



MATHS

BOOKS - SHARAM PUBLICATION

MODEL QUESTION PAPER 12

Exercise

1. Let R is the equivalence in the set $A = \{0, 1, 2, 3, 4, 5\}$ given by $R = \{(a, b) : 2 \text{ divides } (a - b)\}$.

Write the equivalence class $[0]$.



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2. Write the value of

$$\tan^{-1} \left[2 \sin \left(2 \cos^{-1} \left(\frac{\sqrt{3}}{2} \right) \right) \right]$$



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3. Solve the following matrix equation for x

$$\begin{bmatrix} x & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 \\ -2 & 0 \end{bmatrix} = 0.$$



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4. If every element of a third order determinant of value 8 is multiplied by 2, then write the value of the new determinant.



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5. If $y = \tan^{-1} \sqrt{\frac{1 - \cos x}{1 + \cos x}}$, then find $\frac{dy}{dx}$



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6. Evaluate $\int \log x dx$



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7. Write the order and degree of the

differential equation $\log \left(\frac{d^3y}{dx^3} \right) = a$



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8. If $\left| \vec{a} + \vec{b} \right| = \left| \vec{a} \right| + \left| \vec{b} \right|$ then what is the angle between \vec{a} and \vec{b}



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9. Write the angle between the planes $3x - 5y + 2z - 8 = 0$ and $2x + 4y + 7z + 16 = 0$.



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10. Show that the relation R defined on the set Z of all integers defined as $R = \{(x, y) : x - y \text{ is an integer}\}$ is reflexive, symmetric and transitive.



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11. Let $f(x) = \sqrt{x}$, $g(x) = 1 - x^2$. Compute $f \circ g$ and $g \circ f$.



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12. 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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13.

Prove

that

$$\cos \tan^{-1} \sin \cot^{-1} x = \sqrt{\frac{1+x^2}{2+x^2}}$$



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14. Solve the LPP Maximize $z = 3x + 2y$

Subject to $x + y \leq 400$

$2x + y \leq 500, x \geq 0, y \geq 0$



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15. If the matrix A is such that

$$\begin{bmatrix} 1 & -1 \\ 2 & 3 \end{bmatrix} A = \begin{bmatrix} -4 & 1 \\ 7 & 7 \end{bmatrix}, \text{ find } A.$$



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16. Verify that $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$

satisfies the equation

$$A^2 - (a + d)A + (ad - bc)I = 0 \text{ where } I \text{ is}$$

the 2×2 unit matrix.



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17. Factorise the determinant

$$\begin{vmatrix} x^3 - a^3 & x^2 & x \\ b^2 - a^3 & b^2 & b \\ c^3 - a^3 & c^2 & c \end{vmatrix} \text{ without expanding.}$$



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18. Factorize the following.

$$\begin{bmatrix} x + a & b & c \\ b & x + c & a \\ c & a & x + b \end{bmatrix}$$



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19. If $A = \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$ then prove that

$$A^2 - 5A + 7I = O$$



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20. Find the value of k if the function $f(x)$

defined by $f(x) = \begin{cases} 2x - 1 & \text{when } x < 2 \\ k & \text{when } x = 2 \\ x + 1 & \text{when } x > 2 \end{cases}$ is

continuous at $x=2$.



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21. If $\sin y = x \sin (a + y)$ then show that

$$\frac{dy}{dx} = \frac{\sin^2(a + y)}{\sin a}$$



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22. If $y^2 \cot x = x^2 \cot y$ then find $\frac{dy}{dx}$



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23. Find the intervals where function is increasing function $y = \cos x + \sin x, x \in [0, 2\pi]$





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24. Find the equation of the normal to the curve

$$5x^2 + 3y^2 = 23 \text{ at } (2,-1)$$



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25. Integrate $\int \sec x \tan x \cdot \sqrt{\tan^2 x - 3} \cdot dx$



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26. $\int \frac{x e^x}{1 + x^2} dx$



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27. Evaluate $\int_0^1 \left[\tan^{-1} x + \frac{x}{1 + x^2} \right] dx$



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28. Find the area of region enclosed by

$y^2 = 4ax$ and $x^2 = 4ay$.



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29. Find the particular solution of the following differential equation :

$$\frac{dy}{dx} + \frac{1 + y^2}{1 + x^2} = 0, y(-1) = -\sqrt{3}$$



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30. If the sum of two unit vectors is a unit vector find the magnitude of their difference.



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31. If $\hat{i} + \hat{j} + \hat{k}$ and $2\hat{i} - \alpha\hat{j} + 3\hat{k}$ are orthogonal to each other then find α



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32. Find the equation of the line through the point $(2, 3, 5)$ and parallel to the line $\frac{x - 3}{2} = \frac{y + 1}{1} = \frac{z + 7}{4}$.



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33. Prove that the lines

$$\frac{x + 4}{3} = \frac{y + 6}{5} = \frac{z - 1}{-2}$$

and

$$3x - 2y + z + 5 = 0 = 2x + 3y + 4z - 4$$

are co-planar.



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34. Solve : $\tan^{-1} x + \tan^{-1} \left(\frac{2x}{1 - x^2} \right) = \frac{\pi}{2}$



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35. If $y = x^{\sin x - \cos x} + \frac{x^2 - 1}{x^2 + 1}$, then find $\frac{dy}{dx}$



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36. Find the equation of the tangent to the curve $y = x^4 - 6x^3 + 13x^2 - 10x + 2$ at the point $x=1$ and $y=0$.



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37. Find $\int x^2 (\sin^4 x + \cos^4 x) dx$



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38. Find the area enclosed by $y = 4x - 1$ and $y^2 = 2x$.



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39. Find the solution of the following differential equations:

$$x dy - y dx = \sqrt{x^2 + y^2} dx$$



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40. For $\vec{a} = \hat{i} + \hat{j}$, $\vec{b} = -\hat{i} + 2\hat{k}$, $\vec{c} = \hat{j} + \hat{k}$, obtain $\vec{a} \times (\vec{b} \times \vec{c})$ and also verify the formula

$$\vec{a} \times (\vec{b} \times \vec{c}) = (\vec{a} \cdot \vec{c})\vec{b} - (\vec{a} \cdot \vec{b})\vec{c}.$$


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41. Prove that the measure of the angle between two main diagonals of a cube is

$$\cos^{-1} \frac{1}{3}.$$



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