MATHS

BOOKS - VGS PUBLICATION-BRILLIANT

MODEL PAPER 3

Section A

1. If $f: R - (\pm 1) \rightarrow R$ is defined by $f(x) = \log\left|\frac{1+x}{1-x}\right|$, then show that $f\left(\frac{2x}{1+x^2}\right) = 2f(x)$.

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2. Find the domain of the real function $f(x) = \sqrt{x^2 - 25}$

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3. If $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ then find $A + A^T$ and $\forall^T$

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

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5. Let $\bar{a} = \bar{i} + 2\bar{j} + 3\bar{k}$ and $\bar{b} = 3\bar{i} + \bar{j}$ Find the unit vector in the direction of $\bar{a} + \bar{b}$

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6. Find the vector equation of the plane passing through the points (0,0,0), (0,5,0) and (2,0,1)

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7. If $\sec\theta + \tan\theta = 2/3$, then value of $\sin\theta$ and determine the quadrant in which θ lies .

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8. If A is not an intergral multiple of $\pi/2$, prove that $\tan A + \cot A = 2\text{cosec}2A$

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9. If $\cosh x = 5/2$, then find the values of

$\cosh(2x)$

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10. If $\cosh x = 5/2$, then find the values of

$\sinh(2x)$

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Section B

1. $\theta - \varphi = \frac{\pi}{2}$ then show that

$$\begin{bmatrix} \cos^2\theta & \cos\theta\sin\theta \\ \cos\theta\sin\theta & \sin^2\theta \end{bmatrix}\begin{bmatrix} \cos^2\phi & \cos\phi\sin\phi \\ \cos\phi\sin\phi & \sin^2\phi \end{bmatrix} = O$$

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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. Let $\bar{a} = 4\bar{i} + 5\bar{j} - \bar{k}, \bar{b} = \bar{i} - 4\bar{j} + 5\bar{k}$ and $\bar{c} = 3\bar{i} + \bar{j} - \bar{k}$ Find vector $\overline{\alpha}$ which is perpendicular to both $\bar{a}$ and $\bar{b}$ and $\overline{\alpha} . \bar{c} = 21$

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4. Prove that $\cos^2 76^\circ + \cos^2 16^\circ - \cos 76^\circ \cos 16^\circ = \frac{3}{4}$

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

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6. Show that $\cos\left(2\tan^{-1}.\frac{1}{7}\right)=\sin\left(2\tan^{-1}.\frac{3}{4}\right)$

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7. Show that $a^2\cot A+b^2\cot B+c^2\cot C=\frac{abc}{R}$

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Section C

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

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4. Solve the following equations by Gauss Jordan Method

x+y+ z=1, 2x+ 2y+ 3z= 6 and x+ 4y+ 9z =3

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5. If $\bar{a} = \bar{i} - 2\bar{j} - 3\bar{k}, \bar{b} = 2\bar{i} + \bar{j} - \bar{k}, \bar{c} = \bar{i} + 3\bar{j} - 2\bar{k}$ then find $\bar{a} \times (\bar{b} \times \bar{c})$ and $|(\bar{b} \times \bar{c}) \times \bar{c}|$.

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6. If A, B, C are angles of a triangle, then prove that
$\sin^2\frac{A}{2} + \sin^2\frac{B}{2} - \sin^2\frac{C}{2} = 1 - 2\cos\frac{A}{2}\cos\frac{B}{2}\sin\frac{C}{2}$.

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7. Show that $r + r_3 + r_1 - r_2 = 4R\cos B$.

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Section A Very Short Answer Type Questions

1. Find the equation of the straight line passing through (-4,5) and cutting off equal and non-zero intercepts on the co-ordinate axes.

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

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4. Find the equation of the plane passing through the point (1,1,1) and parallel to the plane $x + 2y + 3z - 7 = 0$

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5. Compute $Lt_{x \to 0} \frac{\sin ax}{\sin bx}, b \neq 0, a \neq b$

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6. Evaluate $Lt_{x \to \infty} \frac{11x^3 - 3x + 4}{13x^3 - 5x^2 - 7}$

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7. Find the derivative of $y = e^{\sin - 1}x$.

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8. Find the derivative of $\tan^{-1}\sqrt{\dfrac{1-\cos x}{1+\cos x}}$

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9. Find the approximate value of $\sqrt[3]{65}$

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10. Verify Rolle's theorem for the function sinx-sin2x on $[0, \pi]$

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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 origin is shifted to (-1,2) by the translation of axes, find the transformed equation $x^2 + y^2 + 2x - 4y + 1 = 0$.

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

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4. If f is given by $f(x) = \begin{cases} k^2x - k & \text{if } x \geq 1 \\ 2 & \text{if } x < 1 \end{cases}$ is a continuous function on R, then find k .

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5. Find the derivative of $\cos ax$ from the first Principle.

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6. The volume of a cube is increasing at a rate of 8 cubie centimeters per second. How fast is the surface area increasing when the length of the edge is 12 cm?

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7. Find the length of subtangent subnormal at a pont t on the curve $x = a(\cos t + \sin t)y = a(\sin t - t\cos t)$

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Section C Long Answer Type Questions

1. Find the orthocentre of the triangle formed by the vertices (-2,-1),(6,-1),(2,5)

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2. S.T the equation $2x^2 - 13xy - 7y^2 + x + 23y - 6 = 0$ represents a pair of straight lines. Also find the angle between them and the coordinates of the point of intersection of the lines.

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3. Show that the lines joining the origin to the points of intersection of the curve $x^2 + xy + y^2 + 3x + 3y - 2 = 0$ and the straight line $x - y - \sqrt{2} = 0$are mutually perpendicular .

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4. Show that the lines whose d.c's are given by l + m + n = 0,2mn + 3nl - 5ln = 0 are perpendicular to each other.

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5. If

$$y = \tan^{-1}\left(\frac{2x}{1-x^2}\right) + \tan^{-1}\left(\frac{3x - x^3}{1-3x^2}\right) - \tan^{-1}\left(\frac{4x - 4x^3}{1-6x+x^4}\right),$$

then show that $\frac{dy}{dx} = \frac{1}{1+x^2}$.

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6. S.T the curves $6x^2 - 5x + 2y = 0, 4x^2 + 8y^2 = 3$ touch each other at $\left(\frac{1}{2}, \frac{1}{2}\right)$.

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7. Find two positive numbers whose sum is 15 so that the sum of their squares is minimum.

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