\sin \sqrt{x}}{2\sqrt{x}}$ c) $-\frac{\sin \sqrt{x}}{\sqrt{x}}$ d) $-\frac{\sin \sqrt{x}}{2}$ (2019)

5. If x - y = π then $\frac{dy}{dx}$ is

a) 1 b) 3 c) π d) -1 (2019)

6. $\frac{d}{dx} \tan^{-1} x$ is

a) $\frac{1}{1+x^2}$ b) $\frac{1}{1-x^2}$ c) $\frac{-1}{1+x^2}$ d) $\frac{-1}{1-x^2}$ (2019,20)

7. $\frac{d}{dx}(\sec^{-1} x) = ?$

a) $\cos^{-1} x$ b) $\frac{x}{\sqrt{x^2-1}}$ c) $\frac{1}{|x|\sqrt{x^2-1}}, |x| > 0$ d) None of these (2020,21)

8. $\frac{d}{dx}(\cos^{-1} x) = ?$

a) $\frac{1}{\sqrt{x^2-1}}$ b $-\frac{1}{\sqrt{x^2-1}}$ c) $-\frac{1}{\sqrt{1-x^2}}$ d) None of these (2020,21)

9. The function defined by f(x) = $\begin{cases} x, x \leq 1 \\ 5, x > 1 \end{cases}$

a) Continuous at x = 2 b) Discontinuous at x = 2

c) Continuous at x = 1 d) Discontinuous at x = -1 (2021)

10. $\frac{d}{dx}(\sin^{-1} x)$ is equal to

a) $\frac{1}{1-x^2}$ b) $\frac{1}{\sqrt{1-x^2}}$ c) $\frac{-1}{1-x^2}$ d) $-\frac{1}{\sqrt{1-x^2}}$ (2021)

11. $\frac{d}{dx} e^x$ is equal to

a) x b) 1 c) e^x d) None of these (2021)

12. $\frac{d}{dx} \sin(\log x)$, x>0 :

a) $\frac{\cos(\log x)}{x}$ b) $\frac{\log x}{x}$ c) $\cos(\log x)$ d) - $\cos(\log x)$ (2015,21)

13. The function defined by f(x) = $\begin{cases} x, x \leq 1 \\ 5, x > 1 \end{cases}$

a) Continuous at x = 1 b) Continuous at x = 5

c) Continuous at x = -1 d) Continuous at x = 0 (2021)

14. $\frac{d}{dx} \log x$ is equal to :

a) $\frac{1}{x}$ b) x c) 1 d) None of these (2021)

15. $\frac{d}{dx} \log\{\cos e^x\}$ is equal to :

a) $e^x \tan e^x$ b) - $e^x \tan e^x$ c) $\frac{1}{\cos e^x}$ d) $\tan e^x$ (2021)

16. The function defined by f(x) = $\begin{cases} x, x \leq 1 \\ 5, x > 1 \end{cases}$ is

a) Continuous at x = 1 b) Not Continuous at x = 1
c) Continuous at x = 2 d) Continuous at x = (2021)

17. $\frac{d}{dx}\log(\log x)$, x> 1 is equal to :
a) $\frac{1}{x}$ b) $\frac{1}{\log x}$ c) $\frac{1}{x\log x}$ d) 0 (2021)

18. The derivative of $\sin 30^0$ is :
a) $\frac{1}{2}$ b) $\cos 30^0$ c) $-\cos 30^0$ d) 0 (2017)

19. The derivative of $\cos 30^0$ is :
a) $\frac{1}{2}$ b) $\sin 30^0$ c) $-\sin 30^0$ d) 0 (2017)

20. The derivative of $\tan 45^0$ is :
a) $\frac{1}{2}$ b) $\cot 30^0$ c) $-\cot 30^0$ d) 0 (2017)

21. The derivative of $e^{\sin^{-1}x}$ is :
a) $e^{\sin^{-1}x}\left(\sqrt{1-x^2}\right)$ b) $\frac{e^{\sin^{-1}x}}{\sqrt{1+x^2}}$ c) $\frac{e^{\sin^{-1}x}}{\sqrt{1-x^2}}$ d) None of these (2015,16)

22. The derivative of f(x) = x at x = 0 is
a) 1 b) 0 c) -1 d) None of these (2016)

23. The derivative of $\log(ax+b)$ is
a) $\frac{1}{ax+b}$ b) $\frac{b}{ax+b}$ c) $\frac{a}{ax+b}$ d) $\frac{a+b}{ax+b}$ (2016)

Long Answer Type Question :-

1. Find the value of k so that the function f is continuous at the indicated point
f(x) = $\begin{cases} kx^2, x \le 2 \\ 3, x > 2 \end{cases}$ $at\ x = 2$ (2022)

2. Differentiate $\cos^{-1}(\frac{1-x^2}{1+x^2})$, w.r.t.x. (2022)

3. If y = $\sin^{-1}x$, then show that : $(1-x^2)\frac{d^2y}{dx^2} - x\frac{dy}{dx} = 0$. (2022)

4. Discuss the continuity of the function f(x) = sin x - cos x (2022)

5. Find $\frac{dy}{dx}$ in the following y = $\sin^{-1}\left[\frac{1-x^2}{1+x^2}\right]$. (2022)

6. If y = $3\cos(\log x) + 4\sin(\log x)$, show that $x^2y_2 + xy_1 + y = 0$. (2016,22)

7. Find the value of k so that the function f is continuous at the indicated point
f(x) = $\begin{cases} kx+1, x \le 5 \\ 3x-5, x > 5 \end{cases}$ $at\ x = 5$ (2017,21)

8. Find the value of k so that the function f is continuous at the indicated point
f(x) = $\begin{cases} kx+1, x \le \pi \\ \cos x, x > \pi \end{cases}$ $at\ x = \pi$ (2021)

9. Find $\frac{dy}{dx}$, if y = $(x+3)^2(x+4)^3(x+5)^4$ (2016,21)

10. Find $\frac{dy}{dx}$, if y = $\cos x \cos 2x \cos 3x$ (2021)

11. Find $\frac{dy}{dx}$, if y = $\sqrt{\frac{(x-1)(x-2)}{(x-3)(x-4)(x-5)}}$ (2021)

12. Find $\frac{dy}{dx}$, if x = $a(\cos\theta + \theta\sin\theta)$ and y = $a(\sin\theta - \theta\cos\theta)$. (2021)

13. Find $\frac{dy}{dx}$, if x = $a(\theta - \sin\theta)$ and y = a(1+cos θ) (2021)

14. Find $\frac{dy}{dx}$, if x = $\cos\theta - \cos 2\theta$ and y =$\sin\theta - \sin 2\theta$. (2021)

15. Find all points of discontinuity of f, where f is defined by f(x) = $\begin{cases} x^{10}-1, if\ x \le 1 \\ x^2, if\ x > 1 \end{cases}$ (2019,22)

16. Find $\frac{dy}{dx}$ in the y = $\cos^{-1}\left(\frac{2x}{1+x^2}\right)$, -1 < x < 1 (2022)

17. If y = $3e^{2x} + 2e^{3x}$, then prove that $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = 0$ (2017,22)

18. Find all points of discontinuity of 'f' where f(x) = $\begin{cases} \frac{\sin x}{x}, if\ x < 0 \\ x + 1, if\ x \geq 0 \end{cases}$ (2018,21)

19. If y = $500e^{7x} + 600e^{-7x}$, then show that $\frac{d^2y}{dx^2} = 49y$ (2016,17,20)

20. If y = A$e^{mx} + Be^{nx}$, then show that $\frac{d^2y}{dx^2} - (m-n)\frac{dy}{dx} + mny = 0$ (2017,20)

21. Find all points of discontinuity of 'f' where f(x) = $\begin{cases} x + 1, if\ x \geq 1 \\ x^2 + 1, if\ x < 1 \end{cases}$ (2016,19,20)

22. Find all points of discontinuity of 'f' where f(x) = $\begin{cases} x^3 - 3, & x \leq 2 \\ x^2 + 1, x > 2 \end{cases}$ (2016,20)

23. If y = $3e^{2x} + 2e^{3x}$, then show that $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = 0$ (2020)

24. Find all points of discontinuity of 'f' where f(x) = $\begin{cases} 2x + 3, if\ x \leq 2 \\ 2x - 3, if\ x > 2 \end{cases}$ (2016,19)

25. Differentiate : $cosx.cos2x.cos3x$ w.r.t.x. (2019)

26. Differentiate : $(\log x)^{\cos x}$ (2019)

27. Differentiate : $x^x - 2^{\sin x}$ (2019)

28. Differentiate $(\log x)^{\cos x}$ w.r.t.x. (2018)

29. Find $\frac{dy}{dx}$ if $y^x = x^y$ (2018)

30. Examine the function given by $\begin{cases} \sin x - \cos x, & x \neq 0 \\ -1, & x = 0 \end{cases}$ for continuity. (2018)

31. Differentiate $\cos(\log x + e^x)$ w.r.t.x. (2018)

32. Find $\frac{dy}{dx}$ if $\cos x^y = \cos y^x$ (2016,18)

33. Differentiate $\sin(\tan^{-1}(e^{-x}))$ w.r.t.x. (2018)

34. Find $\frac{dy}{dx}$ if xy = $e^{(x-y)}$ (2015,18)

35. Differentiate the function w.r.t x. $(\log x)^x + x^{\log x}$. (2016)

36. If y = $(\tan^{-1} x)^2$ show that $(x^2+1)^2 y_2 + 2x(x^2+1)y_1 = 2$ (2016)

37. Find the relationship between a and b so that the function f, defined by
f(x) = $\begin{cases} ax + 1\ if\ x \leq 3 \\ bx + 3\ if\ x > 3 \end{cases}$ is continuous at x = 3 . (2017)

38. Find $\frac{dy}{dx}$ if $sin^2x + cos^2y = 1$ (2017)

39. Find the values of a and b such that the function defined by f(x) = $\begin{cases} 5\ if\ x \leq 2 \\ ax + b\ if\ 2 < x < 10 \\ 21\ if\ x \geq 10 \end{cases}$
is continuous. (2017)

40. Find $\frac{dy}{dx}$ if xy + y^2 = tanx + y (2017)

41. Find $\frac{dy}{dx}$ if $sin^2y + \cos xy = \pi$ (2017)

Ch.6- Applications of Derivatives

M.C.Q. :-

1. The function f(x) =logx is strictly increasing on :
   a) [0,∞] b) (0,∞) c) (-∞, ∞) d) None of these (2018)
2. The interval in which y = x^2e^{-x} is increasing is :
   a) [-∞, ∞] b) (-2,0) c) (2,∞) d) (0,2) (2015,18,20)
3. On which of the following intervals is the function f given by f(x) = $x^{100} + \sin x - 1$ strictly decreasing?
   a) (0,1) b) $(\frac{\pi}{2}, \pi)$ c) $(0,\frac{\pi}{2})$ d) None of these (2015,18,20)
4. The slope of the normal to the curve y = $2x^2$+3sin x , at x=0 is :
   a) 3 b) -3 c) $\frac{1}{3}$ d) $-\frac{1}{3}$ (2019)
5. The line y = x + 1 is a tangent to the curve y^2 = 4x at the point
   a) (1,2) b) (2,1) c) (1,-2) d) (-1,2) (2019)
6. The rate of change of the area of a circle w.r.t. its radius r at r = 6 cm is
   a) 10π cm^2/s b) 12π cm^2/s c) 8π cm^2/s d) 11π cm^2/s (2019)
7. The function y = $\log(\sin x)$ is strictly increasing in the interval :
   a) $(\frac{\pi}{2}, \pi)$ b) $[0,\frac{\pi}{2}]$ c) $(0,\frac{\pi}{2})$ d) None of these (2020)
8. If f(x) = x^2+2x-5, the f(x) is strictly increasing in the interval is :
   a) $(-\infty, -1)$ b) (-1,∞) c) (1,∞) d) $(\infty, 1)$ (2021)
9. If y = sin x, then y is neither increasing nor decreasing in the interval is :
   a) $(0,\frac{\pi}{2})$ b) $(\frac{\pi}{2}, \pi)$ c) (o,π) d) None of these (2021)
10. If y = x^2+2x-5, then y is neither strictly increasing nor decreasing in the interval is :
    a) (-1,∞) b) (-∞, ∞) c) $(-\infty, -1)$ d) None of these (2021)
11. If y = sin x, then y is strictly increasing in the interval is :
    a) $(0,\frac{\pi}{2})$ b) $(\frac{\pi}{2}, \pi)$ c) (o,π) d) None of these (2021)
12. If y = x^2+2x-5, then y is neither strictly decreasing in the interval is :
    a) (1,∞) b) (-∞, 1) c) $(-\infty, -1)$ d) None of these (2021)
13. If y = sin x, then y is strictly decreasing in the interval is :
    a) $(0,\frac{\pi}{2})$ b) $(\frac{\pi}{2}, \pi)$ c) (o,π) d) None of these (2021)
14. The slope of the tangent to the curve y = $3x^4$-4x at x = 4 is :
    a) 752 b) 764 c) $\frac{-1}{764}$ d) $\frac{-1}{752}$ (2022)
15. The slope of the tangent to the curve y = x^3-x+1 at the point, whose x-co-ordinate is 2 :
    a) 11 b) 7 c) $\frac{-1}{11}$ d) $\frac{-1}{7}$ (2022)
16. The slope of the tangent to the curve y = x^3-3x+2 at the point, whose x-co-ordinate is 2 :
    a) $\frac{-1}{24}$ b) 20 c) 24 d) $\frac{-1}{20}$ (2022)
17. The approximate change in the volume V of a cube of side x metres caused by increasing the side by 2% is :
    a) 0.06 x^3m^3 b) 0.002 x^3m^3 c) 0.6 x^3m^3 d) 0.006 x^3m^3 (2017)
18. The approximate change in the volume V of a cube of side x metres caused by increasing the side by 3% is :
    a) 0.06 x^3m^3 b) 0.09 x^3m^3 c) 0.6 x^3m^3 d) 0.9x^3m^3 (2017)
19. The approximate change in the volume V of a cube of side x metres caused by increasing the side by 1% is :
    a) 0.03 x^3m^3 b) 0.3 x^3m^3 c) 0.003 x^3m^3 d) 0.001 x^3m^3 (2017)

20. The radius of a circle is increasing at the rate of 0.7 cm/s then the rate of increasing circumference is :
a) 1.4π cm/s b) 2.4π cm/s c) 0.4π cm/s d) -0.4π cm/s (2016)
21. The volume of cube is increasing at a rate of 9 cm^3/s. How fast is surface area increasing when the length of an edge is 10cm.
a) 1.8 cm^2/s b) 2.7 cm^2/s c) 3.6 cm^2/s d) None of these (2016)
22. The length x of a rectangle is decreasing at the rate of 3 cm/min and breadth is increasing at the rate of 2 cm/min. At what rate the perimeter of rectangle decrease?
a) 3 cm/min b) 2 cm/min c) 1 cm/min d) 4 cm/min (2016)

Long Answer Type Question :-

1. Find point at which the tangent to the curve $y = x^3-3x^2-9x+7$ is parallel to the x-axis. (2018,22)
2. Find the equation of tangent and normal to the parabola $y^2 = 4ax$ at the point $(at^2,2at)$. (2016,17,22)
3. Find the interval in which the1function $f(x) = 10-6x-2x^2$ is strictly increasing or decreasing? (2016,22)
4. Show that the tangent to the curve $y = 7x^3 + 11$ at the points were x = 2 and x = -2 are parallel. (2022)
5. Find the equation of tangent and normal to the curve $x^{\frac{2}{3}} + y^{\frac{2}{3}} = 2$ at (1,1). (2017,19,20,22)
6. Find the interval in which the function $f(x) = x^2+2x-5$ is strictly increasing or decreasing. (2022)
7. Find the interval in which the function $f(x) = 6-9x-x^2$ is strictly increasing or decreasing. (2022)
8. Find the equation of normal at the point (am^2,am^3) for the curve $ay^2 = x^3$. (2020,22)
9. Find the points on the curve $x^2 + y^2 -2x - 3 =0$ at which the tangents are parallel to the x-axis. (2022)
10. Find intervals in which the function $f(x) = -2x^3-9x^2-12x+1$ is increasing or decreasing. (2016,17,20)
11. Find the equation of tangent and normal to the curve $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1\ at\ P(x_0, y_0)$. (2017,20)
12. Show that right circular cone of least curved surface area and given volume has an altitude equal to $\sqrt{2}$ times the radius of the base. (2016,18,20)
13. Find the intervals for which function $f(x) = 10-6x-2x^2$ is strictly increasing. (2020)
14. Show that semi-vertical angle of right circular cone of given surface area and maximum volume is $\sin^{-1}\left(\frac{1}{3}\right)$. (2018,20)
15. Find the intervals for which function $f(x) = 4x^3-6x^2-72x+30$ is strictly increasing. (2016,17,20)
16. Show that semi-vertical angle of the cone of maximum volume and of given slant height is $\tan^{-1}\sqrt{2}$. (2018,20)
17. Find two positive numbers whose sum is 16 and sum of whose cubes is minimum. (2017,19)
18. Find two positive numbers x and y such that x+y=60 and xy^3 is maximum. (2017,19)
19. Find the equation of tangent and normal to the curve $y = x^4-6x^3+13x^2-10x+5$ at (0,5) (2019)
20. A balloon which always remains spherical on inflation,is being inflated by pumping in 900 cubic cm of gas per second. Find the rate at which the radius of the balloon increases when the radius is 15 cm. (2018)
21. A balloon which always remains spherical has a variable radius. Find the rate at which

its volume is increasing with the radius when the later is 10 cm. (2018)

22. Find a point on the curve y = $(x-2)^2$ at which the tangent is parallel to the chord joining the points (2,0) and (4,4). (2018)
23. A balloon which always remains spherical, has a variable diameter $\frac{3}{2}(2x+1)$. Find the rate of change of its volume with respect to x. (2018)
24. Find the point on the curve y = x^3-11x+5 at which the tangent is : y = x-11. (2018)
25. Find the equation of the tangent to the curve y = $\sqrt{3x-2}$, which is parallel to the line 4x-2y+5=0. (2022)
26. Find the equation of normals to the curve y = x^3+2x+6, which are parallel to the line x+14y+4=0. (2022)
27. Find the equation of tangent line to the curve y = x^2-2x+7 which is perpendicular to the line 5y-15x=13. (2022)
28. Prove that the curves x = y^2 and xy = k cut at right angles, if $8k^2$ = 1. (2022)
29. Find the equation of tangent line to the curve y = x^2-2x+7 which is parallel to the line 2x-y+9=0 . (2022)
30. Prove that the volume of the largest cone that can be inscribed in a sphere of radius "R" is $\frac{8}{27}$ of the volume of the sphere. (2015,16)
31. Find the equation of the normal to the curve, y=x^3+2x+6 which are parallel to the line x+14y+4=0. (2016)
32. Find intervals in which the function f(x) = $2x^3$-$3x^2$-36x+7 is strictly increasing or strictly decreasing. (2017)
33. Find two positive numbers x and y such that their sum is 35 and product x^2y^5 is maximum. (2017)

Ch.7- Integral

M.C.Q. :-

1. The anti derivative of $\left(\frac{x^3+5x^2-4}{x^2}\right)$ equal : (2023)

   a) $\frac{x^3}{3}+\frac{5x^2}{2}-\frac{4}{x^2}+c$ b) $\frac{x^2}{2}+5x+\frac{4}{x}+c$ c) $\frac{x^3}{3}+5x-\frac{4}{x}+c$ d) $\frac{x^4}{4}-\frac{5x^3}{3}-4x+c$

2. $\int \tan x\,dx$ is equal to : (2023)

   a) $\log|\sec x+\tan x|+c$ b) $\log|\sec x|+c$ c) $\log|\cos x|+c$ d) None of these.

3. $\int \frac{1}{sin^2x\,cos^2x}dx$ is equal to : (2016,23)

   a) tan x + cot x + c b) tan x - cot x + c c) tan x cot x + c d) tan x + cot 2x + c

4. $\int \frac{\cos x}{1+\cos x}dx$ equals : (2023)

   a) x - $\tan\frac{x}{2}$ +c b) x + $\tan\frac{x}{2}$ +c c) $\frac{x^2}{2}$ -2 $\tan\frac{x}{2}$ +c d) x- $tan^2\frac{x}{2}$ + c

5. $\int \frac{1}{\sqrt{x^2+2x+2}}dx$ equal : (2023)

   a) $\log\left|(x+1)-\sqrt{x^2+2x+2}\right|$ + c b) $\log\left|x-\sqrt{x^2+2x+2}\right|$ + c

   c) $\log\left|\sqrt{x^2+2x+2}\right|$ + c d) $\log\left|(x+1)+\sqrt{x^2+2x+2}\right|$ + c

6. $\int \frac{x}{(x-1)(x-2)}dx$ equals : (2022,23)

   a) $\log\left|\frac{(x-1)^2}{x-2}\right|$+ c b) $\log\left|\frac{(x-2)^2}{x-1}\right|$+ c c) $\log\left|\left(\frac{x-1}{x-2}\right)^2\right|$ + c d) $\log|(x-1)(x-2)|$ + c

7. $\int_1^{\sqrt{3}} \frac{1}{1+x^2}dx$ equals : (2022,23)

   a) $\frac{\pi}{3}$ b) $\frac{2\pi}{3}$ c) $\frac{\pi}{6}$ d) $\frac{\pi}{12}$

8. The anti derivative of $\left(\frac{x^3+3x+4}{\sqrt{x}}\right)$ equals : (2023)

   a) $\frac{2}{7}x^{\frac{7}{2}}+2x^{\frac{3}{2}}+8x^{\frac{1}{2}}+c$ b) $\frac{2}{5}x^{\frac{5}{2}}+\frac{2}{3}x^{\frac{3}{2}}+8x+c$

   c) $\frac{7}{2}x^{\frac{7}{2}}+\frac{4}{3}x^{\frac{3}{2}}+8x+c$ d) $\frac{3}{4}x^{\frac{4}{3}}+\frac{3}{2}x^2+4x+c$

9. $\int \sec x\,dx$ is equal to : (2020,23)

   a) $\log|\cos x|$+c b) $\log|\sec x+\tan x|$+c c) $\log|cosecx-\cot x|$+c d) None of these

10. $\int \frac{10x^9+10^x log_e 10}{x^{10}+10^x}dx$ equals : (2023)

    a) $10^x-x^{10}+c$ b) $10^x+x^{10}+c$ c) $(10^x-x^{10})^{-1}$+c d) $\log(10^x+x^{10})$+c

11. $\int \frac{1-\cos x}{1+\cos x}dx$ equals : (2023)

    a) $2\tan\frac{x}{2}+\frac{x}{2}+c$ b) $2\tan\frac{x}{2}-x+c$ c) $\tan\frac{x}{2}-x+c$ d) None of these

12. $\int \frac{1}{\sqrt{7-6x-x^2}}dx$ equals : (2023)

    a) $\sin^{-1}\left(\frac{x+3}{4}\right)+c$ b) $\tan^{-1}\left(\frac{x+3}{4}\right)+c$ c) $\log\left|\sqrt{7-6x-x^2}\right|+c$ d) None of these

13. $\int \frac{x}{(x-1)(x-2)(x-3)}dx$ equals : (2023)

    a) $\frac{1}{2}\log|x-1|-2\log|x-2|+\frac{3}{2}\log|x-3|+c$

    b) $\log|x-1|+\log|x-2|+\log|x-3|+c$

    c) $\log x-\log|x-1|-\log|x-2|-\log|x-3|+c$ d) None of these

14. $\int_2^3 \frac{x}{x^2+1}dx$ equals (2022,23)

    a) $\frac{1}{2}\log 2$ b) $\log 2$ c) $\log\frac{3}{2}$ d) None of these

15. The anti derivative of $\sqrt{x}(3x^2+2x+3)$ equals : (2023)

    a) $\frac{6}{7}x^{\frac{7}{2}}+\frac{4}{5}x^{\frac{5}{2}}+2x^{\frac{3}{2}}+c$ b) $\frac{1}{7}x^{\frac{7}{2}}+\frac{1}{5}x^{\frac{5}{2}}+\frac{1}{3}x^{\frac{3}{2}}+c$ c) $\frac{2}{7}x^{\frac{7}{2}}+\frac{2}{5}x^{\frac{5}{2}}+\frac{2}{3}x^{\frac{3}{2}}+c$

d) $\frac{7}{2}x^{\frac{7}{2}}+\frac{5}{2}x^{\frac{5}{2}}+\frac{3}{2}x^{\frac{3}{2}}+c$

16. $\int cosec\ x\ dx$ equals : (2023)

a) $\log|cosec\ x+\ \cot x|$ +c b) $\log|\sec x+\tan x|+c$

c) $\log|cosec\ x-\ \cot x|$ +c d) None of these (2020)

17. $\int \frac{(1+\log x)^2}{x}dx$ equals : (2023)

a) $\frac{(1+\log x)^3}{3}+c$ b) $\frac{(1+\log x)^2}{2}+c$ c) $\frac{(1+\log x)^4}{4}+c$ d) $\frac{(1-\log x)^5}{5}+c$

18. $\int \frac{sin^2x}{1+\cos x}dx$ equals : (2023)

a) x+cos x +c b) x-cos x +c c) x-sin x +c d) x+sin x +c

19. $\int \frac{1}{\sqrt{(x-1)(x-2)}}dx$ equals : (2023)

a) $\log|x^2-3x+2|+c$ b) $\log\left|x+\sqrt{x^2+3x+2}\right|+c$

c) $\log\left|\left(x-\frac{3}{2}\right)+\sqrt{x^2-3x+2}\right|+c$ d) $\log|x-1|-\log|x-2|+c$

20. $\int \frac{2x}{x^2+3x+2}dx$ equals : (2023)

a) $\log|x+2|+\log|x+1|+c$ b) $4\log|x+2|-2\log|x+1|+c$

c) $\log|(x+2)(x+1)|+c$ d) $\log|x-2|-\log|x-1|+c$

21. $\int_0^1 \frac{1}{\sqrt{1-x^2}}dx$ equals : (2023)

a) $\frac{\pi}{2}$ b) $\frac{\pi}{4}$ c) $\frac{\pi}{6}$ d) π

22. $\int e^x \sec x\,(1+\tan x)\,dx$ is equal to :

a) $e^x\cos x$ + c b) $e^x\sec x+c$ c) $e^x\sin x+c$ d) $e^x\tan x+c$ (2015,18,22)

23. $\int e^x(\sin x+\cos x)\,dx$ is equal :

a) $e^x\cos x$ + c b) - $e^x\cos x$ + c c) $e^x\sin x+c$ d) - $e^x\sin x+c$ (2018,22)

24. $\int \sin mx\,dx$ is

a) m cosmx + c b) - m cosmx + c c) $-\frac{\cos mx}{m}+c$ d) $\frac{\cos mx}{m}+c$ (2017,19)

25. $\int \frac{sin^2x-cos^2x}{sin^2xcos^2x}dx$

a) tanx+cotx+c b) tanx+cosecx+c c) -tanx+cotx+c d) tanx+secx+c (2019)

26. $\int \frac{e^x(1+x)}{cos^2(e^xx)}dx$ equal to

a) $\cot(ex^x)+c$ b) $\tan(xe^x)+c$ c) $\tan(x^x)+c$ d) $\cot(x^x)+c$ (2016,19)

27. $\int cotx\,dx$ = ?

a) tanx + c b) $\log(\sin x)+c$ c) - $\log(\sin x)+c$ d) - $cosec^2x+c$ (2020)

28. The anti derivative of cos 2x is :

a) - cos 2x b) sin 2x c) $\frac{-1}{2}\cos 2x$ d) $\frac{1}{2}\sin 2x$ (2022)

29. The anti derivative of sin 2x is :

a) - cos 2x b) sin 2x c) $\frac{-1}{2}\cos 2x$ d) $\frac{1}{2}\sin 2x$ (2017,22)

30. The anti derivative of $(ax+b)^2$ is :

a) $3a(ax+b)^2$ b) $3(ax+b)^3$ c) $\frac{1}{3a}(ax+b)^3$ d) $\frac{1}{3}(ax+b)^3$ (2022)

31. $\int \frac{1}{x\sqrt{x^2-1}}$dx =

a) $\sin^{-1}x+c$ b) - $\text{cosec}^{-1}x+c$ c) $\sec^{-1}x+c$ d) None of these (2022)

32. $\int \frac{1}{9x^2+6x+5}dx$ = (2022)

a) $\frac{1}{6}\tan^{-1}\left(\frac{3x+1}{2}\right)+c$ b) $\tan^{-1}\left(\frac{3x+1}{2}\right)+c$ c) $\frac{1}{3}\tan^{-1}\left(\frac{3x+1}{2}\right)+c$ d) None of these

33. $\int \frac{1}{x(x^2+1)}$dx =

a) $\log|x|-\frac{1}{2}\log(x^2+1)+c$ b) $\log|x|+\frac{1}{2}\log(x^2+1)+c$

c) $\log|x|+\frac{1}{2}\log(x^2-1)+c$ d) $\log|x|+\frac{1}{2}\log(x^2-1)+c$ (2022)

34. $\int x^2 e^x \, dx =$

a) $e^x(x^2 - 2x - 2) + c$ b) $e^x(x^2 + 2x - 2) + c$

b) $e^x(x^2 + 2x + 2) + c$ d) $e^x(x^2 - 2x + 2) + c$ (2022)

35. $\int_0^{\frac{\pi}{2}} \frac{cos^5 x}{sin^5 x + cos^5 x} dx =$

a) $\frac{\pi}{4}$ b) $-\frac{\pi}{4}$ c) $\frac{3\pi}{4}$ d) $-\frac{3\pi}{4}$ (2022)

36. $\int \frac{1}{1+x^2} dx$ =

a) $\tan^{-1} x + c$ b) $\cos^{-1} x + c$ c) $\sin^{-1} x + c$ d) None of these (2022)

37. $\int \frac{3x^2}{x^6+1} dx$ =

a) $\cot^{-1} x^2 + c$ b) $\tan^{-1} x^3 + c$ c) $\tan^{-1} x^2 + c$ d) None of these (2022)

38. $\int \frac{2x}{(x^2+1)(x^2+3)} dx =$

a) $\log \left| \left(\frac{x^2+3}{x^2+1} \right) \right| + c$ b) $\log \left| \left(\frac{x^2+1}{x^2+3} \right) \right| + c$

c) $\frac{1}{2} \log \left| \left(\frac{x^2+1}{x^2+3} \right) \right| + c$ d) $-\frac{1}{2} \log \left| \left(\frac{x^2+1}{x^2+3} \right) \right| + c$ (2022)

39. $\int x \cos x \, dx =$

a) x cosx+ sinx+ c b) x sinx+ x cosx+ c c) x sinx- x cosx+c d) sinx- x cosx+c (2022)

40. $\int_0^{\frac{\pi}{2}} \frac{\sqrt{\sin x}}{\sqrt{\sin x} + \sqrt{\cos x}} dx =$

a) $\frac{\pi}{4}$ b) $-\frac{\pi}{4}$ c) $\frac{3\pi}{4}$ d) $\frac{5\pi}{4}$ (2022)

41. $\int_0^{\frac{\pi}{2}} \frac{sin^{\frac{3}{2}} x}{sin^{\frac{3}{2}} x + cos^{\frac{3}{2}} x} dx =$

a) $\frac{\pi}{4}$ b) $-\frac{\pi}{4}$ c) $\frac{3\pi}{4}$ d) $\frac{5\pi}{4}$ (2022)

42. $\int \frac{1}{\sqrt{1-x^2}} dx$ =

a) $\tan^{-1} x + c$ b) $\cos^{-1} x + c$ c) $\sin^{-1} x + c$ d) None of these (2022)

43 $\int \frac{1}{9-25x^2} dx$ =

a) $\frac{1}{5} \sin^{-1} \frac{5x}{3} + c$ b) $\frac{1}{5} \sin^{-1} 5x + c$ c) $\sin^{-1} \frac{5x}{3} + c$ d) None of these (2022)

44. $\int x \, sinx \, dx =$

a) - x cosx+ sinx+ c b) x cosx+ sinx+ c c) - x cosx- sinx+ c d) x cosx- sinx+c (2022)

45. $\int e^x \left(\frac{1}{x} - \frac{1}{x^2} \right) dx =$

a) $\frac{e^x}{x^2} + c$ b) $\frac{-e^x}{x^2} + c$ c) $\frac{-e^x}{x} + c$ d) $\frac{e^x}{x} + c$ (2015,22)

46. $\int_0^{\frac{3}{2}} \frac{1}{4+9x^2} dx =$

a) $\frac{\pi}{6}$ b) $\frac{\pi}{12}$ c) $\frac{\pi}{24}$ d) $\frac{\pi}{4}$ (2022)

47. The anti derivative of cos 5x is :

a) sin5x b) - 5 sin 5x c) $5 \, cos5x$ d) $\frac{1}{5} \sin 5x$ (2022)

48. $\int \frac{1}{x^2+2x+2} dx$ equals to (2016)

a) $x\tan^{-1}(x+1) + c$ b) $\tan^{-1}(x+1) + c$ c) $\tan^{-1} x + c$ d) $(x+1)\tan^{-1} x + c$ (2016)

Long Answer Type Question :-

1. Evaluate : $\int \frac{5x+3}{\sqrt{x^2+4x+10}} dx$ (2016,23)

2. Evaluate : $\int_0^{\frac{\pi}{2}} \frac{cos^{\frac{3}{2}} x}{sin^{\frac{3}{2}} x + cos^{\frac{3}{2}} x} dx$ (2015,17,23)

3. Evaluate : $\int \frac{6x+7}{\sqrt{(x-5)(x-4)}}\,dx$ (2015,16,23)

4. Evaluate : $\int_0^{\frac{\pi}{2}} \frac{cos^5 x}{sin^5 x+cos^5 x}\,dx$ (2015,17,23)

5. Evaluate : $\int \frac{x+2}{\sqrt{x^2+2x+3}}\,dx$ (2015,18,23)

6. Evaluate : $\int_0^{\frac{\pi}{2}} \frac{\sqrt{\sin x}}{\sqrt{\sin x}+\sqrt{\cos x}}\,dx$ (2015,17,23)

7. Evaluate : $\int e^x(\frac{1}{x}-\frac{1}{x^2})\,dx$ (2017,20)

8. Evaluate : $\int \frac{2}{(1-x)(1+x^2)}\,dx$ (2020)

9. Evaluate : $\int_2^8 |x-5|\,dx$ (2016,20)

10. Evaluate : $\int e^x \left(\frac{x}{(1+x)^2}\right) dx$ (2017,20)

11. Evaluate : $\int \frac{x}{(x-1)^2(x+2)}\,dx$ (2016,18,20)

12. Evaluate : $\int_0^4 |x-1|\,dx$ (2016,20)

13. Evaluate : $\int e^x \left(\tan^{-1} x+\frac{1}{1+x^2}\right) dx$ (2017,20)

14. Evaluate : $\int \frac{x}{(x^2+1)(x-1)}\,dx$ (2018,20)

15. Evaluate : $\int_{-5}^5 |x+2|\,dx$ (2016,20)

16. Evaluate : $\int \frac{1}{x^2-6x+13}\,dx$ (2019)

17. Evaluate : $\int \frac{\sin x}{1+\cos x}\,dx$ (2019)

18. Evaluate : $\int_0^2 x\sqrt{x+2}\,dx$ (2019)

19. Evaluate : $\int \frac{1}{\sqrt{x^2+2x+2}}\,dx$ (2019)

20. Evaluate : $\int \frac{1}{1+\tan x}\,dx$ (2015,19,22)

21. Evaluate : $\int_0^{\frac{\pi}{2}} \frac{\sin x}{1+cos^2 x}\,dx$ (2019)

22. Evaluate : $\int \frac{1}{9x^2+6x+5}\,dx$ (2019)

23. Evaluate : $\int \frac{1}{1-\tan x}\,dx$ (2015,19,22)

24. Evaluate : $\int_0^1 \frac{x}{x^2+1}\,dx$ (2019)

25. Evaluate : $\int \frac{5x+3}{\sqrt{x^2+4x+10}}\,dx$ (2018)

26. Evaluate : $\int_0^{\pi} \frac{x\tan x}{\sec x+\tan x}\,dx$ (2018)

27. Evaluate : $\int_0^{\pi} \frac{x}{1+\sin x}\,dx$ (2018)

28. Evaluate : $\int_0^{\pi} \frac{x\sin x}{1+cos^2 x}\,dx$ (2018)

29. Evaluate : $\int \frac{5x}{(x+1)(x^2+4)}\,dx$ (2016,18)

30. Evaluate : $\int \frac{6x+7}{\sqrt{(x-5)(x-4)}}\,dx$ (2018)

31. Evaluate : $\int_0^1 x(1-x)^n\,dx$ by using properties. (2022)

32. Evaluate : $\int_0^{\frac{\pi}{4}} \log(1+\tan x)\,dx$ by using properties (2022)

33. Evaluate : $\int \frac{1}{1+\cot x}\,dx$ (2015,22)

34. Evaluate : $\int_0^2 x\sqrt{2-x}dx$ by using properties. (2022)

35. Evaluate : $\int \frac{x+3}{\sqrt{5-4x-x^2}}\,dx$ (2016)

36. Evaluate : $\int \frac{x}{(x-1)(x-2)(x-3)}\,dx$ (2016)

37. Evaluate : $\int x\sqrt{1+x-x^2}\,dx$ (2017)

38. Evaluate : $\int (x+3)\sqrt{3-4x-x^2}\,dx$ (2017)

39. Evaluate : $\int (x+1)\sqrt{2x^2+3}\,dx$ (2017)

Ch.8- Applications of Integrals

M.C.Q. :-

1. Find area of region bounded by ellipse $\frac{x^2}{4}+\frac{y^2}{9}=1$ is :
   a) 3π b) 2π c) 6π d) π (2022)
2. Find area of region bounded by ellipse $\frac{x^2}{16}+\frac{y^2}{9}=1$ is :
   a) $12\ \pi$ b) -12π c) 4π d) 3π (2022)
3. Find area of region bounded by ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ is :
   a) 2πab b) πab c) $3\pi ab$ d) $4\pi ab$ (2022)

Long Answer Type Question :-

1. Find area of region bounded by ellipse $\frac{x^2}{4}+\frac{y^2}{9}=1$ (2016,20)
2. Find area of region bounded by ellipse $\frac{x^2}{16}+\frac{y^2}{9}=1$ (2020)
3. Using integration, find area of region bounded by ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ (2020)

Ch.9- Differential Equation

M.C.Q. :-

1.The degree of the differential equation $\left(\frac{d^2y}{dx^2}\right)^3 + \left(\frac{dy}{dx}\right)^2 + \sin\left(\frac{dy}{dx}\right) + 1 = 0$ (2020,22,23)

a) 3 b) 2 c) 1 d) Not defined

2. The differential equation of the family of circles touching the y-axis at origin is : (2023)

a) $2yy' + x^2 + y^2 = 0$ b) $2xyy' = 0$ c) $2xyy'+x^2 - y^2=0$ d) None of these

3. The integrating factor of the differential equation $(x+y)\frac{dy}{dx} = 1$ is :

a) e^{-y} b) e^{-x} c) e^{x+y} d) e^{x-y} (2023)

4. The degree of the differential equation $\left(\frac{d^2y}{dx^2}\right)^2 + \cos\left(\frac{dy}{dx}\right) = 0$ is :

a) 1 b) 2 c) 4 d) Not defined (2015,20,22,23)

5. The differential equation of the family of ellipses having foci on y-axis and centre at origin is

a) $yy'' + y'^2 + yy' = 0$ b) $xyy'' + xy'^2 - yy' = 0$ c) $xyy'' - yy' = 0$ d) None

6. The integrating factor of the differential equation $y\,dx + (x-y^2)dy = 0$ is :

a) $\log|y|$ b) y c) $\frac{1}{y}$ d) None of these (2023)

7. The degree of the differential equation $xy\frac{d^2y}{dx^2} + x\left(\frac{dy}{dx}\right)^2 - y\left(\frac{dy}{dx}\right) = 0$ is : (2016,23)

a) 2 b) 1 c) 0 d) not defined

8. The differential equation of the family of circles having centre on y-axis and radius 3 units is

a) $x^2(y')^2 + x = 0$ b) $(x^2 - 9)(y')^2 + x^2 = 0$ c) $(y')^2 + x^2 = 0$ d) None (2023)

9. The integrating factor of the differential equation $(x+3y^2)\frac{dy}{dx} = y$ $(y > 0)$ is : (2023)

a) $\frac{1}{y}$ b) $\frac{1}{x}$ c) $\log|y|$ d) None of these

10. Order of differential equation $\frac{dy}{dx} - \cos x = 0$ is

a) 0 b) 1 c) 2 d) Not defined (2019)

11. The order of $y''' + y^2 + e^y = 0$ is

a) 2 b) 1 c) 3 d) Not defined (2019)

12. The degree of $y''' + y^2 + e^y = 0$ is

a) 2 b) 1 c) 3 d) Not defined (2019)

13. The degree of differential equation $(y''')^2 + (y'')^3 + (y')^4 + y^5 = 0$ is

a) 2 b) 4 c) 5 d) 3 (2015,16,20,22)

14. The degree of differential equation $\left(\frac{ds}{dt}\right)^4 + 3s\frac{d^2s}{dt^2} = 0$ is :

a) 1 b) 2 c) 3 d) 4 (2022)

15. The integrating factor of the differential equation $x\frac{dy}{dx} + 2y = x^2$ is :

a) e^x b) $e^{\log x^3}$ c) x d) x^2 (2022)

16. The integrating factor of the differential equation $\frac{dy}{dx} + y\cot^{-1}x = 2x + x^2\cot^{-1}x$ is

a) cotx b) sinx c) cosx d) tanx (2022)

17. The integrating factor of the differential equation $x\frac{dy}{dx} + -y = 2x^2$ is :

a) e^{-x} b) e^{-y} c) $\frac{1}{x}$ d) x (2022)

18. Order of differential equation $\frac{d^2y}{dx^2} = \cos 3x + \sin 3x$ is :

a) Not defined b) 2 c) 1 d) 3 (2022)

19. The degree of the differential equation $2x^2\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + y = 0$ is :

a) 1 b) 2 c) 3 d) Not defined (2017)

20. The degree of the differential equation $\left(\frac{dy}{dx}\right)^2 + \left(\frac{dy}{dx}\right) - sin^2y = 0$ is

a) 1 b) 2 c) 3 d) Cannot be defined (2017)

21. The degree of the differential equation $\frac{d^3y}{dx^3} + 2\left(\frac{d^2y}{dx^2}\right)^2 - \frac{dy}{dx} + y = 0$ is :

a) 1 b) 2 c) 3 d) Not defined (2017)

22. The degree of differential equation $\frac{d^4y}{dx^4} + \sin(y''') = 0$

a) 1 b) 3 c) 4 d) Not defined (2015,16)

Long Answer Type Question :-

1. Find the general solution of the differential equation : x log x $\frac{dy}{dx}$ + y = $\frac{2}{x}\log x$. (2023)
2. Solve the differential equation and find the particular solution satisfying given condition $x^2dy+(xy+y^2)dx=0$; y=1 when x=1. (2023)
3. Find the general solution of the differential equation : $x\frac{dy}{dx}+2y=x^2\log x$. (2023)
4. Solve the differential equation and find the particular solution satisfying given condition $2xy+y^2-2x^2\frac{dy}{dx}=0$; y=2 when x=1. (2023)
5. Solve the differential equation and find the particular solution satisfying given condition $\frac{dy}{dx} - \frac{y}{x} + cosec\ \frac{y}{x} = 0$; y=0 when x=1. (2023)
6. Solve the differential equation : (x-y)dy - (x-y)dx = 0 . (2018,20,22)
7. Find the particular solution of the differential equation $\frac{dy}{dx} - 3y\cot x = \sin 2x$, y=2 when x = $\frac{\pi}{2}$. (2015,20)
8. Solve the differential equation : $(x^2-y^2)dx + 2xy\,dy = 0$ (2018,20,22)
9. Find the particular solution of the differential equation $(1+x^2)\frac{dy}{dx} + 2xy = \frac{1}{1+x^2}$, y=0 when x = 1. (2015,20)
10. Solve the differential equation : $(x^2+xy)\,dy = (x^2+y^2)dx$ (2015,20)
11. Find the particular solution of the differential equation $\frac{dy}{dx} + 2y\tan x = \sin x$, y=0 when x = $\frac{\pi}{3}$. (2015,20)
12. Find the general solution of : $\frac{dy}{dx} = \frac{1-\cos x}{1+\cos x}$ (2019,22)
13. Find the general solution of : $\frac{dy}{dx} = \sqrt{4-y^2}$ (-2 < y < 2) (2019,22)
14. Find the general solution of : $\frac{dy}{dx} = \frac{1+y^2}{1+x^2}$ (2019)
15. Find the general solution of : $(x+3y^2)\frac{dy}{dx} = y, (y>0)$ (2018)
16. Solve the differential equation : $y\,dx + (x - y^2)\,dy = 0$ (2018)
17. Solve the differential equation : $(x - y)\frac{dy}{dx} = x + 2y$ (2015,18)
18. Solve the differential equation : $(x + y)\frac{dy}{dx} = 1$ (2016,18)
19. Solve the differential equation : $\frac{dy}{dx} + y = 1$ $(y \neq 1)$ (2022)
20. Solve the differential equation : $x^2\frac{dy}{dx} = x^2-2y^2+xy$ (2022)
21. Solve the differential equation : $x\frac{dy}{dx} + 2y = x^2$ (2016)
22. Solve the differential equation : $x\frac{dy}{dx} - y + x\sin\left(\frac{y}{x}\right) = 0$ (2016)
23. Solve the differential equation and find the particular solution satisfying given condition (x+y)dy+(x-y)dx=0; y=1 when x=1. (2016)
24. Solve the differential equation : $\frac{dy}{dx} + 3y = e^{-2x}$ (2017)

25 Solve the differential equation : $\frac{dy}{dx} = (1 + x^2)(1 + y^2)$ (2017)

26. Solve the differential equation : $\frac{dy}{dx} + \frac{y}{x} = x^2$ (2017)

27. Solve the differential equation : $\frac{dy}{dx} = \frac{x+1}{2-y}, (y \neq 2)$ (2017)

28. Solve the differential equation : $\frac{dy}{dx} + \sec xy = \tan x$ (2017)

29. Solve the differential equation : y logy dx - x dy = 0 (2017)

Ch.10- Vectors

M.C.Q. :-

1.The angle between two vector $\vec{a}$ and $\vec{b}$ with magnitudes 1 and 2 respectively and when $\vec{a}.\vec{b} = 1$ is :

a) $\frac{\pi}{4}$ b) $\frac{\pi}{3}$ c) $\frac{\pi}{6}$ d) π (2023)

2. The area of parallelogram whose adjacent sides and determined by the vectors $\vec{a} = \hat{\imath} - \hat{\jmath} + 3\hat{k}$ and $\vec{b} = 2\hat{\imath} - 7\hat{\jmath} + \hat{k}$ is :

a) $16\sqrt{3}$ b) $17\sqrt{2}$ c) $13\sqrt{2}$ d) $15\sqrt{2}$ (2022,23)

3. The unit vector in the direction of $\vec{a} = \hat{\imath} + \hat{\jmath} + 2\hat{k}$ is : (2023)

a) $\frac{2}{\sqrt{6}}\hat{\imath} + \frac{1}{\sqrt{6}}\hat{\jmath} + \frac{1}{\sqrt{6}}\hat{k}$ b) $\frac{1}{\sqrt{6}}\hat{\imath} + \frac{1}{\sqrt{6}}\hat{\jmath} + \frac{2}{\sqrt{6}}\hat{k}$ c) $\frac{1}{\sqrt{6}}\hat{\imath} + \frac{2}{\sqrt{6}}\hat{\jmath} + \frac{1}{\sqrt{6}}\hat{k}$ d) $\frac{1}{\sqrt{6}}\hat{\imath} + \frac{1}{\sqrt{6}}\hat{\jmath} + \frac{1}{\sqrt{6}}\hat{k}$

4. The angle between two vectors $\vec{a} = \hat{\imath} + \hat{\jmath} - \hat{k}$ and $\vec{b} = \hat{\imath} - \hat{\jmath} + \hat{k}$ is :

a) $\cos^{-1}\left(\frac{1}{3}\right)$ b) $\cos^{-1}\left(\frac{2}{3}\right)$ c) $\cos^{-1}\left(-\frac{1}{3}\right)$ d) 0 (2023)

5. The area of triangle with vertices A(1,1,2),B(2,3,5) and C(1,5,5) is :

a) $\frac{\sqrt{61}}{2}$ b) $\frac{\sqrt{61}}{4}$ c) $\frac{\sqrt{61}}{3}$ d) $\sqrt{61}$. (2022,23)

6. The unit vector in the direction of vector $\overrightarrow{PQ}$, where P aand Q are the points (1,2,3) and (4,5,6) respectively is : (2023)

a) $\frac{1}{\sqrt{3}}\hat{\imath} - \frac{2}{\sqrt{3}}\hat{\jmath} + \frac{1}{\sqrt{3}}\hat{k}$ b) $\frac{2}{\sqrt{3}}\hat{\imath} + \frac{1}{\sqrt{3}}\hat{\jmath} + \frac{1}{\sqrt{3}}\hat{k}$ c) $\frac{1}{\sqrt{3}}\hat{\imath} - \frac{1}{\sqrt{3}}\hat{\jmath} + \frac{1}{\sqrt{3}}\hat{k}$ d) $\frac{1}{\sqrt{3}}\hat{\imath} - \frac{1}{\sqrt{3}}\hat{\jmath} + \frac{2}{\sqrt{3}}\hat{k}$

7. The angle between two vector $\vec{a}$ and $\vec{b}$ with magnitudes $\sqrt{3}$ and 2 respectively and when $\vec{a}.\vec{b} = \sqrt{6}$ is :

a) $\frac{\pi}{4}$ b) $\frac{\pi}{3}$ c) $\frac{\pi}{6}$ d) π (2023)

8. Area of rectangle having vertices A,B,C and D with position vectors $-\hat{\imath} + \frac{1}{2}\hat{\jmath} + 4\hat{k}$, $\hat{\imath} + \frac{1}{2}\hat{\jmath} + 4\hat{k}$, $\hat{\imath} - \frac{1}{2}\hat{\jmath} + 4\hat{k}$ and $-\hat{\imath} - \frac{1}{2}\hat{\jmath} + 4\hat{k}$ respectively is :

a) $\frac{1}{2}$ b) 1 c) 2 d) 4 (2023)

9. The unit vector in the direction of the sum of vectors $\vec{a} = 2\hat{\imath} + 2\hat{\jmath} - 5\hat{k}$ and $\vec{b} = 2\hat{\imath} + \hat{\jmath} + 3\hat{k}$ is :

a) $\frac{4}{\sqrt{29}}\hat{\imath} + \frac{3}{\sqrt{29}}\hat{\jmath} - \frac{2}{\sqrt{29}}\hat{k}$ b) $\frac{4}{\sqrt{29}}\hat{\imath} - \frac{3}{\sqrt{29}}\hat{\jmath} + \frac{2}{\sqrt{29}}\hat{k}$

c) $\frac{3}{\sqrt{29}}\hat{\imath} + \frac{4}{\sqrt{29}}\hat{\jmath} - \frac{2}{\sqrt{29}}\hat{k}$ d) $-\frac{4}{\sqrt{29}}\hat{\imath} + \frac{2}{\sqrt{29}}\hat{\jmath} + \frac{3}{\sqrt{29}}\hat{k}$ (2023)

10. The value of $\hat{\imath}.\left(\hat{\jmath}X\hat{k}\right) + \hat{\jmath}.\left(\hat{\imath}X\hat{k}\right) + \hat{k}.(\hat{\imath}X\hat{\jmath})$ is

a) 0 b) - 1 c) 1 d) 3 (2016,19,22)

11. For mutually perpendicular unit vectors $\hat{\imath}, \hat{\jmath}, \hat{k}$ we have

a) $\hat{\imath}.\hat{\imath} = \hat{\jmath}.\hat{\jmath} = \hat{k}.\hat{k} = 3$ b) $\hat{\imath}.\hat{\imath} = \hat{\jmath}.\hat{\jmath} = \hat{k}.\hat{k} = 1$

c) $\hat{\imath}.\hat{\imath} = \hat{\jmath}.\hat{\jmath} = \hat{k}.\hat{k} = -1$ d) $\hat{\imath}.\hat{\imath} = \hat{\jmath}.\hat{\jmath} = \hat{k}.\hat{k} = 0$ (2019)

12. For mutually perpendicular unit vectors $\hat{\imath}, \hat{\jmath}, \hat{k}$ we have

a) $\hat{\imath}.\hat{\jmath} = \hat{\jmath}.\hat{k} = \hat{k}.\hat{\imath} = 2$ b) $\hat{\imath}.\hat{\jmath} = \hat{\jmath}.\hat{k} = \hat{k}.\hat{\imath} = 1$

c) $\hat{\imath}.\hat{\jmath} = \hat{\jmath}.\hat{k} = \hat{k}.\hat{\imath} = 0$ d) $\hat{\imath}.\hat{\jmath} = \hat{\jmath}.\hat{k} = \hat{k}.\hat{\imath} = -1$ (2019)

13. The vectors $\vec{a}$ and $\vec{b}$ are perpendicular if :

a) $\vec{a}.\vec{b} = 0$ b) $\vec{a}.\vec{b} \neq 0$ c) $\vec{a}X\vec{b} = 0$ d) None of these (2020)

14. The area of parallelogram whose adjacent sides are given by vectors $\vec{a}$ and $\vec{b}$ is :

a) $\vec{a}X\vec{b}$ b) $\vec{b}X\vec{a}$ c) $|\vec{a}X\vec{b}|$ d) $\frac{1}{2}|\vec{a}X\vec{b}|$ (2020)

15. If $\vec{a}.\vec{b} = -|\vec{a}||\vec{b}|$, then θ = ?

a) $\frac{\pi}{4}$ b) 0 c) π d) $\frac{\pi}{2}$ (2015,20)

16. Let $\vec{a}$ and $\vec{b}$ are two non-zero vectors then - $\vec{a}.\vec{b} = |\vec{a}||\vec{b}|$, if θ is equal to :

a) - $\frac{\pi}{2}$ b) π c) 0 d) None of these (2016,20)

17. Let $\vec{a}$ and $\vec{b}$ be two non-zero vectors. Then $\vec{a}X\vec{b} = 0$, iff $\vec{a}$ and $\vec{b}$ are : (2015,20)

a) Perpendicular b) Parallel c) Neither perpendicular nor parallel d) None of these

18. The cross product of two vectors $\vec{a}$ and $\vec{b}$ is :

a) $|\vec{a}||\vec{b}| \sin\theta\, \hat{n}$ b) $|\vec{a}||\vec{b}| \sin\theta$ c) $|\vec{a}||\vec{b}| \cos\theta\, \hat{n}$ d) None of these (2017,20)

19. The area of parallelogram whose adjacent sides and determined by the vectors $\vec{a} = 3\hat{\imath} + \hat{\jmath} + 4\hat{k}$ and $\vec{b} = \hat{\imath} - \hat{\jmath} + \hat{k}$ is :

a) $\frac{1}{2}\sqrt{42}$ sq. units b) $\sqrt{42}$ sq. units c) 42 sq. units d) $\sqrt{21}$ sq. units (2022)

20. If $\vec{a}$ is a non zero vector of magnitude 'a' and λ is a non zero scalar, then $\lambda\vec{a}$ is unit vector, if :

a) $\lambda = 1$ b) $\lambda = -1$ c) a = I λ I d) a = $\frac{1}{|\lambda|}$ (2015,22)

21. Let the vectors $\vec{a}$ and $\vec{b}$ be such that $|\vec{a}|$ = 3, $|\vec{b}| = \frac{\sqrt{2}}{3}$, then $\vec{a}X\vec{b}$ is unit vector, if the angle between $\vec{a}$ and $\vec{b}$ is :

a) $\frac{\pi}{4}$ b) $\frac{\pi}{4}$ c) $\frac{\pi}{4}$ d) None of these (2015,22)

22. The dot product of two vectors $\vec{a}$ and $\vec{b}$ is :

a) $|\vec{a}| = |\vec{b}| \cos\theta$ b) $|\vec{b}| = |\vec{a}| \cos\theta$ c) $|\vec{a}||\vec{b}| \cos\theta$ d) None of these (2017)

23. The angle between two vector $\vec{a}$ and $\vec{b}$ is zero, then

a) $\vec{a}.\vec{b} = |\vec{a}||\vec{b}|$ b) $\vec{a}.\vec{b}$ = 0 c) $|\vec{a}||\vec{b}|$= 1 d) None of these (2017)

24. The area of triangle whose adjacent sides are given by vectors $\vec{a}$ and $\vec{b}$ is :

a) $\vec{a}X\vec{b}$ b) $\vec{b}X\vec{a}$ c) $|\vec{a}X\vec{b}|$ d) $\frac{1}{2}|\vec{a}X\vec{b}|$ (2016)

25. The Projection of the vector $\vec{a} = 2\hat{\imath} + 3\hat{\jmath} + 2\hat{k}$ and $\vec{b} = \hat{\imath} + 2\hat{\jmath} + \hat{k}$ is

a) $\frac{5}{3}\sqrt{6}$ b) $\frac{2}{3}\sqrt{5}$ c) $\frac{3}{5}\sqrt{6}$ d) $\frac{5}{6}\sqrt{3}$ (2016)

26. The Projection of the vector $\hat{\imath} - \hat{\jmath}$ on the vector $\hat{\imath} + \hat{\jmath}$ is

a) 0 b) -1 c) $\frac{1}{\sqrt{2}}$ d) None of these (2017)

27. The Projection of the vector $\vec{a} = \hat{\imath} + 3\hat{\jmath} + 7\hat{k}$ on the vector $\vec{b} = 7\hat{\imath} - \hat{\jmath} + 8\hat{k}$ is

a) $\frac{60}{\sqrt{114}}$ b) $\frac{60}{114}$ c) $\frac{66}{\sqrt{114}}$ d) None of these (2017)

28. If $\vec{a}$ and $\vec{b}$ are two collinear vectors then which of the following are incorrect

a) $\vec{b} = \lambda\vec{a}$ for some scalar λ b) $\vec{a} = \pm\vec{b}$

c) The respect component of $\vec{a}$ and $\vec{b}$ are proportional

d) Both $\vec{a}$ and $\vec{b}$ have same direction but different magnitude (2016)

29. If $\vec{a}X\vec{b} = |\vec{a}||\vec{b}| \sin\theta\, \hat{n}$ which one is correct

a) $\hat{n}$ is unit vector perpendicular to both $\vec{a}$ and $\vec{b}$

b) $\hat{n}$ is unit vector Parallel to both $\vec{a}$ and $\vec{b}$

c) $\hat{n}$ is unit vector neither perpendicular nor parallel to $\vec{a}$ and $\vec{b}$

d) None of these (2016)

Long Answer Type Question :-

1. Find the projection of vector $\hat{\imath} + \hat{3\jmath} + \hat{7k}$ on the vector $7\hat{\imath} - \hat{\jmath} + \hat{8k}$. (2023)
2. Find the projection of vector $2\hat{\imath} + \hat{3\jmath} + \hat{2k}$ on the vector $\hat{\imath} + 2\hat{\jmath} + \hat{k}$. (2023)
3. Find the projection of vector $\hat{\imath} - \hat{\jmath}$ on the vector $\hat{\imath} + \hat{\jmath}$. (2023)
4. Find area of parallelogram whose adjacent sides are given by vectors $\vec{a} = \hat{\imath} - \hat{\jmath} + 3\hat{k}$ and $\vec{b} = \hat{2\imath} - \hat{7\jmath} + \hat{k}$. (2015,20)
5. Find area of parallelogram whose adjacent sides are given by vectors $\vec{a} = 3\hat{\imath} + \hat{\jmath} + 4\hat{k}$ and $\vec{b} = \hat{\imath} - \hat{\jmath} + \hat{k}$. (2015,20)
6. Two adjacent sides of a parallelogram are $2\hat{\imath} - 4\hat{\jmath} + 5\hat{k}$ and $\hat{\imath} - \hat{2\jmath} - 3\hat{k}$. Find the area. (2020)
7. Show that A(1,2,7),B(2,6,3) and C(3,10,-1) are collinear. (2016,19)
8. Show that the points A($\hat{-2\imath} + \hat{3\jmath} + \hat{5k}$), B($\hat{\imath} + \hat{2\jmath} + \hat{3k}$) and C($7\hat{\imath} - \hat{k}$) are collinear. (2019)
9. Find the angle 'θ' between the vectors $\vec{a} = \hat{\imath} + \hat{\jmath} + \hat{k}\ and\ \vec{a} = \hat{\imath} - \hat{\jmath} + \hat{k}$ (2019)
10. Find λ if the vectors $\vec{a} = \hat{\imath} + 3\hat{\jmath} + \hat{k}, \vec{b} = 2\hat{\imath} - \hat{\jmath} - \hat{k}$ and $\vec{c} = \lambda\hat{\imath} + 7\hat{\jmath} + 3\hat{k}$ are coplanar. (2018)
11. Find λ if the vectors $\vec{a} = \hat{\imath} - \hat{\jmath} + \hat{k}, \vec{b} = 3\hat{\imath} + \hat{\jmath} + 2\hat{k}$ and $\vec{c} = \hat{\imath} + \lambda\hat{\jmath} - 3\hat{k}$ are coplanar. (2016,18)
12. Find x if the four points A(3,2,1), B(4,x,5), C(4,2,-2) and D(6,5,-1) are coplanar. (2018) (2015)
13. Find a unit vector perpendicular to each of the vectors $\vec{a} + \vec{b}\ and\ \vec{a} - \vec{b}$, where $\vec{a} = 3\hat{\imath} + 2\hat{\jmath} + 2\hat{k}$ and $\vec{b} = \hat{\imath} - 2\hat{\jmath} - 2\hat{k}$. (2022)
14. Let $\vec{a} = \hat{\imath} + 4\hat{\jmath} + 2\hat{k}, \vec{b} = 3\hat{\imath} - 2\hat{\jmath} + 7\hat{k}$ and $\vec{c} = 2\hat{\imath} - \hat{\jmath} + 4\hat{k}$. Find a vector $\vec{d}$, which is perpendicular to both $\vec{a}\ and\ \vec{b}\ and\ \vec{c}.\vec{d} = 15$. (2022)
15. Find λ aand μ , if $(2\hat{\imath} + 6\hat{\jmath} + 27\hat{k})x(\hat{\imath} + \lambda\hat{\jmath} + \mu\hat{k})$=0 (2022)
16. Show that the vectors $\vec{a} = \hat{\imath} - 2\hat{\jmath} + 3\hat{k}, \vec{b} = 2\hat{\imath} + 3\hat{\jmath} - 4\hat{k}$ and $\vec{c} = \hat{\imath} - 3\hat{\jmath} + 5\hat{k}$ are coplanar. (2016)
17. Show that the four points A, B, C and D with position vectors $4\hat{\imath} + 5\hat{\jmath} + \hat{k}$, $-(\hat{\jmath} + \hat{k})$, $3\,\hat{\imath} + 9\hat{\jmath} + 4\hat{k}$ and 4(- $\hat{\imath} + \hat{\jmath} + \hat{k}$) respectively are coplanar. (2017)
18. Show that the four points A(3,2,1), B(4,5,5), C(4,2,-2) and D(6,5,-1) are coplanar. (2017)
19. Show that the four points A, B, C and D with position vectors $4\hat{\imath} + 8\hat{\jmath} + 12\hat{k}$,$2\,\hat{\imath} + 4\hat{\jmath} + 6\hat{k}$, $3\,\hat{\imath} + 5\hat{\jmath} + 4\hat{k}$ and $5\hat{\imath} + 8\hat{\jmath} + 5\hat{k}$ are coplanar. (2017)

Ch.11- Three Dimensional Geometry

M.C.Q. :-

1.If a line makes angle $90^0, 135^0, 45^0$ with the positive direction of x,y and z-axis,respectively then the direction cosines of the line is :

a) $0,\frac{-1}{\sqrt{2}},\frac{1}{\sqrt{2}}$ b) $0,\frac{1}{\sqrt{2}},\frac{-3}{\sqrt{2}}$ c) $1,\frac{1}{\sqrt{2}},\frac{-1}{\sqrt{2}}$ d) $1,\frac{\sqrt{3}}{\sqrt{2}},\frac{1}{\sqrt{2}}$ (2023)

2. The angle between the pair of lines $\hat{r} = \left(2\hat{\imath} - 5\hat{\jmath} + \hat{k}\right) + \lambda(3\hat{\imath} + 2\hat{\jmath} + 6\hat{k})$ and $\hat{r} = \left(7\hat{\imath} - 6\hat{k}\right) + \mu(\hat{\imath} + 2\hat{\jmath} + 2\hat{k})$ is :

a) $\cos^{-1}\left(\frac{19}{21}\right)$ b) $\cos^{-1}\left(\frac{13}{21}\right)$ c) $\cos^{-1}\left(\frac{17}{21}\right)$ d) $\cos^{-1}\left(\frac{11}{21}\right)$ (2023)

3. The planes 7x+5y+6z+30=0 and 3x-y-10z+4=0 are : (2023)

a) Parallel b) Perpendicular c) Intersecting at $\theta = \cos^{-1}\left(\frac{2}{5}\right)$ d) None of these

4. If a line has direction ratio's -18,12,-4 then the direction cosines of the line is :

a) $\frac{9}{11},\frac{-6}{11},\frac{2}{11}$ b) $\frac{-9}{11},\frac{6}{11},\frac{-2}{11}$ c) $\frac{-9}{11},\frac{-6}{11},\frac{-2}{11}$ d) $\frac{9}{11},\frac{6}{11},\frac{2}{11}$ (2023)

5. The angle between the pair of lines $\hat{r} = \left(3\hat{\imath} + \hat{\jmath} - 2\hat{k}\right) + \lambda(\hat{\imath} - \hat{\jmath} - 2\hat{k})$ and $\hat{r} = \left(2\hat{\imath} - \hat{\jmath} - 56\hat{k}\right) + \mu(3\hat{\imath} - 5\hat{\jmath} - 4\hat{k})$ is :

a) $\cos^{-1}\frac{6}{5\sqrt{3}}$ b) $\cos^{-1}\frac{8}{5\sqrt{3}}$ c) $\cos^{-1}\frac{7}{5\sqrt{3}}$ d) $\cos^{-1}\frac{4}{5\sqrt{3}}$ (2023)

6. The planes 2x-2y+4z+5=0 and 3x-3y+6z-1=0 are : (2022,23)

a) Parallel b) Perpendicular c) Intersecting d) None of these

7. The planes 2x+y+3z-2=0 and x-2y+5=0 are : (2022,23)

a) Parallel b) Perpendicular c) Intersecting at $\theta = \cos^{-1}\left(\frac{2}{5}\right)$ d) None of these

8. The direction cosines of the line passing through the two points (-2,4,-5) and (1,2,3) is :

a) $\frac{1}{\sqrt{77}},\frac{2}{\sqrt{77}},\frac{-3}{\sqrt{77}}$ b) $\frac{4}{\sqrt{77}},\frac{-3}{\sqrt{77}},\frac{5}{\sqrt{77}}$ c) $\frac{3}{\sqrt{77}},\frac{-2}{\sqrt{77}},\frac{8}{\sqrt{77}}$ d) $\frac{6}{\sqrt{77}},\frac{-3}{\sqrt{77}},\frac{2}{\sqrt{77}}$ (2016,20,23)

9. The angle between the pair of lines $\frac{x-2}{2} = \frac{y-1}{5} = \frac{z+3}{-3}$ and $\frac{x+2}{-1} = \frac{y-4}{8} = \frac{z-5}{4}$ is :

a) $\cos^{-1}\left(\frac{26}{9\sqrt{38}}\right)$ b) $\cos^{-1}\left(\frac{23}{9\sqrt{38}}\right)$ c) $\cos^{-1}\left(\frac{20}{9\sqrt{38}}\right)$ d) $\cos^{-1}\left(\frac{29}{9\sqrt{38}}\right)$ (2023)

10. Direction cosines of $\vec{a} = \hat{\imath} + \hat{\jmath} - 2\hat{k}$ are

a) $\frac{1}{6},\frac{1}{6},\frac{-2}{6}$ b) $\frac{1}{\sqrt{6}},\frac{1}{\sqrt{6}},\frac{-2}{\sqrt{6}}$ c) $\sqrt{6},\sqrt{6},-\sqrt{6}$ d) $\sqrt{6},\sqrt{6},-\frac{\sqrt{6}}{2}$ (2019)

11. The relation between Direction cosines l,m,n of a line is : (2019)

a) $l^2 + m^2 + n^2 = 1$ b) $l^2 + m^2 + n^2 = -1$ c) $l^2 + m^2 + n^2 = 0$ d) $l^2 + m^2 = n^2$

12. Direction ratio of vector $\vec{a} = \hat{\imath} + \hat{\jmath} - 2\hat{k}$ are

a) 1,2,1 b) 1,1,-2 c) $\frac{1}{\sqrt{6}},\frac{1}{\sqrt{6}},\frac{2}{\sqrt{6}}$ d) $\frac{1}{\sqrt{6}},\frac{1}{\sqrt{6}},-\frac{2}{\sqrt{6}}$ (2019,22)

13. Direction cosines of x-axis are

a) 1,0,0 b) 0,1,0 c) 0,0,1 d) None of these (2019)

14. Direction cosines of z-axis are

a) 1,0,0 b) 0,1,0 c) 0,0,1 d) None of these (2019)

15. If $\vec{a} = \hat{\imath} + 2\hat{\jmath}$ then $|\vec{a}|$ is

a) 3 b) -1 c) 5 d) $\sqrt{5}$ (2019)

16. If a line has direction ratios (2,-1,-2) then its direction cosines are :

a) $\left(\frac{2}{3},\frac{-1}{3},\frac{-2}{3}\right)$ b) $\left(\frac{-2}{3},\frac{-1}{3},\frac{2}{3}\right)$ c) $\left(\frac{-2}{3},\frac{1}{3},\frac{-2}{3}\right)$ d) None of these (2016,20)

17. If a line makes angle $90^0, 135^0, 45^0$ with the positive direction of x,y and z-axis,respectively then the direction cosines of the line is :

a) $\left(0,\frac{1}{2},\frac{\sqrt{3}}{2}\right)$ b) $\left(1,\frac{1}{2},\frac{\sqrt{3}}{2}\right)$ c) $\left(0,\frac{-1}{2},\frac{\sqrt{3}}{2}\right)$ d) None of these (2020)

18. Direction cosines of $\hat{\imath}+2\hat{\jmath}+3\hat{k}$ are :

a) $\left(\frac{1}{\sqrt{14}},\frac{2}{\sqrt{14}},\frac{3}{\sqrt{14}}\right)$ b) $\left(\frac{1}{\sqrt{14}},\frac{-2}{\sqrt{14}},\frac{3}{\sqrt{14}}\right)$ c) (1,2,3) d) (1,-2,3) (2022)

19. Direction cosines of $2\hat{\imath}+3\hat{\jmath}+\hat{k}$ are :

a) $\left(\frac{1}{\sqrt{14}},\frac{2}{\sqrt{14}},\frac{3}{\sqrt{14}}\right)$ b) $\left(\frac{2}{\sqrt{14}},\frac{1}{\sqrt{14}},\frac{3}{\sqrt{14}}\right)$ c) $\left(\frac{2}{\sqrt{14}},\frac{3}{\sqrt{14}},\frac{1}{\sqrt{14}}\right)$ d) None of these (2022)

20. The distance of point (-6,0,0) from the given plane 2x - 3y + 6z - 2 = 0, is :

a) 14 b) -2 c) 2 d) $\frac{1}{7}$ (2022)

21. The distance of point (2,3,-5) from the given plane x + 2y - 2z = 9, is :

a) 9 b) None of these c) 3 d) $\frac{1}{3}$ (2017,22)

22. The distance of point (3,-2,1) from the given plane 2x - y + 2z + 3 = 0, is :

a) $\frac{13}{3}$ b) 13 c) $\frac{3}{13}$ d) $\frac{1}{13}$ (2017,22)

23. The distance of point (0,0,0) from the given plane 3x - 4y + 12z = 3, is :

a) -2 b) $\frac{3}{13}$ c) 3 d) $\frac{13}{3}$ (2017)

24. If a line makes angle $90^0, 60^0, 30^0$ with the positive direction of x,y and z-axis,respectively then the direction cosines of the line is :

a) $\left(0,\frac{1}{2},\frac{\sqrt{3}}{2}\right)$ b) $\left(1,\frac{1}{2},\frac{\sqrt{3}}{2}\right)$ c) $\left(0,\frac{-1}{2},\frac{\sqrt{3}}{2}\right)$ d) None of these (2016)

Long Answer Type Question :-

1. Find the vector equation of the plane passing through the intersection of the planes $\hat{r}.\left(2\hat{\imath}+2\hat{\jmath}-3\hat{k}\right)=7$ and $\hat{r}.\left(2\hat{\imath}+5\hat{\jmath}+3\hat{k}\right)=9$ and through the point (2,1,3). (2023)

2. Find the shortest distance between the lines $\hat{r}=\left(\hat{\imath}+2\hat{\jmath}+3\hat{k}\right)+\lambda(\hat{\imath}-3\hat{\jmath}+2\hat{k})$ and $\hat{r}=\left(4\hat{\imath}+5\hat{\jmath}+6\hat{k}\right)+\mu(2\hat{\imath}+3\hat{\jmath}+\hat{k})$. (2016,18,20,22,23)

3. Find the equation of the plane passing through the intersection of the planes 3x-y+2z-4=0 and x+y+z-2=0 and through the point (2,2,1). (2016,20,23)

4. Find the shortest distance between the lines $\hat{r}=\left(\hat{\imath}+2\hat{\jmath}+\hat{k}\right)+\lambda(\hat{\imath}-\hat{\jmath}+\hat{k})$ and $\hat{r}=\left(2\hat{\imath}-\hat{\jmath}-\hat{k}\right)+\mu(2\hat{\imath}+\hat{\jmath}+2\hat{k})$. (2016,18,20,23)

5. Find the vector equation of the plane passing through the intersection of the planes $\hat{r}.\left(\hat{\imath}+\hat{\jmath}+\hat{k}\right)=6$ and $\hat{r}.\left(2\hat{\imath}+3\hat{\jmath}+4\hat{k}\right)=-5$ and through the point (1,1,1). (2020,23)

6. Find the shortest distance between the lines $\hat{r}=(\hat{\imath}+\hat{\jmath})+\lambda(2\hat{\imath}-\hat{\jmath}+\hat{k})$ and $\hat{r}=\left(2\hat{\imath}+\hat{\jmath}-\hat{k}\right)+\mu(3\hat{\imath}-5\hat{\jmath}+2\hat{k})$. (2022,23)

7. Find the shortest distance between the lines $\hat{r}=\left(6\hat{\imath}+2\hat{\jmath}+2\hat{k}\right)+\lambda(\hat{\imath}-2\hat{\jmath}+2\hat{k})$ and $\hat{r}=\left(-4\hat{\imath}-\hat{k}\right)+\mu(3\hat{\imath}-2\hat{\jmath}-2\hat{k})$. (2015,17,20)

8. Find the equation of the plane passing through the intersection of the planes x+y+z=1 and 2x+3y+4z=5 which is perpendicular to plane x-y+z=0. (2016,20)

9. Find the shortest distance between the lines $\frac{x+1}{7}=\frac{y+1}{-6}=\frac{z+1}{1}$ and $\frac{x-3}{1}=\frac{y-5}{-2}=\frac{z-7}{1}$ (2015,16,18,19)

10. Find the shortest distance between the lines $\hat{r}=\left(\hat{\imath}+2\hat{\jmath}-4\hat{k}\right)+\lambda(2\hat{\imath}+3\hat{\jmath}+6\hat{k})$ and $\hat{r}=\left(3\hat{\imath}+3\hat{\jmath}-5\hat{k}\right)+\mu(2\hat{\imath}+3\hat{\jmath}+6\hat{k})$. (2017,19)

11. Find the shortest distance between the lines (2019,22)
$\vec{a}=(1-t)\hat{\imath}+(t-2)\hat{\jmath}+(3-2t)\hat{k}$ and $\vec{b}=(s+1)\hat{\imath}+(2s-1)\hat{\jmath}-(2s+1)\hat{k}$

12. Find the vector and cartesian equation of the plane that passes through the point (1,0,-2) and normal to the plane is $\hat{\imath}+\hat{\jmath}-\hat{k}$. (2019)

13. Find the vector and cartesian equation of the plane that passes through the point (1,4,6) and normal to the plane is $\hat{\imath}-2\hat{\jmath}+\hat{k}$. (2018,19)

14. Find the vector and cartesian equation of the plane which passes through the point (5,2,-4) and perpendicular to the line with direction ratio 2,3,-1. . (2018,19)
15. Find the equation of plane passes through three points (1,1,0), (1,2,1) and (-2,2,-1). (2018)
16. Find the equation of plane passes through three points (2,5,-3), (-2,-3,5) and (5,3,-3). (2018)
17. Find the angle between the pairs of lines
    $\hat{r} = (3\hat{\imath} + \hat{\jmath} - 2\hat{k}) + \lambda(\hat{\imath} - \hat{\jmath} - 2\hat{k})$ and
    $\hat{r} = (32\hat{\imath} - \hat{\jmath} - 56\hat{k}) + \mu(3\hat{\imath} - 5\hat{\jmath} - 4\hat{k})$. (2016)
18. Find the angle between the pair of lines
    $\frac{x-2}{2} = \frac{y-1}{5} = \frac{z+3}{3}$ and $\frac{x+2}{-1} = \frac{y-4}{8} = \frac{z-5}{4}$ (2016,17)
19. Find the angle between the pair of planes 3x-6y+2z=7 and 2x+2y-2z=5. (2016)
20. Find the vector equation of the plane passing through the intersection of the planes $\hat{r}.(\hat{\imath} + 2\hat{\jmath} + 3\hat{k}) - 4 = 0$ and $\hat{r}.(2\hat{\imath} + \hat{\jmath} - \hat{k}) + 5 = 0$ and which is perpendicular to the plane $\hat{r}.(\widehat{5\imath} + 3\hat{\jmath} - 6\hat{k}) + 8 = 0$. (2016)
21. Find the shortest distance between the lines $\hat{r} = (\hat{\imath} + \widehat{2\jmath} + 3\hat{k}) + \lambda(\hat{\imath} - 3\hat{\jmath} + 2\hat{k})$ and $\hat{r} = (4\hat{\imath} + 5\hat{\jmath} + 6\hat{k}) + \mu(2\hat{\imath} + 3\hat{\jmath} + \hat{k})$. (2017)
22. Find the coordinates of the point where the line through (5,1,6) and (3,4,1) crosses ZX - plane. (2017)
23. Find the coordinates of the point where the line through A(3,4,1) and B(5,1,6) crosses YZ - plane. (2017)
24. Find the coordinates of the point where the line through (5,1,6) and (3,4,1) crosses XY - plane. (2017)
25. Find the angle between the pairs of lines
    $\hat{r} = (2\hat{\imath} - 5\hat{\jmath} + \hat{k}) + \lambda(3\hat{\imath} + 2\hat{\jmath} + 6\hat{k})$ and
    $\hat{r} = (7\hat{\imath} - 6\hat{k}) + \mu(\hat{\imath} + 2\hat{\jmath} + 2\hat{k})$. (2017)
26. Find the angle between the pair of lines
    $\frac{x-5}{7} = \frac{y+2}{-5} = \frac{z}{1}$ and $\frac{x}{1} = \frac{y}{2} = \frac{z}{3}$ (2017)

Ch.12 :- Linear Programming

Long Answer Type Question :-

1.solve the following linear programming problems graphically :

i) Maximize $Z = 4x + y$, subject to constraints
$x + y \leq 50, 3x + y \leq 90, x \geq 0, y \geq 0$ (2016)

ii). Maximize $Z = 3x + 9y$, subject to constraints
$x + y \leq 60, x + y \geq 10, x \leq y, x \geq 0, y \geq 0$ (2015)

iii). Minimize $Z = -3x + 4y$, subject to constraints
$x + 2y \leq 8, 3x + 2y \leq 12, x \geq 0, y \geq 0$ (2015,18,19,22,23)

iv). Maximize $Z = 5x + 3y$, subject to constraints
$3x + 5y \leq 15, 5x + 2y \leq 10, x \geq 0, y \geq 0$ (2016,17,22,23)

v). Maximize $Z = 5x + 10y$, subject to constraints
$x + 2y \leq 120, x + y \geq 60, x - 2y \geq 0, x \geq 0, y \geq 0$ (2016,20)

vi). Minimize $Z = x + 2y$, subject to constraints
$2x + y \geq 3, x + 2y \geq 6, x \geq 0, y \geq 0$ (2018,19)

vii). Maximize $Z = 3x + 2y$, subject to constraints
$x + 2y \leq 10, 3x + y \leq 15, x \geq 0, y \geq 0$ (2016,17,18,19,22,23)

viii). Maximize and minimize, $Z = 200x + 500y$, subject to constraints
$x + 2y \geq 10, 3x + 4y \leq 24, x \geq 0, y \geq 0$ (2017,20)

ix). Maximize and minimize, $Z = x + 2y$, subject to constraints
$x + 2y \geq 100, 2x - y \leq 0, 2x + y \leq 200, x \geq 0, y \geq 0$ (2020)

Ch.13- Probability

M.C.Q. :-

1. If A and B are independent events such that P(A)=0.3, P(B)=0.6,then P(A or B) is
   a) 0.18 b) 0.72 c) 0.9 d) 0.28 (2023)
2. If A and B are two events such that P(A) ≠ 0 and P(B/A) = 1, then
   a) A⊂B b) B⊂A c) B = ∅ d) A = ∅ (2017,23)
3. If A and B are events such that P(A/B) = P(B/A), then
   a) A ⊂ B but A ≠ B b) A = B c) A ∩ B = ∅ d) P(A) = P(B) (2016,22,23)
4. If A and B are independent events such that P(A)=0.3, P(B)=0.4,then P(A or B) is
   a) 0.58 b) 0.3 c) 0.12 d) 0.4 (2023)
5. If P(A) = $\frac{1}{2}$, P(B) = 0, then P(A/B) is :
   a) 0 b) $\frac{1}{2}$ c) Not defined d) 1 (2016,20,22,23)
6. If P(A/B) > P(A), then which of the following is correct
   a) P(B/A) < P(B) b) P(A∩B) < P(A)P(B) c) P(B/A) > P(B) d) P(B/A) = P(B) (2017,23)
7. If A and B are any two events such that P(A) + P(B) - P(A and B) = P(A), then
   a) P(B/A) = 1 b) P(A/B) = 1 c) P(B/A) = 0 d) P(A/B) = 0 (2017,23)
8. If A and B are independent events such that P(A)=0.3, P(B)=0.6,then P(A and not B) is
   a) 0.18 b) 0.28 c) 0.72 d) 0.12 (2023)
9. The probability of obtaining an even Prime number on each die, when a pair of dice is rolled is :
   a) 0 b) $\frac{1}{3}$ c) $\frac{1}{12}$ d) $\frac{1}{36}$ (2015,19,23)
10. If P(A)=0.8, P(B)=0.5 and P(B/A) = 0.4, then P(A ∩ B)
    a) 0.15 b) 0.23 c) 0.32 d) 0.51 (2019)
11. If P(A)=0.8, P(B)=0.5 and P(B/A) = 0.4, then P(A ∪ B) is
    a) 0.15 b) 0.1 c) 0.32 d) 0.98 (2019)
12. If P(A) = $\frac{3}{5}$ and P(B) = $\frac{1}{5}$, A and B are independent events, then P(A∩B) = ?
    a) $\frac{3}{25}$ b) $\frac{1}{3}$ c) $\frac{25}{3}$ d) None of these (2015,20)
13. If P(A) = $\frac{7}{13}$ and P(B) = $\frac{9}{13}$ and P(A∩B) = $\frac{4}{13}$ then
    a) $\frac{4}{9}$ b) $\frac{9}{4}$ c) $\frac{7}{9}$ d) $\frac{4}{7}$ (2015,20)
14. Two events A and B will be independent, if
    a) A and B are mutually exclusive b) P($A'B'$) = [1-P(A)][1-P(B)]
    c) P(A) = P(B) d) P(A) + P(B) = 1 (2016,22)
15. Two balls are drawn at random with replacement from a box containing 10 black and 8 red balls, then the probability that one of them is black and other is red :
    a) $\frac{20}{81}$ b) $\frac{16}{81}$ c) $\frac{40}{81}$ d) None of these (2022)
16. Two balls are drawn at random with replacement from a box containing 10 black and 8 red balls, then the probability that first ball is black and second ball is red :
    a) $\frac{16}{81}$ b) $\frac{20}{81}$ c) $\frac{40}{81}$ d) None of these (2022)
17. Two balls are drawn at random with replacement from a box containing 10 black and 8 red balls, then the probability that both are red balls :
    a) $\frac{16}{81}$ b) $\frac{20}{81}$ c) $\frac{40}{81}$ d) None of these (2022)

Long Answer Type Question :-

1. Find the probability distribution of number of heads in four tosses of a coin. (2015,17,23)
2. If a fair coin is tossed 10 times, find the probability of : i) exactly six heads. ii) at least six heads. (2023)
3. From a lot of 30 bulbs which include 6 defectives, a sample of 4 bulbs is drawn at random with replacement. Find the probability distribution of number of defective bulbs. (2023)
4. A die is thrown 6 times. If 'getting an odd number' is a success, what is the probability of : i) 5 successes ? ii) at most 5 successes ? iii) at least 5successes (2015,18,23)
5. Find the probability distribution of number of tails in the simultaneous tosses of three coins. (2023)
6. 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) at least one.
will fuse after 150 days of use. (2015,23)
7. If P(A) = 0.8, P(B) = 0.5 and P(B/A) = 0.4. Find P(A∩ B) (2020)
8. A pair of dice is thrown 4 times. If getting a doublet is considered a success. Find the probability of two successes. (2015,20)
9. If A and B are independent events such that P(A)=0.3, P(B)=0.6. Find P(neither A nor B). (2015,20,22)
10. Find the probability of getting 5 exactly twice in 7 throws of a die. (2020,22)
11. Events A and B are such that P(A) = $\frac{1}{2}$, P(B) = $\frac{7}{12}$ and P(not A or not B) = $\frac{1}{4}$. State whether A and B are independent. (2015,18,20,22)
12. There are 5% defective items in a large bulk of items. What is the probability that a sample of 10 items will include not more than one defective item? (2020)
13. Two coins are tossed once, where E : tail appears on one coin, F : one coin shows head. Find P(E/F). (2019)
14. If A and B are independent events such that P(A)=0.3, P(B)=0.6. Find P(A and B). (2019)
15. If A and B are independent events such that P(A)=0.3, P(B)=0.6. Find P(A or B). (2019)
16. Find the mean number of heads in three tosses of a fair coin. (2019)
17. Find the mean of the number obtained on a throw of an unbiased die. (2019)
18. Two dice are thrown simulataneously. If X denotes the number of sixes. Find the mean of X. (2019)
19. Find the probability of throwing almost 2 sixes in 6 thrown of a single die . (2022)
19. Two cards are drawn at random and without replacement from a pack of 52 cards. Find the probability that both the cards are black. (2018)
20. A fair coin and unbiased die are tossed. Let A be the event 'head appears on the coin' and B be the event '3 on the die'. Check whether A and B are independent events or not. (2018)
21. If a fair coin is tossed 10 times, find the probability of : i) exactly six heads
ii) at least six heads iii) at most six heads (2018)
22. If A and B are two events such that P(A) = $\frac{1}{4}$, P(B) = $\frac{1}{2}$ and P(A∩B) = $\frac{1}{8}$,
find P(not A and not B) (2015,18,22)
23. A die marked 1,2 3 in red and 4,5,6 in green is tossed. Let A be the event,'the number is even' and B be the event,'the number is red'. Are A and B independent? (2018)

24. If pair of dice is thrown 4 times. If getting a doublet is considered a success, find the probability of two successes. (2018,22)

25. Given two independent events A and B such that P(A)=0.3, P(B)=0.6. Find
    i) P(A and B) ii) P(A and not B) (2018)

26. Two balls are drawn at random with replacement fro6 a box containing 10 black and 8 red balls. Find the probability that,
    i) First ball is black and second is red
    ii) one of them is black and other is red. (2016)

27. A bag contains 4 red and 4 black balls, another bag contains 2 red and 6 black balls. One of the two bags is selected at random and a ball is drawn from the bag which is found to be red Find the probability that the ball is drawn from the first bag. (2016)

28. Find the mean number of heads in three tosses of a fair coin. (2016)

29. A dice is tossed thrice. Find the probability of getting an odd number at least once. (2016)

30. From a lot of 30 bulbs which include 6 defectives, a sample of 4 bulbs is drawn at random with replacement. Find the probability distribution of the number of defective bulbs. (2016)

31. If a fair coin is tossed 10 times find the probability of
    i) exactly six heads
    ii) at least six heads
    iii) at most six heads (2016)

32. Five cards are drawn successively with replacement from a well shuffled deck of 52 cards. What is the probability that
    i) all five cards are spade
    ii) none is a spade (2015,16)

33. Two cards drawn at random without replacement from a deck of 52 cards. Find probability that both the cards are black. (2016)

34. Five cards are drawn successively with replacement from a well shuffled deck of 52 cards. What is the probability that
    i) all five cards are spades
    ii) only three cards are spades (2015,17)

35. Find the probability distribution of number of heads in two tosses of a coin. (2017)

36. A couple has two children, then find the probability that both children are males if it is known that at least one of the children is male. (2017)

37. It is known that 10% of certain articles manufactured are defective. What is the probability that in a random sample of 12 such articles, 9 are defective? (2017)

38. Find the probability distribution of number of tails in three tosses of a coin. (2017)