# MATHS

## BOOKS - SUNSTAR MATHS (KANNADA ENGLISH)

## ANNUAL EXAM QUESTION PAPER MARCH - 2016

**Part A Answer All The Then Questions**

**1.** Find $\int \text{cosec} x(\text{cosec} x + \cot x)dx$

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**2.** Find the values of x for which

$$\begin{vmatrix} x & 2 \\ 18 & x \end{vmatrix} = \begin{vmatrix} 6 & 2 \\ 18 & 6 \end{vmatrix}$$

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**3.** If $y = a^{\frac{1}{2}\log_a \cos x}$, find $\frac{dy}{dx}$

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**4.** Find the value of $\cos\left(\sec^{-1} x + \operatorname{cosec}^{-1} x\right), |x| \geq 1.$

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**5.** If vector $\overline{AB} = 2\hat{i} - \hat{j} + \hat{k}$ and $\overline{OB} = 3\hat{i} - 4\hat{j} + 4\hat{k}$, find the position vector $\overline{OA}$

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**6.** Find the distance of the point $(-6, 0, 0)$ from the plane $2x - 3y + 6z = 2.$

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**7.** If $\begin{bmatrix} x+2 & y-3 \\ 0 & 4 \end{bmatrix}$ is a scalar matrix. Find x and y.

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**8.** If $P(A) = 0.8, P(B) = 0.5$ and $P(B \mid A) = 0.4$ then find $P(A \cap B)$.

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**9.** An operation $*$ on $Z^*$ (the set of all non-negative integers) is defined as $a * b = a - b, \forall a, b \varepsilon Z^+$. Is $*$ binary operation on $Z^+$?

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**10.** Define Feasible region in LPP.

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**11.** Find $\int \text{cosec} x(\text{cosec} x + \cot x)dx$

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**12.** Find the values of x for which

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**20.** Define Feasible region in LPP.

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## Part B Answer Any Ten Questions

**1.** Write the simplest form of $\tan^{-1}\left[\frac{3\cos x - 4\sin x}{4\cos x + 3\sin x}\right]$, if $\frac{3}{4}\tan x > -1$

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**2.** Using determinants show that points $A(a, b+c), B(b, c+a)$ and $C(c, a+b)$ are collinear.

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**3.** If functions $f: R \to R$ and $g: R \to R$ are given by $f(x) = |x|$ and $g(x) = [x]$, ( where $[x]$ is greatest function) find fog $\left(-\frac{1}{2}\right)$ and gof$\left(-\frac{1}{2}\right)$

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**4.** Show that $\sin^{-1}\left(2x\sqrt{1-x^2}\right) = 2\cos^{-1}x, \frac{1}{\sqrt{2}} \leq x \leq 1.$

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**5.** Find $\frac{dy}{dx}$ if $y = \sec^{-1}\left(\frac{1}{2x^2-1}\right), 0 < x < \frac{1}{\sqrt{2}}$

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**6.** If $x^y = a^x$, prove that $\frac{dy}{dx} = \frac{x \log_e a - y}{x \log_e x}$

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**7.** Find $\int \frac{1}{\sin x \cos^3 x} dx$

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**8.** Using differentials, find the approximate value of $(25)^{\frac{1}{3}}$.

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**9.** Evaluate : $\int_0^{\pi} \left(\sin^2\left(\frac{x}{2}\right) - \cos^2\left(\frac{x}{2}\right)\right) dx$

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**10.** If $\left|\vec{a}+\vec{b}\right|=\left|\vec{a}-\vec{b}\right|$, prove that $\vec{a}$ and $\vec{b}$ are perpendicular

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**11.** Find the order and degree, if defined, of the differential equation.

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

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**12.** Find angle between the vectors $\vec{a}=\hat{i}+\hat{j}-\hat{k}$ and $\vec{b}=\hat{i}+\hat{j}+\hat{k}$

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**13.** The random variable X has probability distribution P(X) of the following form.

$$P(X) = \begin{cases} k & \text{if } X = 0 \\ 2k & \text{if } X = 1 \\ 3k & \text{if } X = 2 \\ 0 & \text{otherwise} \end{cases}$$

Determine value of K

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**14.** Find the Cartesian equation of the line parallel to y - axis and passing through the point $(1, 1, 1)$.

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**15.** Write the simplest form of $\tan^{-1}\left[\frac{3\cos x - 4\sin x}{4\cos x + 3\sin x}\right]$, if $\frac{3}{4}\tan x > -1$

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**24.** If $\left|\vec{a} + \vec{b}\right| = \left|\vec{a} - \vec{b}\right|$, prove that $\vec{a}$ and $\vec{b}$ are perpendicular

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**25.** Find the order and degree, if defined, of the differential equation.

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

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**26.** Find angle between the vectors $\vec{a} = \hat{i} + \hat{j} - \hat{k}$ and $\vec{b} = \hat{i} + \hat{j} + \hat{k}$

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**27.** The random variable X has probability distribution P(X) of the following form.

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Determine value of K

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**28.** Find the Cartesian equation of the line parallel to y - axis and passing through the point $(1, 1, 1)$.

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## Part C Answer Any Ten Questions

**1.** Show that $\tan^{-1}\frac{1}{2} + \tan^{-1}\frac{2}{11} + \tan^{-1}\frac{4}{3} = \frac{\pi}{2}$

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**2.** Using elementary transformations, find the inverse of the matrices

$$\begin{bmatrix} 1 & -1 \\ 2 & 3 \end{bmatrix}$$

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**3.** Show that the relation R in the set $A = \{x \in Z : 0 \leq x \leq 12\}$ is given by $R = \{(a, b) : |a - b| \text{ is a multiple of } 4\}$ is an equivalence relation .

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**4.** Verify Mean Value Theorem if $f(x) = x^3 - 5x^2 - 3x$ in the interval $[1, 3]$.

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**5.** If $x = a\cos^3\theta$ and y = a $\sin^3\theta$ then $\frac{dy}{dx} =$

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**6.** Box-I contains 2 gold coins, while another Box-II contains 1 gold and 1 silver coin. A person chooses a box at random and takes out a coin. If the

coin is of gold, what is the probability that the other coin in the box is also of gold?

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**7.** Find $\int \frac{xdx}{(x+1)(x+2)}$

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**8.** Integrate $\frac{2x}{(x^2+1)(x^2+3)}$ with respect to $x$.

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**9.** Find two numbers whose product is 100 and whose sum is minimum.

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**10.** Find the area lying between the curve $y^2 = 4x$ and the line $y = 2x$

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**11.** For any three vectors $\vec{a}, \vec{b}$ and $\vec{c}$, prove that vectors $\vec{a}-\vec{b}, \vec{b}-\vec{c}, \vec{c}-\vec{a}$ are coplanar.

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**12.** Find the distance between the lines $\vec{r}=\hat{i}+2\hat{j}-4\hat{k}+\lambda\left(2\hat{i}+3\hat{j}+6\hat{j}\right)\&\vec{r}=3\hat{i}+3\hat{j}-5\hat{k}+\mu\left(-2\hat{i}+3\hat{j}\right.$

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**13.** Find the sine of the angle between the vectors $\hat{i}+2\hat{j}+2\hat{k}$ and $3\hat{i}+2\hat{j}+6\hat{k}$

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**14.** Find the equation of the curve passing through the point $(1, 1)$, given that the slope of the tangent to the curve at any point is $\frac{2y}{x}$

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**15.** Show that $\tan^{-1}\frac{1}{2} + \tan^{-1}\frac{2}{11} + \tan^{-1}\frac{4}{3} = \frac{\pi}{2}$

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**27.** Find the sine of the angle between the vectors $\hat{i}+2\hat{j}+2\hat{k}$ and $3\hat{i}+2\hat{j}+6\hat{k}$

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**28.** Find the equation of the curve passing through the point $(1, 1)$, given that the slope of the tangent to the curve at any point is $\frac{x}{y}$

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## Part D Answer Any Six Questions

**1.** If $A = \begin{bmatrix} -2 \\ 4 \\ 5 \end{bmatrix}$ and $B = [1, 3 - 6]$, verify that $(AB)^1 = B^1 A^1$

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**2.** Solve the system of linear equations by matrix method : $2x - 3y + 5z = 11, 3x + 2y - 4z = -5, x + y - 2x = -3.$

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**3.** 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 function f, is invertible. Also find the inverse of f.

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**4.** IF length of x reactangle is decreasing at the rate of 3 cm / minute and the width is increasing at the rate of 2 cm / minute , when x=10 cm and y=6 cm . Find the rate of change of

I. The perimeter

II. The area of the reactange

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**5.** IF length of x reactangle is decreasing at the rate of 3 cm / minute and the width is increasing at the rate of 2 cm / minute , when x=10 cm and y=6 cm . Find the rate of change of

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**6.** If $y = \left(\sin^{-1} x\right)^2$, show that $\left(1 - x^2\right)\frac{d^2y}{dx^2} - x\frac{dy}{dx} = 2$

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**7.** Find the integral of $\frac{1}{x^2 + a^2}$ w.r.t.x and hence evaluate $\int \frac{1}{x^2 + 2x + 3}$ dx.

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**8.** 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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**9.** Derive the equation of a plane perpendicular to a given vector and passing through a given point in both vector and Cartesian form.

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**10.** Choose the correct answer:

The probability that a student is not a swimmer is $\frac{1}{5}$ out of five students, four are swimmers is

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**11.** The probability that a student is not a swimmer is $\frac{1}{5}$. Find the probability that out of 5 students.

at most three are swimmers.

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**12.** Solve the differential equation $ydx + (x - ye^y)dy = 0$

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**21.** Derive the equation of a plane perpendicular to a given vector and passing through a given point in both vector and Cartesian form.

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**22.** The probability that a student is not a swimmer is $\frac{1}{5}$. Find the probability that out of 5 students.

at most three are swimmers.

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**24.** Solve the differential equation $ydx + (x - ye^y)dy = 0$

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## Part E Answer Any One Questions

**1.** Minimise and Maximise $z = 5x + 10y$

subject to constraints :

$x + 2y \leq 120,$

$x + y \geq 60,$

$x - 2y \geq 0,$

$x > 0 \text{ and } y \geq 0$

by graphical method.

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**2.** if the function $f(x) = \begin{cases} \frac{1 - \cos 2x}{1 - \cos x}, & x \neq 0 \end{cases}$

$iskf \text{ or } x = 0$

is continuous at $x = 0$ then the the value of k is

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**3.** Evaluate $\int_0^{2\pi} \cos^5 x dx$

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**4.** Prove that $\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^3 & b^3 & c^3 \end{vmatrix} = (a-b)(b-c)(c-a)(a+b+c)$

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**8.** Prove that $\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^3 & b^3 & c^3 \end{vmatrix} = (a-b)(b-c)(c-a)(a+b+c)$

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