MATHS

BOOKS - SUNSTAR MATHS (KANNADA ENGLISH)

SUPPLEMENTARY EXAM QUESTION PAPER JULY -2014

Part A

1. Define binary operation on a set. Verify whether the operation * defined on Q set of rational number by $a \cdot b = ab + 1 \forall a, b \in Q$ is commutative or assosiative.

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

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3. Define a diagonal matrix.

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

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5. Find $\frac{dy}{dx}, \quad \text{if} \quad y = \cos(1 - x).$

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6. Evaluate : $\int (2x - 3\cos x + e^x)dx.$

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7. Define unit vector.

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

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9. In linear propagmming problem , define linear objective function.

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10. IF $P(E)=0.6, P(F)=0.3 \text{ and } P(E \cap F)=0.2,$ find $P(F \mid E)$.

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Part B

1. Show that the function $f: N \rightarrow N$ given by $f(1) = f(2) = 1$ and $f(x) = x - 1$ for every $x > 2$ is on to but not one -one.

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2. Prove that $\tan^{-1} x + \cot^{-1} x = \frac{\pi}{2}, x \in R.$

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3. Write in the simplest form of $\tan^{-1} \sqrt{\frac{1 - \cos x}{1 + \cos x}}, 0 < x < \pi$

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4. Find the equation of a line passing through (3,1) and (9,3) using determinants.

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5. If $\sqrt{x}+\sqrt{y}=\sqrt{10}$, show that $\frac{dy}{dx}+\sqrt{\frac{y}{x}}=0$

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6. Find $\frac{dy}{dx}$, if $y=(\log x)^{\cos x}$.

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7. Use differential to approximate $\sqrt{36.6}$.

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8. Integrate $\sin x.\ \sin(\cos x)$ with respect to x.

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9. Evaluate $\int_a^1 \frac{1}{1+x^2}dx$

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10. Find the order and degree of the D.E

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

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11. Find the area of the parallelogram whose adjacent sides determined by vectors.

$\overrightarrow{a} = \hat{i} + \hat{j} - \hat{k} \quad \overrightarrow{b} = \hat{i} - \hat{j} + \hat{k}$

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12. Find the projection of the vector $\overrightarrow{a} = 2\hat{i} + 3\hat{j} + 2k$ on the vector $\overrightarrow{b} = \hat{i} + 2\hat{j} + \hat{k}$.

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

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14. A die is throuwn. If E is the event the number appearing is a multiple of 3 and F be the event the number appearing is even then prove that E and F are independent events.

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Part C

1. Solve that the relation R in the set z of intergers given by $R = \{(x, y) : 2 \text{ divides } (x - y)\}$ is an equivalence relation.

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2. Prove that $\tan^{-1}x + \tan^{-1}\left(\frac{2x}{1-x^2}\right) = \tan^{-1}\left(\frac{3x - x^3}{1 - 3x^2}\right)|x| < \frac{1}{\sqrt{3}}$

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3. For any square matrix A with real numbers.

Prove that $A + A^1$ is a symmetric and

$A - A^1$ is a skew symmetric.

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4. If $x = a(\theta - \sin\theta)$ and $y = a(1 + \cos\theta)$ then prove that $\frac{dy}{dx} = -\cot\left(\frac{\theta}{2}\right)$

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5. Verify Mean value theorem, if $f(x) = x^2 - 4x - 3$ in the interval [a,b] where a=1 and b=4

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6. Find two positive numbers x and y such that x + y = 60 and xy^3 is maximum.

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7. Evaluate : $\int \sin 3x \cos 4x dx$

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8. Evaluate $\int x^2 e^x dx$

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9. Determine the area of the region bounded by $y^2 = x$ and the line $x = 1, x = 4$ and $x -$ axis in 1st quadrant.

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10. Form the differential equation of the family of circles having centre on y - axis and radius 3 units.

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11. If two vectors $\vec{a}$ and $\vec{b}$ such that $|\vec{a}| = 2|\vec{b}| = 3$ and $\vec{a} . \vec{b} = 4$. Find $|\vec{a} - \vec{b}|$.

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12. Find a unit vector perpendicular to each of the vectors $\left(\vec{a}+\vec{b}\right)$ and $\left(\vec{a}-\vec{b}\right)$ where $\vec{a}=\hat{i}+\hat{j}+\hat{k},\ \vec{b}=\hat{i}+2\hat{j}+3\hat{k}$

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13. Find the shortest distance betweeen the line l_1 and l_2 whose vector equations are $\vec{r}=\hat{i}+\hat{j}+\lambda\left(2\hat{i}-\hat{j}+\hat{k}\right)$ and $\vec{r}=2\hat{i}+\hat{j}+\lambda\left(3\hat{i}-5\hat{j}+2\hat{k}\right)$

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14. A Bag I contain 3 red and 4 black balls. White bag II contains 5 red 6 black balls. One ball is drawn at random from one of the bags and it is found to be red. Find the probability that it was drawn from bag II.

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15. If $A = \begin{bmatrix} 1 & 2 & 3 \\ 3 & -2 & 1 \\ 4 & 2 & 1 \end{bmatrix}$ then show that $A^3 - 23A - 40I = 0.$

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16. If $y = 3\cos(\log x) + 4\sin(\log x)$ show that $x^2 y_2 + x y_1 + y = 0$

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17. The length x of a rectangle is decreasing at the rate of 5 cm / minute & the width y is increasing at the rate of 4cm/minute. When x=8 cm & y=6 cm. Find the rate of change of

i. The perimeter and

ii. The area of rectangle

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18. Find the integral of $\frac{1}{\sqrt{x^2+a^2}}$ with respect to x and hence evaluate $\int \frac{1}{\sqrt{x^2+7}} dx$

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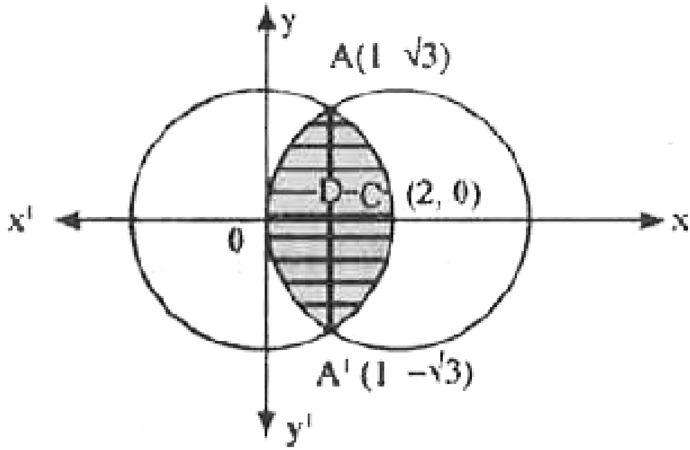
19. Find the area of the region enclosed between the circles $x^2 + y^2 = 4$ and $(x - 2)^2 + y^2 = 4$



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20. Let y(x) be the solution of the differential equaiton :

$$(x \log x)\frac{dy}{dx} + y = 2x \log x, \ (x \geq 1)$$

Then y(e) is equal to :

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21. Derive the equation of the line in space passing through a point and parallel to a vector both in vector and cartesian form.

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22. If a fair coin is tossed 6 times. Find the probability of (i) at least five heads and (ii) exactly 5 heads.

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Part E

1. Prove that $\int_a^b f(x)dx = \int_a^b f(a+b-x)dx$ and hence evaluate $\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{1}{1+\sqrt{\tan x}}dx.$

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2. $f(x) = \begin{cases} \frac{k\cos x}{\pi - 2x} \text{if} & x \neq \frac{\pi}{2} \\ 3 & \text{if} x = \frac{\pi}{2} \end{cases}$ at $x = \frac{\pi}{2}$, f (x) is containuous , find the value of k .

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3. a) Solve the following linear programming problem graphically : Minimize and maximize Z = x + 2y, subject to constraints

$x+2y \geq 100, 2x-y \leq 0, 2x+y \leq 200, x, y \geq 0.$

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4. 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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