MATHS

BOOKS - SHARAM PUBLICATION

MODEL QUESTION PAPER-3

Exercise

1. Write fog, if $f: R \to R$ and $g: R \to R$ are given by $f(x) = 8x^3$ and $g(x) = x^{1/3}$.

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2. write the principal value of $\sin^{-1}\left[\sin\left(\frac{3\pi}{5}\right)\right]$.

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3. If $\begin{bmatrix} a+4 & 3b \\ 8 & -6 \end{bmatrix} = \begin{bmatrix} 2a+2 & b+2 \\ 8 & a-8b \end{bmatrix}$ then write the value if a-2b .

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4. Evaluate the following determinants.

$$\begin{bmatrix} 1 & x & y \\ 0 & \sin x & \sin y \\ 0 & \cos x & \cos y \end{bmatrix}$$

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5. What is $\frac{dy}{dx}$ at $t = \frac{3\pi}{4}$ when $x = a\cos^3 t$, and $y = a\sin t$.

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6. Write the set of values of k for which the function $f(x) = kx - \sin x$ is increasing.

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7. Write the value of $\int \frac{x + \cos 6x}{3x^2 + \sin 6x} dx$.

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8. Find the particular solution of the differential equation $\frac{dy}{dx} = 3x$, given that $y = 0$ when $x = 0$.

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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. If the cartesian equation of a line is $\frac{3-x}{5} = \frac{y+4}{7} = \frac{2z-6}{4}$ then write the corresponding vector equation of the line.

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11. If Z is the set of all integers and R is the relation on Z defined as $R = \{(a, b) : a, b \in Z \text{ and } a - b \text{ is divisible by } 3\}$. Prove that R is an equivalence relation.

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12. If A = {1, 2, 3}, B = {4, 5, 6, 7} and f = {(1, 4), (2, 5), (3, 6)} is a function from A to B. State whether f is one-one or not.

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13. if $*$ is the binary operation on N given by $a * b$= L. C. M of a and b. Find $20 * 16$. Is $*$ Commutative.

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14. Prove that $\tan^{-1}\sqrt{x} = \frac{1}{2}\cos^{-1}\left(\frac{1-x}{1+x}\right), x \in (0, 1).$

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15. Sole the following LPP graphically

Maximise $Z = 6x_1 + 7x_2$

Subject to $x_1 + 2x_2 \geq 2, x_1, x_2 \geq 0.$

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16. If $A = \begin{bmatrix} 1 & -2 & 2 \\ 3 & 1 & -1 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 4 \\ 1 & 2 \\ 3 & -1 \end{bmatrix}$, then verify that $(AB)^T = B^T A^T$.

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17. Using elementary operation find the inverse of $\begin{bmatrix} 2 & 3 \\ 5 & 7 \end{bmatrix}$

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18. Prove that the following.

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

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19. 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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20. Find the value of k if the function f(x) defined by

$$f(x) = \begin{cases} 2x - 1 & when x < 2 \\ k & when x = 2 \\ x + 1 & when x > 2 \end{cases}$$ is continous at x=2.

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21. If $y = \log\left[x + \sqrt{x^2 + 1}\right]$, then prove that $\left(x^2 + 1\right)\frac{d^2y}{dx^2} + x\frac{dy}{dx} = 0.$

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22. If sin y = x sin (a + y) then show that $\frac{dy}{dx} = \frac{\sin^2(a + y)}{\sin a}$

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23. Find the equations of the tangent to the curve $x = \sin 3t, y = \cos 2t$ at $t = \frac{\pi}{4}$

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24. If f(x) = a In $x + bx^2 + x$ has extreme values at $x = -1$ and $x = 2$ then find a and b.

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25. Evaluate the following integrals :

$$\int \frac{\cos^{-1} x}{\sqrt{1-x^2}} dx.$$

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26. Evaluate $\int(\sin x - \cos x)dx.$

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27. Prove that $\int_0^{\frac{\pi}{2}} \ln \sin x dx = \frac{\pi}{2}\ln\left(\frac{1}{2}\right)$

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

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29. Solve the differential equation $\left(1+x^2\right)\frac{dy}{dx}+y=\tan^{-1}x$

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30. Show by vector method that the line joining the points $(1, 4, 2)$ and $(-1, 1, -2)$ is perpendicular to the line joining the points $(2, -3, 4)$ and $(5, 3, -2)$.

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

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

$x - y + z - 5 = 0$. Also find the angle between the line and the plane.

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34. 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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35. Solve for x,

$$\tan^{-1}\left(\frac{2x}{1-x^2}\right) + \cot^{-1}\left(\frac{1-x^2}{2x}\right) = \frac{\pi}{3}, \ -1 < x < 1$$

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36. 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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37. Find the values of a and b such that the function f defined by $f(x) = \begin{cases} ax^2 + b & \text{if } x < 1 \\ 1 & \text{if } x = 1. \\ 2ax + b & \text{if } x > 1 \end{cases}$

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

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

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40. Evaluate $\int_0^{\pi} \frac{x}{1+\sin x} dx$

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41. Find the solution of the following differential equations:

(2x+y+1)dx+(4x+2y-1)dy=0

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

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43. Find the coordinates of foot of perpendicular drawn from the point (0, 2, 3) on the line $\frac{x+3}{5} = \frac{y-1}{2} = \frac{z+4}{3}$. Also, find the length of perpendicular.

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