MATHS

BOOKS - SHARAM PUBLICATION

QUESTION PAPER 2020

Exercise

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

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

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

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4. 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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5. 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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6. 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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7. 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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8. Write the differential equation of all non-horizontal lines in a plane.

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

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

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

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

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

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17. 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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18. Eliminate x,y,z from

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

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19. 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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20. 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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21. Examine the continuity of the following function at x = 0 :

$$f(x) = \begin{cases} 2x+1 & \text{if} \quad x \leq 0 \\ x & \text{if} \quad 0 < x \leq 1 \\ 2x-1 & \text{if} \quad x \geq 0 \end{cases}$$

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

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

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23. 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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24. Find the approximate value of $\sqrt{48.96}$

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25. 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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26. $\int \frac{2\sin x + 3\cos x}{3\sin x + 4\cos x} dx$=?

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27. 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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28. 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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29. Solve: $x\frac{dy}{dx} + y = y^2 \ln x$

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

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

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

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

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

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37. 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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38. 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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39. Prove the following:

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

$=(a^2+b^2+c^2)(a+b+c)(b-c)(c-a)(a-b)$

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

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

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44. 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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45. Find the solution of the following differential equations:

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

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46. Show that $\vec{a}, \vec{b}$ and $\vec{c}$ are coplanar if $\vec{a}+\vec{b}, \vec{b}+\vec{c}$ and $\vec{c}+\vec{a}$ are coplanar.

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47. Find the shortest distance between the lines

$$\frac{x-1}{2}=\frac{y-2}{3}=\frac{z-3}{4} \text{ and } \frac{x-2}{3}=\frac{y-3}{4}=\frac{z-5}{5}$$

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