MATHS

BOOKS - USHA MATHS (ODIA ENGLISH)

PREVIOUS YEAR QUESTION 2020

Previous Year Question

1. If $\vec{a}$ and $\vec{b}$ are unit vectors and $\vec{a}-\vec{b}$ is also a unit vector, then write the measure of the angle between $\vec{a}$ and $\vec{b}$.

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2. Write the axis to which the plane by+cz+d=0 is parallal.

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3. Write down all the partitions of the set {a,b,c}.

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4. Write the domain of the function defined by f(x)=$\sin^{-1}x + \cos x$

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5. A is a square matrix of order 3. write the value n, $|2A| = n|A|$.

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6. A discrete random variable X has the probability distribution as given below:

X	0.5	1	1.5	2
$P(X)$	k	k^2	$2k^2$	k

Then, find the value of k.

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7. Find the derivative of $\tan^{-1}\left(\frac{\cos x + \sin x}{\cos x - \sin x}\right)$ w.r.t. x.

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8. If f(x) = sin x + 2 in the interval $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$, what can you say about the greatest value of f(x)?

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9. If $\int_{-\frac{1}{2}}^{\frac{1}{2}} \cos x In \frac{1+x}{1-x} dx = kIn^2$ then write the value of k.

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10. Write the differential equation of all non-horizontal lines in a plane.

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11. Prove that for any $f: X \to Y,\ foid_x = f = id_Y$ of.

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12. Solve equation $3\tan^{-1}\frac{1}{\left(2+\sqrt{3}\right)} - \tan^{-1}\frac{1}{x} = \tan^{-1}\frac{1}{3}$

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13. Prove that

$$\tan\left\{\frac{\pi}{4} + \frac{1}{2}\cos^{-1}\frac{a}{b}\right\} + \tan\left\{\frac{\pi}{4} - \frac{1}{2}\cos^{-1}\left(\frac{a}{b}\right)\right\} = \frac{2b}{a}.$$

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14. A man plans to start a poultry farm by investing at most ₹ 3000. He can buy old hens for ₹80 each and young ones for ₹ 140 each, but he cannot house more than 30 hens. Old hens lay 4 eggs per week ,each ell bing sold at ₹5. It costs ₹ 5 to feed an old hen and ₹8 to feed a young hen per week. Formulate his problem determining the number of hens of each type he should buy so as to earn a proft of more than ₹ 300 per week.

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15. Test whether the relation : $R = \{(m, n) : 2 \mid (m + n)\}$ on $\mathbb{Z}$ is reflexive, symmetric or transitive.

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16. There are two families A and B. There are 4 men, 6 women and 2 children in family A and 2 men, 2 women and 4 children in family B. The recommended daily amount of calories is 2400 for men, 1900 for women and 1800 for children, and 45 g of proteins for men, 55 g for women and 33 g for children. Represent the above information by matrices. Using matrices multiplication, calculate the total requirement of calories and proteins for each of the 2 families.

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17. Eliminate x,y,z from

a=x/y-z, b=y/z-x, c=z/x-y

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18. There are 25 girls and 15 boys in class XI and 30 boys and 20 girls in class XII. If a student chosen from a class, selected at random, happens to be a boy, find the probability that he has been chosen from class XII.

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19. Four cards are drawn successively with replacement from a well shuffled pack of 52 cards. Find the probability distribution of the number of aces. Calculate the mean and variance of the number of aces.

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20. Find the inverse of the matrix $\begin{bmatrix} 4 & -2 \\ 3 & 1 \end{bmatrix}$

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21. If sin (x + y) = y cos (x + y) then prove that

$$\frac{dy}{dx} = -\frac{1+y^2}{y^2}$$

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22. What is the derivative of $\sec^{-1}\left(\frac{1}{2x^2-1}\right)$,with respect to $\left(\sqrt{1-x^2}\right)$?

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23. Find the approximate value of $\sqrt{0.24}$.

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24. Show that the tangent to the curve $x = a(t - \sin t), y = at(1 + \cos t)$ at $t = \frac{\pi}{2}$ has slope.(1- pi/2)`

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25. Examine the contiunity of the following functions at the indicated points .$f(x)$=$\begin{cases} 2x+1 & \text{if} \quad x \leq 0 \\ x & \text{if} \quad 0 < x < 1 \\ 2x-1 & \text{if} \quad x \geq 1 \end{cases}$ at $x = 0, 1$.

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26. Evaluate the following integrals :

$$\int_0^{\pi/2} \log\left|\frac{4+3\sin x}{4+3\cos x}\right| dx.$$

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27. The area between $x = y^2$ and $x = 4$ is divided into two equal parts by the line $x = a$. Find the value of a.

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28. Solve the following differential equation:- $x\frac{dy}{dx} + y = y^2 \ln x$

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29. Solve : $In\left(\frac{dy}{dx}\right) = 3x + 4y$ given that y=0, when x=0.

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30. Evaluate the following integrals $\int \frac{3\sin x + 28\cos x}{5\sin x + 6\cos x} dx$

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31. If $\overrightarrow{a} = 3\hat{i} + \hat{j} - 2\hat{k}$, $\overrightarrow{b} = 2\hat{i} - 3\hat{j} + 4\hat{k}$ then verify that $\overrightarrow{a} \times \overrightarrow{b}$ is perpendicular to both $\overrightarrow{a}$ and $\overrightarrow{b}$.

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32. Passing throughthe point $(2, -3, 1)$ and $(-1, 1 - 7)$ and perpendicular to the plane $x - 2y + 5z + 1 = 0$.

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33. Find the perpendicular distance of the point $(-1, 3, 9)$ from the line

$$\frac{x - 13}{5} = \frac{y + 8}{-8} = \frac{z - 31}{1}$$

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34. Prove that the measure of the angle between two main diagonals of a cube is $\cos^{-1}\frac{1}{3}$.

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35. Prove that the four points with position vectors $2\vec{a}+3\vec{b}-\vec{c}$, $\vec{a}-2\vec{b}+3\vec{c}$, $3\vec{a}+4\vec{b}-2\vec{c}$ and $\vec{a}-6\vec{b}+6\vec{c}$ are coplanar.

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36. If A,B,C are matrices of order 2×2 each and $2A+B+C=\begin{bmatrix}1 & 2\\ 3 & 0\end{bmatrix}$

$A+B+C=\begin{bmatrix}0 & 1\\ 2 & 1\end{bmatrix}$

$A+B-C=\begin{bmatrix}1 & 2\\ 1 & 0\end{bmatrix}$ find A,B and C.

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37. The probability of a shooter hitting a target is $\frac{3}{4}$ Find the minimum number of times he must fire, so that the probability of hitting the target atleast once is greater than 0.999.

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38. Prove the following:

$$\begin{bmatrix}(b+c)^2 & a^2 & bc \\ (c+a)^2 & b^2 & ca \\ (a+b)^2 & c^2 & ab\end{bmatrix}$$

$=\left(a^2+b^2+c^2\right)(a+b+c)(b-c)(c-a)(a-b)$

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39. Show that the semivertical angle of a cone of given slant height is $\tan^1\sqrt{2}$ when its volume is maximum.

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40. If $y = x^{\sin x} + x^3 \frac{\sqrt{x^2+4}}{\sqrt{x^3+3}}$ find $\frac{dy}{dx}$.

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41. Evaluate : $\int \frac{x^5 + x^4 + x^3 + x^2 + 4x + 1}{x^2 + 1} dx$

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42. Find the solution of the following differential equations:

(4x+6y+5)dx-(2x+3y+4)dy=0

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43. Find the area of the smaller region bounded by the ellipse $\frac{x^2}{9} + \frac{y^2}{4} = 1$ and the line $\frac{x}{3} + \frac{y}{2} = 1$.

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44. Find the shortest distance between the lines $\frac{x-3}{3}=\frac{y-8}{-1}=\frac{z-3}{1}$ and $\frac{x+3}{-3}=\frac{y-7}{2}=\frac{z-6}{4}$ Find also the equation of the line of shortest distance.

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45. Solve the following LPP graphically Optimize $Z=5x_1+25x_2$ subject to $-0.5x_1+x_2\leq 2,\ x_1+x_2\geq 2,\ -x_1+5x_2\geq 5,\ x_1, x_2\geq 0$

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46. If $\sin^{-1}x+\sin^{-1}y+\sin^{-1}z=\pi \text{prove that} x^4+y^4+z^4+4x^2y^2z^2=2(x^2y$

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