MATHS

BOOKS - JEEVITH PUBLICATIONS MATHS (KANNADA ENGLISH)

ANNUAL EXAMINATION QUESTION PAPER MAR-2018

Part A

1. Define a bijective function.

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2. Write the principal value branch of $\cos^{-1} x$.

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3. Construct a 2×2 matrix, $A = [a_{ij}]$, whose elements are given by $a_{ij} = \frac{i}{j}$

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4. If A is invertible matrix of order 2 then find $|A^{-1}|$.

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5. If $y = e^{3x}$, find $\frac{dy}{dx}$

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6. Find : $\int \frac{x^3 - 1}{x^2} dx$

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

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8. If a line makes angle $90^\circ, 60^\circ \text{ and } 30^\circ$ with the positive direction of x,y and z-aixs respectively, find its direction cosines.

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9. Define optimal solution in linear programming problem.

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10. If $P(A) = \frac{7}{13}, P(B) = \frac{9}{13}$ and $P(A \cap B) = \frac{4}{13}$, find $P(A/B)$

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Part B

1. Let * be a binary operation on Q, defined by a * b $= \frac{ab}{2}, \forall a, b \in Q$. Determine whether * is commutative or associative.

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2. Simplify the following:

If $\sin\left\{\sin^{-1}\frac{1}{5}+\cos^{-1}x\right\}=1$ find x

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3. Write the simplest from of

$\tan^{-1}\left(\frac{\cos x-\sin x}{\cos x+\sin x}\right), 0<x<\frac{\pi}{2}$

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4. Find the area of the triangle whose vertices are (-2,-3), (3,2) and (-1,-8) by using determinant method.

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5. Differentiate : $x^{\sin x}$ with respect to x.

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6. Find $\frac{dy}{dx}$ given $x^2 + xy + y^2 = 100.$

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7. Find the slope of the tangent to the curve $y = x^3 - x$ at $x = 2.$

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8. Integrate $\frac{e^{\tan^{-1} x}}{1 + x^2}$ with respect to x.

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9. Evaluate : $\int_2^3 \frac{x dx}{x^2+1}$

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10. Find the order and degree of the differential equation:

$$\left(\frac{d^3y}{dx^3}\right)^2 + \left(\frac{d^2y}{dx^2}\right)^3 + \left(\frac{dy}{dx}\right)^4 + y^5 = 0$$

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11. 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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12. 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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13. Find the angle between the planes whose vector equation are $r.\left(2\hat{i} + 2\hat{j} - 3\hat{k}\right) = 5, r.\left(3\hat{i} - 3\hat{j} + 5\hat{k}\right) = 3.$

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Part C

1. Show that the relation R in the set A={1,2,3,4,5} given by R= {(a,b) : |a-b| is even}, is an equivalence relation.

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2. Prove that $2\tan^{-1}\frac{1}{2}+\tan^{-1}\frac{1}{7}=\tan^{-1}\frac{31}{17}$

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3. By using elementary transformations, find the inverse of the matrix $A=\begin{bmatrix}1 & 3\\ 2 & 7\end{bmatrix}$

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4. x=sin t, y= cos 2t. Find dy/dx

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5. Verify Rolle's theorem for the function $f(x)=x^2+2, x\in[-2,2]$

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6. Find two number whose sum is 24 and whose product is larger as possible.

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7. Evaluate: $\int \frac{x}{(x+1)(x+2)} dx$

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8. Find : $\int e^x \sin x dx.$

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9. Find the area of the region bounded by the curve $y = x^2$ and the line $y = 4$.

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10. Form the differential equation representing the family of curves $y = a\sin(x + b)$ where a,b are arbitrary constant.

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11. Show that the position vector of the point P, which divides the line joining the points A and B having position vectors $\vec{a}$ and $\vec{b}$ internally in the ratio $m:n$ is $\frac{m\vec{b} + n\vec{a}}{m+n}$

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12. Find x such that the four point A(3,2,1),B(4,x,5),C(4,2,-2) and D(6,5,-1) are coplanar.

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13. Find the equation of the plane through the intersection of the planes $3x - y + 2z - 4 = 0$ and $z + y + z - 2 = 0$ and the point (2,2,1)`.

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14. A beg contains 4 red and 4 black , another bag contains 2 red and 6 black balls. One of the two bags is selected at random and a ball is drawn from the bag which is found to be red. Find the probability that the ball is drawn from the first bag.

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Part D

1. Let R_+ be the set of all non-negative real numbers. Show that the function $f: R_+ \to [4, \infty]$ defind by $f(x) = x^2 + 4$ Is invertible and write the inverse of f.

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2. If

$$A = \begin{bmatrix} 0 & 6 & 7 \\ -6 & 0 & 8 \\ 7 & -8 & 0 \end{bmatrix}, B = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 2 \\ 1 & 2 & 0 \end{bmatrix} \text{ and } C = \begin{bmatrix} 2 \\ -2 \\ 3 \end{bmatrix}$$

Calculate AC, BC and (A+B)C. Also verify that (A+B)C=AC+BC.

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

x-y+2z=7

3x+4y-5z=-5

2x-y+3z=12

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4. If $y = \left(\tan^{-1} x\right)^2$ then show that $\left(x^2+1\right)^2 \frac{d^2y}{dx^2} + 2x\left(x^2+1\right)\frac{dy}{dx} = 2$

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5. Sand is pouring from a pipe at the rate of $12cm^3/s$. The falling sand forms a cone on the ground in such a way that the

height of the cone is always one-sixth of the base. How fast height of the sand cone increasing when the height is 4 cm?

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6. Find the integral of $\frac{1}{x^2+a^2}$ with respect to x and hence find $\int \frac{1}{x^2-6x+13}dx$.

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7. Using integration find the area of the region bounded by the triangle whose vertices are (1,0),(2,2) and (3,1).

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8. Find the general solution of the differential equation $x\frac{dy}{dx} + 2y = x^2 \log x.$

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9. Derive the equation of a line in space passing through two given plots both in vector and Cartesian form.

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10. If a fair coin is tossed 10 times, find the probability of.

(i) exactly six heads and (ii) atleast six heads.

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Part E

1. Prove that $\int_0^a f(x)dx = \int_0^a f(a-x)dx$ and hence evaluate the following:

(a) $\int_0^a \frac{\sqrt{x}}{\sqrt{x}+\sqrt{a}-x}dx$

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2. Prove that

$$\begin{vmatrix} x+y+2z & x & y \\ z & y+z+2x & y \\ z & x & z+x+2y \end{vmatrix} = 2(x+y+z)^3.$$

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3. Solve the following problem graphically

Minimise and Maximise

z=3x+9y

Subject to the constraints:

$x + 3y \leq 60, x + y \geq 10, x \leq yx \geq 0, y \geq 0$

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4. Find the relationship between a and b so that the function defined by

$f(x) = \begin{cases} ax + 1 & \text{if} \quad x \leq 3 \\ bx + 3 & \text{if} \quad x > 3 \end{cases}$ is continuous at x = 3.

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