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MATHS

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MATHEMATICS -I(A) MODEL PAPER 5

Section A

1. If $A = \left\{0, \frac{\pi}{6}, \frac{\pi}{4}, \frac{\pi}{3}, \frac{\pi}{2}\right\}$ and $f: A \to B$ is a surjection defined by $f(x) = \cos x$ then find B.

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2. Find the domain of the real function $f(x) = \frac{1}{(x^2 - 1)(x + 3)}$

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3. Define Trace of a matrix and skew symmetric matrix.

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4. Find the Adjoint and Inverse of the matrix $A = \begin{bmatrix} 2 & -3 \\ 4 & 6 \end{bmatrix}$

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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 $6\bar{i} - 3\bar{j} - 12\bar{k}$ respectively and $\bar{A}B = \lambda \bar{A}C$, then find the value of λ.

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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. Find the area of the parallelogram for which the vectors $\vec{a} = 2\vec{i} - 3\vec{j}$ and $\vec{b} = 3\vec{i} - \vec{k}$ are adjacent sides.

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

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

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

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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 $A^2 - 4A - 5I = O$.

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

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4. If A is not an integral multipe of π , prove that $\cos A \cos 2A \cos 4A \cos 8A = \frac{\sin 16A}{16 \sin A}$

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5. If θ_1, θ_2 are solutions of the equation a $\cos 2\theta + b \sin 2\theta = c, \tan \theta_1 \neq \tan \theta_2$ and $a + c \neq 0$, then find the values of (i) $\tan \theta_1 + \tan \theta_2$ (ii) $\tan \theta_1 . \tan \theta_2$.

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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 if $a : b : c = 7 : 8 : 9, then \cos A : \cos B : \cos C =$

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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:

(iii) $\frac{1}{1.4} + \frac{1}{4.7} + \frac{1}{7.10} + \ldots\ldots\ldots + \text{n terms} = \frac{n}{3n+1}$.

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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. Solve the following system of equations by using Cramer,s ruel .

$3x + 4y + 5z = 18, 2x - y + 8z = 13, 5x - 2y + 7z = 20$

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5. 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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6. IF A,B,C are angles in the triangle, then prove that

$\cos A + \cos B - \cos C = -1 + 4\cos\frac{A}{2}.\cos\frac{B}{2}.\sin\frac{C}{2}$

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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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