MATHS

BOOKS - VGS PUBLICATION-BRILLIANT

MODEL PAPER 2

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. If $f(x) = 2x - 1, g(x) = \frac{x+1}{2}$ for all $x \in R$, then find (gof) (x).

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

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

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

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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 the vectors $\lambda\bar{i} - 3\bar{j} + 5\bar{k}$ and $2\lambda\bar{i} - \lambda\bar{j} - \bar{k}$ are perpendicular to each other. Find λ.

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8. IF $\sin\theta = \frac{4}{5}$ and θ is not in the first quadrant, find the value of $\cos\theta$.

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9. If θ is not an integral multiple 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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10. $\tan h^{-1}\left(\frac{1}{2}\right) =$

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Section B

1. IF $A = \begin{bmatrix} -1 & -2 & -2 \\ 2 & 1 & -2 \\ 2 & -2 & 1 \end{bmatrix}$ then show that adj $A = 3A^T$. Also find A^{-1}.

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2. Show that the line joining the pair of points $6\bar{a} - 4\bar{b} + 4\bar{c}, \ -4\bar{c}$ and the line joining the pair of points, $-\bar{a} - 2\bar{b} - 3\bar{c}, \bar{a} + 2\bar{b} - 5\bar{c}$ intersect at the point $-4\bar{c}$ when $\bar{a}, \bar{b}, \bar{c}$ are non-coplanar vectors.

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

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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. Given $p \neq \pm q$, show that the solutions of $\cos p\theta + \cos q\theta = 0$ form two series each of which is in A.P. Also, find the common difference of each A.P.

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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 $a=(b+c)\cos\theta, \quad$ then prove that $\sin\theta=\frac{2\sqrt{bc}}{b+c}\cos\left(\frac{A}{2}\right)$

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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 the principle of finite Mathematical Induction prove the following:

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

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3. Show that

$$\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}^2 = \begin{vmatrix} 2bc - a^2 & c^2 & b^2 \\ c^2 & 2ac - b^2 & a^2 \\ b^2 & a^2 & 2ab - c^2 \end{vmatrix} = \left(a^3 + b^3 + c^3 - 3abc\right)^2$$

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4. $x - y + 3z = 5, 4x + 2y - z = 0, -x + 3y + z = 5,$ solve the system of equation of using Cramer's rule.

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5. Show that volume of a tetrahedron with $\bar{a}, \bar{b}$ and $\bar{c}$ as cote-rminous edges is $\frac{1}{6}[\bar{a}\bar{b}\bar{c}]$

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6. If $A + B + C = 0,$ then prove that $\sin 2A + \sin 2B + \sin 2C = -4 \sin A \sin B \sin C.$

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7. In a ΔABC if $a = 13, b = 14, c = 15$ then show that $R = \frac{65}{8}, r = 4, r_1 =$

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Section A Very Short Answer Type Questions

1. Find the angle which the straight line $y = \sqrt{3}x - 4$ makes with the Y-axis.

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2. Find the distance between the parallel lines $3x + 4y - 3 = 0$ and $6x + 8y - 1 = 0$

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3. Find x if the distance between (5,-1,7) and (x,5,1) is 9 units.

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4. Write the equation of the plane $4x - 4y + 2z + 5 = 0$ in the intercept form.

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5. Evaluate the following limits :

$$Lt_{x \to 0} \frac{e^{3+x} - e^3}{x}$$

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6. Evaluate $Lt_{x \to 3} \frac{x^2 + 3x + 2}{x^2 - 6x + 9}$

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7. Find the derivatives of the function

$\tan^{-1}(\log x)$

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8. If $y = \frac{2x+3}{4x+5}$ then find y''.

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9. Define relative error and percentage error.

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10. Find the absolute extremum of $f(x) = x^2$ is defined on [-2,2]

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Section B Short Answer Type Questions

1. A(5,3) and B(3,-2) are 2 fixed points. Find the equation of locus of P, so that the area of $\triangle PAB$ is 9sq. Units.

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2. The point to which the origin is shifted and the transformed equation are given below. Find the original equation.

$(3, -4) : x^2 + y^2 = 4$

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3. If the straight lines ax + by + c= 0 , bx +cy + a = 0 and cx +ay + b =0 are concurrent , then prove that $a^3 + b^3 + c^3 = 3abc$.

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4. Find $\lim_{x \to a} \left(\frac{x \sin a - a \sin x}{x - a} \right)$

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5. Find the derivative of the function cotx from the first principle.

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6. Find the approximate value of $\sqrt[3]{999}$

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7. The distance-time formula for the motion of a particle along a straight line is $s = t^3 - 9t^2 + 24t - 18$. Find when and where the velocity is zero.

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Section C Long Answer Type Questions

1. If $Q(h, k)$ is the foot of the perpendicular of $P(x_1, y_1)$ on the line $ax + by + c = 0$ then prove that $(h - x_1), a = (k - y_1), b = -(ax_1 + by_1 + c) : (a^2 + b^2)$.

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2. If $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ represents a pair of parallel lines then sqrt([q^2-ac/f^2-bc])=

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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. If $y=x\sqrt{a^2+x^2}+a^2\log\left(x+\sqrt{a^2+x^2}\right)$, then show that $\frac{dy}{dx}=2\sqrt{a^2+x^2}.$

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6. If $ax^2+by^2=1, a_1x^2+b_1y^2=1$, then show that the condition for orthogonality of above curves is $\frac{1}{a}-\frac{1}{b}=\frac{1}{a_1}-\frac{1}{b_1}$

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7. Find the points of local extrema for the function

f(x) = cos4x defined on $\left[0,\frac{\pi}{2}\right]$

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