MATHS

BOOKS - SHARAM PUBLICATION

MODEL QUESTION PAPER-5

Exercise

1. For the binary operation $a * b = 3a + 2b$ for $a, b \in Z$ test whether it is associative.

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2. What is the principal value of $\tan^{-1}\left(\tan\left(\frac{2\pi}{4}\right)\right)$?

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3. If $A_\alpha = \begin{bmatrix} \cos\alpha & \sin\alpha \\ -\sin\alpha & \cos\alpha \end{bmatrix}$, then what is the value of $A_\alpha A_\beta$.

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4. If ω is a complex cube root of 1,then for what value of. lamda the determinant $\begin{vmatrix} 1 & \omega & \omega^2 \\ \omega & \lambda & 1 \\ \omega^2 & 1 & \omega \end{vmatrix} = 0$?

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5. Write interval in which the function $f(x) = \sin^{-1}(3-x)$ is differentiable.

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6. Write the anti derivative of $2^x + x$?

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7. Form the differential equation from $y = a\cos ecx$ by elliminating the arbitrary constant.

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8. If $f(x) = \sqrt{x}$ and $g(x) = \frac{x}{4}$ then what is (g of) (x).?

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9. Write the angle between $\vec{a}$ and $\vec{b}$ with magnitude $\sqrt{5}$ and 2 respectively having $\vec{a}.\ \vec{b} = \sqrt{10}$.

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10. Write the distance of the plane $3x - 4y + 12z = 3$ from the origin.

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

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12. 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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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. 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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15. 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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16. 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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17. If $A = \begin{bmatrix} -1 & 3 & 5 \\ 1 & -3 & -5 \\ -1 & 3 & 5 \end{bmatrix}$ then show that $A^2 = 9A$

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18. If $\begin{bmatrix} x+y & x-2 \\ 2x-y & 0 \end{bmatrix} = \begin{bmatrix} 2 & 2 \\ 1 & 0 \end{bmatrix}$ then find the values of x,y?

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19. Show that $(a+1)$ is a factor of $\begin{vmatrix} (a+1) & 2 & 3 \\ 1 & a+1 & 3 \\ 3 & -6 & a+1 \end{vmatrix}$

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20. 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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21. Differentiate

$$\tan^{-1} \frac{\sqrt{1+x^2} + \sqrt{1-x^2}}{\sqrt{1+x^2} - \sqrt{1-x^2}}$$

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22. If $y = (\sin x)^x$ find (dy)/(dx).

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23. 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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24. Evaluate $\int \frac{x}{(x^2+4)} dx$.

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

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26. Evaluate $\int \frac{\sin x + \cos x}{\sqrt{\sin 2x}} dx$

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27. Solve $dy + e^{-y} \sin x dx = 0.$

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

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

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38. 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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39. Find the equations of the plane passing through the point $(2, 1, 3)$ and perpendicular to the lines $\frac{x-1}{1} = \frac{y-2}{2} = \frac{z-3}{3}$.

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