MATHS

BOOKS - VGS PUBLICATION-BRILLIANT

MODEL PAPER 1

Section A

1. If $A = \{-2, -1, 0, 1, 2\}$ and $f: A \to B$ is a surjection defined by $f(x) = x^2 + x + 1$ then find B.

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2. Find the domain of the real function $f(x) = \sqrt{4x - x^2}$

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

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4. Find the rank of the matrix $\begin{bmatrix} 1 & 4 & -1 \\ 2 & 3 & 0 \\ 0 & 1 & 2 \end{bmatrix}$

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5. If the position vectors of the points A, B and C are $-2\bar{i} + \bar{j} - \bar{k}, \ -4\bar{i} + 2\bar{j} + 2\bar{k}$ and $6\bar{i} - 3\bar{j} - 13\bar{k}$ respectively and $\overline{AB} = \lambda\overline{AC}$, then find the value of λ.

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6. Find the vector equation of the plane passing through the points $\bar{i} - 2\bar{j} + 5\bar{k}, \ -5\bar{j} - \bar{k}, \ -3\bar{i} + 5\bar{j}$.

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7. If $\bar{a} = 2\bar{i} - \bar{j} + \bar{k}, \bar{b} = \bar{i} - 3\bar{j} - 5\bar{k}$, find the vector $\bar{c}$ such that $\bar{a}, \bar{b}$ and $\bar{c}$ form the sides of a triangle.

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8. Sketch the graph of $\sin 2x$ in the intervals $(0, \pi)$

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9. Find the value of $\cos^2 52\frac{1^\circ}{2} - \sin^2 22\frac{1^\circ}{2}$

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10. If $\sin hx = 3$, then show that $x = \log_e\left(3 + \sqrt{10}\right)$.

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Section B

1. If A is a non-singular matrix then prove that $A^{-1} = \frac{adjA}{|A|}$.

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2. $\bar{a}, \bar{b}, \bar{c}$, are non-coplanar vectors, Prove that the following four points are coplanar.

$6\bar{a} + 2\bar{b} - \bar{c}, 2\bar{a} - \bar{b} + 3\bar{c}, \ -\bar{a} + 2\bar{b} - 4\bar{c}, \ -12\bar{a} - \bar{b} - 3\bar{c}.$

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3. if $\bar{a} + \bar{b} + \bar{c} = \bar{0}, |\bar{a}| = 3, |\bar{b}| = 5, |\bar{c}| = 7$ then find angle between $\bar{a}, \bar{b}$.

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4. If α, β are the solutions of the equation $a\cos\theta + b\sin\theta = c$, where $a, b, c \in R$ and if $a^2 + b^2 > 0, \cos\alpha \neq \cos$ then show that (i) $\sin\alpha + \sin\beta = \frac{2bc}{a^2+b^2}$ (ii) $\sin\alpha.\sin\beta = \frac{c^2-a^2}{a^2+b^2}$

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5. Solve the equation $\cot^2 x - (\sqrt{3}+1)\cot x + \sqrt{3} = 0, 0 < x < \frac{\pi}{2}$

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6. Prove that: $\tan^{-1}\frac{1}{7} + \tan^{-1}\frac{1}{13} - \tan^{-1}\frac{2}{9} = 0$

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7. Prove that: $\frac{1+\cos(A-B)\cos C}{1+\cos(A-C)\cos B} = \frac{a^2+b^2}{a^2+c^2}$

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Section C

1. If $f: A \to B, g: B \to C$ are two bijective functions then P.T $(\text{gof})^{-1} = f^{-1}\text{og}^{-1}$

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2. Using Mathematical Induction, prove that statement for all n $\in$ N

$$\left(1+\frac{3}{1}\right)\left(1+\frac{5}{4}\right)\left(1+\frac{7}{9}\right)\ldots\ldots\left(1+\frac{2n+1}{n^2}\right) = (n+1)^2.$$

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3. Find the value of x, if $\begin{vmatrix} x-2 & 2x-3 & 3x-4 \\ x-4 & 2x-9 & 3x-16 \\ x-8 & 2x-27 & 3x-64 \end{vmatrix} = 0.$

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4. Apply the test of rank to examine whether the equations $x+y+z=6, x-y+z=2, 2x-y+3z=9$ is consistent or inconsistent and if consistent find the complete solution.

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5. $\bar{a}, \bar{b}, \bar{c}$ are three vectros, then prove that:

$(\bar{a} \times \bar{b}) \times \bar{c} = (\bar{a}.\ \bar{c})\bar{b} - (\bar{b}.\ \bar{c})\bar{a}.$

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6. If A,B, C are angles in a triangle, then prove that: $\sin^2 A + \sin^2 B - \sin^2 C = 2\sin A \sin B \cos C$

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7. In ΔABC, show that:

$$(r_1 + r_2)\sec^2\frac{C}{2} = (r_2 + r_3)\sec^2\frac{A}{2} = (r_3 + r_1)\sec^2\frac{B}{2}$$

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Section A I Very Short Answer Type Questions

1. If $f: R \to (0, \infty)$ defined by $f(x) = 5^x$, then find $f^{-1}(x)$

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2. Find the domains of the real valued function

$$f(x) = \frac{1}{\sqrt{x^2 - a^2}}, \text{(a > 0)}$$

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3. 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.

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4. For any square matrix A, show that AA' is symmetric.

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5. If $\vec{a} = 2i + 4j - 5k$, $\vec{b} = i + j + k$ and $\vec{c} = j + 2k$. Find the unit vector in the opposite direction of $\vec{a} + \vec{b} + \vec{c}$

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6. Find the vector equation of the line passing through the point $2\bar{i} + 3\bar{j} + \bar{k}$ and parallel to the vector $4\bar{i} - 2\bar{j} + 3\bar{k}$

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7. If $\bar{a} = \bar{i} + \bar{j} + t\bar{k}, \bar{b} = \bar{i} + 2\bar{j} + 3\bar{k}$, then the value of 't' when $\bar{a} + \bar{b}$ and $\bar{a} - \bar{b}$ are perpendicular is

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8. Find the period of the function $\tan\left(x + 4x + 9x + \ldots\ldots\ldots + n^2x\right)$.

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9. Prove that $\frac{\cos 9^\circ + \sin 9^\circ}{\cos 9^\circ - \sin 9^\circ} = \cot 36^\circ$

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10. S.T $\frac{\tanh^{-1} 1}{2} = \frac{1}{2}\log_e 3.$

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11. If $f: Q \to Q$ is defined by $f(x) = 5x + 4$, find f^{-1}.

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12. Find the domain of the real function $f(x) = \sqrt{4x - x^2}$

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13. 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')'.

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14. 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.

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15. IF the vectors $-3\bar{i}+4\bar{j}+\lambda\bar{k}, \mu\bar{i}+8\bar{j}+6\bar{k}$ are collinear vectors then find $\lambda\&\mu$.

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16. Find the vector equation of the plane passing through the points. $\vec{i}-2\vec{j}+5\vec{k}, -5\vec{j}-\vec{k}$ and $-3\vec{j}+5\vec{j}$.

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17. Find the angle between the vectors $\vec{i}+2\vec{j}+3\vec{k}$ and $3\vec{i}-\vec{j}+2\vec{k}$.

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18. If $3\sin A+4\cos A=5$, then find the value of $4\sin\theta-3\cos\theta$.

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19. Show that $\cos 42^\circ + \cos 78^\circ + \cos 162^\circ = 0$

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20. If $\sinh x = \frac{3}{4}$ then find $\cosh 2x$ and $\sinh 2x$.

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Section B Ii Short Answer Type Questions

1. If $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ and $E = \begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix}$ then show that $(aI + bE)^3 = a^3 I + 3a^2 bE$ where I is identify matrix of order 2.

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2. If ABCDEF is a regular hexagon with centre O , then P.T $\overline{AB} + \overline{AC} + \overline{AD} + \overline{AE} + \overline{AF} = 3\overline{AD} = 6\overline{AO}$

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3. If $\vec{a} = 2i + j - k$, $\vec{b} = -i + 2j - 4k$ and $\vec{c} = i + j + k$, then find $\left(\vec{a} \times \vec{b}\right).\left(\vec{b} \times \vec{c}\right)$

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4. Prove that $\left(1 + \cos\frac{\pi}{10}\right)\left(1 + \cos\frac{3\pi}{10}\right)\left(1 + \cos\frac{7\pi}{10}\right)\left(1 + \cos\frac{9\pi}{10}\right) = \frac{1}{16}$

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5. Solve $\sqrt{2}(\sin x + \cos x) = \sqrt{3}$

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6. Prove that $\tan^{-1}\left(\frac{1}{2}\right)+\tan^{-1}\left(\frac{1}{5}\right)+\tan^{-1}\left(\frac{1}{8}\right)=\frac{\pi}{4}$

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7. In ΔABC show that $\frac{b^2-c^2}{a^2}=\frac{\sin(B-C)}{\sin(B+C)}$

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8. IF $3A=\begin{bmatrix}1 & 2 & 2\\ 2 & 1 & -2\\ -2 & 2 & -1\end{bmatrix}$ then show that $A^{-1}=A'$.

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9. Find the vector equation of the plane which passes through the points $2\bar{i}+4\bar{j}+2\bar{k}, 2\bar{i}+3\bar{j}+5\bar{k}$ and parallel to the vector $3\bar{i}-2\bar{j}+\bar{k}$. Also

find the point where this plane meets the line joining the points $2\bar{i}+\bar{j}+3\bar{k}$ and $4\bar{i}-2\bar{j}+3\bar{k}$.

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10. P.T the smaller angle θ between any two diagonals of a cube is given by $\cos\theta = 1/3$

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11. IF θ is not an integral muliple of $\frac{\pi}{2}$, prove that

$\tan\theta + 2\tan 2\theta + 4\tan 4\theta + 8\cot 8\theta = \cot\theta$

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12. Solve $\sqrt{2}(\sin x + \cos x) = \sqrt{3}$

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13. Prove that $\sin^{-1}\frac{3}{5}+\sin^{-1}\frac{8}{17}=\cos^{-1}\frac{36}{85}$

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14. Prove that $\cot A+\cot B+\cot C=\frac{a^2+b^2+c^2}{4\triangle}$.

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Section C Iii Long Answer Type Questions

1. If $f:A\to B$ is a bijective function then prove that

(ii) $f^{-1}of=I_A$.

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2. Using Mathematical Induction, prove that statement for all n $\in$ N

$\left(1+\frac{3}{1}\right)\left(1+\frac{5}{4}\right)\left(1+\frac{7}{9}\right).....\left(1+\frac{2n+1}{n^2}\right)=(n+1)^2$.

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3. Without expanding the determinant show that

$$\begin{vmatrix} b+c & c+a & a+b \\ c+a & a+b & b+c \\ a+b & b+c & c+a \end{vmatrix} = 2\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$$

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4. Solve the equations $3x + 4y + 5z = 18, 2x + y + 8z = 13, 5x - 2y + 7z = 20$ by matrix inversion method.

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5. If $\vec{a}, \vec{b}, \vec{c}$ are three vectors, then prove that

$$\vec{a} \times \left(\vec{b} - \vec{c}\right) = \left(\vec{a} \times \vec{b}\right) - \left(\vec{a} \times \vec{c}\right)$$

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6. If $\vec{a}, \vec{b}, \vec{c}$ are three vectors, then prove that

$$\vec{a} \times \left(\vec{b} - \vec{c}\right) = \left(\vec{a} \times \vec{b}\right) - \left(\vec{a} \times \vec{c}\right)$$

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7. IF $A + B + C = \pi$, then P.T

$$\cos^2 \frac{A}{2} + \cos^2 \frac{B}{2} + \cos^2 \frac{C}{2} = 2\left(1 + \sin \frac{A}{2} \sin \frac{B}{2} \sin \frac{C}{2}\right)$$

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8. In a $\triangle ABC$ if $a = 13, b = 14, c = 15$ then S.T

$$R = \frac{65}{8}, r = 4, r_1 = \frac{21}{2}, r_2 = 12, r_3 = 14.$$

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9. If $f: A \to B, g: B \to C$ are two bijective functions then prove that $gof: A \to C$ is also a bijective function.

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10. Using the principle of finite Mathematical Induction prove the following:

(v) $3.5^{2n+1} + 2^{3n+1}$ is divisible by 17, $\forall n \in N$.

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

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12. Solve the system of equations by Matrix inverse method, $2x - y + 3z = 8, \ -x + 2y + z = 4, 3x + y - 4z = 0$

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13. If $\vec{a} = \vec{i} - 2\vec{j} - 3\vec{k}$, $\vec{b} = 2\vec{i} + \vec{j} - \vec{k}$ and $\vec{c} = \vec{i} + 3\vec{j} - 2\vec{k}$, verify that $\vec{a} \times \left(\vec{b} \times \vec{c}\right) \neq \left(\vec{a} \times \vec{b}\right) \times \vec{c}$.

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14. If A, B, C are the angles in a triangle then prove that $\sin.\frac{A}{2} + \sin.\frac{B}{2} + \sin.\frac{C}{2} = 1 + 4\sin\left(\frac{\pi - A}{4}\right)\sin\left(\frac{\pi - B}{4}\right)\sin\left(\frac{\pi - C}{4}\right.$

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15. If $r_1 = 2, r_2 = 3, r_3 = 6$ and $r = 1$, prove that $a = 3, b = 4$ and $c = 5$.

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Section A Very Short Answer Type Questions

1. If the function f is defined by $f(x) = \begin{cases} 3x-2, & x > 3 \\ x^2-2, & -2 \leq x \leq 2 \\ 2x-1, & x < -3 \end{cases}$ then find the values, if exist, of (i) $f(4)$

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2. Find the domain of the real function $\log\left(x^2-4x+3\right)$

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

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

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5. If $\bar{a} = 2\bar{i} + 5\bar{j} + \bar{k}$ and $\bar{b} = 4\bar{i} + m\bar{j} + n\bar{k}$ are collinear vectors then find m,n.

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6. Find the vector equation of the line passing through the points $2\bar{i} + \bar{j} + 3\bar{k}$ and $-4\bar{i} + 3\bar{j} - \bar{k}$.

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7. If the vectors $2\bar{i} + \lambda\bar{j} - \bar{k}$ and $4\bar{i} - 2\bar{j} + 2\bar{k}$ are perpendicular to each other than find λ.

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8. If $\sec\theta + \tan\theta = 5$, find the quadrant in which θ lies and find the value of $\sin\theta$.

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9. Prove that $\sin^2 52\frac{1}{2} - \sin^2 22\frac{1}{2}$.

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10. $(\cos hx - \sin hx)^n$ =

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Section B Short Answer Type Questions

1. If $A = \begin{bmatrix} 1 & -2 & 1 \\ 0 & 1 & -1 \\ 3 & -1 & 1 \end{bmatrix}$ then show that $A^3 - 3A^2 - A - 3I = O$, where I is unit matrix of order 3

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

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3. If $\bar{a}=2\bar{i}+3\bar{j}+4\bar{k}, \bar{b}=\bar{i}+\bar{j}-\bar{k}, \bar{c}=\bar{i}-\bar{j}+\bar{k}$, compute $\bar{a}x\left(\bar{b}x\bar{c}\right)$ and verify that it is perpendicular to $\bar{a}$.

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4. Prove that $\sin 78^\circ+\cos 132^\circ=\frac{\sqrt{5}-1}{4}$.

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5. Solve the equation $1+\sin^2\theta=3\sin\theta\cos\theta$.

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6. $\tan\left[\cos^{-1}\frac{4}{5}+\tan^{-1}\frac{2}{3}\right]=$

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7. If $a=(b-c)\sec\theta$, then prove that $\tan\theta=\frac{2\sqrt{bc}}{b-c}\frac{\sin A}{2}$.

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Section C Long Answer Type Questions

1. If $f:A\to B$ and $g:B\to A$ are two functions such that $gof=I_A$ and $fog=I_B$ then $g=f^{-1}$.

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2. Prove that $a+ar+ar^2+\ldots\ldots+n\text{terms}=\frac{a(r^n+1)}{r-1}, r\neq 1$

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3. $\begin{vmatrix} a-b-c & 2b & 2c \\ 2a & b-c-a & 2c \\ 2a & 2b & c-a-b \end{vmatrix} =$

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4. Solve the equations $x+y+z=9, 2x+5y+7z=52, 2x+y-z=0,$ by Gauss-Jordan Method.

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5. If $\bar{a}=2\bar{i}+\bar{j}-3\bar{k}, \bar{b}=\bar{i}-2\bar{j}+\bar{k}, \bar{C}=-\bar{i}+\bar{j}-4\bar{k}, \bar{D}=\bar{i}+\bar{j}+\bar{k},$ then compute $\left|\left(\bar{a}\times\bar{b}\right)\times\left(\bar{c}\times\bar{d}\right)\right|$.

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6. In triangle ABC, prove that $\cos.\frac{A}{2}+\cos.\frac{B}{2}+\cos.\frac{C}{2}=4\cos.\frac{\pi-A}{4}\cos.\frac{\pi-B}{4}\cos.\frac{\pi-C}{4}$

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7. In ΔABC, show that $\frac{ab-r_1r_2}{r_3}=\frac{bc-r_2r_3}{r_1}=\frac{ca-r_3r_1}{r_2}$

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Section A Very Short Answer Type Questions

1. Find the ratio in which the straight line $3x+4y=6$ divides the line joining the points (2,-1) and (1,1). State whether the points lie on the same side or on either side of the straight line.

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2. Find the value of p, if the straight lines $3x + 7y - 1 = 0$ and $7x - py + 3 = 0$ are mutually perpendicular.

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3. Show that the points $A(3, 2, -4), B(5, 4, -6)$ and $C(9, 8, -10)$ are collinear and find the ratio in which B divides $\overline{AC}$.

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4. Find the equation to the plane parallel to the ZX-plane and passing through (0,4,4).

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5. Show that

$$Lt_{x \to 2-} \frac{|x-2|}{x-2} = -1$$

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6. Find $Lt_{x \to -\infty} \frac{5x^3 + 4}{\sqrt{2x^4 - 1}}$.

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7. If $f(x) = \cos[\log(\cot x)]$, then find f'(x).

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8. If f(x)=$2x^2 + 3x + 5$, then prove that $f'(0) + 3f'(-1) = 0$

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9. The time 't' of a complete oscillation of a simple pendulum of length 1 is given by $t = 2\pi\sqrt{\frac{l}{g}}$ where gis gravitational constant. Find the

approximate percentage of error in t when the percentage of error in lis 1%

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10. What is polymerization? Explain with one example.

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Section B Short Answer Type Question

1. Find the equation of locus of P, if the line segment joining (2,3) & (-1,5) subtends a right angle at P.

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2. When the origin is shifted to the point (2 , 3) the transformed equation of a curve is $x^2 + 3xy - 2y^2 + 17x - 7y - 11 = 0$. Find the original

equation of curve.

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3. A straight line passing through $A(1, -2)$ makes an angle $\frac{\tan^{-1} 4}{3}$ with the positive direction of the X-axis in the anticlock wise sense. Find the point on the straight line whose distance from A is 5 units.

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4. Check the continity of the following function at 2 .

$$f(x) = \begin{cases} \frac{1}{2}(x^2 - 4) & \text{if } 0 < x < 2 \\ 0 & \text{if } x = 2 \\ 2 - 8x^{-3} & \text{if } x > 2 \end{cases}$$

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5. Find the derivative of x^x.

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6. A stone is dropped into a quiet lake and ripples move in circles at the speed of 5 cm/sec. At the instant when the radius of circular ripple is 8cm, how fast is the enclosed area increases?

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7. Find the angle between the curves $y^2 = 4x, x^2 + y^2 = 5$

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Section C Long Answer Type Question

1. Find the equation of the straight lines passing through the point $(1, 2)$ and making an angle of 60° with the line $\sqrt{3}x + y + 2 = 0$

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2. Area of the triangle formed by the lines $3x^2 - 4xy + y^2 = 0, 2x - y = 6$ is

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3. Show that product of the perpendicular distances from origin to pair of lines represented by $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ is $\frac{|c|}{\sqrt{(a-b)^2 + 4h^2}}$

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4. Find the angle between the lines, whose direction cosines are given by the equation $3l + m + 5n = 0$ and $6mn - 2nl + 5lm = 0$.

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5. Find the derivative of the w.r.to x.

$x^x + (\cot x)^x$

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6. Find the equations of the tangent to the curve $y = 3x^2 - x^3$, where it meets the X-axis.

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7. From a rectangular sheet of dimension $30cm \times 80cm$, four equal squares of side x cm. are removed at the corners, and the sieds are then turned up so as to form an open rectangular box.

Find the value of x, so that the volume of the box is the greatest.

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Section A Very Short Answer Type Questions

1. Find the value of x if the slope of the line passing through (2,5) and $(x, 3)$ is 2.

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2. Transform the equation of $x + y + 1 = 0$ into

Normal form

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3. Show that the points (1,2,3), (2,3,1) and (3,1,2) form an equilateral triangle.

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4. Find the angle between the planes 2x - y + z = 6 and x + y + 2 z = 7 .

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5. Show that $\underset{x \to 0^+}{\text{Lt}} \left\{ \frac{2|x|}{x} + x + 1 \right\} = 3.$

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6. Find $\underset{x \to 0}{\text{Lt}} \frac{e^{3+x} - e^3}{x}$

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7. If $f(x) = a^x . e^{x^2}$ then find $f'(x)$.

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8. A grocer has a sale of Rs. 6435, Rs. 6927, Rs. 6855, Rs. 7230 and Rs. 6562 for 5 consecutive months. How much sale must he have in the sixth month so that he gets an average sale of Rs. 6500?

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9. The average monthly income of P and Q is Rs. 5050. The average monthly income of Q and R is Rs. 6250 and the average monthly income of P and R is Rs. 5200. The monthly income of P is:

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10. 2x+32=24 then find x?

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11. Find the equation of the straight line passing through A(-1,3) and (i) parallel (ii) perpendicular to the straight line passing through B(2,-5),C(4,6)

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12. If the area of the triangle formed by the straight lines $x = 0, y = 0$ and $3x + 4y = a(a > 0$ is 6. Find the value of a.

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13. If (3, 2, -1) (4, 1,-1) and (6,2,5) are three vertices and (4, 2, 2) is the centroid of a tetrahedron, then find the fourth vertex.

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14. Find the equation of the plane whose intercepts on x, y, z axes are 1, 2, 4 respectively.

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15. Show that $\underset{x \to \infty}{\text{Lt}} \sqrt{x^2 + x} - x = \frac{1}{2}$.

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16. Compute $\underset{x \to 0}{\text{Lt}} \frac{1 - \cos 2mx}{\sin^2 nx} (m, n \in Z)$.

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17. If f(x) = log (sec x + tan x), then find f' (x).

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18. Find the derivative of the function $\sin^{-1}\left(3x - 4x^3\right)$.

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19. If an error of 3% occurs in measuring the side of a cube, find the percentage error in its volume.

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20. Find the value of 'c' in Rolle's theorem for the function $f(x) = (x-1)(x-2)(x-3)$ on $[1, 3]$.

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Section B Short Answer Type Questions

1. A(2,3) and B(-3,4) be two given points. Find the equation of the locus of P so that the area of the triangle PAB is 8.5 sq.units.

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2. When the axes are rotated through an angle $\pi/6$. Find the transformed equation of $x^2 + 2\sqrt{3}xy - y^2 = 2a^2$.

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3. Find the points on the line $3x - 4y - 1 = 0$ which are at a distance of 5 units from the point (3,2).

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4. Show that

$$f(x) = \begin{cases} \frac{\cos ax - \cos bx}{x^2} & \text{if } x \neq 0 \\ \frac{1}{2}(b^2 - a^2) & \text{if } x = 0 \end{cases}$$

where a and b are real constants is continuous at x = 0.

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5. Find the derivative of sin2x from the first principles .

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6. A particle is moving in a straight line so that after 't' seconds its distance is 'S' (in cms) from a fixed point of the line is given be S=f(t)=

$8t + t^3$.

Find (i) the velocity at time t=2 (ii) the initial velocity (iii) acceleration at t=2 sec

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7. A particle is moving along a line according $s = f(t) = 8t + t^3$. Find the initial velocity

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8. A particle is moving in a straight line so that after 't' seconds its distance is 'S' (in cms) from a fixed point of the line is given be S=f(t)= $8t + t^3$.

Find (i) the velocity at time t=2 (ii) the initial velocity (iii) acceleration at t=2 sec

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9. S.T the tangent at any point θ on the curve $x = c\sec\theta, y = c\tan\theta$ is $y\sin\theta = x - \cos\theta.$

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Section C Long Answer Type Questions

1. Find the equation of straight lines passing through (1,2) and making an angle 60° with the line $\sqrt{3}x + y + 2 = 0.$

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2. Show that the area of the triangle formed by the lines $ax^2 + 2hxy + by^2 = 0$ and $lm + my + n = 0$ is $\frac{n^2\sqrt{h^2 - ab}}{|am^2 - 2hlm + bl^2|}$

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3. Find the value if k , if the lines joining the origin with the points of intersection of the curve $2x^2 - 2xy + 3y^2 + 2x - y - 1 = 0$ and the x + 2y = k are mutually perpendicular .

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4. If a line makes angles $\alpha, \beta, \lambda, \delta$ with the four diagonals of a cube, then show that $\cos^2\alpha + \cos^2\beta + \cos^2\lambda + \cos^2\delta = \frac{4}{3}$.

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5. If $x = \frac{3at}{1+t^3}, y = \frac{3at^2}{1+t^3}$ then find $\frac{dy}{dx}$.

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6. At any point t on the curve $x = a(t + \sin t), y = a(1 - \cos t)$ find the lengths of tangent and normal.

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7. A wire of length l is cut into two parts which are bent respectively in the form of a square and a circle. What are the lengths of pieces of wire so that the sum of areas is least ?

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8. Find the circumcentre of the triangle whose sides are $3x - y - 5 = 0, x + 2y - 4 = 0$ and $5x + 3y + 1 = 0.$

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9. If $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ represents two parallel lines then prove that $h^2 = ab.$

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10. If $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ represents two parallel lines then prove that $af^2 = bg^2$.

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11. If $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ represents two parallel lines then prove that the distance between the parallel lines is $2\sqrt{\frac{g^2 - ac}{a(a+b)}}$ or $2\sqrt{\frac{f^2 - bc}{b(a+b)}}$.

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12. Find the angle between the lines joining the origin to the points of intersection of the curve $x^2 + 2xy + y^2 + 2x + 2y - 5 = 0$ and the line 3x-y+1=0.

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13. Find the angle between the lines whose direction cosines satisfy the equaitons $l+m+n=0, l^2+m^2-n^2=0.$

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14. If $\sqrt{1-x^2}+\sqrt{1-y^2}=a(x-y)$, then show that $\frac{dy}{dx}=\frac{\sqrt{1-y^2}}{\sqrt{1-x^2}}$

.

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15. S.T the curves $y^2=4(x+1), y^2=36(9-x)$ intersect orthogonally.

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16. Show that when the curved surface of a is right circular cylinder inscribed in a sphere of radius R is maximum , then the height of the cylinder is $\sqrt{2R}.$

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Section B Short Answer Type Questions

1. Find the equation of locus of a point such that the difference of whose distances from (-5,0) and (5,0) is 8

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2. When the axes rotated through an angegle $\frac{\pi}{4}$, find the transformed equation of $3x^2 + 10xy + 3y^2 = 9$.

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3. Find the value of k if the angle between the straight lines $4x - y + 7 = 0, kx - 5y - 9 - 0$ is 45°

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4. Check the continity of the following function at 2 .

$$f(x) = \begin{cases} \frac{1}{2}(x^2 - 4) & \text{if } 0 < x < 2 \\ 0 & \text{if } x = 2 \\ 2 - 8x^{-3} & \text{if } x > 2 \end{cases}$$

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5. Find the derivative of the function tan 2x from the first principle.

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6. A container in the shape of an inverted cone has height 12 cm and radius 6cm at the top. If it is filled with water at the rate of $12cm^3/\text{sec}$, what is the rate of change in the rate of change in the height of water level when the tank is filled 8 cm?

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7. Show that the area of the triangle formed by the tangent at any point on the curve $xy=c$, $(c \neq 0)$, with the coordinate axes is constant.

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