



MATHS

BOOKS - SHARAM PUBLICATION

MODEL QUESTION PAPER -15

Exercise

1. If $f(x) = (1 - x^3)^{\frac{1}{3}}$ then find $f \circ f(x)$.



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2. Write the principal value of $\tan^{-1}(\sqrt{3}) - \cot^{-1}(-\sqrt{3})$.



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3. Find the value of $\begin{vmatrix} x^2 - x + 1 & x - 1 \\ x + 1 & x + 1 \end{vmatrix}$



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4. If $\begin{bmatrix} 3 & 5 & 3 \\ 2 & 4 & 2 \\ \lambda & 7 & 8 \end{bmatrix}$ is a singular matrix, write the value of lambda.



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5. What is the first derivative of

$$\cos^{-1} \left(\sin \left(\frac{\sqrt{1+x}}{2} \right) \right) + x^x \text{ w.r.t } x \text{ at } x=1.$$



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6. Find the intervals in which the function

$y = \frac{\ln x}{x}$ is increasing and decreasing.



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7. Write the value of $\int_{-\pi/4}^{\pi/4} \sin^5 x \cos x dx$



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8. What is the solution of the equation

$$\frac{d^2y}{dx^2} = e^{-(2x)} ?$$



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9. What is the equation of the line passing through the point $(1,2,3)$ and parallel to the vector $3\hat{i} + 2\hat{j} - 2\hat{k}$



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10. If $f: R \rightarrow R$ is the function defined by $f(x) = 4x^3 + 7$, then show that f is a bijection.



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11. If R and S are two equivalence relation on the set then prove that $R \cap S$ is also an equivalence relation on the set.



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12. If $*$ is a binary operation on set Q of rational numbers such that $a * b = (2a - b)^2$, $a, b \in Q$. Find $3 * 5$ and $5 * 3$. Is $3 * 5 = 5 * 3$?



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13. Solve the following equation:

$$\cos(\tan^{-1}x) = \sin\left(\cot^{-1}\frac{3}{4}\right).$$



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14. $\begin{bmatrix} 1 & -2 \\ 3 & 2 \end{bmatrix} \begin{bmatrix} x & 2 \\ 1 & y \end{bmatrix} = \begin{bmatrix} -3 & 4 \\ -1 & 4 \end{bmatrix}$ Find x and

y .



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15. Factorize the following.

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



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16. Solve the following :

$$\begin{bmatrix} 1 + x & 1 & 1 \\ 1 & 1 + x & 1 \\ 1 & 1 & 1 + x \end{bmatrix} = 0$$



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17. Eliminate x, y, z from

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



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18. For what value of λ , is the function

$$f(x) = \begin{cases} \lambda x^2 - 2x & \text{if } x \leq 0 \\ 4x + 1 & \text{if } x > 0 \end{cases} \text{ is}$$

continuous at $x=0$



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19. If $\cos y = x \cos(a+y)$ then prove that

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



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



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21. Find the equation of the normal to the curve $y = (\log x)^2$ at $x = \frac{1}{e}$.



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22. Find two positive numbers whose product is 256 and whose sum is least.



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23. Integrate: $\int \frac{a}{b + ce^x} dx$



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24. Integrate: $\int \frac{\sec(\sqrt{x})}{\sqrt{x}} dx$

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25. Prove that $\int_0^{\frac{\pi}{2}} \frac{\sin^n x}{\sin^n x + \cos^n x} dx = \frac{\pi}{4}$

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26. Find the area bounded by

$$y = \sin x, y = 0, x = \frac{\pi}{2}$$

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27. Solve : $(x + y)dy + (x - y)dx = 0$.



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28. 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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29. If the magnitude of the difference of two unit vectors is $\sqrt{3}$ then find the magnitude of their sum.



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30. Find the equation of the plane Parallel to the plane $2x - y + 3z + 1 = 0$ and at a distance 3 units away from it.



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31. If $\vec{a} = 2\vec{b}$ and $\vec{c} = -3\vec{b}$, then what is the angle between \vec{a} and \vec{c} ?



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32. If l_1, m_1, n_1 and l_2, m_2, n_2 are the direction cosines of two mutually perpendicular lines show that the d.cs. Of the line perpendicular to both of them are $m_1n_2 - n_1m_2, n_1l_2 - l_1n_2, l_1m_2 - m_1l_2$



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33. Find the value of k for which

$$f(x) = \begin{cases} \frac{\sqrt{1+kx} - \sqrt{1-kx}}{x}, & \text{if } -1 \leq x < 0 \\ \frac{2x+1}{x-1}, & \text{if } 0 \leq x < 1 \end{cases}$$

is continuous at $x = 0$



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34. Find the derivative of

$$\left(\frac{x-1}{x^2+5} \right)^{-4} \cos^{-1} \left(\frac{1-x^2}{1+x^2} \right)$$



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35. Use the function $f(x) = x^{\frac{1}{x}}$, $x > 0$ to show that $e^{\pi} > \pi^e$.



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



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37. If
$$\begin{bmatrix} x & x^2 & x^3 - 1 \\ y & y^2 & y^3 - 1 \\ z & z^2 & z^3 - 1 \end{bmatrix} = 0$$

then prove that $xyz=1$ when x,y,z are non zero and unequal.



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38. Show that the inverse of a bijective function is unique.



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39. Prove the following

$$\tan^{-1} \frac{2a - b}{b\sqrt{3}} + \tan^{-1} \frac{2b - a}{a\sqrt{3}} = \frac{\pi}{3}$$



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40. Solve the following LPP graphically

$$\text{Maximize } z = 20x + 10y$$

$$\text{Subject to } x + 2y \leq 40$$

$$3x + y \geq 30$$

$$4x + 3y \geq 60$$

$$x, y \geq 0$$



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