MATHS

BOOKS - JEEVITH PUBLICATIONS MATHS (KANNADA ENGLISH)

MODEL QUESTION PAPER 2

Part A

1. Give an example of a relation which is symmetric but neither reflexive nor transitive.

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2. Find the principal value of the following: $\cos^{-1}\left(-\frac{1}{\sqrt{2}}\right)$

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3. Construct a 2×2 matrix $A = |a_{ij}|$ whose elements are given by $a_{ij} = 2i + j$.

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4. If $A = \begin{bmatrix} 2 & 3 \\ -1 & 2 \end{bmatrix}$, find |2A|.

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5. If $y = e^{3\log x}$, then show that $\frac{dy}{dx} = 3x^2$

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6. Find the antiderivative of $x^2\left(1-\frac{1}{x^2}\right)$ with respect to x.

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7. Define feasible region.

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8. Find unit vector in the direction of vector $\hat{i}+\hat{j}+2\hat{k}$

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9. Find the direction ratio of the line $\frac{x-1}{2}=3y=\frac{2z+3}{4}$

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10. If P(E)=0.6, P(F)=0.3 $P(E \cap F) = 0.2$ then find $P(F/E)$.

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Part B

1. Define binary operation on a set. Verify whether the operation * defined on Z by a* b=ab+1 is binary or not

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2. Write $\cot^{-1}\left(\frac{1}{\sqrt{x^2-1}}\right), x > 1$, in the simplest form.

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3. find the equation of line joining (1,2) and (3,6) using determinants

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4. Prove the following:

$$\sin^{-1}\left(2x\sqrt{1-x^2}\right) = 2\sin^{-1}x, \ -\frac{1}{\sqrt{2}} \leq x \leq \frac{1}{\sqrt{2}}$$

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5. $y = \tan^{-1}\left(\frac{3x-x^3}{1-3x^2}\right), \frac{1}{\sqrt{3}}, x, \frac{1}{\sqrt{3}}.$

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6. Find $\frac{dy}{dx}$ if $\sin^2 x + \cos^2 y = k$, where k is constant.

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7. If the radius of a sphere is measured as 7m with an error of 0.02 m, then find the approximate error in calculating its volume.

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8. Evaluate: $\int \frac{\cos 2x}{(\sin x + \cos x)^2} dx$

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9. Evaluate : $\int \tan^{-1} x dx$

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10. Find the projection of the vector $\hat{i} + 3\hat{j} - 7\hat{k}$ on the vector $7\hat{i} + \hat{j} + 8\hat{k}$

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11. Find the area of the parallelogram whose adjacent sides are given by the vectors $\vec{a} = 3\hat{i} + \hat{j} + 4\hat{k}$ and $b = \hat{i} - \hat{j} + \hat{k}$.

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12. Find the distance of a point $(2, 5, -7)$ from the plane $\vec{r}.\left(6\hat{i} - 3\hat{j} + 2\hat{k}\right) = 4$

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13. Find the order and the degree of the differential equation

$$\frac{d^3y}{dx^2} + \frac{d^2y}{dx^2} + \frac{dy}{dx} = 0$$

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14. Given that the event A and B are such that P (A)= $\frac{1}{2}, P(A \cap B) = \frac{3}{7}$ and P(B)=K find k if A and B are independent.

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Part C

1. Show thaT the relation R in the set of all integers Z defined by R{(a,b) : 2 divides a-b} is an equivalence relation.

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2. Simplify: $\tan^{-1}\left[\frac{2\cos x - 3\sin x}{3\cos x + 2\sin x}\right], \frac{2}{3}\tan x > -1$

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3. Express matrix A= $\begin{bmatrix} 1 & 2 \\ 2 & -1 \end{bmatrix}$

as the sum a symmetric and skew symmetric matrix.

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4. If a function $f(x)$ is differentiable at x = c prove that it is continuous at x = c.

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5. Verify Rolle's theorem for the function $f(x) = x^2 - 4x - 3$, in the interval [1,4].

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6. Find the equation of tangent to the curve given by $x = a\sin^3 t, y = b\cos^3 t$ a point where $t = \frac{\pi}{2}$

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7. Evaluate : $\int \frac{x+2}{2x^2+6x+5} dx$

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8. Evaluate : $\int e^x \left(\frac{1+\sin x}{1+\cos x} \right) dx$

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9. Find the area hounded by parabola $y^2 = 4x$ and the line $y = 2x$

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10. Three vectors $\bar{a}, \bar{b}$ and $\bar{c}$ satisfy the condition $\vec{a} + \vec{b} + \vec{c} = \vec{0}$

evaluate

$\mu = \vec{a} . \vec{b} + \vec{b} . \vec{c} + \vec{c} . \vec{a}$ if $\left|\vec{a}\right| = 1, \left|\vec{b}\right| = 4$ and $\left|\vec{c}\right| = 2$

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11. Find the shortest distance betweenn the lines.

$\vec{r} = \hat{i} + \hat{j} + \lambda\left(2\hat{i} - \hat{j} + \hat{k}\right)$

$\vec{r} = 2\hat{i} + \hat{j} - \hat{k} + \mu\left(3\hat{i} - 5\hat{j} + 2\hat{k}\right).$

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12. Form the differential equation of circles touching the x-axis at origin:

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13. An insurance company insured 2000 scooter drivers, 4000 car drivers and 6000 truck drivers. The probability of an accident is 0.01, 0.03 and 0.15 respectively. One of the insured person meets with an accident. What is the probability that he is a cooter driver?

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Part D

1. Let $f: N \to R$ be defined by $f(x) = 4x^2 + 12x + 15$, show that $f: N \to S$, where S is the range of f, is invertible. Also find the inverse.

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2. Verify $(B+C)A = BC + CA$, if $A = \begin{bmatrix} 2 & 3 \\ 4 & 5 \end{bmatrix}$, $B = \begin{bmatrix} 3 & 8 \\ 11 & 21 \end{bmatrix}$ and $C = \begin{bmatrix} 7 & 13 \\ 5 & 19 \end{bmatrix}$

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3. Solve the following system of equations by matrix method.

$x + y + 3z = 10, x - y - z = -2, 2x + 3y + 4z = 4$

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4. If $y = Ae^{mx} + Be^{nx}$, prove that $\frac{d^2y}{dx^2} - (m+n)\frac{dy}{dx} + mny = 0.$

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5. A ladder 5 m long is leaning against a well. The bottom of the ladder is pulled along the ground, away from the well, at the rate of 2 m/s. How fat is its height on the wall decreasing when the foot of the ladder is 4m away from the wall?

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6. Find the integral of $\frac{1}{\sqrt{x^2 - a^2}}$ with respect to x and hence evalute $\int \frac{1}{\sqrt{x^2 - 2x}} dx$

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7. Using integration, find the area bounded by the circle $x^2 + y^2 = 16$ and the parabola $y^2 = 6x$

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8. Derive the equation of a line in space passing through a given pont and parallel to a given vector in both vector and Cartesian form.

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9. Solve the differential equation $x \log x \frac{dy}{dx} + y = \frac{2}{x} \log x.$

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10. A pair of dice is thrown 4 times. If getting a doublet is considered a success find the probability of 2 success.

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Part E

1. One king of cake requires 200 g of flour and 25 g of fat another kind of cake requires 100 g of flour and 50 g of fat . Find the maximum number of cakes which can be made from 5 kg of flour and 1 kg of fat assuming that there is no shortage of the other ingredients used in making the cakes.

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2. Prove that $\int_{-a}^{a} dx = \begin{cases} 2\int_0^a f(x)dx & \text{if } f(x)\text{is even} \\ 0 & \text{if } f(x)\text{is odd} \end{cases}$ and hence evaluate

(d) $\int_{-\pi/2}^{\pi/2} \tan^9 x dx.$

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3. Prove that

$$\begin{vmatrix} 1+a & 1 & 1 \\ 1 & 1+b & 1 \\ 1 & 1 & 1+c \end{vmatrix}$$

$= ab + bc + ca + abc$

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