MATHS

BOOKS - SHARAM PUBLICATION

MODEL QUESTION PAPER 19

Exercise

1. If R be a relation on a finite set A having n elements, then the number of relations on A is-

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2. If A and B are independent events and $P(A) = \frac{3}{5}, P(B) = \frac{1}{5}$ then what is $P(A \cap B)$.

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3. Write the value of k, if

$$\begin{vmatrix} aa_1 & aa_2 & aa_3 \\ ab_1 & ab_2 & ab_3 \\ ac_1 & ac_2 & ac_3 \end{vmatrix} = k \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}$$

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4. If $\begin{bmatrix} 3 & x \\ 7 & 5 \end{bmatrix} + \begin{bmatrix} 1 & -2 \\ -4 & y \end{bmatrix} = \begin{bmatrix} 3 & 2 \\ 5 & 1 \end{bmatrix}$ then write the value of x and y.

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5. Write the anti-derivative of $3x^2 + 4x^3$.

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6. Differentiate $\log \tan^{-1}\left(1 + x^2\right)$ w.r.t x.

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7. Form the differential equation from $y = c\tan^{-1} x$ by eliminating the arbitrary constant.

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8. Write the angle between $\vec{a}$ and $\vec{b}$ with magnitude $\sqrt{3}$ and $\sqrt{2}$ respectively having $\vec{a} . \vec{b} = \sqrt{6}$.

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9. Find the distance of the plane 6x- y + 3z = 3 from the origin.

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10. Find the least positive integer r such that $185 \in [r]_7$

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

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12. 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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13. Show that $2\tan^{-1}\left(\frac{1}{4}\right) + 2\tan^{-1}\left(\frac{2}{9}\right) = \tan^{-1}\left(\frac{4}{3}\right)$.

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14. Evaluate $\int \frac{1}{\sqrt{x}\sqrt{x - a^2}} dx$.

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15. Evaluate $\int \frac{x+3}{\sqrt{9-x^2}} dx.$

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16. Evaluate $\int \cos(2-7x) dx$

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17. Solve $\frac{d^2y}{dt^2} = e^{2t} + e^{-t}.$

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18. Using integration, find the area of the region bounded by the curves $y = x^2$ and $y = x.$

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19. Find the value of a such that the function f defined by

$$f(x) = \begin{cases} \frac{\sin ax}{\sin x} & \text{if} \quad x \neq 0 \\ \frac{1}{a} & \text{if} \quad x = 0 \end{cases}$$

is continuous at x=0.

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20. Find $\frac{dx}{dy}$ when $y = (\sin x)^x$.

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21. Differentiate $y = \tan^{-1}. \frac{\sqrt{1+x^2} + \sqrt{1-x^2}}{\sqrt{1+x^2} - \sqrt{1-x^2}}$

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22. Find the points on the curve $y = x^3 - 11x + 5$ at which the equation of the tangent is $y = x - 11$.

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23. If $A = \begin{bmatrix} -1 & 3 & 5 \\ 1 & -3 & -5 \\ -1 & 3 & 5 \end{bmatrix}$ Show that $A^2 = A$.

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24. If $\begin{bmatrix} x+y & x-2 \\ 2x-z & 0 \end{bmatrix} = \begin{bmatrix} 2 & 5 \\ 3 & 1 \end{bmatrix}$ then the values of x,y,z.

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25. Prove that

$$\begin{vmatrix} 1+a & 1 & 1 \\ 1 & 1+b & 1 \\ 1 & 1 & 1+c \end{vmatrix} = abc\left(1+\frac{1}{a}+\frac{1}{b}+\frac{1}{c}\right) \text{ or } (abc+bc+ca+ab)$$

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26. Prove that $\begin{vmatrix} 1 & a & a^3 \\ 1 & b & b^3 \\ 1 & c & c^3 \end{vmatrix}$ = (a-b)(b-c)(c-a)(a+b+c).

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27. If $A = \begin{bmatrix} 2 & 1 \\ -1 & 3 \end{bmatrix}$ $B = \begin{bmatrix} 2 & 5 \\ -3 & 2 \end{bmatrix}$ find AB and BA.

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

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29. Find a vector of magnitude 5 units and parallel to the resultant of $\vec{a} = 2\hat{i} + 3\hat{j} - \hat{k}$ and $\vec{b} = \hat{i} - 2\hat{j} + \hat{k}$.

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30. Show that $\left[\vec{a}+\vec{b}\,\vec{b}+\vec{c}\,\vec{c}+\vec{a}\right]=2\left[\vec{a}\,\vec{b}\,\vec{c}\right]$

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31. Find the equation of the plane through the points (1, 2, -3), (2,3, -4) and perpendicular to the plane x + y + z + 1 = 0.

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32. If p is a prime and $ab \equiv 0$ (mod p) then show that either a=0 (mod p) or $b \equiv 0$ (mod p).

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33. If $\sin^{-1}\left(\frac{x}{a}\right)+\sin^{-1}\left(\frac{y}{b}\right)=\alpha \text{prove that} \frac{x^2}{a^2}+\frac{2xy}{ab}\cos\alpha+\frac{y^2}{b^2}=\sin^2\alpha$

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34. Solve the following LPP graphically

Maximize, $Z = 20x + 30y$

Subject to $3x + 5y \leq 15$

$x, y \geq 0.$

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35. $\begin{bmatrix} 2 & 5 \\ 3 & 4 \end{bmatrix} \begin{bmatrix} 3 & 1 \\ -2 & 3 \end{bmatrix} = \begin{bmatrix} x & y \\ 1 & z \end{bmatrix}$ find x,y and z.

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36. Using properties of determinants, prove the following

$$\begin{vmatrix} a^2 & bc & ac + c^2 \\ a^2 + ab & b^2 & ac \\ ab & b^2 + bc & c^2 \end{vmatrix} = 4a^2b^2c^2.$$

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37. If $x = \frac{1-\cos^2\theta}{\cos\theta}, y = \frac{1-\cos^{2n}\theta}{\cos^n\theta}$ then show that $\left(\frac{dy}{dx}\right)^2 = n^2\left(\frac{y^2+4}{x^2+4}\right)$

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38. Find the tangent to the curve $y = \cos(x+y), 0 \leq x \leq 2\pi$ which is parallel to the line x + 2y = 0

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39. $\int_{\pi/6}^{\pi/3} \frac{dx}{1+\sqrt{\cot x}}$

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40. Using integration, find the area bounded by the curve $x^2 = 4y$ and the line y = x.

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41. Solve the differential equation $\left(x^2+1\right)\frac{dy}{dx}+2xy=\sqrt{x^2+4}$,

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42. Find a unit vector perpendicular to both of the vectors $\vec{a}+\vec{b}$ and $\vec{a}-\vec{b}$ where $\vec{a}=\hat{i}+\hat{j}+\hat{k}$ and $b=\hat{i}+2\hat{j}+3\hat{k}$.

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43. Find the vector and cartesian equations of the line passing through the point (2, 1, 3) and perpendicular to the lines $\frac{x-1}{1}=\frac{y-2}{2}=\frac{z-3}{3}$ and $\frac{x}{-3}=\frac{y}{2}=\frac{z}{5}$.

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