S.No.	RELATION AND FUNCTION	YEAR	MARKS
1	If $f(x)$is the invertible function, find the inverse of $f(x)=\frac{3x-2}{5}$	2008	1
2	Let T be the set of all triangles in a plane with R as relation in T given by $R=\{(T_1,T_2):T_1\cong T_2\}$. Show that R is equivalence relation.	2008	4
3	Let * be a binary operation on N given by a*b=HCF (a, b) where a, b $\epsilon\, N$ find a*b	2009	1
4	Let $f: N\to N\ be\ defined\ by\ f(n)=\begin{cases}\frac{n+1}{2}, if\ n\ is\ odd\\ \frac{n}{2}, if\ n\ is\ even\end{cases}\quad n\ \forall N$ find whether the function is bijective.	2009	4
5	If $f(x): R\to R\ be\ defined\ by\ f(x)=(3-x)^{1/3}\ then\ find\ f0f(x)$	2010	1
6	Show that the relation on the set $N\times N$ by $(a,b)S(c,d)\Rightarrow a+d=b+c$ is equivalence relation.	2010	4
7	Let A={1,2,3}, B={4,5,6,7} and $f=\{(1,4),(2,5),(3,6)\}$ be a function from A to B. State whether f is one-one oe not.	2011	1
8	Let $f: R\to R$ be the defined as $f(x)=10x+7.$ Find the function $g: R\to R$ such that $g0f=f0g=I_{R.}$**OR** A binary operation on the set {0,1,2,3,4,5} is defined as: $a*b=\begin{cases}a+b\ if\ a+b<6\\ a+b-6\ if\ a+b\geq 6\end{cases}$ Show that zero is the identity for this operation and each element 'a' of the set is invertible with 6- a being the inverse of 'a'	2011	4
9	The binary operation *$R\times R\to R$ is defined as $a*b=2a+b. Find\ (2*3)*4$	2012	1
10	Show that $f: N\to N$, given by $f(x)=\begin{cases}x+1\ if\ x\ is\ odd\\ x-1\ if\ x\ is\ even\end{cases}$ is one-one and onto. **OR** Consider the binary operation $*: R\times R\to R\ \ and\ 0: R\times R\to R\ \ defined\ as\ a*b=\|a-b\|\ and\ a0b=a\ for\ all\ a,b\epsilon R$. show that the * is commutative but not associative, '0' is associative but not commutative.	2012	4
11	Consider $f: R_+\to[4,\infty) given\ by\ f(x)=x^2+4$ show that $f$is invertible with the inverse f^{-1} of given by $f^{-1}(y)=\sqrt{y-4}$where R_+ is the set of all non-negative real numbers.	2013	4
12	If $R=\{(x,y): x+2y=8\}$ is a relation on N, write the range of R.	2014	1
13	If $f: R\to R, be\ given\ by\ f(x)=x^2+2$ and g: $R\to R$ be given by $g(x)=\frac{x}{x-1}, x\neq 1$ find $g0f, f0g$ and hence find $f0g(2)$ and $g0f(-3)$	2014	4
14	Determine whether the relation R defined on the set $\mathbb{R}$ of all real number as $R=\left\{(a,b): a,b\epsilon\ \mathbb{R}\ and\ a-b+\sqrt{3}\ \epsilon S, where\ S\ is\ the\ set\ of\ all\ irretinal\ number\right\}$ is equivalence relation. **OR** **Let** $\mathrm{A}=\mathbb{R}\times\mathbb{R}$ and $*$ be the binary operation on A defined as $(a,b)*(c,d)=(a+c,b+d)$. Prove that $*$ is commutative and associative. Find the identity element for $*$ on A. Also write the inverse element of the element (3,-5) in A.	2015	6

15	Let $A = R \times R$ and $*$ be a binary operation on A defined by $(a, b) * (c, d) = (a + c, b + d)$ show that $*$ commutative and associative. Find the identity element for $*$ on A. Also find the inverse of every element $(a, b) \epsilon A$.	2016	6
16	Let $A = \mathbb{Q} \times \mathbb{Q}$ and $*$ be a binary operation on A defined by $(a, b) * (c, d) = (ac, b + ad)$ $(a, b), (c, d) \epsilon\ A$ determine, whether $*$ commutative and associative. Then, with respect to $*$ on A (i) find the identity element in A (ii) find the invertible elements of A. **OR** Consider $f: R - \left\{-\frac{4}{3}\right\} \to R - \left\{\frac{4}{3}\right\}$ given by $(x) = \frac{4x+3}{3x+4}$. show that $f$is bijective. Find the inverse of $f$and hence find $f^{-1}(0)$ and x such that $f^{-1}(x) = 2$	2017	6
17	If $a * b$ denotes the larger of $'a'$ and $'b'$ and if $a o \mathrm{b} = a * \mathrm{b} + 3$, then write the value of $5o10$, where $*$ and oare the binary operations.	2018	1
18	Let $A = \{x \epsilon Z: 0 \leq x \leq 12\}$. Show that $R = \{(a , b): a, b \epsilon A, \|a - b\|\ is\ divisible\ by\ 4\}$ is an equivalence relation. Find the set of all elements related to 1. Also write the equivalence class of $[2]$. **OR** Show that the function $f: \mathbb{R} \to \mathbb{R}$ defined by $f(x) = \frac{x}{x^2+1}$, $\forall \in \mathbb{R}$ is neither one-one nor onto. Also if $g: \mathbb{R} \to \mathbb{R}$ is defined as $g(x) = 2x - 1$, find $gof(x)$.	2018	6
19	Examine the whether the operation $*$ defined on $\mathbb{R}$, the set of all real number, by $a * b = \sqrt{a^2 + b^2}$ is a binary operation or not, and if it is a binary operation, find whether it is associative or not.	2019	2
20	Check whether the relation defined on the set $A = \{1, 2, 3, 4, 5, 6\}$ as $R = \{(a, b): b = a + 1\}$ is reflexive, symmetric and transitive. **OR** Let $f: N \to Y$ be a function defined as $f(x) = 4x + 3$, where $Y = \{y \in N: y = 4x + 3, for\ some\ x\ \in N\}$. Show that f is invertible. Find its inverse.	2019	4
21	If $f: R \to R$ is given by $f(x) = (3 - x^3)^{1/3}$ then $fof(x) = \cdots$	2020	1
22	Check if the relation $R\ \ on$ the set $A = \{1, 2, 3,\ 4,\ 5, 6\}$ defined as $R = \{(x, y) : y\ is\ divisible\ by\ x\}$ is (i) symmetric (ii) transitive **OR** Prove that $\frac{9\pi}{8} - \frac{9}{4}\sin^{-1}\frac{1}{3} = \frac{9\pi}{4}\sin^{-1}\frac{2\sqrt{2}}{3}$	2020	2
23	Prove that the relation R on Z defined as $R = \{(x, y) : x - y\ is\ divisible\ by\ 5\}$ is an equivalence relation	2020	4
24			

S.No.	INVERSE TRIGONOMETRIC FUNCTION	YEAR	MARKS
1	Write the principal value of $\cos^{-1}\left(cos\frac{7\pi}{6}\right)$	2009	1
2	Prove the following: $\cot^{-1}\left[\frac{\sqrt{1+sinx}+\sqrt{1-sinx}}{\sqrt{1+sinx}-\sqrt{1-sinx}}\right]$ **OR**	2009	4

	Solve for$x$: $2\tan^{-1}(cosx) = \tan^{-1}(2cosecx)$		
3	Write the principal value of $\sec^{-1}(-2)$	2010	1
4	Write the principal value of $\cot^{-1}(-\sqrt{3})$	2010	1
5	Find the value of $\sin^{-1}\left(sin\frac{4\pi}{5}\right)$	2010	1
6	Prove the following: $\tan^{-1}\frac{1}{3}+\tan^{-1}\frac{1}{5}+\tan^{-1}\frac{1}{7}+\tan^{-1}\frac{1}{8}=\frac{\pi}{4}$**OR** **If** $\tan^{-1}\frac{x-1}{x-2}+\tan^{-1}\frac{x+1}{x+2}=\frac{\pi}{4}$ then find the value of x.	2010	4
7	Prove the following: $\tan^{-1}x+\tan^{-1}\frac{2x}{1-x^2}=\tan^{-1}\frac{3x-x^3}{1-3x^2}$ **OR** Prove thefollowing:$\cos[\tan^{-1}\{\sin(\cot^{-1}x)\}]=\sqrt{\frac{1+x^2}{2+x^2}}$	2010	4
8	Find the principal value of $cos^{-1}\left(cos\frac{2\pi}{3}\right)+\sin^{-1}\left(sin\frac{2\pi}{3}\right)$	2011	1
9	Prove that: $\tan^{-1}\frac{1}{2}+\tan^{-1}\frac{1}{5}+\tan^{-1}\frac{1}{8}=\frac{\pi}{4}$	2011	4
10	Prove that: $2\tan^{-1}\frac{1}{2}+\tan^{-1}\frac{1}{7}=\tan^{-1}\frac{31}{17}$	2011	4
11	Prove the following: $\tan^{-1}\left[\frac{\sqrt{1+x}-\sqrt{1-x}}{\sqrt{1+x}-\sqrt{1-x}}\right]=\frac{\pi}{4}-\frac{1}{2}\cos^{-1}x, -\frac{1}{\sqrt{2}}\leq x\leq 1$	2011	4
12	Write the principal value of $\tan^{-1}(\sqrt{3})-\sec^{-1}(2)$	2012	1
13	Prove the following: $\cos(\sin^{-1}\frac{3}{5}+\cot^{-1}\frac{3}{2})=\frac{6}{5\sqrt{13}}$	2012	4
14	Prove that : $\sin^{-1}\frac{3}{5}+\cos^{-1}\frac{12}{13}=\sin^{-1}\frac{56}{65}$	2012	4
15	Prove that : $\cos^{-1}\frac{12}{13}+\cos^{-1}\frac{4}{5}=\cos^{-1}\frac{33}{65}$	2012	4
16	Write the principal value of $\tan^{-1}(\sqrt{3})-\cot^{-1}(-\sqrt{3})$	2013	1
17	Write the value of: $\tan^{-1}\left[2\sin(2\cos^{-1}\frac{\sqrt{3}}{2})\right]$	2013	1
18	Show that: $\tan\left(\frac{1}{2}\sin^{-1}\frac{3}{4}\right)=\frac{4-\sqrt{7}}{3}$ **OR** Solve the following equation: $\cos(\tan^{-1}x)=\sin(\cot^{-1}\frac{3}{4})$	2013	4
19	If $\tan^{-1}x+\tan^{-1}y=\frac{\pi}{4}, xy<1$then write the value of $x+y+xy$.	2014	1
20	Prove the following: $\tan^{-1}\left[\frac{\sqrt{1+x}-\sqrt{1-x}}{\sqrt{1+x}-\sqrt{1-x}}\right]=\frac{\pi}{4}-\frac{1}{2}\cos^{-1}x, -\frac{1}{\sqrt{2}}\leq x\leq 1$ **OR** **If** $\tan^{-1}\frac{x-2}{x-4}+\tan^{-1}\frac{x+2}{x+4}=\frac{\pi}{4}$ then find the value of x.	2014	4
21	Evaluate: $tan\left\{2\tan^{-1}\left(\frac{1}{5}\right)+\frac{\pi}{4}\right\}$	2015	4
22	Solve for x: $\tan^{-1}(x-1)+\tan^{-1}x+\tan^{-1}(x+1)=\tan^{-1}3x$ OR Prove that :$\tan^{-1}\frac{(6x-8x^3)}{1-12x^2}-\tan^{-1}\frac{4x}{1-4x^2}=\tan^{-1}2x \quad \lvert 2x\rvert<\frac{1}{\sqrt{3}}$	2016	4
23	**If** $\tan^{-1}\frac{x-3}{x-4}+\tan^{-1}\frac{x+3}{x+4}=\frac{\pi}{4}$ then find the value of x.	2017	4
24	Find the value of $\tan^{-1}(\sqrt{3})-\cot^{-1}(-\sqrt{3})$	2018	1
25	Prove that : $3\sin^{-1}x=\sin^{-1}(3x-4x^3)$. $x\in\left[-\frac{1}{2},\frac{1}{2}\right]$	2018	2
26	Find the value of $\sin(\cos^{-1}\frac{4}{5}+\tan^{-1}\frac{2}{3})$ **SET-1,2** Solve for x: $\tan^{-1}(x-1)+\tan^{-1}x+\tan^{-1}(x+1)=\tan^{-1}\frac{8}{31}$.	2019	4

27	The value of $\sin^{-1}\left(\cos\frac{3\pi}{5}\right)$ (i) $\frac{\pi}{10}$ (ii) $\frac{3\pi}{5}$ (iii) -$\frac{\pi}{10}$ (iv) -$\frac{3\pi}{5}$	2020	1
28	Th value of $\tan^{-1}\left[\frac{1}{2}\cos^{-1}\frac{\sqrt{5}}{3}\right]$	2020	1

S.No.	MATRICES	YEAR	MARKS
1	Find the value of $x\ if\ \begin{bmatrix}3x+y & -y\\ 2y-x & 3\end{bmatrix}=\begin{bmatrix}1 & 2\\ -5 & 3\end{bmatrix}$	2009	1
2	Find the value of $y\ if\ \begin{bmatrix}x-y & 2\\ x & 5\end{bmatrix}=\begin{bmatrix}2 & 2\\ 3 & 5\end{bmatrix}$	2009	1
3	Find the value of $x\ if\ \begin{bmatrix}2x-y & 5\\ x & 5\end{bmatrix}=\begin{bmatrix}6 & 5\\ 3 & -2\end{bmatrix}$	2009	1
4	Write the adjoint of the following matrix $\begin{bmatrix}2 & -1\\ 4 & 3\end{bmatrix}$	2010	1
5	A is the square matrix of order 3 and $\|A\|=7.write\ the\ value\ of\ \|adjA\|$	2010	1
6	Express the following matrix as sum of a symmetric and skew symmetric matrix, and verify the result $\begin{bmatrix}3 & -2 & -4\\ 3 & -2 & -5\\ -1 & 1 & 2\end{bmatrix}$	2010	4
7	If A=$\begin{bmatrix}2 & 0 & 1\\ 2 & 1 & 3\\ 1 & -1 & 0\end{bmatrix}$, then find the value of $A^2-3A+2I$	2010	4
8	For the following matrix A and B verify that $(AB)'=B'A'$, $A=\begin{bmatrix}1\\ -4\\ 3\end{bmatrix}$ and $B=[-1\ 2\ 1]$	2010	4
9	If A= $\begin{bmatrix}2 & 3\\ 5 & -2\end{bmatrix}$ write A^{-1} in term of A.	2011	1
10	If a matrix has 5 elements, write all possible orders it can have.	2011	1
11	Find the value of $x+y$ in the following equation: $2\begin{bmatrix}x & 5\\ 7 & y-3\end{bmatrix}+\begin{bmatrix}3 & -4\\ 1 & 2\end{bmatrix}=\begin{bmatrix}7 & 6\\ 15 & 14\end{bmatrix}$	2012	1
12	If $A^T=\begin{bmatrix}3 & 4\\ -1 & 2\\ 0 & 1\end{bmatrix}\ and\ B=\begin{bmatrix}-1 & 2 & 1\\ 1 & 2 & 3\end{bmatrix}, then\ find\ \ A^T$-$B^T$	2012	1
13	Let A be the square matrix of order 3× 3. Write the value of $\|2A\ \|\ where\ \ \|A\|=4$	2012	1
14	Find the value of $x+y$ in the following equation: $2\begin{bmatrix}1 & 3\\ 0 & x\end{bmatrix}+\begin{bmatrix}y & 0\\ 1 & 2\end{bmatrix}=\begin{bmatrix}5 & 6\\ 1 & 8\end{bmatrix}$	2012	1
15	If matrix A= $\begin{bmatrix}1 & -1\\ -1 & 1\end{bmatrix}$ and $A^2=kA$ then write the value of k.	2013	1
16	For what value of x is the matrix A= $\begin{bmatrix}0 & 1 & -2\\ -1 & 0 & 3\\ x & -3 & 0\end{bmatrix}$ a skew matrix ?	2013	1
17	Find the value of b if $\begin{bmatrix}a-b & 2a+c\\ 2a-b & 3c+d\end{bmatrix}=\begin{bmatrix}-1 & 5\\ 0 & 13\end{bmatrix}$	2013	1
18	If A is square matrix such that $A^2=A$, then the value of $7A-(I+A)^3$, where I is an identity matrix	2014	1
19	If $\begin{bmatrix}x-y & z\\ 2x-y & w\end{bmatrix}=\begin{bmatrix}-1 & 4\\ 0 & 5\end{bmatrix}\ then\ find\ the\ value\ of\ x+y.$	2014	1
20	There are two families A and B. there are 4 men, 6 women and 2 children in family A, and 2 men, 2 women and 4 children in family B. The recommended daily amount of calories is 2400 for men, 1900 for women , 1800 for children and 45 gm of proteins for men, 55 gm for women and 33 gm for children. Represent the above information using matrices. Using matrix multiplication, calculate the total requirement of calories and proteins for each of the two families. What	2015	4

	awareness can you create among the people about the balanced diet form this question?		
21	Using elementary operations, find the inverse of the following matrix: $\begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 0 \end{bmatrix}$ **OR** If $A = \begin{bmatrix} 0 & 6 & 7 \\ -6 & 0 & 8 \\ 7 & -8 & 0 \end{bmatrix}, \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 2 \\ 1 & 2 & 0 \end{bmatrix}, C = \begin{bmatrix} 2 \\ -2 \\ 3 \end{bmatrix}$,then calculate AC, BC and (A+B) C. Also veriry (A+B)=AC+BC.	2015	4
22	If $A = \begin{bmatrix} \cos\alpha & \sin\alpha \\ -\sin\alpha & \cos\alpha \end{bmatrix}$, find α satisfying $0 < \alpha < \frac{\pi}{2}$ when $A + A' = \sqrt{2} I_2$: where $A'$is transpose of A.	2016	1
23	If A is a 3×3 matrix and $\vert 3A \vert = K \vert A \vert$, then write the value of k.	2016	1
24	If $A = \begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix}$ and $A^3 - 6A^2 + 7A + kI_3 = 0$	2016	6
25	If for any 2×2 matrix A, $A(adjA) = \begin{bmatrix} 8 & 0 \\ 0 & 8 \end{bmatrix}$, then write the value of $\vert A \vert$.	2017	1
26	If the matrix $A = \begin{bmatrix} 0 & a & -3 \\ 2 & 0 & -1 \\ b & 1 & 0 \end{bmatrix}$ is skew symmetric, then find the value of a and b.	2018	1
27	Given that A= $\begin{bmatrix} 2 & -3 \\ -4 & 7 \end{bmatrix}$, compute $A^{-1}$and show that $2A^{-1} = 9I - A$.	2018	2
28	Using elementary row operations, find the inverse of the following matrix: $\begin{bmatrix} 1 & 2 & 3 \\ 2 & 5 & 7 \\ -2 & -4 & -5 \end{bmatrix}$	2018	6
29	If A is square matrix satisfying $A'A = I$, write the value of $\vert A \vert$ **SET-1** If $A = \begin{bmatrix} 0 & -1 \\ 0 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & 5 \\ 0 & 0 \end{bmatrix}$ find $\vert AB \vert$. **SET-2** If A is matrix such satisfying $A'\ A = I$,write the value of $\vert A \vert$. **SET-3**	2019	1
30	If $A = \begin{bmatrix} 4 & 2 \\ -1 & 1 \end{bmatrix}$, show that $(A - 2I)\ (A - 3I) = 0$.	2019	2
31	If $A = [2 \quad -3 \quad 4], B = \begin{bmatrix} 3 \\ 2 \\ 2 \end{bmatrix}, X = [1 \quad 2 \quad 3]$ and $Y = [2 \quad 3 \quad 4]$ then find $AB + XY$ (i) [28] (ii) [24] (iii) 28 (iv) 24	2020	1
32	If $\begin{bmatrix} x+y & 7 \\ 9 & x-y \end{bmatrix} = \begin{bmatrix} 2 & 7 \\ 9 & 4 \end{bmatrix}$ then $x \cdot y = \cdots$	2020	1
33	Find $adj\ A$ if $A = \begin{bmatrix} 2 & -1 \\ 4 & 3 \end{bmatrix}$	2020	1
34	If $A = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$ then find A^3	2020	1

S. No.	**DETERMINANTS**	**YEAR**	**MARKS**

1	Write the value of the following determinants: $\begin{vmatrix} a-b & b-c & c-a \\ b-c & c-a & a-b \\ c-a & a-b & b-c \end{vmatrix}$	2009	1
2	Find the value of x, form the following : $\begin{vmatrix} x & 4 \\ 2 & 2x \end{vmatrix}$=0	2009	1
3	Using the properties of the determinant, prove the following :$\begin{vmatrix} 1+x & 1 & 1 \\ 1 & 1+y & 1 \\ 1 & 1 & 1+z \end{vmatrix} = xyz + xy + yz + zx$	2009	4
4	Using the properties of the determinant, prove the following :$\begin{vmatrix} 1 & 1+p & 1+p+q \\ 2 & 3+2p & 1+3p+2q \\ 3 & 6+3p & 1+6p+3q \end{vmatrix} = 1$	2009	4
5	Using the properties of the determinant, prove the following :$\begin{vmatrix} x+y & x & x \\ 5x+4y & 4x & 2x \\ 10x+8y & 8x & 3x \end{vmatrix} = x^3$	2009	4
6	Using matrices solve the solve the following system of equations: $2x - y + z = 3$, $-x + 2y - z = -4$ $x - y + 2z = 1$ **OR** Obtain the inverse of the following matrix using elementary operations:$\begin{bmatrix} 3 & 0 & -1 \\ 2 & 3 & 0 \\ 0 & 4 & 1 \end{bmatrix}$	2009	6
7	What positive value of x makes the following determinants equal? $\begin{vmatrix} 2x & 3 \\ 5 & x \end{vmatrix} = \begin{vmatrix} 16 & 3 \\ 5 & 2 \end{vmatrix}$	2010	1
8	Using the properties of the determinant, prove the following :$\begin{vmatrix} x & x^2 & 1+px^3 \\ y & y^2 & 1+py^3 \\ z & z^2 & 1+pz^3 \end{vmatrix} = (1+pxyz)(x-y)(y-z)(z-x)$ **OR** Obtain the inverse of the following matrix using elementary operations:$\begin{bmatrix} 1 & 2 & -2 \\ -1 & 3 & 0 \\ 0 & -2 & 1 \end{bmatrix}$	2010	6
9	Using matrices solve the solve the following system of equations: $x + 2y - 3z = -4$ $2x + 3y + 2z = 2$ $3x - 3y - 4z = 11$ **OR**If a, b and c are positive and unequal, show that the following determinant is negative :$\Delta = \begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$	2010	6
10	Evaluate: $\begin{vmatrix} cos15^0 & sin15^0 \\ sin75^0 & cos75^0 \end{vmatrix}$	2011	1
11	Using the properties of the determinant, and solve for x :$\begin{vmatrix} x+a & x & x \\ x & x+a & x \\ x & x & x+a \end{vmatrix} = 0$	2011	4
12	Using the properties of the determinant, prove the following :$\begin{vmatrix} x-2 & 2x-3 & 3x-4 \\ x-4 & 2x-9 & 3x-16 \\ x-8 & 2x-27 & 3x-64 \end{vmatrix} = 0$	2011	4
13	Using the properties of the determinant, solve for x :$\begin{vmatrix} a+x & a-x & a-x \\ a-x & a+x & a-x \\ a-x & a-x & a+x \end{vmatrix} = 0$	2011	4

14	Using matrices solve the solve the following system of equations: $4x+3y+3z=4 \quad x+2y+3z=45 \;\; 6\,x+2y+3z=70$	2012	6
15	Using matrices solve the solve the following system of equations: $x+2y-3z=-4 \quad 2x+3y+2z=2 \;\; 3\,x-3y-4z=11$	2012	6
16	Using matrices solve the solve the following system of equations: $x+2y+z=7 \quad ,x++3z=11 \;\; 2\,x-3y=1$	2012	6
17	If A_{ij} is the cofactor of the element a_{ij} of the determinant $\begin{vmatrix} 2 & -3 & 5 \\ 6 & 0 & 4 \\ 1 & 5 & -7 \end{vmatrix}$, then write the value of A_{32} and a_{32}	2013	1
18	Using the properties of the determinant, prove the following : $\begin{vmatrix} x & x+y & x+2y \\ x+2y & x & x+y \\ x+y & x+2y & x \end{vmatrix} = 9y^2(x+y)$	2013	4
19	The management committee of a residential colony decided to award some of its members (say x) honesty, some (say y) for helping others and some other (say z) for supervising the workers to keep the colony neat and clean. The sum of all awards is 12, Three times the sum of awardees for cooperation and supervision added to two times of the number of awardees for the honesty is 33. If the sum of the numbers of awardees for honesty and supervision is twice the numbers of awardees for helping others. Using matrix method, find the number of awardees for each category. Apart from these value, namely, honesty, cooperation and supervision, suggest one more value which the management of the colony must include for awards.	2013	6
20	Using the properties of the determinant, prove the following : $\begin{vmatrix} x+y & x & x \\ 5x+4y & 4x & 2x \\ 10x+8y & 8x & 3x \end{vmatrix} = x^3$	2014	4
21	Using the properties of the determinant, prove that $\begin{vmatrix} b+c & c+a & a+bx \\ q+r & r+p & p+q \\ y+z & z+x & x+y \end{vmatrix} = 2\begin{vmatrix} a & b & c \\ p & q & r \\ x & y & z \end{vmatrix}$	2014	4
22	Using the properties of the determinant, prove the following : $\begin{vmatrix} 1+a & 1 & 1 \\ 1 & 1+b & 1 \\ 1 & 1 & 1+c \end{vmatrix} = abc+bc+ca+ab$	2014	4
23	Two school A and B want to award their students selected on the value of sincerity, truthfulness and helpfulness. The school A wants to award Rs. X each, Rs. Y each and Rs. Z each for the three respective value to 3,2 and 1 students respectively with a total award money of Rs. 1600. School B wants to spend Rs. 2300 to award its 4,1 and 3 students on the respective values (by giving the same award money to the three values as before.) If the total amount of award for one prize on each value is Rs. 900, using matrices, find the award money for each value. Apart from these three value, suggest one more value which should be considered for awards.	2014	6
24	If $A=\begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}$, then for any natural number n, find the value of $Det(A^n)$.	2015	1
25	Use the properties of determinants, prove that : $\begin{vmatrix} a^3 & 2 & a \\ b^3 & 2 & b \\ c^3 & 2 & c \end{vmatrix} = 2(a-b)(b-c)(c-a)(a+b+c)$	2015	4

26	For what value of k, the system has unique solution? $x + y + z = 2, 2x + y - z = 3\ 3x + 2y = kz = 4$	2016	1
27	A typist charges Rs. 145 for typing 10 English and 3 hindi pages, while charges for typing 3 English and 10 Hindi pages are Rs. 180. Using matrices, find the charges of typing one English and one Hindi page separately. However typist charges only Rs. 2 per page from a poor student Shyam for 5 Hindi pages. How much less was charged from this poor boy? Which values are reflected in this problem?	2016	4
28	For what values of k, the system of linear equations $x + y + z = 2, 2x + y - z = 3$ $3x + 2y + kz = 4$ has a unique solution?	2016	1
29	Using properties of determinant, prove that $\begin{bmatrix} (x+y)^2 & zx & zy \\ zx & (y+z)^2 & xy \\ zy & xy & (z+x)^2 \end{bmatrix} =$ $2xyz(x+y+z)^3$ **OR** If $A = \begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix}$ $and\ A^3 - 6A^2 + 7A + kI_3 = 0\ find\ k.$	2016	6
30	If A is a skew-symmetric matrix of order 3, then prove that det A=0.	2017	2
31	Using properties of determinants, prove that $\begin{vmatrix} a^2+1 & 2a+1 & 1 \\ 2a+1 & a+2 & 1 \\ 3 & 3 & 1 \end{vmatrix} = (a-1)^3$ **OR** Find a matrix A such that $\begin{bmatrix} 2 & -1 \\ 1 & 0 \\ -3 & 4 \end{bmatrix} A = \begin{bmatrix} -1 & -8 \\ 1 & -2 \\ 9 & 22 \end{bmatrix}$	2017	4
32	Determine the product $\begin{bmatrix} -4 & 4 & 4 \\ -7 & 1 & 3 \\ 5 & -3 & -1 \end{bmatrix} \begin{bmatrix} 1 & -1 & 1 \\ 1 & -2 & -2 \\ 2 & 1 & 3 \end{bmatrix}$ and use it to solve the system of equation $x - y + z = 4$,and $x - 2y - 2z = 9$ and $2x + y + 3z = 1$	2017	4
33	If $A = \begin{bmatrix} 2 & -3 & 5 \\ 3 & 2 & -4 \\ 1 & 1 & -2 \end{bmatrix}$, find A^{-1}. Hence using A^{-1} solve the system of equation $2x - 3y + 5z = 11, 3x + 2y - 4z = -5, x + y - 2z = -3.$	2017	6
34	Using the properties of the determinant, prove the following : $\begin{vmatrix} 1 & 1 & 1+3x \\ 1+3y & 1 & 1 \\ 1 & 1+3z & 1+c \end{vmatrix} = 9(3xyz + xy + yz + zx)$	2018	4
35	If $A = \begin{bmatrix} 2 & -3 & 5 \\ 3 & 2 & -4 \\ 1 & 1 & -2 \end{bmatrix}$, find A^{-1}. Hence using A^{-1} solve the system of equation $2x - 3y + 5z = 11, 3x + 2y - 4z = -5, x + y - 2z = -3.$	2018	6
36	Using the properties of the determinant, prove that $\begin{vmatrix} 3a & -a+b & -a+c \\ -b+a & 3b & -b+c \\ -c+a & -c+b & 3c \end{vmatrix} = (a+b+c)\,(bc+ca+ab)$	2019	4
37	If $A = \begin{bmatrix} 1 & 3 & 4 \\ 2 & 1 & 2 \\ 5 & 1 & 1 \end{bmatrix}$, find A^{-1}. Hence using A^{-1} solve the system of equation $x + 3y + 4z = 8, 2x + y + 2z = 5, 5x + y + z = 7.$ **OR** Find the inverse of the matrix by elementary transformations. $\begin{bmatrix} 2 & 0 & -1 \\ 5 & 1 & 0 \\ 0 & 1 & 3 \end{bmatrix}$	2019	6

38	If $A = \begin{bmatrix} p & 2 \\ 2 & p \end{bmatrix}$ and $\lvert A^3 \rvert = 125$, then find the value of p.	2019	2
39	If $\begin{vmatrix} 2 & 3 & 2 \\ x & x & x \\ 4 & 9 & 1 \end{vmatrix} + 3 = 0$ then find the value of x (i) 3 (ii) 0 (iii) -1 (iv) 1	2020	1
40	Using properties of determinants prove that: $\begin{vmatrix} a-b & b+c & a \\ b-c & c+a & b \\ c-a & a+b & c \end{vmatrix} = a^3 + b^3 + c^3 - 3abc$ **OR** If $A = \begin{bmatrix} 1 & 3 & 2 \\ 2 & 0 & -1 \\ 1 & 2 & 3 \end{bmatrix}$ $then\ show\ that A^3 - 4A^2 - 3A + 11I_3 = 0$. Hence find A^{-1}.	2020	6
41	Let $A = \begin{bmatrix} 200 & 50 \\ 10 & 2 \end{bmatrix}$ andd $B = \begin{bmatrix} 50 & 40 \\ 2 & 3 \end{bmatrix}$ then find $\lvert AB \rvert$	2020	1
42	If $A = \begin{bmatrix} a & 0 & 0 \\ 0 & a & 0 \\ 0 & 0 & a \end{bmatrix}$ then find the value of det $(adjA)$	2020	1
S.No.	**CONTINUITY AND DIFFERENTIABILITY**	**YEAR**	**MARKS**
1	If $y = 3e^{2x} + e^{3x}$,porve that $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = 0$	2009	4
2	If$sin\ y = x\sin(a+y)$,prove that $\frac{dy}{dx} = \frac{sin^2(a+y)}{\sin a}$ **OR** If $(\cos x)^y = (\sin y)^x, find\ \frac{dy}{dx}$	2009	4
3	If $y = \frac{\sin^{-1} x}{\sqrt{1-x^2}}$, show that $(1-x^2)\frac{d^2y}{dx^2} - 3x\frac{dy}{dx} - y = 0$	2009	4
4	If $y = e^x(\sin x + \cos x\ )$, then show that :$\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 2y = 0$	2009	4
5	If $y = \text{coses}^{-1} x, x > 1. then\ show\ that: x(x^2-1)\frac{d^2y}{dx^2} + (2x^2-1)\frac{dy}{dx} = 0$	2010	4
6	If $y = e^{a\sin^{-1} x}, -1 \le x \le 1, then\ show\ that:\ (1-x^2)\frac{d^2y}{dx^2} - x\frac{dy}{dx} - a^2y = 0$	2010	4
7	If $y = \cos^{-1}(\frac{3x+4\sqrt{1-x^2}}{5})\ , find\ \ \frac{dy}{dx}$.	2010	4
8	Find the relationship between a and b so that the function f defined by: $f(x) = \begin{cases} ax+1, & x \le 3 \\ bx+1, & x > 3 \end{cases}$ is continuous at $x = 3$ **OR** If $y^x = x^y$, show that $\frac{dy}{dx} = \frac{\log x}{\{\log(ex)\}^2}$	2011	4
9	If $x = \tan\left(\frac{1}{a}\log y\right), then\ show\ that:\ (1+x^2)\frac{d^2y}{dx^2} + (2x-a)\frac{dy}{dx} = 0$	2011	4
10	If $x = \sqrt{a^{\sin^{-1} t}}, y = \sqrt{a^{\cos^{-1} t}}$, then show that: $\frac{dy}{dx} = -\frac{y}{x}$ **OR** Differentiate $\tan^{-1}\left[\frac{\sqrt{1+x^2}-1}{x}\right]$ with respect to x	2012	4
11	If $x = a(\cos t + t\sin t) and\ y = a(\sin t - t\cos t), 0 < t < \frac{\pi}{2}, find\ \frac{d^2y}{dt^2}, \frac{d^2x}{dt^2}$ and $\frac{d^2y}{dx^2}$	2012	4
12	If $z = a\left(\cos t + \log tan\frac{t}{2}\right), y = a\ sin\ t$ find$\frac{d^2y}{dt^2}\ and\ \frac{d^2y}{dx^2}$	2012	4
13	If $y = (\tan^{-1} x)^2$, show that : $(1+x^2)^2\frac{d^2y}{dx^2} + 2x(1+x^2)\frac{dy}{dx} = 2$.	2012	4

14	If $y^x = e^{y-x}$ prove that $\frac{dy}{dx} = \frac{(1+\log y)^2}{logy}$	2013	4
15	Differentiate the following with respect to x: $\sin^{-1}(\frac{2^{x-1}.3^x}{1+(36)^x})$	2013	4
16	Find the value of k for which $f(x) = f(x) = \begin{cases} \frac{\sqrt{1+kx}-\sqrt{1-kx}}{x}, if -1 \leq x < 0 \\ \frac{2x+1}{2x-1}, if\ 0 \leq x < 1 \end{cases}$ **OR** If $x = a\ cos^3\theta\ and\ y = a\ sin^3\theta$, then find the value of $\frac{d^2y}{dx^2}$ at $\theta = \frac{\pi}{6}$	2013	4
17	If $x = a\sin 2t(1+\cos 2t) and\ y = b\cos 2t\ (1 - cos2t)$,then show that at t= $\frac{\pi}{4}, \frac{dy}{dx} = \frac{b}{a}$	2014	4
18	If $x = ae^x(\sin\theta - \cos\theta) and\ y = be^x(\sin\theta + \cos\theta)$ then find the value of $\frac{dy}{dx}\ at\ \theta = \frac{\pi}{4}$	2014	4
19	If$x = \cos t(3 - 2cos^2t)\ \ and\ y = sint(3 - 2sin^2t)$ find the value of $\frac{dy}{dx}$at t= $\frac{\pi}{4}$	2014	4
20	Discuss the continuity and differentiability of the function $f(x) = \|x\| + \|x-1\|$ in the interval (-1,2).	2015	4
21	If $= a(\cos 2t + 2t\sin 2\,t) and\ y = a(\sin 2\,t - 2t\cos 2\,t), find\ \frac{d^2y}{dx^2}$.	2015	4
22	If $(ax+b)e^{y/x} = x$, then show that $x^3\left(\frac{d^2y}{dx^2}\right) = (x\frac{dy}{dx} - y)^2$	2015	4
23	If $f(x) = \begin{cases} \frac{\sin(a+1)x + 2\sin x}{x}, & x < 0 \\ 2 & x = 0 \\ \frac{\sqrt{1+bx-1}}{x} & x > 0 \end{cases}$ is continuous at $x = 0$ then find the value of *a* and *b*.	2016	4
24	If $xcos\ (a+y) = \cos y$ then show that $\frac{dy}{dx} = \frac{cos^2(a+y)}{\sin a}$ Hence show that $\frac{d^2y}{dx^2} + sin2(a+y)\frac{dy}{dx} = 0$ **OR** If $y = \sin^{-1}\left[\frac{6x-4\sqrt{1-4x^2}}{5}\right]$ find $\frac{dy}{dx}$	2016	4
25	Determine the value of 'k' for which the following function is continuous at $x = 3$. $f(x) = \begin{cases} \frac{(x+3)^2 - 36}{x-3} & , x \neq 3 \\ k & , x = 3 \end{cases}$	2017	1
26	Find the value of c in Rolle's theorem for the function $f(x) = x^2 - 3x, [-\sqrt{3}, 0]$.	2017	2
27	If $y^x + x^y = a^b$, then find $\frac{dy}{dx}$ **OR** If $e^y(x+1) = 1$ then show that $\frac{d^2y}{dx^2} = (\frac{dy}{dx})^2$	2017	4
28	Differentiate $\tan^{-1}\left(\frac{1+\cos x}{\sin x}\right)$ w.r. t. x.	2018	2
29	If $(x^2+y^2)^2 = xy$, find $\frac{dy}{dx}$ **OR** If $x = a\ (2\theta - \sin 2\theta)\ and\ y = a(1 - cos2\theta),\ find\ \frac{dy}{dx}$ when $\theta = \frac{\pi}{4}$	2018	4
30	If $y = \sin\ (\sin x)$, prove that $\frac{d^2y}{dx^2} + \tan x\frac{dy}{dx} + ycos^2x = 0$.	2018	4
31	If $y = x\|x\|$, find $\frac{dy}{dx}$ for $x < 0$ **SET-1** Differentiate $e^{\sqrt{3x}}$ with respect to x. **SET-2** If $y = \cos\sqrt{3x}$, then find $\frac{dy}{dx}$. **SET-3**	2019	1
32	$if\ x\sqrt{1+y} + y\sqrt{1+x} = 0$ and $x \neq y$, prove that $\frac{dy}{dx} = \frac{-1}{(x+1)^2}$.	2019	4

	OR If $(\cos x)^y = (\sin y)^x, find\ \frac{dy}{dx}$ **SET-1,2** If $x = ae^t(\sin t + \cos t)$ and $y = ae^t(\sin t - \cos t)$ then prove that $\frac{dy}{dx} = \frac{x+y}{x-y}$ **OR** Differentiate $x^{\sin x} + (\sin x)^{\cos x}$ with respect to x. **SET-3**		
33	If $(x-a)^2 + (y-b)^2 = c^2$ for $c > 0$ prove that $\frac{\left(1+(\frac{dy}{dx})^2\right)^{3/2}}{\frac{d^2y}{dx^2}}$ is constant independent of a and b. **SET-1,3** If $(a+bx)e^{y/x} = x, (x\frac{dy}{dx} - y)^2$ **SET-2**	2019	4
34	The number of points of discontinuity of the function $f(x) = \|x\| - \|x+1\| = \cdots$	2020	1
35	Find the value of $\frac{dy}{dx}$ at $\theta = \frac{\pi}{3}$, if $x = \cos\theta - \cos 2\theta$, $y = \sin\theta - \sin 2\theta$	2020	2
36	If $y = \sin^{-1}\left(\frac{\sqrt{1-x}+\sqrt{1+x}}{2}\right)$ then prove that $\frac{dy}{dx} = \frac{-1}{2\sqrt{1-x^2}}$ **OR** Verify the Rolle's theorem for the function $y = e^x \cos x$ in the interval $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$.	2020	4
37	$f(x) = 2\|x\| + 2\|\sin x\| + 6$ then the right hand derivative of $f(x)$ at $x = 0$	2020	1
38	Find the derivative of $x^{\log x}$	2020	1
39	If $f(x) = x\|x\|$ then $f'(x) =$	2020	1

S.No.	APPLICATION OF DERIVATIVE	YEAR	MARKS
1	The length x of a rectangle is decreasing at the 5 cm/minute and the width y is increasing at the rate of 4 cm/minute. When x=8cm and y= 6 cm, find the rate of change of (i) the perimeter (ii) the area of the rectangle. **OR** Find the interval in which the function *f* given by $f(x) = \sin x + \cos x, 0 \le x \le 2\pi$ is strictly increasing or strictly decreasing.	2009	4
2	If the sum of the hypotenuse and a side of a right angled triangle is given, show that the area of triangle is maximum, when the angle between them is $\frac{\pi}{3}$ **OR** A manufacturer can sell x items at a price of Rs. (5-$\frac{x}{100}$) each. The cost price of x items is Rs. (500+-$\frac{x}{5}$). Find the number of items he should sell to earn maximum profit.	2009	6
3	Find the equation of tangent and normal to the curve $x = (1-\cos\theta), y = \theta - \sin\theta\ at\ \theta = \frac{\pi}{4}$	2010	6
4	Show that the volume of the greatest cylinder that can be inscribed in a cone of height 'h' and semi-vertical angle 'α' $is\ \frac{4}{27}\pi h^3 tan^2\alpha$	2010	6
5	The length three side of a trapezium other than the base is 10 cm each; find the area of the trapezium, when it is maximum.	2010	6
6	Find the interval in which the function *f* given by $f(x) = \sin x + \cos x, 0 \le x \le 2\pi$ is strictly increasing or strictly decreasing	2010	6
7	Prove that the function $y = \frac{4\sin\theta}{2+\cos\theta} - \theta$ is an increasing in the interval $\left[0, \frac{\pi}{2}\right]$ **OR** If the radius of a sphere is measured as 9 cm with an error of 0.03cm, then find the approximate error in calculating its surface area.	2011	4
8	Show that the right- circular cone of least curved surface area and given volume	2011	6

	has an altitude equal to $\sqrt{2}$ times the radius of the base. **OR** A window has the shape of a rectangle surmounted by an equilateral triangle. If the perimeter of the window is 12m, find the dimensions of the rectangle that will produce the largest area of the window.		
9	A ladder 5m is long is leaning against a wall. The bottom of the ladder is pulled along the ground, away from the wall, at the rate of 2 cm/s. How fast is its height on the wall is decreasing when the foot of the ladder is 4m away from the wall?	2012	4
10	Prove that the radius of the right circular cylinder of greatest curved surface area which can be inscribed in a given cone is half of that of the cone. **OR** An open box with the square is to be made out of a given quantity of cardboard of area c^2 square units. Show that the maximum volume of the box is $\frac{c^3}{6\sqrt{3}}$	2012	6
11	The money to be spent on the welfare of the employees of a firm is proportional to the rate of change of its total revenue (marginal revenue). If the total revenue (in Rs.) received from the sale of x units of a product is given by $R(x) = 3x^2 + 36x + 5$, find the marginal revenue when x=5, and write which value does the equation indicates.	2013	1
12	Find the area of the greatest rectangle that can be inscribed in an ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ **OR** Find the equation of tangents to the curve $3x^2 - y^2 = 8$ which passes through $(\frac{4}{3}, 0)$	2013	6
13	Find the value of x for which $y = [x(x-2)]^2$ is increasing function. **OR** Find the equation of the tangent and normal to the curve $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ at the point $\left(\sqrt{2}a, b\right)$	2014	4
14	Show that the altitude if the right circular cone of maximum volume that can be inscribed in a sphere of radius r is $\frac{4r}{3}$. Also show that the maximum volume of the cone is $\frac{8}{27}$of the volume of the sphere.	2014	6
15	Prove that the height of the cylinder of maximum volume that can be inscribed in a sphere of radius R is $\frac{2R}{\sqrt{3}}$. Also find the maximum volume.	2014	6
16	If the sum of the hypotenuse and a side of a right angled triangle is given, show that the area of triangle is maximum, when the angle between them is $\frac{\pi}{3}$	2014	6
17	Tangent to circle $x^2 + y^2 = 4$ at any point on it in the first quadrant makes intercepts OA and OB on x and y axis respectively, O being the centre of the circle. Find the minimum distance value of (OA+OB).	2015	6
18	Prove that the function $y = \frac{4\sin\theta}{2+\cos\theta} - \theta$ is an increasing in the interval $\left[0, \frac{\pi}{2}\right]$ **OR** Show that the semi-vertical angle of maximum volume and given slant height is $\cos^{-1}\frac{1}{\sqrt{3}}$	2016	6
19	Find the equation of tangents to the curve $y = x^3 + 2x - 4$, which are	2016	4

	13erpendicular to line $x + 14y + 3 = 0$.		
20	The volume of a cube is increasing at the rate of 9 $\frac{cm^3}{s}$. How fast is its surface area increasing when the length of an edge is 10cm ?	2017	2
21	Show that the function $f(x) = x^3 - 3x^2 + 6x - 100$ id increasing function on R.	2017	2
22	The length x, of a rectangle is decreasing at he rate of 5cm/minute and the width y, is increasing at the rate of 4 cm/minute. When $x = 8$ cm and $y = 6$ cm, find the rate of change of the area of the rectangle.	2017	2
23	The volume of the sphere is increasing at the rate of 8 $\frac{cm^3}{s}$. Find the rate at which its surface area is increasing when the radius of the sphere is 12 cm.	2017	2
24	Show that the surface area of a closed cuboid with square base and given volume is minimum, when it is a cube.	2017	6
	AB is the diameter of the circle and C is any point on the circle. Show that the area of triangle ABC is maximum, when it is an isosceles triangle.	2017	6
25	A window in the form of rectangle surmounted by a semicircular opening. The total perimeter of the window is 10 m. Find the dimensions of the window to admit maximum light through the whole opening.		
26	The total cost $C(x)$ associated with the production of x units of item is given by $C(x) = 0.005x^3$-0.02$x^2 + 30x + 5000$. Find the marginal cost when 3 units are produced, where by marginal cost we mean the instantaneous rate of change of total cost at any level of output.	2018	2
27	Find the equation of tangent and normal to the curve16 $x^2 + 9y^2 = 145$ at the point (x_1, y_1) where $x_1 = 2$ and $y_1 > 0$. **OR** Find the intervals in which the function $f(x) = \frac{x^4}{4} - x^3 - 5x^2 + 24x + 12$ is (a) strictly increasing, (b) strictly decreasing.	2018	4
28	An open tank with square base and vertical sides is to be constructed from a metal sheet so as to hold a given quantity of water. Show that the cost of material will be least when depth of the tank is half of its width. If the cost is to be borne by nearby settled lower income families, for whom water will be provided, what kind of value is hidden in this question?	2018	4
29	Find the equation of the normal to the curve $x^2 = 4y$ which passes through the point $(-1, 4)$. **SET-1** The volume of a cube is increasing at the rate of 8 $cm^3/_s$. How fast is the surface area increasing when the length of its edge is 12cm. **SET-2**	2019	4
30	Prove that the height of the cylinder of maximum volume that can be inscribed in a sphere of radius R is $\frac{2R}{\sqrt{3}}$. Also find the maximum volume. **SET-1** Find the point on the curve $y^2 = 4x$, which is nearest to the point $(2, -8)$. **SET-2**	2019	6
31	The slop of tangent to the curve $y = x^3 - x$ at the point $(2, 6)$ is … **OR** The rate of change of area of circle with respect to its radius r, when $r = 3\ cm$ is …	2020	1
32	Show that the function $f(x) = \frac{x}{3} + \frac{3}{x}$ is decreases in the interval $(-3, 0) \cup (0, 3)$	2020	2
33	Show that the function f defined by $f(x) = (x-1)e^x + 1$ is an increasing function for all $x > 0$.	2020	2
34	Find the intervals in which $f(x) = (x-1)^3(x-2)^2$ is (a) strictly increasing (b) strictly decreasing. **OR** Find the dimension of rectangle of perimeter 36 cm which will sweep out a volume as large as possible, when revolved about one of its side. Also find the maximum volume.	2020	6

S.No.	INTEGRAL	YEAR	MARKS
1	Evaluate: $\int \frac{sin\sqrt{x}}{\sqrt{x}}$	2009	1
2	Evaluate: $\int_0^{\frac{1}{\sqrt{2}}} \frac{1}{\sqrt{1-x^2}}$	2009	1
3	Evaluate: $\int \frac{cos\sqrt{x}}{\sqrt{x}}$	2009	1
4	Evaluate: $\int \frac{sec^2\sqrt{x}}{\sqrt{x}}$	2009	1
5	Evaluate: $\int \frac{dx}{\sqrt{5-4x-2x^2}}$ **OR** Evaluate: $\int x \sin^{-1} x\, dx$	2009	4
6	Evaluate: $\int_0^{\pi} \frac{x\, dx}{a^2cos^2x+b^2sin^2x}$	2009	6
7	Evaluate: $\int sec^2(7-4x)\, dx$	2010	1
8	Write the value of the following integral: $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} sin^5x\, dx$	2010	1
9	Evaluate: $\int \frac{5x+3}{\sqrt{x^2+4x+10}}\, dx$	2010	4
10	Evaluate: $\int_1^2 \frac{5x^2}{x^2+4x+3}\, dx$	2010	4
11	Evaluate: $\int \frac{x+2}{\sqrt{(x-2)(x-3)}}\, dx$	2010	4
12	Evaluate: $\int \frac{e^{\tan^{-1}x}}{1+x^2}\, dx$	2011	1
13	Evaluate: $\int (ax+b)^3\, dx$	2011	1
14	Evaluate: $\int \frac{dx}{\sqrt{1-x^2}}$	2011	1
15	Evaluate: $\int \frac{(\log x)^2}{x}\, dx$	2011	1
16	Evaluate: $\int_0^1 \log(\frac{1}{x}-1)\, dx$	2011	4
17	Evaluate: $\int_0^{\frac{\pi}{2}} \frac{x+\sin x}{1+\cos x}\, dx$	2011	4
18	Evaluate: $\int_0^{\frac{\pi}{4}} \log(1+\tan x)dx$	2011	4
19	Evaluate: $\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{dx}{1+\sqrt{tanx}}$**OR** Evaluate: $\int \frac{6x+7}{\sqrt{(x-5)(x-4)}}\, dx$	2011	6
20	Evaluate: $\int_0^2 \sqrt{4-x^2}\, dx$	2012	1
21	Given $e^x(1+\tan x)\sec x\, dx = e^x f(x) + c$.Write $f(x)$ satisfying the above	2012	1
22	Evaluate: $\int_{-1}^2 \lvert x^3 - x\rvert\, dx$**OR** Evaluate:$\int_0^{\pi} \frac{x\sin x}{1+cos^2x}\, dx$	2012	4
23	Evaluate: $\int \frac{x\sin^{-1}x}{\sqrt{1-x^2}}\, dx$ $OR \quad Evaluate{:}\ \int \frac{1+x^2}{(x-1)^2(x+3)}\, dx$	2012	6
24	Evaluate: $\int \frac{\cos 2x - cos2\alpha}{\cos x - \cos\alpha}\, dx$**OR** Evaluate: Evaluate:$\int \frac{x+2}{\sqrt{x^2+2x+3}}\, dx$	2013	4
25	Evaluate: $\int \frac{dx}{x(x^5+3)}$	2013	4

26	Evaluate: $\int_0^{2\pi} \frac{1}{1+e^{\sin x}}\, dx$	2013	4
27	Evaluate: $\int_1^3 [\lvert x-1\rvert + \lvert x-2\rvert + \lvert x-3\rvert]\, dx$	2013	4
28	$Evaluate: \int \frac{1+x^2}{(x^2+4)(x^2+25)}\, dx$	2013	4
29	$Evaluate: \int \frac{1+2x^2}{(x^2+4)x^2}\, dx$	2013	4
30	Evaluate: $\int_1^3 [\lvert x-5\rvert + \lvert x-2\rvert + \lvert x-3\rvert]\, dx$	2013	4
31	If $f(x) = \int_0^x t \sin t\, dt, then\ write\ the\ value\ of\ f'(x).$	2014	1
32	Evaluate: $\int_2^4 \frac{x}{1+x^2}\, dx$	2014	1
33	Evaluate: $\int_e^{e^2} \frac{dx}{x \log x}$	2014	1
34	If $\int_0^a \frac{1}{4+x^2}\, dx = \frac{\pi}{8}$ then find the value of *a*	2014	1
35	Evaluate: $\int_0^\pi \frac{x \sin x}{1+cos^2 x}\, dx$ **OR** Evaluate: $\int \frac{x+2}{\sqrt{x^2+5x+6}}\, dx$	2014	4
36	Evaluate: $\int \frac{dx}{cos^4 x + sin^4 x}$	2014	6
37	Evaluate: $\int \left(\sqrt{\cot x} + \sqrt{\tan x}\right) dx$	2014	6
38	Evaluate: $\int \frac{dx}{cos^4 x + sin^4 x + sin^2 x\, cos^2 x}$	2014	6
39	Evaluate: $\int \frac{\sin x - x \cos x}{x(x+\sin x)}\, dx$**OR**$\int \frac{\boldsymbol{x^3}}{(\boldsymbol{x-1})(x^2+1)} \boldsymbol{dx}$	2015	4
40	Evaluate: $\int_0^{\frac{\pi}{2}} \frac{cos^2 x}{1+3sin^2 x}\, dx$	2015	4
41	Evaluate: $\int_0^{\frac{\pi}{4}} \frac{\sin x + \cos x}{3+\sin 2x}\, dx$	2015	4
42	Find $\int (x+3)\sqrt{3-4x-x^2}\, dx$	2016	4
43	Evaluate: $\int_{-2}^2 \frac{x^2}{1+5^x}\, dx$	2016	4
44	$\int \frac{\boldsymbol{(2x-3)e^{2x}}}{(2x-3)^3} \boldsymbol{dx}$ **OR** $\int \frac{\boldsymbol{x^2+x+1}}{(\boldsymbol{x+2})(x^2+1)} \boldsymbol{dx}$	2016	4
45	Find : $\int \frac{sin^2 x - cos^2 x}{sinx\ cosx}\, dx$	2017	1
46	Find: $\int \frac{dx}{5-8x-x^2}$	2017	2
47	$Evaluate: \int \frac{\cos\theta\, d\theta}{(4+sin^2\theta)(5-4cos^2\theta)}$	2017	4
48	$Evaluate: \int_0^\pi \frac{x \tan x}{\sec x + \tan x} dx$ **OR** Evaluate: $\int_1^4 [\lvert x-1\rvert + \lvert x-2\rvert + \lvert x-4\rvert]\, dx$	2017	4
49	$Evaluate: \int \frac{sin\theta\, d\theta}{(4+cos^2\theta)(2-sin^2\theta)}$	2017	4
50	Find: $\int \frac{\boldsymbol{e^x}}{(\boldsymbol{e^x+2})(\boldsymbol{e^x}-1)^2} \boldsymbol{dx}$	2017	4
51	Evaluate: $\int \frac{\cos 2x + 2sin^2 x}{cos^2 x}\, dx$	2018	2
52	Evaluate: $\int \frac{2 \cos x\, dx}{(1-\sin x)(1+sin^2 x)}$	2018	4
53	Evaluate: $\int_0^{\frac{\pi}{4}} \frac{\sin x + \cos x}{16+9 \sin 2x}\, dx$	2018	4

54	Evaluate: $\int_1^3 (x^2+3x+e^x)dx$ as the limit of sum	2018	6
55	Find $\int \sqrt{3-2x-x^2}\, dx$	2019	2
56	Find: Find : $\int \frac{sin^3x+cos^3x}{sin^2x\, cos^2x}\, dx$ **OR** Find : $\int \frac{(x-3)e^x}{(x-1)^3} dx$ **SET-1,2** Find : $\int \frac{(x-5)e^x}{(x-3)^3} dx$ **SET-3**	2019	2
x57	Find : $\int \frac{x^2+x+1}{(x+2)(x^2+1)}\, dx$	2019	4
58	Prove that $\int_0^a f(x)\ dx = \int_0^a f(a-x)\, dx$ and hence evaluate: $\int_0^{\frac{\pi}{2}} \frac{x}{\sin x+\cos x}\, dx$	2019	4
59	$\int_0^{\frac{\pi}{8}} tan^2(2x)dx =$ (i) $\frac{4-\pi}{8}$ (ii) $\frac{4+\pi}{8}$ (iii) $\frac{4-\pi}{4}$ (iv) $\frac{4-\pi}{2}$	2020	1
60	Find $\int \frac{2^{x+1}-5^{x-1}}{10^x} dx$	2020	1
61	Evaluate $\int_0^{2\pi} \|\sin x\| dx$	2020	1
62	If $\int_0^a \frac{1}{1+4x^2}\ dx = \frac{\pi}{8}$ then find the value of a **OR** Find $\int \frac{dx}{\sqrt{x}+x}$	2020	1
63	Evaluate:$\int_0^{\pi} \frac{x\sin x}{1+cos^2x}\ dx.$	2020	4
64	Find $\int sin^5\frac{x}{2}\cos\frac{x}{2}dx$	2020	1
65	Evaluate :$\int_{-1}^{2} \|x^3-x\| dx$	2020	4
66	Find $\int \frac{1}{x(1+x^2)}dx$	2020	1
67	If $[x]$ denotes the greatest integer function then $\int_0^{3/2} [x^2]\, dx$	2020	1
68	Evaluate $\int_0^1 \sqrt{3-2x-x^2}\ dx$	2020	4

S.No.	APPLICATION OF INTEGRAL	YEAR	MARKS
1	Find the area bounded by the curves $y^2=4ax$ and $x^2=4ay$	2009	6
2	Find the area of the region included between the parabola $y^2=x$ and the line $x+y=2$	2009	6
3	Find the area of the region included between the parabola $3x^2=4y$ and the line $3x-2y+12=0$	2009	6
4	Find the area of the circle $4x^2+4y^2=9$ which is interior to the parabola $x^2=4y$. **OR** Using integration, find the area of the triangle ABC, coordinate of whose vertices are A(4,1), B(6,6) and C (8,4).	2010	6
5	Sketch the curve graph of $y=\|x+3\|$ and valuate the area under the curve $y=\|x+3\|$ above x – axis and between x =-6 to $x=0$.	2011	6
6	Find the area of the region $\{(x,y): x^2+4y^2\le 4, x+y\ge 2\}$	2012	6

7	Find the area of the region bounded by the parabola $y^2 = x$ and $y = \|x\|$	2013	6
8	Using integration, find the area of the region bounded by the triangle whose vertices are (-1,2), (1,5) and (3,4).	2014	6
9	If the area bounded by the parabola $y^2 = 16ax$ and line $y = 4mx$ is $\frac{a^2}{12}$ units, then using integration, find the value of m.	2015	6
10	Using integration, find the area of the region bounded by the triangle whose vertices are (2,-2), (4,3) and (1,2).	2016	6
11	Using integration, find the area of the triangle ABC, coordinate of whose vertices are A(4,1), B(6,6) and C (8,4). **OR** Find the area enclosed between parabola $4y = 3x^2$ and the straight line $3x - 2y + 12 = 0$	2017	6
12	Using integration, find the area of the region in the first quadrant enclosed by the x-axis , the line $y = x$ and the circle $x^2 + y^2 = 32$.	2018	6
13	Using integration, find the area of the region bounded by the triangle whose vertices are (1,0), (2,2) and (3,1). **OR** Using method of integration, find the area of the region enclosed between two circles $x^2 + y^2 = 4$ and $(x-2)^2 + y^2 = 4$. **SET-1** Find $\int_1^3 (x^2 + 2 + e^{2x})\, dx$ **OR** Using integration, find the area of the triangular region whose sides have the equations $y = 2x + 1, y = 3x + 1$ and $x = 4$. **SET-2**	2019	6
14	Find the area lying in first quadrant and enclosed by x-axis, the line $y = x$ and circle $x^2 + y^2 = 32$.	2020	6
15	Using integration find the area of the region bounded by $\{(x, y): 0 \le y \le x^2, 0 \le y \le x, 0 \le x \le 2\}$	2020	6
S.No.	**DIFFRENTIAL EQUATIONS**	**YEAR**	**MARKS**
1	Form the differential equation representing the family of curve given by $(x-a)^2 + 2y^2 = a^2$ where a is constant	2009	4
2	Solve the following differential equation: $x\frac{dy}{dx} = y - x\tan(\frac{y}{x})$	2009	4
3	Solve the following differential equation: $cos^2 x \frac{dy}{dx} + y = \tan x$	2009	4
4	Form the differential equation of the family of circles touching the y- axis at origin.	2009	4
5	Solve the differential equation: $(x^2 - 1)\frac{dy}{dx} + 2xy = \frac{1}{x^2-1}$; $\|x\| \neq 1$ **OR** Solve the differential equation: $\sqrt{1 + x^2 + y^2 + x^2y^2} + xy\frac{dy}{dx} = 0$	2010	4
6	Solve the differential equation: $(x^2 + 1)\frac{dy}{dx} + 2xy = \sqrt{x^2 + 4}$ **OR** Solve the differential equation: $(x^3 + x^2 + x + 1)\frac{dy}{dx} = 2x^2 + x$	2010	4
7	Show that the differential equation $(x - y)\frac{dy}{dx} = x + 2y$, is homogeneous and solve it.	2010	4
8	Show that the differential equation is homogeneous and solve it. $ydx + x\log\left(\frac{y}{x}\right)dy - 2xdy = 0$	2010	4
9	Solve the differential equation: $x\,dx + (y - x^3)dx = 0$	2011	4

10	Solve the differential equation: $x\,dy - y\,dx = \sqrt{x^2+y^2}\,dx$	2011	4
11	Solve the differential equation: $(y+3x^2)\frac{dx}{dy} = x$	2011	4
12	Solve the differential equation: $x\,dy - (y+2x^2)dx = 0$	2011	4
13	Solve the differential equation: $(1+x^2)dy + 2xy\,dx = \cot x\,dx; x \neq 0$	2012	4
14	Find the particular solution of the differential equation $\frac{dy}{dx} + y\cot x = 4xcosecx, (x \neq 0)\ given\ that\ when\ x = \frac{\pi}{2}, y = 0$	2012	4
15	Find the particular solution of the differential equation $x\frac{dy}{dx} - y + xsin\left(\frac{y}{x}\right) = 0.\ given\ that\ when\ x = 2, y = \pi$	2012	4
16	Write the differential equation representing family of curve $y = mx$ where m is arbitrary constant.	2013	1
17	Write the degree of the differential equation: $(\frac{dy}{dx})^4 + 3x\frac{d^2y}{dx^2} = 0$	2013	1
18	Write the degree of the differential equation: $x(\frac{d^2y}{dx^2})^3 + y(\frac{dy}{dx})^4 + x^3 = 0$	2013	1
19	Find the particular solution of the differential equation: $(\tan^{-1}y - x)dy = (1+y^2)dx\ given\ that\ \ when\ x = 0\,, y = 0$	2013	4
20	Show that the differential equation $x\frac{dy}{dx}sin\left(\frac{y}{x}\right) + x - ysin\left(\frac{y}{x}\right) = 0$is homogeneous. Find the particular solution of this differential equation given that $x = 1\,, y = \frac{\pi}{2}$	2013	4
21	Show that the differential equation $\left(xe^{y/x} + y\right)dx = x\,dy$ is homogeneous. Find the particular solution of this differential equation given that $x = 1\,, y = 1$	2013	4
22	Find the particular solution of the differential equation $\frac{dy}{dx} = 1 + x = y + xy$, given that $y = 0\ when\ x = 1$	2014	4
23	Solve the differential equation: $(x^2+1)\frac{dy}{dx} + y = e^{\tan^{-1}x}$	2014	4
24	Find the particular solution of the differential equation $x(1+y^2)dx - y(1+x^2)dy = 0$ given that $y = 1\ when\ x = 0$	2014	4
25	Find the particular solution of the differential equation $\log\left(\frac{dy}{dx}\right) = 3x + 4y$ given that $y = 0\ when\ x = 0$	2014	4
26	Find the sum of the order and degree of the following differential equation: $y = x.\left(\frac{dy}{dx}\right)^3 + \frac{d^2y}{dx^2}$	2015	1
27	Find the solution of the differential equation: $x\sqrt{1+y^2}\,dx +\ y\sqrt{1+x^2}\,dy = 0$.	2015	1
28	Show that the differential equation $(x-y)\frac{dy}{dx} = x + 2y$ is homogeneous and solve it. **OR** Find the differential equation of the family of curves $(x-h)^2 + (y-k)^2 = r^2$, where h and k are arbitrary constants.	2015	6
29	Find the particular solution of this differential equation $ye^{x/y}dx + \left(y - 2xe^{x/y}\right)dy = 0$ given that $x = 0\,, y = 1$is homogeneous.	2016	4
30	Find the particular solution of this differential equation $\frac{dy}{dx} = -\frac{x+y\cos x}{1+\sin x}$ given that , $y = 1 whren\ x = 0$.	2016	4
31	Solve the differential equation: $(\tan^{-1}x - y)dx = (1+x^2)dy$	2017	4

32	Find the particular solution of the differential equation $(x-y)\frac{dy}{dx}=(x+2y)$, given that $y=0$ when $x=1$.	2017	4
33	Find the general solution of the differential equation $y\,dx-(x+2y^2)dy=0$.	2017	4
34	Find the general solution of the differential equation $\frac{dy}{dx}-y=\sin x$	2017	6
35	Find the differential equation representing the family of curves $y=ae^{bx+c}$, where a and b are arbitrary constant.	2018	2
36	Find the particular solution of the differential equation $e^x\tan y\,dx+(2-e^x)sec^2xdy$ Given that $y=\frac{\pi}{4}$ when $x=0$ **OR** Find the particular solution of the differential equation $\frac{dy}{dx}+2y\tan x=\sin x$, given that $y=0$ when $x=\frac{\pi}{3}$.	2018	4
37	Find the order and degree(id defined) of the differential equation $\frac{d^2y}{dx^2}+x\left(\frac{dy}{dx}\right)^2=2x^2\log(\frac{d^2y}{dx^2})$ **SET-1,2** Find the differential equation representing the family of curves $y=ae^{2x+b}$, where a arbitrary constant. **SET-3**	2019	1
38	Find the differential equation of the family of curves $y=Ae^{2x}+Be^{-2x}$, where A and B are arbitrary constant. **SET-1** Find the general solution of the differential equation $\frac{dy}{dx}=e^{x+y}$. **SET-2**	2019	2
39	Solve the differential equation: $x\frac{dy}{dx}=y-x\,tan\frac{y}{x}$ **OR** $\frac{dy}{dx}=-\left[\frac{x+y\cos x}{1+\sin x}\right]$	2019	4
40	Show that the function $y=ax+2a^2$ is solution of the differential equation $2\left(\frac{dy}{dx}\right)^2+x\left(\frac{dy}{dx}\right)-y=0$	2020	1
41	Find the solution of the differential equation given below, satisfying the given condition $(x+1)\frac{dy}{dx}=2e^{-y}+1\,;y=0$ when $x=0$.	2020	4
42	Find the general solution of the the differential equation $\frac{dy}{dx}+\frac{1}{x}=\frac{e^y}{x}$	2020	4

4S.No.	VECTOR ALGEBR	YEAR	MARKS
1	Find the value of $p\ if\ (i+6j+27k)\times(i+3j+pk)=\vec{0}$	2009	1
2	If $\vec{p}$ is a unit vector and $(\vec{x}-\vec{p})(\vec{x}+\vec{p})$=80 then find $\|\vec{x}\|$	2009	1
3	The scalar product of the vector $i+j+k$with the unit vector along the sum of vector $2i+4j-5k\ and\ \lambda i+2j+3k$ is equal to one. Find the value of λ	2009	4
4	Vector $\vec{a}$ and $\vec{b}$ are such that $\|\vec{a}\|=\sqrt{3},\|\vec{b}\|=\frac{2}{3}$ and $(\vec{a}\times\vec{b})$ is the unit vector. Write the angle between $\vec{a}$ and $\vec{b}$.	2010	1
5	Write a vector of magnitude 9 units in the direction of vector $-2i+j+2k$	2010	1
6	Find $\lambda\ if\ (2i+6j+14k)\times(i-\lambda j+7k)=\vec{0}$	2010	1
7	Vector $\vec{a}$ and $\vec{b}$ are such that $\|\vec{a}\cdot\vec{b}\|=\left\|\overrightarrow{a\times b}\right\|$, then what is the angle between $\vec{a}$ and $\vec{b}$	2010	1
8	If $\vec{a}=i+j+k,\vec{b}=4i-2j+3k\ and\ \vec{c}=i-2j+k$, find a vector of magnitude 6 units which is parallel to the vector $2\vec{a}-\vec{b}+3\vec{c}$.	2010	4

	OR Let $\vec{a} = i + 4j + 2k, \vec{b} = 3i - 2j + 7k$ and $\vec{c} = 2i - j + 4k$. Find a vector $\vec{d}$ which is perpendicular to both $\vec{a}$ and $\vec{b}$ and $\vec{c} \cdot \vec{d} = 18$		
9	Write the angle between two vector $\vec{a}$and $\vec{b}$ with magnitude $\sqrt{3}$and 2 respectively having $\vec{a} \cdot \vec{b} = \sqrt{6}$	2011	1
10	Write the projection of the vector$i - j$ on the vector $i + j$	2011	1
11	Write the unit vector in the direction of the vector $\vec{a} = 2i + j + 2k$	2011	1
12	Using vector, find the area of the triangle with vertices A(1,1,2), B(2,3,5) and C(1,5,5).	2011	4
13	Write the value of: $(i \times j) \cdot k + i \cdot j$	2012	1
14	Find the scalar components of vector $\overrightarrow{AB}$ with initial point A(2,1) an terminal point(-5,7)	2012	1
15	Write the value of: $(k \times j) \cdot i + j \cdot k$	2012	1
16	Let $\vec{a} = i + 4j + 2k, \vec{b} = 3i - 2j + 7k$ and $\vec{c} = 2i - j + 4k$. Find a vector $\vec{p}$ which is perpendicular to both $\vec{a}$ and $\vec{b}$ and $\vec{c} \cdot \vec{p} = 18$	2012	4
17	P and Q are two points with position vectors $\overrightarrow{3a} - 2\vec{b}$ and $\vec{a} + \vec{b}$ respectively. Write the position vector R which divides the line segment PQ in the ratio 2: 1 externally.	2013	1
18	Find $\|\vec{x}\|$If $\vec{a}$ is a unit vector and $(\vec{x} - \vec{a})(\vec{x} + \vec{a})$=15	2013	1
19	Write a unit vector in the direction of the sum of the vectors $\vec{a} = 2i - j + 2k$ and $\vec{b} = -i + j + 3k$	2013	1
20	If $\vec{a} = i - j + 7k$ and $\vec{b} = 5i - j + \lambda k$, then find the value of λ so that $\vec{a} + \vec{b}$ and $\vec{a} - \vec{b}$ are perpendicular vectors.	2013	4
21	If $\vec{a} = i + j + k$ and $\vec{b} = i - j$ and $\vec{c}$ is such that $\vec{a} \times \vec{c} = \vec{b}$and $\vec{a} \cdot \vec{c} = 3$	2013	4
22	Using vector, find the area of the triangle with vertices A(1,2,3), B(2,-1,4) and C(4,5,-1).	2013	4
23	Find the value of $p$for which vectors $\vec{a} = 3i + 2j + 9k$ and $\vec{b} = i - 2pj + 3k$ are parallel	2014	1
24	If $\vec{a} = 2i + j + 3k, \vec{b} = -i + 2j + k$ and $\vec{c} = 3i + j + 2k$ then find $\vec{a} \cdot (\vec{b} \times \vec{c})$	2014	1
25	Find a vector $\vec{a}$of magnitude$5\sqrt{2}$, making an angle $\frac{\pi}{4}$ with x- axis, $\frac{\pi}{2}$ with y- axis and an acute angle θ with z-axis.	2014	1
26	If $\vec{a}$ and $\vec{b}$ are perpendicular vectors, $\left\|\vec{a} + \vec{b}\right\|$ and $\|\vec{a}\|$=5, find the value of $\left\|\vec{b}\right\|$.	2014	1
27	The scalar product of vectors $\vec{a} = i + j + k$ with the unit vector along the sum of vectors $\vec{b} = 2i + 4j - 5k$ and $\vec{c} = \lambda i + 2j + 3k$ is equal to one. Find the value of λ and hence find the unit vector along $\vec{b} + \vec{c}$	2014	4
28	In a triangle OAC, if B is the mid-point of side AC and $\overrightarrow{AC} = \vec{a}$, and $\overrightarrow{OB} = \vec{b}, then\ what\ is\ \overrightarrow{OC}$?	2015	1
29	Find a vector of magnitude $\sqrt{171}$ which is perpendicular to both of the vectors $\vec{a} = i + 2j - 3k$ and $\vec{b} = 3i - j + 2k$	2015	1
30	Let $\vec{a} = i + 4j + 2k,\ \vec{b} = 3i - 2j + 7k$ and $\vec{c} = 2i - j + 4k$. Find a vector $\vec{d}$ which is perpendicular to both $\vec{a}$ and $\vec{b}$and $\vec{c} \cdot \vec{d} = 27$.	2015	4
31	If $\vec{a} = 4i - j + k, \vec{b} = 2i - 2j + k$, find a vector parallel to the vector $\vec{a} + \vec{b}$.	2016	1

32	Find $\lambda\ and\ \mu\ if\ (i+3j+9k)\times(3i-\lambda j+\mu k)=\vec{0}$	2016	1
33	Show that the points A, B, and C with position vectors $2i-j+k, i-3j-5k$ and $3i-4j-4k$ respectively, are the vertices of a right-angled triangle. Hence find the area of the triangle.	2017	4
34	If $\vec{a}=2i-j-2k\ and\ \vec{b}=7i+2j-3k$, then express $\vec{b}$ in the form of $\vec{b}=\overrightarrow{b_1}+\overrightarrow{b_2}$, where $\overrightarrow{b_1}$ is parallel to $\vec{a}$ and $\overrightarrow{b_2}$ is perpendicular to $\vec{a}$.	2017	4
35	Find the magnitude of each of the two vectors $\vec{a}$ and $\vec{b}$, having the same magnitude such that the angle between them is 60° and their scalar product is 9/2	2018	1
36	If θ is the angle between two vectors $i-2j+3k$ and $3i-2j+k$ find $\sin\theta$	2018	2
37	Let $\vec{a}=4i+5j-k,\ \vec{b}=i-4j+5k$ and $\vec{c}=3i+j-k$. Find a vector $\vec{d}$ which is perpendicular to both $\vec{c}$ and $\vec{b}$and $\vec{d}\cdot\vec{a}=21$.	2018	4
38	If $\lvert\vec{a}\rvert$=2, $\lvert\vec{b}\rvert=7$ and $\vec{a}\times\vec{b}=3\hat{\imath}+2\hat{\jmath}+6\hat{k}$ find the angle between $\vec{a}$and $\vec{b}$ **OR** Find the volume of cuboid whose edges are given by $-3\hat{\imath}+7\hat{\jmath}+5\hat{k}, -5\hat{\imath}+7\hat{\jmath}-3\hat{k}$ and $7\hat{\imath}-5\hat{\jmath}-3\hat{k}$ **SET-1,2** Show that the points $A(-2\hat{\imath}+3\hat{\jmath}+5\hat{k}), B(\hat{\imath}+2\hat{\jmath}+3\hat{k})$ and $C(7\hat{\imath}-\hat{k})$ are collinear. **OR** Find $\lvert\vec{a}\times\vec{b}\rvert$, if $\vec{a}=2\hat{\imath}+\hat{\jmath}+3\hat{k}$ and $\vec{b}=3\hat{\imath}+5\hat{\jmath}-2\hat{k}$.	2019	2
39	The scalar product of vector $\vec{a}=\hat{\imath}+\hat{\jmath}+\hat{k}$ with a unit vector along the sum of the vectors $\vec{b}=2\hat{\imath}+4\hat{\jmath}-5\hat{k}$ and $\vec{c}=\lambda\hat{\imath}+2\hat{\jmath}+3\hat{k}$ is equal to 1. Find the value of λ and hence find the unit vector along $\overrightarrow{b+c}$.	2019	4
40	If $\vec{a}\cdot\vec{b}=\frac{1}{2}\lvert\vec{a}\rvert\,\lvert\vec{b}\rvert$ then the angle between $\vec{a}$ and $\vec{b}$ is (i) 0° (ii) 30° (iii) 60° (iv) 90°	2020	1
41	If $\vec{a}$ is a non-zero vector, then $(\vec{a}\cdot\hat{\imath})\hat{\imath}+(\vec{a}\cdot\hat{\jmath})\hat{\jmath}+(\vec{a}\cdot\hat{k})\hat{k}=$ **OR** The projection of $\hat{\imath}-\hat{\jmath}$ on the vector $\hat{\imath}+\hat{\jmath}$ is …	2020	1
42		2020	1
43	Find If $\lvert\vec{a}\rvert\ and\ \lvert\vec{b}\rvert$ If $\lvert\vec{a}\rvert$=2 $\lvert\vec{b}\rvert$ and $(\vec{a}-\vec{b})(\vec{a}+\vec{b})$=12 **OR** Find the unit vector perpendicular to each of the vectors $\vec{a}=4\hat{\imath}+3\hat{\jmath}+\hat{k}$ and $\vec{b}=2\hat{\imath}-\hat{\jmath}+2\hat{k}$.	2020	2
44	If $\vec{a}=\hat{\imath}-2\hat{\jmath}+3\hat{k}$ and $\vec{b}$ is such that $\vec{b}\cdot\vec{b}=\lvert\vec{b}\rvert^2$ and$\lvert\vec{a}-\vec{b}\rvert=\sqrt{7}$ then find $\lvert\vec{b}\rvert$	2020	1

S.No.	THREE DIMENSIONAL GEOMETRY	YEAR	MARKS
1	Write the direction cosines of a line equally inclined to the three coordinate axes.	2009	1
2	Find the shortest distance between two lines: $\vec{r}=(i+2j+3k)+\lambda(i-3j+2k)$ $\vec{r}=(4+2\mu)i+(5+3\mu)j+(6+\mu)k$	2009	4
3	Find the shortest distance between two lines: $\vec{r}=(2i+j-k)+\mu(3i-5j+2k)$ $\vec{r}=(1+2\lambda)i+(1-\lambda)j+\lambda k$	2009	4

4	Find the shortest distance between two lines: $\vec{r} = (2i - j - k)$+μ$(2i + j + 2k)$ $\vec{r} = (1 + \lambda)\mathrm{i} + (2 - \lambda)\mathrm{j} + (\lambda + 1)\mathrm{k}$	2009	4
5	Find the equation of the plane determined by the points A(3,-1,2), B(5,2,4) and C(-1,-1,6). Also find the distance of the point P(6,5,9) form the plane.	2009	6
6	Write the distance of the following plane from the origin: $2x - y + 2z + 1 = 0$	2010	1
7	Find the point on the line $\frac{x+2}{3} = \frac{y+1}{2} = \frac{z-3}{2}$ at a distance of 5 units from the point P(1,3,3) **OR** Find the distance of the point P(6,5,9) from the plane determined by the points A(3,-1,2), B(5,2,4) and C(-1,-1,6)	2010	4
8	Find the equation of the plane passing through the point P(1,1,1) and containing the line $\vec{r} = (-3i + j + 5k)$+ $\lambda(3i - j - 5k)$. Also show that the plane contains the line $\vec{r} = (-i + 2j + 5k)$+μ$(i - 2j - 5k)$	2010	6
9	Find the coordinate of the foot of the perpendicular and the perpendicular distance of the point P(3,2,1) form the plane $2x - y + z + 1 = 0$. Find the image of the point in the plane.	2010	6
10	Write the direction cosines of the line joining the points (1,0,0) and (0,1,1)	2011	1
11	Write the vector equation given by $\frac{x-5}{3} = \frac{y+4}{7} = \frac{z-6}{2}$	2011	1
12	Find the shortest distance between two lines: $\vec{r} = (1 - \mathrm{t})\mathrm{i} + (\mathrm{t} - 2)\mathrm{j} + (3 - 2\mathrm{t})\mathrm{k}$ and $\vec{r} = (\mathrm{s} + 1)\mathrm{i} + (2\mathrm{s} - 1)\mathrm{j} - (2\mathrm{s} + 1)\mathrm{k}$	2011	4
13	Find the equation of the plane passing through line intersection of the planes $2x + y - z = 3$ and $5x - 3y + 4z + 9 = 0$ and parallel the line $\frac{x-1}{2} = \frac{y-3}{4} = \frac{z-5}{5}$	2011	6
14	Find the distance of the point (-1,-5,-10) from the point of intersection of planes $\vec{r} = (2i - j + 2k)$+ $\lambda(3i + 4j + 2k)$ and the plane $\vec{r} \cdot (i - j + k) = 5$	2011	6
15	Find the equation of the plane passing through line intersection of the planes $\vec{r} \cdot (i + j + k) = 1$ and $\vec{r} \cdot (2i + 3j - k) + 4 = 0$ and parallel to x- axis.	2011	6
16	Write the distance of the following plane from the origin: $3x - 4y + 12z = 3$	2012	1
17	Find the coordinate of the point where the line through the points (3,-4,-5) and (2,-3,1) crosses the plane $3x + 2y + z + 14 = 0$	2012	4
18	Find the coordinate of the point where the line through the points (3,4,1) and (5,1,6) crosses the plane XY −plane.	2012	4
19	Find the coordinate of the point where the line through the points (3,-4,-5) and (2,-3,1) crosses the plane $2x + y + z = 7$	2012	4
20	If the lines $\frac{x-1}{-3} = \frac{y-2}{-2k} = \frac{z-3}{2}$ and $\frac{x-1}{k} = \frac{y-2}{1} = \frac{z-3}{5}$ are perpendicular, find the value of k and hence find the equation and the plane containing these lines.	2012	6
21	Find the coordinate of the foot of the perpendicular and the length of perpendicular drawn from the point P(5,4,2) to the line $\vec{r} = (-i + 3j + k)$+ $\lambda(2i + 3j - k)$.Also find the image of the point in these plane.	2012	6
22	Find the length and the foot of the perpendicular from the point P(7,14,5) to the plane $2x + 4y - z = 2$. Find the image of the point in the plane.	2012	6
23	Find the length of the perpendicular from origin to the plane : $2x - 3y + 6z + 21 = 0$	2013	1
24	Show that the lines are intersecting : $\vec{r} = (3i + 2j - 4k)$+ $\lambda(i + 2j + 2k)\vec{r} = (5i - 2j)$+μ$(3i + 2j + 6k)$ **OR** Find the vector equation of the plane through the points (2,1,-1) and (-1,3,4) and perpendicular to the plane $x - 2y + 4z = 10$	2013	6

25	Find the equation of the plane passing through the line intersection of the plane $\vec{r}\cdot(i+3j-6=0$and $\vec{r}\cdot(3i-j-4k)=0$, whose perpendicular distance from origin is unity. **OR** Find the vector equation of the line passing through the point (1,2,3) and parallel to the plane $\vec{r}\cdot(i-j-2k)=5$, and $\vec{r}\cdot(3i+j+k)=6$,	2013	6
26	Find the vector equation of the plane determined by the points A(3,-1,2), B(5,2,4) and C(-1,-1,6). Also find the distance of the point (6,5,9) from this plane.	2013	6
27	Find the coordinate of the point where the line through the points (3,-4,-5) and (2,-3,1) crosses the plane, passing through the points (2,2,1), (3,0,1) and (4,-1,0)	2013	6
28	If the Cartesian equation of a line is $\frac{3-x}{5}=\frac{y+4}{-7}=\frac{2z-6}{4}$, write the vector equation for the line.	2014	1
29	Show that the four points A, B, C and D with position vectors $4i+5j+k, -i-k$, $3i+9j+4k$and $4(-i+j+k)$ respectively are coplanar.	2014	4
30	A line passes through (2,-1,3) and perpendicular to the line $\vec{r}=(i+j-k)+\lambda(2i-2j+k)$ and $\vec{r}=(2i-j-3k)+\mu(i+2j+2k)$. Obtain its equation in the vector and Cartesian form.	2014	4
31	Find the vector Cartesian equation of the line passing through the points (2,1,3) and perpendicular to the lines $\frac{x-1}{1}=\frac{y-2}{2}=\frac{z-3}{3}$ and $\frac{x}{-3}=\frac{y}{2}=\frac{z}{5}$	2014	4
32	Find the value of p, so that the lines l_1: $\frac{1-x}{3}=\frac{7y-14}{p}=\frac{z-3}{2}$ and $\frac{7-7x}{3p}=\frac{y-5}{1}=\frac{6-z}{5}$ are perpendicular to each other. Also find the equation of a line passing through a point (3,2,-4) and parallel to line l_1	2014	4
33	Find the equation of the plane passing through line intersection of the planes $x+y+z=1$ and $2x+3y+4z=5$ which is perpendicular to the plane $x-y+z=0$ .Also find the distance of the plane obtained above form the origin. **OR** Find the distance of the point (2,12,5) form the points of intersection of the line $\vec{r}=(2i-4j+2k)+\lambda(3i+4j+2k)$ and the plane $\vec{r}\cdot(i-2j+k)=0$	2014	6
34	Find the angle between the lines $2x=3y=-z$ and $2x=-y=-4z$.	2015	1
35	Find the shortest distance between the lies: $\vec{r}=i+2j+3k+\lambda(2i+3j+4k)$ $\vec{r}=2i+4j+5k+\mu(4i+6j+8k)$**OR** Find the equation of plane passing through line of intersection of the plane $2x+y-z=3$and $5x-3y+4z+9=0$ and is parallel to the line $\frac{x-1}{2}=\frac{y-3}{4}=\frac{5-z}{-5}$	2015	4
36	Find the equation of the plane passing through the point P(6,5,9) and parallel to the plane determined by the points A(3,-1,2), B(5,2,4) and C(-1,-1,6). Also find the distance of this plane from the point A.	2015	6
37	Write the sum of the intercepts cut off by the plane $\vec{r}\cdot(2i+j-k)-5=0$ on the three axes.	2016	1
38	Find the coordinates of the foot of the perpendicular drawn from the point A(-1, 8, 4) to the line joining the points B(0, -1, 3) and C(2, -3, -1). Hence find the image of the point A in the line BC.	2016	4
39	Show that the four points A(4, 5, 1),B (0, -1, -1),C(3, 9, 4)and D(-4, 4, 4) are coplanar.	2016	4
40	Find the equation of the plane which contains the line intersection of the planes $\vec{r}\cdot(i-2j+3k)-4=0$ and $\vec{r}\cdot(-2i+j+k)+5=0$ whose intercepts on x-axis is equal to that of on y −axis.		
41	Find the distance between the planes $2x-y+2z=5$and $5x-2.5y+5z=20$.	2017	1

42	The x –coordinate of a point on the line joining the points P(2, 2, 1) and Q(5, 1, -2) is 4. Find its z-coordinate.	2017	2
43	Find the value of λ, if four points with position vectors $3i+6j+9k$, $i+2j+3k$ $2i+3j+k$ and $4i+6j+\lambda k$ are coplanar	2017	4
44	Find the value of x such that the points A(3, 2, 1), B(4, x, 5), C(4, 2, -2) and D(6, 5, -1) are coplanar.	2017	4
45	Find the coordinates of the point where the line through the points (3, -4, -5) and (2, -3, 1) crosses the plane determined by the points (1, 2, 3), (4, 2, -3) and (0, 4, 3). **OR** A variable plane which remains at a constant distance $3p$ for the origin cuts the coordinate axes at A, B, C. Show that the locus of the centroid of the triangle ABC is $\frac{1}{x^2}+\frac{1}{y^2}+\frac{1}{z^2}=\frac{1}{p^2}$.	2017	6
46	Find the shortest distance between the lies: $\vec{r}=4i-j+\lambda(i+2j-3k)$ $\vec{r}=i-j+2k+\mu(2i+4j-5k)$	2018	4
47	Find the distance of the point (-1,-5,-10) from the point of intersection of planes $\vec{r}=(2i-j+2k)+\lambda(3i+4j+2k)$ and the plane $\vec{r}\cdot(i-j+k)=5$	2018	6
48	Write the direction cosines of the line which makes equal angles with the coordinate axes. **OR** A line passes through the point with position vector $2\hat{\imath}-\hat{\jmath}+\hat{k}$ and is in the direction of the vector $\hat{\imath}+\hat{\jmath}-2\hat{k}$.Find the equation of the line in the Cartesian form. **SET-1** A line passes through the point with position vector $2\hat{\imath}-\hat{\jmath}+4\hat{k}$ and is in the direction of the vector $\hat{\imath}+\hat{\jmath}-2\hat{k}$.Find the equation of the line in the Cartesian form. **SET-2**	2019	1
49	If the lines $\frac{x-1}{-3}=\frac{y-2}{2\lambda}=\frac{z-3}{2}$ and $\frac{x-1}{3\lambda}=\frac{y-1}{2}=\frac{z-6}{-5}$ are perpendicular, find the value of λ. Hence find the whether the lines are intersecting or not. **SET-1** Find the Cartesian and vector equation of the plane passing through the points $(2,5,-3),(-2,-3,5)$ and $(5,3,-3)$. **SET-2**	2019	4
50	Find the vector and Cartesian equation of the passing through points having position $\hat{\imath}+\hat{\jmath}-2\hat{k},\ 2\hat{\imath}-\hat{\jmath}+\hat{k}$ and $\hat{\imath}+2\hat{\jmath}+\hat{k}$. Write the equation of the plane passing through a point $(2,3,\ 7)$and parallel to the plane obtained above. Hence, find the distance between the two parallel planes. **OR** Find the equation of the plane passing through $(2,-1,2)$ and $(5,3,4)$ and the plane passing through $(2,0,3),(1,1,5)$ and $(3,2,4)$. Also, find their point of intersection.	2019	6
51	Two lines $x=ay+b,\ z=cy+d$ and $x=a'y+b',\ \ z=c'y+d'$ are perpendicular to each other if (i) $\frac{a}{a'}+\frac{c}{c'}=1$ (ii) $\frac{a}{a'}+\frac{c}{c'}=1$ (iii) $aa'+cc'=1$ (iv) $aa'+cc'=-1$	2020	1
52	Two planes $x-2y+4z=10$ and $18x+17y+kz=50$ are perpendicular, if k is equal to (i)-4 (ii) 4 (iii) 2 (iv) -2	2020	1
53	Find equation of plane with intercept 3 on y axis and parallel to xz-plane.	2020	2
54	Find the distance between the parallel $2x+y+2z=8$ and $4x+2y+4z+5=0$	2020	1
55	The line $\frac{x-2}{3}=\frac{y-3}{4}=\frac{z-4}{5}$ is parallel to the plane (a) $2x+3y+4z=0$ (b) $3x+4y-5z=7$ (c) $2x+y-2z=0$ (d) $x-y+z=2$	2020	1
56	Find the image of the point $(-1,3,4)$ in the plane $x-2y=0$	2020	6

S.No.	LINEAR PROGRAMMING PROBLEM	YEAR	MARKS
1	A dealer wishes to purchase a number of fans and sewing machines. He has only Rs. 5760 to invest and has a space for at most 20 items. A fan costs him Rs. 360 and a sewing machine Rs. 240. His expectation is that he can sell a fan at a profit of Rs. 22 and a sewing machine at a profit of Rs. 18. Assuming that he can sell all the items that he can buy, how should he invest his money in order to maximize the profit? Formulate this a linear programming problem and solve it graphically.	2009	6
2	One kind of cake required 300g of flour and 15g of fat, another kind of cake requires 150g of flour and 30g of fat. Find the maximum number of cakes which can be made from 7.5kg of flour and 600g of fat, assuming that there is no shortage of the other ingredients used in making the cakes. Make it as an L.P.P. and solve it graphically.	2010	6
3	A merchant planes to sell two types of personal computer- a desktop model and a portable model that will cost Rs. 25,000 and Rs. 40,000 respectively. He estimates that the total monthly demand of computers will not exceed 250 units. Determine the number of units of each type of computers which the merchant should stock to get maximum profit if he if he doesn't wants to invest more than Rs. 70 lakhs, and his profit on the desktop model is Rs. 4,500 and on the portable model is Rs. 5000. Make it as an L.P.P. and solve it graphically	2011	6
4	A dietician wishes to mix two types of foods in such a way that the vitamin contain of the mixture contains at least 8 units of vitamin A and 10 units of vitamin c. Food I contains 2 units/kg of vitamin A and 1 unit/kg of vitamin of C while food II contains 1 unit/kg of vitamin A and 2 units/kg of vitamin C. It costs Rs. 5 per kg to purchase food I and Rs. 7 per kg to purchase food II. Determine the minimum cost of such a mixture. Formulate the above L.P.P. and solve it graphically.	2012	6
5	A manufacturer consider that the men and women are equally efficient and so pays them at the same rate. He has 30 and 17 units of workers (male and female) and capital respectively, which he used to produce one unit of A, 2 workers and 3 units of capital are required while 3 workers and 1 unit of capital is required to produce one unit B. If A and B are priced at Rs. 100 and Rs. 120 per unit respectively. How should he use his resource to maximize the total revenue? Form the above as an L.P.P. and solve graphically. L.P.P. you agree with this view of the manufacturer that men and women workers are equally efficient and so should be paid at the same rate?	2013	6
6	A manufacturer company makes two types of teaching aids A and B of mathematics for class XII. Each type of A requires 9 labor hours of fabricating and 1 labor hour for finishing. Each type of B requires 12 labor hour for fabricating and 3 labor hour for finishing. For fabricating and finishing, the maximum labor hour available per week are 180 and 30 respectively. The company makes a profit of Rs. 80 on each piece of type A and Rs. 120 on each piece of type B. How many pieces of type A and type B should be manufactured per week to get a maximum profit? Make it as an LPP and solve graphically. What is the maximum profit per week?	2014	6
7	Solve the following LPP graphically. Minimize $Z = 3x + 5y$ subject to the constraints $x + 2y \geq 0, x + y \geq 6, 3x + y \geq 8 and\ x, y \geq 0$	2015	6
8	A retired person wants to invest an amount of Rs. 50,000. His broker recommends investing in two types of bonds 'A' and 'B' yielding 10% and 9% return respectively on the invested amount. He decides to invest at least Rs.		

<table>
<tr><td></td><td>20,000 in bond ‘A’ and at least Rs. 10,000 in bond ‘B’. He also wants to invest at least as much in bond ‘A’ as in bond ‘B’. Solve this linear programming problem graphically to maximize his return.</td><td></td><td></td></tr>
<tr><td>9</td><td>Two tailor, A and B earn Rs. 300 and Rs. 400 per day respectively. A can stitch 6 shirts and 4 pairs of trousers while B can stitch 10 shirts and 4 pairs of trousers per day. To find how many days should each of them work and if it is desired to produce at least 60 shirts and 32 pairs of trousers at a minimum labour cost, formulate this as an LPP.</td><td>2017</td><td>2</td></tr>
<tr><td>10</td><td>Maximise $Z = x + 2y$ subject to the constraints $x + 2y \geq 100, 2\,x - y \leq$
$, 2x + y \geq 200$ Solve the above LPP graphically.</td><td>2017</td><td>4</td></tr>
<tr><td>11</td><td>Solve the following LPP graphically. Minimize $Z = 34x + 45y$ under the constraints $x + y \leq 300, 2\,x + 3y \leq 70\ and\ x, y \geq 0$</td><td>2017</td><td>4</td></tr>
<tr><td>12</td><td>Solve the following LPP graphically. Minimize $Z = 7x + 10y$ under the constraints $4x + 6y \leq 240, 6\,x + 3y \leq 240, x \geq 10\ and\ x, y \geq 0$</td><td>2017</td><td>4</td></tr>
<tr><td>13</td><td>A factory manufactures two types of screws, A and B. Each type of screw requires the use of two machines, an automatic and a hand operated. It takes 4 minutes on the automatic and 6 minutes on hand operated machines to manufacture a package of screws A, while it takes 6 minutes on automatic and 3 minutes on the hand operated machines to manufacture a package of screws B. Each machine is available for at the most 4 hours on any day. The manufacturer
can sell a package of screws A at a profit of 70 paise and screws B at a profit of Rs 1. Assuming that he can sell all the screws he manufactures, how many packages of each type should the factory owner produce in a day in order to maximise his profit? Formulate the above LPP and solve it graphically and find the maximum profit?</td><td>2018</td><td>6</td></tr>
<tr><td>14</td><td>A company produces two types of goods, A and B, that require gold and silver. Each unit of A requires 3 g of silver and 1g of gold while that of type B requires 1g of silver and 2g of gold. The company can use at the most 9g of silver and 8g of gold. If each unit of type A brings a profit of Rs. 40 and that of type B Rs. 50, find the number of units of each type that the company should produce to maximize profit. Formulate the above LPP and solve it graphically and also find the maximum profit.</td><td>2019</td><td>6</td></tr>
<tr><td>15</td><td>In an LPP, the objective function $z = ax + by$ has same maximum value on two corner points of the feasible region, then the number of points at which Z_{max} ocurs (i) 0 (ii) 2 (iii) finite (iv) infinite</td><td>2020</td><td>1</td></tr>
<tr><td>16</td><td>A manufacturer has three machines I, II and III installed in his factory. Machine I and II are capable of being operated for at most 12 hours, whereas machine III must be operated for at least 5 hours a day. He produces only two items M and N which requiring use of all three machines. The number of hours required for producing 1 units of each M and N on three machines are given in following table
If he makes a profit of Rs. 600 and Rs.400 on each unit of M and N respectively. How many units of each item should he produce so as two maximize his profit assuming that he can sell all the items he produced. What is maximum profit?

<table>
<tr><td rowspan="2">item</td><td colspan="3">Number of hours required on machines</td></tr>
<tr><td>I</td><td>II</td><td>III</td></tr>
<tr><td>M</td><td>1</td><td>2</td><td>1</td></tr>
<tr><td>N</td><td>2</td><td>1</td><td>1.25</td></tr>
</table></td><td></td><td></td></tr>
</table>

<table>
<tr><th>S.No.</th><th>PROBABILITY</th><th>YEAR</th><th>MARKS</th></tr>
<tr><td>1</td><td>On a multiple choice examination with three possible answers (out of which only one is correct) for each of the five questions, What is the probability that a candidate would get four of or more correct answers just by guessing?</td><td>2009</td><td>4</td></tr>
<tr><td>2</td><td>A man is known to speak the truth 3 out of 5 times. He throws a die and reports that it is a number greater than .find the probability that it is actually a number greater than 4.</td><td>2009</td><td>6</td></tr>
<tr><td>3</td><td>Coloured balls distributed in three bags as shown in the following table:
<table>
<tr><td>Bag</td><td colspan="3">Colour of the ball</td></tr>
<tr><td></td><td>Black</td><td>White</td><td>Red</td></tr>
<tr><td>I</td><td>1</td><td>2</td><td>3</td></tr>
<tr><td>II</td><td>2</td><td>4</td><td>1</td></tr>
<tr><td>III</td><td>4</td><td>5</td><td>3</td></tr>
</table>
A bag is selected at random and then two balls are randomly drawn from the selected bag. They happen to be black and rd. What is the probability that they came from bag I?</td><td>2009</td><td>6</td></tr>
<tr><td>4</td><td>Coloured balls distributed in three bags as shown in the following table:
<table>
<tr><td>Bag</td><td colspan="3">Colour of the ball</td></tr>
<tr><td></td><td>Black</td><td>White</td><td>Red</td></tr>
<tr><td>I</td><td>2</td><td>1</td><td>3</td></tr>
<tr><td>II</td><td>4</td><td>2</td><td>1</td></tr>
<tr><td>III</td><td>5</td><td>4</td><td>3</td></tr>
</table>
A bag is selected at random and then two balls are randomly drawn from the selected bag. They happen to be black and rd. What is the probability that they came from bag II?</td><td>2009</td><td>6</td></tr>
<tr><td>5</td><td>A family has two children. Find the probability that both are boys, if it is known that (i) at least one of the children is a boy. (ii) the elder child is boy</td><td>2010</td><td>4</td></tr>
<tr><td>6</td><td>A bag contains four balls. Two balls are drawn at random, and are found to be white. What is the probability that all ball are white?</td><td>2010</td><td>6</td></tr>
<tr><td>7</td><td>A random variable has following probability distribution:
<table>
<tr><td>X</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr>
<tr><td>P(X)</td><td>0</td><td>k</td><td>$2\,k$</td><td>$2k$</td><td>$3k$</td><td>k^2</td><td>$2k^2$</td><td>$7k^2 + k$</td></tr>
</table>
Determine: (i) k (ii) $P(X < 3)$ (ii) $P(X > 6)$ (iii) $P(0 < X < 3)$
OR
Find the probability of throwing at most 2 sixes in 6 throws of a single throw a die.</td><td>2011</td><td>4</td></tr>
<tr><td>8</td><td>Given three identical boxes I,II and III each containing two coins. In box I, oth coins are gold coins, in box II both are silver coins and in box III, there is one gold coin and one silver coin. A person chooses a box at random and takes out a coin. If the coin is of gold, what is the probability that the other coin in the box is also of gold?</td><td>2011</td><td>6</td></tr>
<tr><td>9</td><td>Two cards are drawn simultaneously (without replacement) from a well-shuffled pack of 52 cards. Find the mean and variance of the number of red cards.</td><td>2012</td><td>4</td></tr>
<tr><td>10</td><td>Suppose a girl throws a die. If she gets 5 or 6, she tosses a coin 3 times and notes the number of heads. If she gets 1,2,3 or 4 she tosses a coin once and</td><td>2012</td><td>6</td></tr>
</table>

	note whether a head or tail is obtained. If she obtained exactly one head, what is the probability that she threw 1,2,3, or 4 with the die?		
11	The probability of two students A and B coming to the school in time are $\frac{3}{7}$,$\frac{5}{7}$ respectively. Assuming that the events 'A coming in time' and 'B coming in time' are independent, find the probability of only one of them coming to the school in time. Write at least one advantage of coming to the school in time. If P(A comes in school time)= $\frac{3}{7}$	2013	4
12	P speaks truth 70% of the cases and Q 80% of the cases. In what % of cases they likely to agree in stating the same fact? Do you think, when they agree, mean both are speaking truth?	2013	4
13	P speaks truth 75% of the cases and Q 90% of the cases. In what % of cases they likely to contradict in stating the same fact? Do you think, that statement of B is true?	2013	4
14	In a hockey match, both team A and B scored same number of goals up the end of the game, so to decide the winner, the referee asked both the captain to throw a die alternatively and decided that the team, whose captain gets a six first, will be declared the winner. If the captain of team A was asked to start, find their respective probabilities of winning the match and state whether the decision was fair or not?	2013	6
15	An experiment succeeds thrice as often as it fails. Find the probability that the next five trails, there will e at least 3 successes.	2014	4
16	There are three coins. One is a two-headed coin (having on both faces), another is a biased coin that comes up heads 75% of the times and third is also a biased coin that comes up tails 40% of the times> One of the three coins is chosen at random and tossed, and it shows heads. What is the probability that it was the two-headed coin? **OR** Two numbers are selected at random (with replacement) from the first six positive integers. Let X denotes the larger of the two numbers obtained. Find the probability distribution of the random variable X, and hence find the mean of the distribution.	2014	6
17	A man takes a step with probability 0.4 and backward with probability 0.6. find the probability that at the end of 5 steps, he is one step away from the starting point. **OR** Suppose a girl throw a die. If she gets a 1 or 2, she tosses a coin three times and notes the number of 'tails'. If she gets 3,4,5 or 6, she tosses a coin once and notes whether a 'head' or 'tail' is obtained. If she obtained exactly one 'tail', what is the probability that she threw 3, 44 5 or 6 with the die?	2015	4
18	A bag contains 4 white balls and 2 black balls, while another bag Y contains 3white and 3 black balls. Two balls are drawn (without replacement) at random from one of the bags and were found to be one white and one black. Find the probability that the balls were drawn from bag Y. **OR** A and B throw a pair of die alternatively till one of them gets a total of 10 and wins the game. Find their respectively probabilities of wining, if A starts first.	2016	4
19	Three number are selected at random (without replacement) from first six positive integers. Let X denotes the largest of the three numbers obtained. Find	2016	6

	the probability distribution of X. Also, find the mean and variance of the distribution.		
20	A die, whose faces are marked 1, 2, 3 in red and 4, 5, 6 in green, is tossed. Let A be the event "number obtained is even" and B be the event " number is red". Find if A and B are independent events.	2017	2
21	There are four cards numbered with 1, 3, 5 and 7, one number on one card. Two cards are drawn at random without replacement. Let X denotes the sum of the number on the two cards. Find the mean and variance of X.	2017	4
22	Of the students in a school, it is known that 30% have 100% attendance and 70% students are irregular. Previous years result report that 70% of the all students attain A grade in their annual examination. At the end of the year, one student is chosen at random from the school and he was found to have an A grade. What is the probability that the student has 1005 attendance? Is regularity required only in school? Justify your answer.	2017	4
23	A black and a red die are rolled together. Find the conditional probability of obtaining the sum 8, given that red die resulted in a number less than 4.	2018	2
24	Suppose a girl throws a die. If she gets 1 or 2, she tosses a coin 3 times and notes the number of tails. If she gets 3,4, 5 or 6 she tosses a coin once and note whether a head or tail is obtained. If she obtained exactly one tail, what is the probability that she threw 3, 4, 5 or 6 with the die?	2018	4
25	Two numbers are selected at random (without replacement) from first five positive integers. Let X denotes the larger of the two numbers obtained. Find the mean and variance of the X.	2018	4
26	If $P(\bar{A}) = 0.7$, and $P(B) = 0.7$ and $P\left({}^{B}/_{A}\right) = 0.5$ then find $P\left({}^{A}/_{B}\right)$	2019	2
27	A coin is tossed 5 times. What is the probability of getting (i) 3 heads (ii) at most 3 heads? **OR** Find the probability distribution of X, the number of heads of simultaneous toss of two coins.	2019	2
28	There are three coins. One is a two-headed coin (having on both faces), another is a biased coin that comes up heads 75% of the times and third is unbiased coin. One of the three coins is chosen at random and tossed, and it shows heads. What is the probability that it was the two-headed coin?	2019	6
29	From the set $\{1, 2, 3, 4, 5\}$ two number a and b $(a \neq b)$ are chosen at random. The probability that $\frac{a}{b}$ is an integer is (i) $\frac{1}{3}$ (ii) $\frac{1}{4}$ (iii) $\frac{1}{2}$ (iv) $\frac{3}{5}$	2020	1
30	A bag contains 3 white, 4 black and 2 red ball. If two balls are drawn at random(without replacement), then probability that both the balls are white is (i) $\frac{1}{18}$ (ii) $\frac{1}{36}$ (iii) $\frac{1}{12}$ (iv) $\frac{1}{24}$	2020	1
31	Find $[P(A/B) + P(B/A)]$, if $P(A) = \frac{3}{10}, P(B) = \frac{2}{5}$ and $P(A \cup B) = \frac{3}{5}$.	2020	2
32	A coin is biased so that the head is 3 times as likely to occur as tail. If the coin is tossed twice, find the probability distribution of number of tails. Hence find the mean number of tails. **OR** Suppose that 5 men out of 100 and 25 women out of 1000 are good operators. Assume that there equal number of men and women, find the probability	2020	4

	choosing a good operator.		
33	Three distinct numbers are chosen from first 50 natural numbers then find the probability of that are three numbers are divisible by 2 and 3.	2020	2