MATHS

BOOKS - VGS PUBLICATION-BRILLIANT

MODEL PAPER 6

Section A I Very Short Answer Type Questions

1. Transform the equation $x + y + 1 = 0$ into Normal form.

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

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4. Evaluate $\lim_{x \to 0} \frac{e^{7x} - 1}{x}$

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5. Compute $\lim_{x \to \infty} \frac{x^2 + 5x + 2}{2x^2 - 5x + 1}$

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6. Find the derivative of 5 sin $x + e^x$ log x .

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7. Find the derivative of $\sec^{-1}\left(\frac{1}{2x^2 - 1}\right), \left(0 < x < \frac{1}{\sqrt{2}}\right)$

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8. Find dy and $\triangle y$ of $y = x^2 + x$ at x=10 when $\triangle x = 0.1$.

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9. Verify Rolle's theorem for the function $y = f(x) = x^2 + 4$on [-3,3]

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Section B Ii Short Answer Type Questions

1. $A(1, 2), B(2, -3), C(-2, 3)$ are 3 points. A point P moves such that $PA^2 + PB^2 = 2PC^2$. Show that

the equation to the locus of P is 7 x - 7y + 4 = 0 .

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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 p, if the lines 3 x + 4 y = 5 , 2 x + 3y = 4 , px + 4y = 6 are concurrent.

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

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

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5. Find the derivative of $\cot x$ from the first principle.

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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. Find the equations of tangent and normal to the curve xy = 10 at (2 , 5)

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Section C Iii Long Answer Type Questions

1. Find the circumcenter of the triangle whose vertices are (-2,3) , (2 , -1) , (4 , 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. 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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5. Find $\frac{dy}{dx}$, if y $= (\sin x)^{\log x} + x^{\sin x}$

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6. Find the angle between the curves xy=2 and $x^2 + 4y = 0$

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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 the pieces of the wire respectively so that the sum of the areas is the least.

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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 valued function $f(x) = \sqrt{9 - x^2}$.

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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 $A = \begin{bmatrix} 2 & 3 \\ -5 & k \end{bmatrix}$ and $A^2 = 0$, then find the value of k.

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5. If α, β and γ be the angle made by the vector $3\bar{i} - 6\bar{j} + 2\bar{k}$ with the positive direction of the coordinate axes, then find $\cos\alpha, \cos\beta, \cos\gamma$.

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

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7. If $\bar{a} = \bar{i} - \bar{j} - \bar{k}, \bar{b} = 2\bar{i} - 3\bar{j} + \bar{k}$ then find the projection vector of $\bar{b}$ on $\bar{a}$ and its magnitude.

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8. If $\cos\theta = t(0 < t < 1)$ and θ does not lies in the first quadrent , find $\sin\theta$ and $\tan\theta$.

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9. Find the maximum and minimum values of $13\cos x + 3\sqrt{3}\sin x - 4$.

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10. $\tan h^{-1}\left(\frac{1}{2}\right) =$

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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 four points $-\bar{a}+4\bar{b}-3\bar{c}$, $3\bar{a}+2\bar{b}-5\bar{c}$, $-3\bar{a}+8\bar{b}-5\bar{c}$, $-3\bar{a}+2\bar{b}+\bar{c}$ are co-planar.

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3. Find the unit vector perpendicular to the plane passing through the points $(1, 2, 3), (2, -1, 1)$ and $(1, 2, -4)$.

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4. Prove that $\sqrt{3}\csc 20^\circ - \sec 20^\circ = 4$

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

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

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7. If $\frac{\cot A}{2} : \cot\frac{B}{2} : \cot\frac{C}{2} = 3:5:7$ then show that $a:b:c = 6:5:4$.

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Section C

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

(i) $fof^{-1} = I_B$

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

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

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3. By Mathematical Induction , show that $49^n + 16n - 1$ is divisible by 64 for all positive Integer n .

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4. Show that :

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

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5. Solve

$x + y + z = 9, 2x + 5y + 7z = 52$ and $2x + y - z = 0$

by using matrix inversion method.

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6. If A=(1, -2, -1), B= (4, 0, -3), C = (1, 2, -1), D=(2, -4, -5)`, then

distance between AB and CD is

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7. If $A + B + C = 180^\circ$, then show that

$\cos 2A + \cos 2B + \cos 2C = -1 - 4\cos A.\cos B.\cos C.$

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8. In ΔABC, if $r_1 = 8, r_2 = 12, r_3 = 24$ then the value of $\sin B =$

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