MATHS

BOOKS - SHARAM PUBLICATION

MODEL QUESTION PAPER-4

Exercise

1. Write the largest and smallest relations on a set $A = \{a, b, c\}$.

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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. Is the matrix $\begin{bmatrix}1 & 0 & 0\\ 1 & 1 & 1\\ 2 & -1 & 1\end{bmatrix}$ invertible?

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4. Differentiate $\tan^{-1}\left(\frac{\sqrt{1-x^2}}{x}\right)$ w.r.t $\sin^{-1}\left(\frac{2x}{1+x^2}\right)$.

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5. An edge of a variable cube is increasing at the rate of $10cm/\sec$. Find the rate of increase of the volume of the cube when the edge is 5 cm long.

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6. Evaluate

$$\int_{-1}^{3}\left[\tan^{-1}\left(\frac{x}{x^2+1}\right)+\tan^{-1}\left(\frac{x^2+1}{x}\right)\right]dx.$$

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7. If p and q are the order and degree of the differential equation

$y\left(\frac{dy}{dx}\right)^2 + x^2\frac{d^2y}{dx^2} + xy = \sin x$, then choose the correct statement out of

$p < q$

A. $p > q$

B. $p = q$

C. $p < q$

D.

Answer:

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8. Find the projection of the vector $\hat{i} + 3\hat{j} + 7\hat{k}$ on the vector $2\hat{i} - 3\hat{j} + 6\hat{k}$.

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9. 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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10. 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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11. If A = R -{3} and B = R -{1}. Consider the function $f: A \to B$ defined by $f(x) = \frac{x-2}{x-3}$, for all $x \in A$. Then, show that f is bijective. Find $f^{-1}(x)$.

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12. Prove that $2\tan^{-1}\left(\frac{1}{2}\right) + \tan^{-1}\left(\frac{1}{7}\right) = \tan^{-1}\left(\frac{31}{17}\right)$.

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13. Find the feasible region of the following system.

$2y - x \geq 0, 6y - 3x \leq 0, x \geq 0, y \geq 0.$

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14. $f(x) = \begin{cases} x^2 \sin\left(\frac{1}{x}\right) & x \neq 0 \\ 0 & x = 0 \end{cases} atx = 0$

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15. Find $\frac{dy}{dx}$ when $y^x = e^{x-y}$.

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16. Differentiate with resi to x :

$$Y = 2^{x^2} + \tan^{-1}\left(\frac{\cos x - \sin x}{\cos x + \sin x}\right)$$

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17. Find the equation of the tangent to the curve $x = y^2 - 1$ at the point where the slope of the normal to the curve is 2.

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18. Find the intervals in which the function $y = \frac{\ln x}{x}$ is increasing and decreasing.

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19. Prove by vector method that in a $\Delta ABC, c^2 = a^2 + b^2 - 2ab\cos C.$

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20. The diagonals of a parallelogram are given by $\vec{a} = 2\hat{i} - 3\hat{j} + 5\hat{k}$ and $\vec{b} = -2\hat{i} + 2\hat{j} + 2\hat{k},$

Determine the area of the parallelogram .

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21. Find the image of the point (2, 3, 4) with respect to the plane x - y + 2z = 4. Obtain the foot of the perpendicular from P on the plane and the corresponding perpendicular distance.

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22. Find the equation of planes passing throught the points $(1, 2, 3), (1, -4, 3)$ and $(-1, 3, 2)$

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23. If A and B are square matrices of same order, then show by means of an example that $AB \neq BA$ in general.

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24. Prove that the following. $\begin{bmatrix} 1+a & 1 & 1 \\ 1 & 1+b & 1 \\ 1 & 1 & 1+c \end{bmatrix}$

= abc(1+1/a+/b+1/c)

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25. Find the value of $\begin{vmatrix} 17 & 58 & 97 \\ 19 & 60 & 99 \\ 18 & 59 & 98 \end{vmatrix}$ without expanding.

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26. Find the inverse of $\begin{bmatrix} 2 & -1 \\ 1 & 3 \end{bmatrix}$.

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27. Evaluate $\int \tan^{-1} \sqrt{\frac{1-x}{1+x}} dx$

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28. Evaluate $\int \frac{e^x - 1}{e^x + 1} dx$

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29. Evaluate $\int_0^{\pi/4} \log(1 + \tan x) dx.$

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30. Find the area of the region bounded by the curve $y = 6x - x^2$, the X-axis and the two ordinates $x = 0$ and $x = 9.$

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31. Solve the following differential equations

$$x \log x \frac{dy}{dx} + y = 2 \log x$$

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32. Find the value of k so that the function f defined by

$$f(x) = \begin{cases} \left(\frac{k \cos x}{\pi - 2x} \right), when x \neq \frac{\pi}{2} \\ \left(0, at x = \frac{\pi}{2} \right) \end{cases}$$

is continuous at $x = \frac{\pi}{2}$.

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33. Find $\frac{dy}{dx}$ if $x^y = y^x$.

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34. Show that the rectangle of maximum area that can be inscribed in a given circle is a square.

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

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36. Find the area of region in the first quadrant enclosed by the X-axis, the line $y = x$ and the circle

$x^2 + y^2 = 32.$

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37. Solve the following differential equation

$(2x + y + 1)dx + (4x + 2y— 1)dy = 0.$

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38. Show that $f: N \to N$, given by

$$f(x) = \begin{cases} x + 1, \text{ if x is odd} \\ x - 1, \text{ if x is even} \end{cases}$$

is bijective (both one-one and onto).

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39. If $A = \begin{bmatrix} 2 & 0 & 1 \\ 2 & 1 & 3 \\ 1 & -1 & 0 \end{bmatrix}$ then find the value of $A^2 - 3A + 2I$

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40. If a, b and c are all positive real, then prove that minimum value of determinant

$$\begin{vmatrix} a^2+1 & ab & ac \\ ab & b^2+1 & bc \\ ac & bc & c^2+1 \end{vmatrix} = 1 + a^2 + b^2 + c^2$$

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41. Three vectors $\vec{a}, \vec{b}$ and $\vec{c}$ satisfy the condition $\vec{a} + \vec{b} + \vec{c} = 0$. Find the value of $\vec{a} . \vec{b} + \vec{b} . \vec{c} + \vec{c} . \vec{a}$ if $\left|\vec{a}\right| = 1, \left|\vec{b}\right| = 4, \left|\vec{c}\right| = 2.$

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