



MATHS

BOOKS - SHARAM PUBLICATION

MODEL QUESTION PAPER -17

Exercise

1. The total number one-one function from a finite set with m elements to a set with n elements form $m > n$ is



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2. If $\tan^{-1}(\sqrt{3}) + \cot^{-1}x = \frac{\pi}{2}$, then find x .



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3. What is the value of $\begin{vmatrix} 0 & 8 & 0 \\ 25 & 520 & 25 \\ 1 & 410 & 0 \end{vmatrix}$?



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4. Write the matrix which when added to the matrix

$\begin{bmatrix} 2 & -3 \\ -4 & 7 \end{bmatrix}$ give the matrix $\begin{bmatrix} 4 & 1 \\ 3 & 2 \end{bmatrix}$



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5. Find $\frac{dy}{dx}$ when $y = \cot^{-1} \tan\left(\frac{\pi}{2} - x\right)$



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6. If the radius of a sphere is doubled, then its volume is increase by _____.



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7. $\int_0^{\frac{\pi}{2}} \ln(\tan x + \cot x) dx$



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8. Write the order of the differential equation of the

system of ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$.

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9. If vectors \vec{a} and \vec{b} are such that $|\vec{a}| = 3$, $|\vec{b}| = \frac{2}{3}$ and $\vec{a} \times \vec{b}$ is a unit vector, then find the angle between \vec{a} and \vec{b} .

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10. Find the direction cosines of the line

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



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11. For what value of K is the following function

continuous at $x = 2$? $f(x) = \begin{cases} 2x + 1 & \text{when } x < 2 \\ k & \text{when } x = 2 \\ 3x - 1 & \text{when } x > 2 \end{cases}$



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12. If $x = a \cos t$, $y = t \sin t$ then find $\frac{dy}{dx}$



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13. Differentiate the function $x^{\cos x}$ w.r.t. x

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14. Find the slope of the tangent to the curve

$$y = \sin 3t, x = 2t \text{ at } t = \frac{\pi}{4}$$

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15. If $f(x) = a \ln x + bx^2 + x$ has extreme values at

$x = -1$ and $x = 2$ then find a and b .

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16. Write the value of $x-y+z$ from the relation

$$\begin{bmatrix} x + y + z \\ x + z \\ y + z \end{bmatrix} = \begin{bmatrix} 4 \\ 8 \\ 5 \end{bmatrix}.$$

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17. Find the transpose of the matrix $\begin{bmatrix} 3 & -2 & -4 \\ 3 & -2 & -5 \\ -1 & 1 & 2 \end{bmatrix}$

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18. Prove the following:

$$\begin{bmatrix} b^2 - ab & b - c & bc - ac \\ ab - a^2 & a - b & b^2 - ab \\ bc - ac & c - a & ab - a^2 \end{bmatrix} = 0$$



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19. Using the properties of determinants prove that

$$\begin{vmatrix} a + b + 2c & a & b \\ c & b + c + 2a & b \\ c & a & c + a + 2b \end{vmatrix} = 2(a + b + c)^3$$

or

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



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20. Evaluate $\int (x + \sqrt{x^2 + a^2}) dx$

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21. Evaluate $\int \cos ec^2 x \sqrt{\cot x} dx$

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22. Prove that $\int_0^{\frac{\pi}{2}} \ln \sin x dx = -\frac{\pi}{2} \ln 2$

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23. Determine the area of the region between the curves $y = \cos x$ and $y = \sin x$, bounded by $x = 0$.

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24. Find the general solution of the differential equation $(1 + x^2)\tan^{-1} y dy = (1 + y^2)\tan^{-1} x dx$.

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25. Prove that $f: R \rightarrow R$ such that $f(x) = \frac{2x^2}{x^2 + 1}$ is neither one-one nor onto function.

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26. Let $A = \{1, 2, 3, 5\}$, $B = \{4, 6, 9\}$, A relation R from A to B is defined by $R = \{(x, y) : x \in A, y \in B \text{ and } x - y \text{ is odd}\}$. write R in roster form.



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27. Consider the binary operation $*$ on the set $\{1, 2, 3, 4, 5\}$ defined by $a * b = \min(a, b)$. Write operation table of operation $*$.



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28. Prove statement $\tan\left(2\tan^{-1}\frac{1}{5} - \frac{\pi}{4}\right) + \frac{7}{17} = 0$

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29. Find the maximum value of $z = 50x_1 + 60x_2$
subject to $2x_1 + 3x_2 \leq 6$, $x_1, x_2 \geq 0$

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30. Write the values of a and b, for which the vectors
 $(a - 1)\hat{i} + (b + 2)\hat{j} + 4\hat{k}$ and
 $(a + 1)\hat{i} + (b - 2)\hat{j} + 8\hat{k}$ will be parallel.

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31. Find the scalar projection of the vector

$$\vec{a} = 3\hat{i} + 6\hat{j} + 9\hat{k} \text{ on } \vec{b} = 2\hat{i} + 2\hat{j} - \hat{k}.$$



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32. Find the co-ordinates of the point where the perpendicular from the origin meets the line joining the points $(-9, 4, 5)$ and $(11, 0, -1)$.



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33. Find the equation of the plane passing through the line $x = y = z$ and the point $(3,2,1)$.



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34. Find the co-ordinates of the point where the line $\frac{x-2}{3} = \frac{y+1}{4} = \frac{z-2}{2}$ intersect the plane $x-y+z-5=0$



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35. Find $\frac{dy}{dx}$ when $x^y + y^x = a^b$



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36. Evaluate $\int e^x \left(\frac{1 + \sin x}{1 + \cos x} \right) dx$.



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37. $\int \sin^{-1} \sqrt{\frac{x}{a+x}} dx = \text{-----}$.



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38. Find the area of the region in the first quadrant bounded by x - axis, the line $y = x$ and the circle $x^2 + y^2 = 18$.



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39. Show that the relation S defined on set $N \times N$ by $(a, b)S(c, d) \Rightarrow a + d = b + c$ is an equivalence relation.

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40. Solve: $\tan^{-1} \frac{x-2}{x-2} + \tan^{-1} \frac{x+1}{x+2} = \frac{\pi}{4}$

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41. Find graphically the maximum value of $z = 2x + 5y$ subject to the constraints

$$2x + 4y \leq 8, 3x + y \leq 6, x \geq 0, y \geq 0.$$



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42. If \vec{a} , \vec{b} and \vec{c} are three vectors such that $|\vec{a}| = 3$, $|\vec{b}| = 4$ and $|\vec{c}| = 5$ and each one of these is perpendicular to the sum of other two, then find $|\vec{a} + \vec{b} + \vec{c}|$.



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43. Find the coordinates of foot of perpendicular drawn from the point $(0, 2, 3)$ on the line

$$\frac{x + 3}{5} = \frac{y - 1}{2} = \frac{z + 4}{3}. \text{ Also, find the length of}$$

perpendicular.



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