



Steps towards success by almighty grace

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THE NO. 1 INSTITUTE

1ST YEAR MATHS-1A MOST IMPORTANT QUESTIONS (LAQS=-7MARKS)

GUNSHOT QUESTIONS -2026

QNO: - 18 (FUNCTIONS)

- 1) $f = \{(4, 5), (5, 6), (-6, 4)\}$, $g = \{(4, -4), (6, 5), (8, 5)\}$ then find
(i) $f+g$ (ii) $f-g$ (iii) $2f+4g$ (iv) $f+4$ (v) fg (vi) f/g (vii) \sqrt{f}
(viii) $2f$ (ix) f^2 (x) $f+3$
- 2) If $f(x)=x^2$ $g(x)=|x|$ then find the following functions
(i) $f+g$ (ii) $f-g$ (iii) fg (iv) $2f$ (v) f^2 (vi) $f+3$
- 3) If $f=\{(1,2), (2,-3), (3,-1)\}$ then find the following
(i) $2f$ (ii) $2+f$ (iii) f^2 (iv) \sqrt{f}
- 4) Let $f : A \rightarrow B$, $g : B \rightarrow C$ be bijections. Then show that $(g \circ f) : A \rightarrow C$ is also a bijection
- 5) Let $f: A \rightarrow B$, $g : B \rightarrow C$ be bijections. Then show that $(g \circ f)^{-1} = f^{-1} \circ g^{-1}$.

QNO :- 19 (MATHEMATICAL INDUCTION)

- 1(a) Show that $1.2.3 + 2.3.4 + 3.4.5 \dots$ upto n terms $= \frac{n(n+1)(n+2)(n+3)}{4}$, $n \in \mathbb{N}$
- 1(b) Prove that $3+7+11+\dots+(5n-3) = \frac{n(5n-1)}{2}$
- 2(a) Prove that $(1+\frac{3}{1})(1+\frac{3}{4})(1+\frac{7}{9})\dots(1+\frac{2n+1}{n^2}) = (n+1)^2$
- 2(b) Show that $\forall n \in \mathbb{N}$, $\frac{1}{1.4} + \frac{1}{4.7} + \frac{1}{7.10} \dots$ upto n terms $= \frac{n}{3n+1}$
3. Show that $1^2 + (1^2 + 2^2) + (1^2 + 2^2 + 3^2) \dots$ upto n terms $= \frac{n(n+1)^2(n+2)}{12}$, $n \in \mathbb{N}$

4(a). Prove by Mathematical induction, for all $n \in \mathbb{N}$ $a + (a + 2d) \dots$ upto n terms $= \frac{n}{2} [2a + (n - 1)d]$

(b). Prove by Mathematical induction, for all $n \in \mathbb{N}$ $a + ar + ar^2 \dots$ upto n terms $= \frac{a(r^n - 1)}{(r - 1)}$, $r \neq 1$

5. Show that $49^n + 16n - 1$ divisible by 64 for all positive integers n .

QNO :- 20 (MATRICES)

1. Solve the following simultaneous linear equations by using Cramer's rule

(i) $x + y + z = 1$, $2x + 2y + 3z = 6$, $x + 4y + 9z = 3$

(ii) $2x - y + 3z = 9$, $x + y + z = 6$, $x - y + z = 2$

(iii) $2x - y + 3z = 8$, $-x + 2y + z = 4$, $3x + y - 4z = 0$

(vi) $x - y + 3z = 5$, $4x + 2y - z = 0$, $-x + 3y + z = 5$

(v) $x + y + z = 9$, $2x + 5y + 7z = 52$, $2x + y - z = 0$

2. Solve the following simultaneous linear equations by using Matrix Inverse Method

(i) $x + y + z = 1$, $2x + 2y + 3z = 6$, $x + 4y + 9z = 3$

(ii) $2x - y + 3z = 9$, $x + y + z = 6$, $x - y + z = 2$

(iii) $2x - y + 3z = 8$, $-x + 2y + z = 4$, $3x + y - 4z = 0$

(vi) $x - y + 3z = 5$, $4x + 2y - z = 0$, $-x + 3y + z = 5$

(v) $x + y + z = 9$, $2x + 5y + 7z = 52$, $2x + y - z = 0$

QNO :- 21 (MATRICES)

1. If $\begin{vmatrix} a & a^2 & 1 + a^3 \\ b & b^2 & 1 + b^3 \\ c & c^2 & 1 + c^3 \end{vmatrix} = 0$ and $\begin{vmatrix} a & a^2 & 1 \\ b & b^2 & 1 \\ c & c^2 & 1 \end{vmatrix} = 0$ then show that $abc = -1$

2. (a) Find the value of $\begin{vmatrix} x - 2 & 2x - 3 & 3x - 4 \\ x - 4 & 2x - 9 & 3x - 16 \\ x - 8 & 2x - 27 & 3x - 64 \end{vmatrix} = 0$ 3(b) Show that $\begin{vmatrix} a - b - c & 2a & 2a \\ 2b & b - c - a & 2b \\ 2c & 2c & c - a - b \end{vmatrix} = (a + b + c)^3$

(c) Show that
$$\begin{vmatrix} a+b+2c & a & b \\ c & b+c+2a & b \\ c & a & c+a+2b \end{vmatrix} = 2(a+b+c)^3$$

3. Show that
$$\begin{vmatrix} 1 & a^2 & a^3 \\ 1 & b^2 & b^3 \\ 1 & c^2 & c^3 \end{vmatrix} = (a-b)(b-c)(c-a)(ab+bc+ca)$$
 4. Show that
$$\begin{vmatrix} b+c & c+a & a+b \\ c+a & a+b & b+c \\ a+b & b+c & c+a \end{vmatrix} = 2 \begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$$

5. Show that
$$\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix} = \begin{vmatrix} 2bc - a^2 & c^2 & b^2 \\ c^2 & 2ac - b^2 & a^2 \\ b^2 & a^2 & 2ab - c^2 \end{vmatrix} = (a^3 + b^3 + c^3 - 3abc)^2.$$

EXTRA

Show that
$$\begin{vmatrix} a^2 + 2a & 2a + 1 & 1 \\ 2a + 1 & a + 2 & 1 \\ 3 & 3 & 1 \end{vmatrix} = (a-1)^3$$

QNO-22 Product of vectors

1(a) Find the shortest distance between the skew lines $r = (6i + 2j + 2k) + t(i - 2j + 2k)$

and $r = (-4i - k) + s(3i - 2j - 2k)$ where s, t are scalars.

(b) If $A = (1, -2, -1)$, $B = (4, 0, -3)$, $C = (1, 2, -1)$ and $D = (2, -4, -5)$, find the distance between AB and CD .

2. If $a = 2i + 3j + 4k$, $b = i + j - k$, $c = i - j + k$ then compute $a \times (b \times c)$, and verify that it is perpendicular to a

3 (a) If $a = 7i - 2j + 3k$, $b = 2i + 8k$ and $c = i + j + k$ then compute $a \times b$, $a \times c$, $a \times (b + c)$. Verify whether the cross product is distributive over the vector addition.

3 (b) If $a = i - 2j + k$, $b = 2i + j + k$, $c = i + 2j - k$ then compute $a \times (b \times c)$, $|(a \times b) \times c|$

(c) If $a = 2i + j - k$, $b = -i + 2j - 4k$, $c = i + j + k$ then find $(a \times b) \cdot (b \times c)$.

QNO-23 Trigonometric of Transformations

1. If A, B, C are angles in a triangle, then prove that (i) $\sin 2A + \sin 2B + \sin 2C = 4 \sin A \sin B \sin C$.
(ii) $\sin 2A + \sin 2B - \sin 2C = 4 \cos A \cos B \sin C$.
2. If A, B, C are angles in a triangle, then prove that (i) Prove that $\cos 2A + \cos 2B + \cos 2C = -4 \cos A \cos B \cos C - 1$.
that (ii) $\sin A + \sin B + \sin C = 4 \cos \frac{A}{2} \cdot \cos \frac{B}{2} \cdot \cos \frac{C}{2}$
3. If A, B, C are angles in a triangle, then prove that $\cos A + \cos B - \cos C = -1 + 4 \cos \frac{A}{2} \cos \frac{B}{2} \sin \frac{C}{2}$
- 4(a). If $A+B+C = \frac{3\pi}{2}$, Prove that $\cos 2A + \cos 2B + \cos 2C = 1 - 4 \sin A \sin B \sin C$
- 4(b). If $A+B+C = \frac{\pi}{2}$ Then prove that $\cos 2A + \cos 2B + \cos 2C = 1 + 4 \sin A \sin B \sin C$
5. If $A+B+C=0$, Ten Prove that $\sin 2A + \sin 2B + \sin 2C = -4 \sin A \sin B \sin C$

QNO :- 24 (PROPERTIES OF TRIANGLES)

- 1(a). If $a = 13, b = 14, c = 15$, show that $R = \frac{65}{8}, r = 4, r_1 = \frac{21}{2}, r_2 = 12$ and $r_3 = 14$
(b) If $r_1 = 2, r_2 = 3, r_3 = 6$ and $r = 1$, Prove that $a = 3, b = 4$ and $c = 5$
(c) In ΔABC $r_1 = 8, r_2 = 12, r_3 = 24$ then find the values of a, b, c .
2. In $\Delta ABC, P_1, P_2, P_3$ are the altitudes drawn from the vertices A,B,C to the opposite sides, then show that
(i) $\frac{1}{P_1} + \frac{1}{P_2} + \frac{1}{P_3} = \frac{1}{r}$ (ii) $\frac{1}{P_1} + \frac{1}{P_2} - \frac{1}{P_3} = \frac{1}{r_3}$ (iii) $P_1 P_2 P_3 = \frac{(abc)^2}{8R^3} = \frac{8\Delta^3}{abc}$
3. In ΔABC , if AD, BE, CF are the perpendicular drawn from the vertices A,B,C to the opposite sides, show that
(i) $\frac{1}{AD} + \frac{1}{BE} + \frac{1}{CF} = \frac{1}{r}$ and (ii) $AD \cdot BE \cdot CF = \frac{(abc)^2}{8R^3}$.
4. Prove that $\left[\frac{1}{r} - \frac{1}{r_1} \right] \left[\frac{1}{r} - \frac{1}{r_2} \right] \left[\frac{1}{r} - \frac{1}{r_3} \right] = \frac{abc}{\Delta^3} = \frac{4R}{r^2 s^2}$.



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GUNSHOT QUESTIONS -2026

QNO-11 MATRICES

1) If $A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$ then show that $A^2 - 4A - 5I = 0$.

2a) If $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, $E = \begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix}$ then show that $(aI + bE)^3 = a^3I + 3a^2bE$.

2b) if $\theta - \phi = \frac{\pi}{2}$, then show that $\begin{bmatrix} \cos^2\theta & \cos\theta\sin\theta \\ \cos\theta\sin\theta & \sin^2\theta \end{bmatrix} \begin{bmatrix} \cos^2\phi & \cos\phi\sin\phi \\ \cos\phi\sin\phi & \sin^2\phi \end{bmatrix} = 0$

3 a) Show that the matrix $A = \begin{bmatrix} 1 & 2 & 1 \\ 3 & 2 & 3 \\ 1 & 1 & 2 \end{bmatrix}$ is a non-singular matrix and find A^{-1}

3 b) If A is non-singular matrix then prove that $A^{-1} = \frac{Adj A}{\det A}$

4 if $A = \begin{bmatrix} 1 & 1 & 3 \\ 5 & 2 & 6 \\ -2 & -1 & -3 \end{bmatrix}$ then find A^3

5a) if $3A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & -2 \\ -2 & 2 & -1 \end{bmatrix}$ then show that $A^{-1} = A^T$

5b) If $A = \begin{bmatrix} 1 & 5 & 3 \\ 2 & 4 & 0 \\ 3 & -1 & -5 \end{bmatrix}$, $B = \begin{bmatrix} 2 & -1 & 0 \\ 0 & -2 & 5 \\ 1 & 2 & 0 \end{bmatrix}$

QNO-12 Addition of vectors

1. If a,b,c are non-coplanar, then prove that a,b,c are co-planar vectors

(i) $-a+4b-3c$, $3a+2b-5c$, $-3a+8b-5c$, $-3c+2b+c$ (ii) $6a+2b-c$, $2a-b+3c$, $-a+2b-4c$, $2a-b-3c$

2.. If the points whose position vectors are $3i - 2j - k$, $2i + 3j - 4k$, $-i + j + 2k$ and $4i + 5j + \lambda k$ are coplanar, then show that $\lambda = \frac{-146}{17}$.

3 (a) If a,b,c are non-coplanar and $a+b+c$, $a+pb+2c$, $-a+b+c$, are coplanar then find p

3 (b) Find the vector equation of the line passing through the point $2i+3j+k$ and parallel to the vector $4i-2j+3k$

4a). OABC is a parallelogram if $OA=a$ and $OB=c$ find the vector equation of the side BC

- 4.b) If a, b, c are the position vectors of the vertices A, B and C respectively of Triangle ABC, then find the vector equation of the median, through the vertex A
5. a) If O is centre of a regular hexagon ABCDEF, show that $AB + AC + AD + AE = 3AD = 6AO$.
 b) Prove that the triangle formed by the vectors $3i + 5j + 2k$, $2i - 3j - 5k$ and $-5i - 2j + 3k$ is equilateral.
 c) Prove that the triangle formed by the vectors $2i - j + k$, $i - 3j - 5k$ and $3i - 4j - 4k$ is right angled triangle.

QNO-13 product of vectors

1. a) Find the volume of the tetrahedron having the coterminous edges $i + j + k$, $i - j$ and $i + 2j + k$.
 b) Find the volume of the tetrahedron whose vertices are $(1, 2, 1)$, $(3, 2, 5)$, $(2, -1, 0)$, $(-1, 0, 1)$.
 c) Find the area of the triangle whose vertices are A $(1, 2, 3)$, B $(2, 3, 1)$ and C $(3, 1, 2)$.
 d) Find the volume of the parallelepiped with coterminous edges $2i - 3j + k$, $i - j + 2k$ and $2i + j - k$.
2. Determine μ , for which the volumes of parallelepiped coterminous edges $i + j$, $3i - j$ and $i + \mu k$ is 16 cubic units.
3. a) If $a = 2i + j - k$, $b = -i + 2j - 4k$ and $c = i + j + k$, then find $(a \times b) \cdot (b \times c)$.
 b) If $a = 2i + 3j + 4k$, $b = i + j - k$ and $c = i - j + k$, then compute $a \times (b \times c)$ and verify that it is perpendicular to a .

QNO-14 Trigonometric of Transformations

1. a) If $A + B = 45^\circ$, then prove that (i) $(1 + \tan A)(1 + \tan B) = 2$ (ii) $(\cot A - 1)(\cot B - 1) = 2$.
 b) If $0 < A < B < \pi/4$, $\sin(A + B) = 24/25$, $\cos(A - B) = 4/5$, then find the value of $\tan 2A$.
2. a) Prove that $(1 + \cos \frac{\pi}{10})(1 + \cos \frac{3\pi}{10})(1 + \cos \frac{7\pi}{10})(1 + \cos \frac{9\pi}{10}) = \frac{1}{16}$
 b) Prove that $\cos^4 \frac{\pi}{8} + \cos^4 \frac{3\pi}{8} + \cos^4 \frac{5\pi}{8} + \cos^4 \frac{7\pi}{8} = \frac{3}{2}$
 c) Prove that $\cos^2 \frac{\pi}{8} + \cos^2 \frac{3\pi}{8} + \cos^2 \frac{5\pi}{8} + \cos^2 \frac{7\pi}{8} = 2$
- 3) prove that $\frac{1}{\cos 290} + \frac{1}{\sqrt{3} \sin 250} = \frac{4}{\sqrt{3}}$
- 4) if $\frac{\sin \alpha}{a} = \frac{\cos \alpha}{b}$ then prove that $a \sin 2\alpha + b \cos 2\alpha = b$
- 5) prove that (i) $\frac{1 - \sec 8\alpha}{1 - \sec 4\alpha} = \frac{\tan 8\alpha}{\tan 2\alpha}$

Some extra

1. Prove that $\frac{\tan \theta + \sec \theta - 1}{\tan \theta - \sec \theta + 1} = \frac{1 + \sin \theta}{\cos \theta}$
3. a) Prove that $\tan 70^\circ - \tan 20^\circ = 2 \tan 50^\circ$. b) Prove that $\sin 18^\circ = \frac{\sqrt{5} - 1}{4}$.
- 4) If $\tan 20^\circ = p$ then prove that $\frac{\tan 610^\circ - \tan 700^\circ}{\tan 560^\circ - \tan 470^\circ} = \frac{1 - p^2}{1 + p^2}$

QNO-15 Trigonometric Equations

- 1) Find general solutions of the following (i) $2\sin^2\theta = 3\cos\theta$ (ii) $\sin^2\theta - \cos\theta = \frac{1}{4}$
(iii) $5\cos^2\theta + 7\sin^2\theta = 6$ (iv) $2\sin^2\theta - 4 = 5\cos\theta$
- 1) Solve the equations $\cot^2x - (\sqrt{3} + 1)\cotx + \sqrt{3} = 0$
2) Solve the equation (i) $\sqrt{3}\sin\theta - \cos\theta = \sqrt{2}$ (ii) $\sinx + \sqrt{3}\cosx = \sqrt{2}$
3) Solve the equations (i) $7\sin^2\theta + 3\cos^2\theta = 4$ (ii) $1 + \sin^2\theta = 3\sin\theta\cos\theta$
4) If θ_1, θ_2 are the solutions of equation $a\cos 2\theta + b\sin 2\theta = c$, $\tan\theta_1 \neq \tan\theta_2$ and $a+b \neq 0$, then find the values of
i) $\tan\theta_1 + \tan\theta_2$ ii) $\tan\theta_1 \cdot \tan\theta_2$ (iii) $\tan(\theta_1 + \theta_2)$

QNO-16 Inverse Trigonometric Functions

- 1) a) Prove that $\tan^{-1}\frac{3}{4} + \tan^{-1}\frac{3}{5} - \tan^{-1}\frac{8}{19} = \frac{\pi}{4}$
b) Prove that $\tan^{-1}\frac{1}{2} + \tan^{-1}\frac{1}{5} + \tan^{-1}\frac{1}{8} = \frac{\pi}{4}$ c) Prove that $\tan^{-1}\frac{1}{7} + \tan^{-1}\frac{1}{3} - \tan^{-1}\frac{2}{9} = 0$
- 2) $\sin^{-1}x + \sin^{-1}y + \sin^{-1}z = \pi$, then prove that $x\sqrt{1-x^2} + y\sqrt{1-y^2} + z\sqrt{1-z^2} = 2xyz$
- 3a) Prove that $\sin^{-1}\frac{4}{5} + \sin^{-1}\frac{7}{25} = \sin^{-1}\frac{117}{125}$
b) Prove that $\sin^{-1}\frac{3}{5} + \cos^{-1}\frac{12}{13} = \cos^{-1}\frac{33}{65}$
c) Prove that $\cos^{-1}\left(\frac{4}{5}\right) + \sin^{-1}\left(\frac{3}{\sqrt{34}}\right) = \tan^{-1}\left(\frac{27}{11}\right)$

QNO-17 Properties Of Triangles Inverse

- 1a) Prove that $\cot\frac{A}{2} + \cot\frac{B}{2} + \cot\frac{C}{2} = \frac{s^2}{\Delta}$ b) In a ΔABC , show that $\frac{\cos A}{a} + \frac{\cos B}{b} + \frac{\cos C}{c} = \frac{a^2+b^2+c^2}{2abc}$
- 2a) Prove that $\cot A + \cot B + \cot C = \frac{a^2+b^2+c^2}{4\Delta}$ 2b) show that $\frac{\cos A}{a} + \frac{\cos B}{b} + \frac{\cos C}{c} = \frac{a^2+b^2+c^2}{2abc}$
- 3a) Express $a\sin^2\frac{C}{2} + c\sin^2\frac{A}{2}$ in terms of s, a, b, c
- 4) In ΔABC show that $\frac{b^2-c^2}{a^2} = \frac{\sin(B-C)}{\sin(B+C)}$
- 5) In ΔABC if AD, BE, CF are perpendiculars drawn from the vertices A, B, c to the opposite sides
show that (i) $\frac{1}{AD} + \frac{1}{BE} + \frac{1}{CF} = \frac{1}{r}$ (ii) $AD \cdot BE \cdot CF = \frac{(abc)^2}{8R^3}$
- 2) a) In a ΔABC , if $\frac{1}{a+c} + \frac{1}{b+c} = \frac{3}{a+b+c}$, then show that $C=60^\circ$ b) if $\sin\theta = \frac{a}{b+c}$, then prove that $\cos\theta = \frac{2\sqrt{bc}}{b+c} \cos\frac{A}{2}$
- 3) a) Show that $a^2 \cot A + b^2 \cot B + c^2 \cot C = \frac{abc}{R}$
b) In a ΔABC , if $a : b : c = 7 : 8 : 9$, then find $\cos A : \cos B : \cos C$
- 4) a) if $\cot\frac{A}{2} : \cot\frac{B}{2} : \cot\frac{C}{2} = 3 : 5 : 7$ then show that $a : b : c = 6 : 5 : 4$ b) show that $\frac{1}{r^2} + \frac{1}{r_1^2} + \frac{1}{r_2^2} + \frac{1}{r_3^2} = \frac{a^2+b^2+c^2}{\Delta^2}$



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GUNSHOT QUESTIONS -2026

QNO-1 FUNCTIONS

- 1.(a) If $f(x) = 2x-1$, $g(x) = \frac{x+1}{2}$ for all $x \in \mathbb{R}$, find $(g \circ f)(x)$
- (b). If $f(x)=2$, $g(x)=x^2$, $h(x)=2x$ then find $(f \circ g \circ h)(x)$
2. If $f: \mathbb{R} \rightarrow \mathbb{R}$, $g: \mathbb{R} \rightarrow \mathbb{R}$ are defined by $f(x)=3x-1$ and $g(x)=x^2+1$ then find
(i) $(f \circ g)(2)$ (ii) $(f \circ f)(x^2+1)$ (iii) $(g \circ f)(2a-3)$
3. (a) If $f: \mathbb{R} - \{0\} \rightarrow \mathbb{R}$ is defined by $f(x) = x^3 - \frac{1}{x^3}$, then show that $f(x) + f(1/x) = 0$.
(b) If $f: \mathbb{R} - \{0\} \rightarrow \mathbb{R}$ is defined by $f(x) = x - \frac{1}{x}$, then show that $(f(x))^2 = f(x^2) + f(1/x^2)$
- 4(a). If $A = \{-2, -1, 0, 1, 2\}$ and $f: A \rightarrow B$ is a surjection defined by $f(x) = x^2 + x + 1$ then find B.
- 4(b). If $A = \left\{0, \frac{\pi}{6}, \frac{\pi}{4}, \frac{\pi}{3}, \frac{\pi}{2}\right\}$ and $f: A \rightarrow B$ is a surjection defined by $f(x) = \cos x$ then find B.

QNO-2 FUNCTIONS

- 1(a). If $f = \{(1,2), (2,-3), (3,-1)\}$ then find (i) $2f$ (ii) f^2
- 2(b). If $f = \{(4,5), (5,6), (6,-4)\}$; $g = \{(4,-4), (6,5), (8,5)\}$ find (i) $f+g$ (ii) $f-g$ (iii) fg (iv) \sqrt{f}
- 3(a). Find the domain of the real function $f(x) = \sqrt{x^2 - 25}$ 3(b). Find the domain of the real function $f(x) = \sqrt{4x - x^2}$
- 4(a). Find the domain of $\frac{1}{\sqrt{x^2 - a^2}}$ 4(b). Find the domain of the real function $f(x) = \sqrt{9 - x^2}$

QNO-3 MATRICES

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

(b) If $A = \begin{bmatrix} 4 & -5 \\ -2 & 3 \end{bmatrix}$ then find $-5A$

2(a). Find the trace of $\begin{bmatrix} 1 & 3 & -5 \\ 2 & -1 & 5 \\ 2 & 0 & 1 \end{bmatrix}$

(b). Find the trace of A, if $A = \begin{bmatrix} 1 & 2 & -1/2 \\ 0 & -1 & 2 \\ -1/2 & 2 & 1 \end{bmatrix}$

3.(a) If $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$, $B = \begin{bmatrix} 3 & 8 \\ 7 & 2 \end{bmatrix}$ and $2X+A=B$ then find X.

3(b). If $A = \begin{bmatrix} 3 & 2 & -1 \\ 2 & -2 & 0 \\ 1 & 3 & 1 \end{bmatrix}$, $B = \begin{bmatrix} -3 & -1 & 0 \\ 2 & 1 & 3 \\ 4 & -1 & 2 \end{bmatrix}$ and $X = A + B$ then find X

3.(c) If $\begin{bmatrix} x-3 & 2y-8 \\ z+2 & 6 \end{bmatrix} = \begin{bmatrix} 5 & 2 \\ -2 & a-4 \end{bmatrix}$ then find the value of x,y,z and a.

3(d). If $\begin{bmatrix} x-1 & 2 & 5-y \\ 0 & 2-1 & 7 \\ 1 & 0 & a-5 \end{bmatrix} = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 4 & 7 \\ 1 & 0 & 0 \end{bmatrix}$ then find the values of x,y,z,a

5.(a) If $A = \begin{bmatrix} 1 & 2 & 3 \\ 3 & 2 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & 2 & 1 \\ 1 & 2 & 3 \end{bmatrix}$, Find $3B-2A$

5.(b) If $A = \begin{bmatrix} 2 & 4 \\ -1 & k \end{bmatrix}$ and $A^2 = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$ then find the value of k.

QNO-4 MATRICES

1(a). If $A = \begin{bmatrix} 2 & 0 & 1 \\ -1 & 1 & 5 \end{bmatrix}$, $B = \begin{bmatrix} -1 & 1 & 0 \\ 0 & 1 & -2 \end{bmatrix}$ then find $(AB)'$

1(b). If $A = \begin{bmatrix} 2 & -4 \\ -5 & 3 \end{bmatrix}$ then find $A+A'$ and AA' .

1(c). If $A = \begin{bmatrix} \cos\alpha & \sin\alpha \\ -\sin\alpha & \cos\alpha \end{bmatrix}$ then show that $AA' = A'A$

2(a). If $A = \begin{bmatrix} -1 & 2 & 3 \\ 2 & 5 & 6 \\ 3 & x & 7 \end{bmatrix}$ is a symmetric matrix, find x

2(b). If $\begin{bmatrix} 0 & 2 & 1 \\ -2 & 0 & -2 \\ -1 & x & 0 \end{bmatrix}$ is a skew symmetric matrix then find the value of x

3(a). If $A = \begin{bmatrix} 1 & 0 & 0 \\ 2 & 3 & 4 \\ 5 & -6 & x \end{bmatrix}$ and $\det A = 45$ then find x

3(b). Show that $\begin{vmatrix} 1 & w & w^2 \\ w & w^2 & 1 \\ w^2 & 1 & w \end{vmatrix} = 0$

4(a). Find the Adjoint and Inverse of the matrix i) $A = \begin{bmatrix} 1 & 2 \\ 3 & -5 \end{bmatrix}$ ii) $A = \begin{bmatrix} 2 & -3 \\ 4 & 6 \end{bmatrix}$

4(b). Find the determinant of the matrix $\begin{bmatrix} 1^2 & 2^2 & 3^2 \\ 2^2 & 3^2 & 4^2 \\ 3^2 & 4^2 & 5^2 \end{bmatrix}$

5(b). Find the rank a) $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$ b) $\begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$

QNO-5 Addition of vectors

- 1(a). Find the unit vector in the direction of vector $a = 2i+3j+k$
- 1(b). Let $a = i + 2j + 3k$ and $b = 3i + j$. Find a unit vector in the direction of $a + b$
- 2(a) Let $a = 2i + 4j - 5k$, $b = i + j + k$, $c = j + 2k$. Find the unit vector in the opposite direction of $a + b + c$
- 2(b). Find a vector in the direction of vector $a = i - 2j$ that has magnitude 7 units.
- 3(a). If $a = 2i + 5j + k$, $b = 4i + mj + nk$ are collinear vectors then find m, n
- 3(b). If vectors $-3i + 4j + \lambda k$, $\mu i + 8j + 6k$ are collinear vectors then find λ & μ
4. If $OA = i + j + k$, $AB = 3i - 2j + k$, $BC = i + 2j - 2k$, $CD = 2i + j + 3k$ then find the vector OD

QNO-6 Addition of vectors

- 1(a). Find the vector equation of the plane passing through $2i + j + 3k$, $-4i + 3j - k$ and parallel to the vector $4i - 2j + 3k$
- 1(b). Find the vector equation of the plane passing through $2i + j + 3k$, $-4i + 3j - k$
- 1(C). Find the vector equation of the plane passing through the points $i - 2j + 5k$, $-5j - k$, $-3i + 5j$
- 2(a). If the vector $\lambda i - 3j + 5k$, $2\lambda i - \lambda j - k$ are perpendicular to each other find λ .
- 2(b). If the vectors $2i + \lambda j - k$ and $4i - 2j + 2k$ are perpendicular to each other then find λ .
- 2(c). If $a = i + 2j - 3k$, $b = 3i - j + 2k$ then show that $a + b$, $a - b$ are perpendicular.

QNO-7 Product of vectorS

1. If $a + b + c = 0$, $|a| = 3$, $|b| = 5$, $|c| = 7$ then find the angle between a and b .
- 1(b). If $a = i - j - k$, $b = 2i - 3j + k$ then find the projection vector of b on a and its magnitude.
- 2(a). Find the angle between the planes $r(2i - j + 2k) = 3$, $r(3i + 6j + k) = 4$
- 2(b). Find the equation of the plane through the point $(3, -2, 1)$ and perpendicular to the vector $(4, 7, -4)$
3. Find the angle between the vectors $i + 2j + 3k$ and $3i - j + 2k$.
- 4(a). Find the area of the parallelogram whose adjacent sides are $a = 2j - k$, $b = -i + k$.
- 4(b). Find the area of the parallelogram whose adjacent sides are $a = 2i - 3j$, $b = -3i - k$
- 5(a). Find the vector area and area of the parallelogram having $a = i + 2j - k$, $b = 2i - j + 2k$ adjacent sides.
- 5(b). Find the area of the parallelogram whose diagonals are $3i + j - 2k$, $i - 3j + 4k$.

QNO-8 Trigonometric of Transformations

- 1(a). Prove that $\tan 70^\circ - \tan 20^\circ = 2\tan 50^\circ$
- 1(b). Prove that $\sin 50^\circ - \sin 70^\circ + \sin 10^\circ = 0$
- 2(a). Prove that $\frac{\cos 9^\circ + \sin 9^\circ}{\cos 9^\circ - \sin 9^\circ} = \cot 36^\circ$
- 2(b). If $\tan 20^\circ = \lambda$ then show that $\frac{\tan 160^\circ - \tan 110^\circ}{1 + \tan 160^\circ \cdot \tan 110^\circ} = \frac{1 - \lambda^2}{2\lambda}$
- 3(a). If $3\sin\theta + 4\cos\theta = 5$, then the value of $4\sin\theta - 3\cos\theta$.
- 3(b). Find the value of $\sin 330^\circ \cos 120^\circ + \cos 210^\circ \cdot \sin 300^\circ$
- 4(a). Show that $\cot \frac{\pi}{16} \cdot \cot \frac{2\pi}{16} \cdot \cot \frac{3\pi}{16} \dots \dots \cot \frac{7\pi}{16} = 1$
- 4(b). If $\sin\theta = 4/5$ and θ is not the first quadrant, find the value of $\cos\theta$.
- 5(a). Show that $\sin^2 \frac{\pi}{10} + \sin^2 \frac{4\pi}{10} + \sin^2 \frac{6\pi}{10} + \sin^2 \frac{9\pi}{10} = 2$
- 5(b). Show that $\cos^4 \frac{\pi}{8} + \cos^4 \frac{3\pi}{8} + \cos^4 \frac{5\pi}{8} + \cos^4 \frac{7\pi}{8} = \frac{3}{2}$

QNO-9 Trigonometric of Transformations

- 1(a). Find the maximum and minimum values of $f(x) = 3\cos x + 4\sin x$
- 1(b). Find the range of $13\cos x + 3\sqrt{3}\sin x - 4$. 1(c). Find the range of $7\cos x - 24\sin x + 5$
- 2(a). Find the period of $f(x) = \cos(3x + 5) + 7$
3. Find the period of $\tan(x + 4x + 9x + \dots + n^2x)$ (n any positive integer)
- 4(a). Find a cosine function whose period is 7.
- 4(b). Find the sine function whose period is $2/3$
5. Find the value of (a) $\sin^2 82\frac{1}{2}^\circ - \sin^2 22\frac{1}{2}^\circ$ (b) $\cos^2 52\frac{1}{2}^\circ - \sin^2 22\frac{1}{2}^\circ$

QNO-10 Hyperbolic Functions

- 1(a). Prove that $\cosh^4 x - \sinh^4 x = \cosh 2x$ 1(b). Prove that $(\cosh x - \sinh x)^n = \cosh(nx) - \sinh(nx)$
- 2(a). If $\sinh x = 3/4$ then find $\cosh 2x$ and $\sinh 2x$. 2(b). If $\cosh x = 5/2$, then find the values of (i) $\cosh(2x)$ and (ii) $\sinh(2x)$
- 3(a). If $\sinh x = 3$ then show that $x = \log(3 + \sqrt{10})$ 3(b). If $\sinh x = 5$ then show that $x = \log_e(5 + \sqrt{26})$
4. Show that $\text{Tanh}^{-1} \frac{1}{2} = \frac{1}{2} \log_e 3$
5. Prove that for any $x \in \mathbb{R}$ $\sinh x = 3\cosh x + 4\sinh^3 x$