

MATHS

BOOKS - OSWAAL MATHS (ENGLISH)

XII Boards

1. The vectors $3\hat{i} - \hat{j} + 2\hat{k}$, $2\hat{i} + \hat{j} + 3\hat{k}$ and $\hat{i} + \lambda\hat{j} - \hat{k}$ are coplanar if value of λ is

(A) -2

(B) 0

(C) 2

(D) any real number



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2. if for any $2 \cdot 2$ square matrix A , $A(\text{adj}A) = \begin{bmatrix} 8 & 0 \\ 0 & 8 \end{bmatrix}$ then write the value of $\det. A$

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3. Determine the value of k for which the following function is

continuous at $x = 3$, $f(x) = \begin{cases} \frac{(x+3)^2 - 36}{x-3} & x \neq 3 \\ k & x = 3 \end{cases}$

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4. Find the distance between the parallel planes $2x - y + 2z + 3 = 0$ and $4x - 2y + 4z + 5 = 0$.

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5. Find the distance between the planes $2x - y + 2z = 5$ and $5x - 2.5y + 5z = 20$.

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6. If A is a skew-symmetric matrix of order 3, then prove that $\det A = 0$.

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7. Find the value of c in Rolle's theorem for the function $f(x) = x^3 - 3x \in [-\sqrt{3}, 0]$.

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8. The volume of a cube is increasing at the rate of $9\text{cm}^3/\text{sec}$. How fast is the surface area increasing when the length of an edge is 10 cm ?

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9. Show that the function $f(x) = x^3 - 3x^2 + 6x - 100$ is increasing on $\mathbb{R}$

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10. The x -coordinates of a point on the line joining the points $Q(2, 2, 1)$ and $R(5, 1, -2)$ is 4. Find its z -coordinate.



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11. A die marked 1, 2, 3 in red and 4, 5, 6 in green is tossed. Let A be the event, the number is even, and B be the event, the number is red. Are A and B independent?



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12. Two tailors, A and B , earn 300 and 400 per day respectively. A can stitch 6 shirts and 4 pairs of trousers while B can stitch 10 shirts and 4 pairs of trousers per day. To find how many days should each of them work and if it is desired to produce at least 60 shirts and 32 pairs of trousers at a minimum labour cost, formulate this as an LPP.



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13. Find : $\int \frac{dx}{5 - 8x - x^2}$

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14. If $\tan^{-1}\left(\frac{x-3}{x-4}\right) + \tan^{-1}\left(\frac{x+3}{x+4}\right) = \frac{\pi}{4}$, find x

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15. Using properties of determinants, prove that

$$\begin{vmatrix} a^2 + 2a & 2a + 1 & 1 \\ 2a + 1 & a + 2 & 1 \\ 3 & 3 & 1 \end{vmatrix} = (a - 1)^3$$

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16. Using properties of determinants, prove that

$$\begin{vmatrix} a^2 + 2a & 2a + 1 & 1 \\ 2a + 1 & a + 2 & 1 \\ 3 & 3 & 1 \end{vmatrix} = (a - 1)^3$$

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17. If $x^y + y^x = a^b$, then find $\frac{dy}{dx}$.

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18. Evaluate : $\int_0^{\pi} \frac{x \tan x}{\sec x + \tan x} dx$

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

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20. Show that the points A, B, C with position vectors $2\hat{i} - \hat{j} + \hat{k}$, $\hat{i} - 3\hat{j} - 5\hat{k}$ and $3\hat{i} - 4\hat{j} - 4\hat{k}$ respectively, are the vertices of a right-angled triangle. Hence find the area of the triangle.



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21. Find the value of λ , if four points with position vectors $3\hat{i} + 6\hat{j} + 9\hat{k}$, $\hat{i} + 2\hat{j} + 3\hat{k}$, $2\hat{i} + 3\hat{j} + \hat{k}$ and $4\hat{i} + 6\hat{j} + \lambda\hat{k}$ are coplanar.



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22. There are 4 cards numbered 1,3,5 and 7, one number on one card. Two cards are drawn at random without replacement. Let X denote the sum of the numbers on the two drawn cards. Find the mean and variance of X.



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23. Of all the students in a school, it is known that 30% have 100% attendance and 70% students are irregular. Previous year results report that 70% of all students who have 100% attendance attain A grade and 10% irregular students attain A grade in their annual examination. At the end of the year, one student is chosen at random from the school and he was found to have an A grade. What is the probability that the student has 100% attendance ? Is regularity required in school ? Justify your answer.



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24. Show that the minimum of Z occurs at more than two points :

Minimise and Maximise $Z = x + 2y$ subject to

$$x + 2y \geq 100, 2x - y \leq 0, 2x + y \leq 200; x, y \geq 0 .$$



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25. Determine the product $\begin{bmatrix} -4 & 4 & 4 \\ -7 & 1 & 3 \\ 5 & -3 & -1 \end{bmatrix} \begin{bmatrix} 1 & -1 & 1 \\ 1 & -2 & -2 \\ 2 & 1 & 3 \end{bmatrix}$ and use it to solve the system of equations $x - y + z = 4$, $x - 2y - 2z = 9$, $2x + y + 3z = 1$

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26. Consider $f: R \rightarrow \left\{ -\frac{4}{3} \right\} \rightarrow R - \left\{ \frac{4}{3} \right\}$ given by $f(x) = \frac{4x + 3}{3x + 4}$. Show that f is bijective. Find the inverse of f and hence find $f^{-1}(0)$ and x such that $f^{-1}(x) = 2$.

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27. Show that the total surface area of a closed cuboid with square base and given volume is minimum, when it is a cube.

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28. Using integration, find the area of the triangle ABC, coordinates of whose vertices are A(4,1), B(6,6) and C(8,4)

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29. Find the particular solution of the following differential equation:

$$\frac{dy}{dx} = 1 + x^2 + y^2 + x^2y^2, \text{ given that } y = 1 \text{ when } x = 0.$$

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30. Find the coordinates of the point where the line through the points (3, -4, -5) and (2, -3, 1), crosses the plane determined by the points (1, 2, 3), (4, 2, -3) and (0, 4, 3).

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31. If $e^y(x + 1) = 1$, show that $\frac{d^2y}{dx^2} = \left(\frac{dy}{dx}\right)^2$.

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32. Find the area enclosed between the parabola $4y = 3x^2$ and the straight line $3x - 2y + 12 = 0$



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33. A variable plane which remains at a constant distance $3p$ from the origin cuts the coordinate axes at A, B, C. Show that the locus of the centroid of triangle ABC is $\frac{1}{x^2} + \frac{1}{y^2} + \frac{1}{z^2} = \frac{1}{p^2}$.



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34. Find the area bounded by the circle $x^2 + y^2 = 16$ and the line $\sqrt{3}y = x$ in the first quadrant, using integration.



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35. If A is a 3×3 invertible matrix, then what will be the value of k if $\det(A^{-1}) = (\det A)^k$.

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36. Determine the value of the constant k , so that the function $f(x) = \begin{cases} kx & \text{if } x < 0 \\ 3 & \text{if } x \geq 0 \end{cases}$ is continuous at $x = 0$

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37. Evaluate $\int_2^3 3^x dx$

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38. If a line makes angle 90° , 60° and 30° with the positive direction of x , y and z -axis respectively, find its direction cosines.

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39. Show that the elements on the main diagonal of a skew-symmetric matrix are all zero.

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40. Find $\frac{dy}{dx}$ at $x = 1, y = \frac{\pi}{4}$ if $\sin^2 y + \cos xy = k$

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41. The volume of a sphere is increasing at the rate of 3 cubic centimeter per second. Find the rate of increase of its surface area, when the radius is 2 cm.

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42. Show that the function $f(x) = 4x^3 - 18x^2 + 27x - 7$ is always increasing on R

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43. Find the vector equation of the line passing through the point $A(1, 2, -1)$ and parallel to the line $5x - 25 = 14 - 7y = 35z$.

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44. Prove that if E and F are independent events, then so are the events E and F .

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45. A small firm manufactures necklaces and bracelets. The total number of necklaces and bracelets that it can handle per day is at most 24. It takes 1 hour to make a bracelet and half an hour to make a necklace. The maximum number of hours available per day is 16. If the profit on a necklace is Rs 100 and that on a bracelet is Rs 300, how many of each should be produced daily to maximize the profit?

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46. $\int \frac{1}{x^2 - 4x + 8} dx$

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47. Prove that

$$\tan\left(\frac{\pi}{4} + \frac{1}{2}\cos^{-1}\left(\frac{a}{b}\right)\right) + \tan\left(\frac{\pi}{4} - \frac{1}{2}\cos^{-1}\left(\frac{a}{b}\right)\right) = \frac{2b}{a}$$

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48. Using properties of determinants, prove the following:

$$\begin{vmatrix} x & y & z \\ y & z & x \\ z & x & y \end{vmatrix} = 9y^2(x + y)$$

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49. Differentiate the function $(\sin x)^x + \sin^{-1} \sqrt{x}$ with respect to x .

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50. Evaluate: $\int \frac{2x}{(x^2 + 1)(x^2 + 2)} dx$

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51. Evaluate: $\int_0^{\pi} \frac{x \sin x}{1 + \cos^2 x} dx$

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52. Prove that $x^2 - y^2 = c(x^2 + y^2)^2$ is the general solution of differential equation $(x^3 - 3xy^2)dx = (y^3 - 3x^2y)dy$, where c is a parameter.

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53. The random variable X can the values 0, 1, 2, 3, Give $P(X = 0) = P(X = 1) = p$ and $P(X = 2) = P(X = 3)$ such that $\sum p_i x_i^2 = 2 \sum p_i x_i$ then find the value of p



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54. Often it is taken that a truthful person commands, more respect in the society. A man is known to speak the truth 4 out of 5 times. He throws a die and reports that it is actually a six. Find the probability that it is actually a six. Do you also agree that the value of truthfulness leads to more respect in the society?



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55. Discuss the commutativity and associativity of binary operation $*$ defined on Q by the rule $a \cdot b = a - b + ab$ for all $a, b \in Q$



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56. If the sum of lengths of hypotenuse and a side of a right angled triangle is given, show that area of triangle is maximum, when the angle between them is $\frac{\pi}{3}$.

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57. Using integration, find the area of region bounded by the triangle whose vertices are $(-2, 1)$, $(0, 4)$ and $(2, 3)$.

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58. Let $A = \begin{bmatrix} 2 & -1 \\ 3 & 4 \end{bmatrix}$, $B = \begin{bmatrix} 5 & 4 \\ 7 & 4 \end{bmatrix}$, $C = \begin{bmatrix} 2 & 5 \\ 3 & 8 \end{bmatrix}$. Find a matrix D such that $CD - AB = 0$

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59. If $x^m y^n = (x + y)^{m+n}$, prove that $\frac{d^2 y}{dx^2} = 0$.

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60. Evaluate : $\int_0^{\frac{3}{2}} |x \sin \pi x| dx$

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61. Find the area bounded by the circle $x^2 + y^2 = 16$ and the line $\sqrt{3}y = x$ in the first quadrant, using integration.

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62. Find the vector equation of line passing through the point $(1, 2, -4)$ and perpendicular to the two lines:

$$\frac{x-8}{3} = \frac{y+19}{-16} = \frac{z-10}{7} \text{ and } \frac{x-15}{3} = \frac{y-29}{8} = \frac{z-5}{-5}$$

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63. If $|A| = 3$ and $A^{-1} = \begin{bmatrix} 3 & -1 \\ -\frac{5}{3} & \frac{2}{3} \end{bmatrix}$ then write the adj A.



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64. For what value of k is the function

$$f(x) = \begin{cases} k \frac{|x|}{x}, & x < 0; \\ 3, & x \geq 0 \end{cases} \text{ continuous at } x = 0 ?$$



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65. Evaluate $\int_0^{2\pi} \sin^2 x \cos^4 x dx$



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66. Write the distance of a point $P(a, b, c)$ from x-axis.



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67. If A and B are square matrices of order 3 such that $|A| = -1$, $|B| = 3$, then find the value of $|2AB|$.

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68. Find $\frac{dy}{dx}$ at $t = \frac{2\pi}{3}$ when $x = 10(t - \sin t)$ and $y = 12(1 - \cos t)$.

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69. Show that the function f given by $f(x) = \tan^{-1}(\sin x + \cos x)$, $x > 0$ is always an strictly increasing function in $\left(0, \frac{\pi}{4}\right)$.

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70. If $P(A) = 0.4$, $P(B) = p$, $P(A \cup B) = 0.6$ and A and B are given to be independent events, find the value of p .

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71. A company produces two types of goods A and B, that require gold and silver. Each unit of type A requires 3 g of silver and 1 g of gold while that of type B requires 1 g of silver and 2 g of gold. The company can procure a maximum of 9 g of silver and 8 g of gold. If each unit of type A brings a profit of Rs 40 and that of type B Rs 50, formulate LPP to maximize profit.

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72. Find $\int \frac{dx}{\sqrt{3 - 2x - x^2}}$

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73.
$$\begin{vmatrix} 1+x & 1 & 1 \\ 1 & 1+y & 1 \\ 1 & 1 & 1+z \end{vmatrix} = xy + yz + zx + xyz$$

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74. The number of irrational roots of the equation

$$\frac{4x}{x^2 + x + 3} + \frac{5x}{x^2 - 5x + 3} = -\frac{3}{2} \text{ is a. 4 b. 0 c. 1 d. 2}$$



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75. Evaluate : $\int_{-1}^2 |x^3 - x| dx$



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76. Show that the differential equation $2ye^{\frac{x}{y}} dx + \left(y - 2xe^{\frac{x}{y}}\right) dy = 0$ is homogeneous. Find the particular solution of this differential equation, given that $x = 0$ when $y = 1$.



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77. Find the area of a parallelogram $ABCD$ whose side AB and the diagonal AC are given by the vectors $3i + j + 4k$ and $4i + 5k$ respectively



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78. In a shop X, 30 tins of pure ghee and 40 tins of adulterated ghee which look alike, are kept for sale while in shop Y, similar 50 tins of pure ghee and 60 tins of adulterated ghee are there. One tin of ghee is purchased from one of the randomly selected shops and is found to be adulterated. Find the probability that it is purchased from shop Y. What measures should be taken to stop adulteration ?



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79. Let $A = \mathbb{R} - \{3\}$, $B = \mathbb{R} - \{1\}$, and let $f: \overrightarrow{AB}$ be defined by $f(x) = \frac{x-2}{x-3}$ is f invertible? Explain.



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80. A wire of length 36m is to be cut into two pieces. One of the pieces is to be made into a square and the other into a circle. What should be the lengths of the two pieces, so that the combined area of the square and the circle is minimum?

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81. Using the method of integration, find the area of the triangle ABC, coordinates of whose vertices are A (1, 2), B (2, 0) and C (4, 3).

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82. Find the equation of the plane through the line of intersection of the planes $x + y + z = 1$ and $2x + 3y + 4z = 5$ which is perpendicular to the plane $x + y + z = 0$.

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83. Find the matrix X so that $X \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix} = \begin{bmatrix} -7 & -8 & -9 \\ 2 & 4 & 6 \end{bmatrix}$

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84. If $y = e^{\tan^{-1} x}$, prove that $(1 + x^2)y_2 + (2x - 1)y_1 = 0$

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85. Find $\int e^{2x} \sin(3x + 1) dx$

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86. Find the value of $\tan^{-1} \sqrt{3} - \cot^{-1}(-\sqrt{3})$

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87. If the matrix $A = \begin{bmatrix} 0 & a & -3 \\ 2 & 0 & -1 \\ b & 1 & 0 \end{bmatrix}$ is skew symmetric, find the value of a and b .

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88. Find the magnitude of each of the two vectors $\vec{a}$ and $\vec{b}$ having the same magnitude such that the angle between them is 60° and their scalar product is $\frac{9}{2}$.

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89. If $a * b$, denoted the larger of 'a' and 'b' and if $aob = a \cdot b + 3$, then write the value of $(5)o(10)$, where $*$ and o are binary operations.

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90. Prove that: $3 \sin^{-1} x = \sin^{-1}(3x - 4x^3)$, $x \in \left[-\frac{1}{2}, \frac{1}{2}\right]$

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91. Given $A = \begin{bmatrix} 2 & -3 \\ -4 & 7 \end{bmatrix}$, compute A^{-1} and show that $2A^{-1} = 9I - A$.

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92. Differentiate $\tan^{-1}\left(\frac{1 + \cos x}{\sin x}\right)$ with respect to x

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93. The total cost $C(x)$ in Rupees, associated with the production of x units of an item is given by $C(x) = 0.005x^3 - 0.02x^2 + 30x + 5000$. Find the marginal cost when 3 units are produced, where by marginal cost we mean the instantaneous rate of change of total cost at any level of output.

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94. Integrate the functions $\frac{\cos 2x + 2 \sin^2 x}{\cos^2 x}$

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95. Find the differential equation representing the family of curves $y = ae^{bx+5}$, where a and b are arbitrary constants.

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96. If θ is the angle between two vectors $\hat{i} - 2\hat{j} + 3\hat{k}$ and $3\hat{i} - 2\hat{j} + \hat{k}$, find $\sin \theta$

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97. A black and a red dice are rolled. (a) Find the conditional probability of obtaining a sum greater than 9. Given that the black die

resulted in a 5. (b) Find the conditional probability of obtaining the sum 8? given that the red die resulted in a number less than 4.

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98. Using properties of determinants prove that

$$\begin{vmatrix} 1 & 1 & 1+3x \\ 1+3y & 1 & 1 \\ 1 & 1+3z & 1 \end{vmatrix} = 9(3xyz + xy + yz + zx)$$

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99. If $y = \sin(\sin x)$, prove that

$$\frac{d^2y}{dx^2} + \tan x \frac{dy}{dx} + y \cos^2 x = 0.$$

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100. An open tank with a square base and vertical sides is to be constructed from a metal sheet so as to hold a given quantity of water.

Show that the cost of material will be least when depth of tank is half its width. If the cost is to be borne by nearby settled lower income families, for whom water will be provided, what kind of value is hidden in the question



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101. Find $\int \frac{2 \cos x}{(1 - \sin x)(1 + \sin^2 x)} dx$



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102. Let $\vec{a} = 4\hat{i} + 5\hat{j} - \hat{k}$, $\vec{b} = \hat{i} - 4\hat{j} + 5\hat{k}$ and $\vec{c} = 3\hat{i} + \hat{j} - \hat{k}$. Find a vector $\vec{d}$ which is perpendicular to both $\vec{c}$ and $\vec{b}$ and $\vec{d} \cdot \vec{a} = 21$



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103. Shortest distance between the lines:

$$\vec{r} = (4\hat{i} - \hat{j}) + \lambda(\hat{i} + 2\hat{j} - 3\hat{k}) \quad \text{and}$$

$$\vec{r} = (\hat{i} - \hat{j} + 2\hat{k}) + u(2\hat{i} + 4\hat{j} - 5\hat{k})$$

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104. Suppose a girl throws a die. If she gets 1 or 2 , she tosses a coin three times and notes the number of tails. If she gets 3,4,5 or 6, she tosses the coin once and notes whether 'head' or 'tail' is obtained. If she obtained exactly one 'tail', what is the probability that she threw 3,4,5,or 6 with the die

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105. Two numbers are selected at random(without replacement) from the first five positive integers. Let X denote the larger of the two numbers obtained. Find the mean and variance of X

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106. Find the area of the 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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107. Find the distance of the point $(-1, -5, -10)$ from the point of intersection of line $\vec{r} = 2\hat{i} - \hat{j} + 2\hat{k} + \lambda(3\hat{i} + 4\hat{j} + 2\hat{k})$ and the plane $\vec{r}(\hat{i} - \hat{j} + \hat{k}) = 5$.



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108. A factory manufactures two types of screws, A and B. Each type of screw requires the use of two machines, an automatic and a hand operated. It takes 4 minutes on the automatic and 6 minutes on hand operated machines to manufacture a package of screws A, while it takes 6 minutes on automatic and 3 minutes on the hand operated machines to manufacture a package of screws B. Each machine is

available for at the most 4 hours on any day. The manufacturer can sell a package of screws A at a profit of 70 paise and screws B at a profit of Rs 1. Assuming that he can sell all the screws he manufactures, how many packages of each type should the factory owner produce in a day in order to maximise his profit? Formulate the above LPP and solve it graphically and determine the maximum profit.

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109. Find $\frac{dy}{dx}$, if $(x^2 + y^2)^2 = xy$

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110. Show that the relation R on the set $A = \{x \in \mathbb{Z} : 0 \leq x \leq 12\}$, given by $R = \{(a, b) : |a - b| \text{ is a multiple of } 4\}$ is an equivalence relation. Find the set of all elements related to 1 i.e. equivalence class $[1]$.

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111. If $x = a(2\theta - \sin 2\theta)$ and $y = a(1 - \cos 2\theta)$ find $\frac{dy}{dx}$ when $\theta = \frac{\pi}{3}$

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112. Show that the function $f: R \rightarrow R$ defined by $f(x) = \frac{x}{x^2 + 1} \forall x \in R$ is neither one-one nor onto. Also if $g: R \rightarrow R$ is defined by $g(x) = 2x - 1$ find fog(x)

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113. If $A = \begin{bmatrix} 2 & -3 & 5 \\ 3 & 2 & -4 \\ 1 & 1 & -2 \end{bmatrix}$ find A^{-1} . Use it to solve the system of equations $2x - 3y + 5z = 11$, $3x + 2y - 4z = -5$ and $x + y - 2z = -3$

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114. Using elementary row transformations, find the inverse of the

matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 5 & 7 \\ -2 & -4 & -5 \end{bmatrix}$



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115. Find the equations of the tangent and the normal to the curve

$16x^2 + 9y^2 = 145$ at the point (x_1, y_1) , where $x_1 = 2$ and $y_1 > 0$



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116. Find the intervals in which the function

$f(x) = \frac{x^4}{4} - x^3 - 5x^2 + 24x + 12$ is (a) strictly increasing (b)

strictly decreasing



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117. Evaluate : $\int_0^{\frac{\pi}{4}} \frac{\sin x + \cos x}{16 + 9 \sin 2x}$

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118. Evaluate : $\int_1^3 (x^2 + 3x + e^x) dx$ as the limit of the sum.

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119. Find the particular solution of the differential equation $e^x \tan y dx + (2 - e^x) \sec^2 y dy = 0$, given that $y = \frac{\pi}{4}$ when $x=0$

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120. For the differential equation, find a particular solution satisfying the given condition: $\frac{dy}{dx} + 2y \tan x = \sin x$; $y = 0$ when $x = \frac{\pi}{3}$

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121. If A is a square matrix of order 2 and $|A| = 4$, then find the value of $|2AA'|$, where A' is the transpose of matrix A .



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122. Find the angle between the line $\vec{r} = (2\hat{i} - \hat{j} + 3\hat{k}) + \lambda(3\hat{i} - \hat{j} + 2\hat{k})$ and the plane $\vec{r} \cdot (\hat{i} + \hat{j} + \hat{k}) = 3$



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123. Find the co-ordinates of the point, where the line $\left(\frac{x+2}{1}\right) = \left(\frac{y-5}{3}\right) = \left(\frac{z+1}{5}\right)$ cuts the yz -plane.



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124. Find the differential equation representing the family of curves $y = -A \cos 3x + B \sin 3x$.

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125. Find the differential of the function $\cos^{-1}(\sin 2x)$ w. r. t x .

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126. If an operation $*$ on the set of integers Z is defined by $a * b = 2a^2 + b$ then find (i) whether is binary or not, and (ii) if binary then is it commutative or not.

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127. Four cards are drawn one by one with replacement from a well-shuffled deck of playing cards. Find the probability that at least three cards are of diamonds.

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128. The probability of two students A and B coming to school are $\frac{2}{7}$ and $\frac{4}{7}$ respectively. Assuming that the events 'A coming on time' and 'B coming on time' are independent, find the probability only one of them comes on time.



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129. Find the value of (x-y) from the matrix equation

$$2 \begin{bmatrix} x & 5 \\ 7 & y-3 \end{bmatrix} + \begin{bmatrix} -3 & -4 \\ 1 & 2 \end{bmatrix} = \begin{bmatrix} 7 & 6 \\ 15 & 14 \end{bmatrix}$$



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130. Solve the following differential equation: $(y + 3x^2) \frac{dx}{dy} = x$



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131. Using vectors, prove that the points $(2,-1,3)$, $(3,-5,1)$ and $(-1,11,9)$ are collinear

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132. For any two vectors $\vec{a}$ and $\vec{b}$, prove that

$$\left(\vec{a} \times \vec{b}\right)^2 = |\vec{a}|^2 |\vec{b}|^2 - \left(\vec{a} \cdot \vec{b}\right)^2$$

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133. Find $\int \left(\frac{x-1}{(x-2)(x-3)} \right) dx$

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134. Evaluate: $\int \frac{e^x}{\sqrt{5-4e^x-e^{2x}}} dx$

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135. Find $\int e^x \left(\frac{2 + \sin 2x}{2 \cos^2 x} \right) dx$



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136. If A and B are independent events with $P(A) = \frac{3}{7}$ and $P(B) = \frac{2}{5}$ then find $P(A' \cap B')$



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137. Find the equation of the plane passing through the point $(-1, 3, 2)$ and perpendicular to each of the planes $x + 2y + 3z = 5$ and $3x + 3y + z = 0$.



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138. $\int_1^5 (|x - 1| + |x - 2| + |x - 4|) dx$



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139. If x, y, z are different and $\Delta = \begin{vmatrix} x & x^2 & x^3 - 1 \\ y & y^2 & y^3 - 1 \\ z & z^2 & z^3 - 1 \end{vmatrix} = 0$, then

using properties of determinants, show that $xyz = 1$

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140. Prove that

$$\sin^{-1}\left(\frac{4}{5}\right) + \tan^{-1}\left(\frac{5}{12}\right) + \cos^{-1}\left(\frac{63}{65}\right) = \frac{\pi}{2}$$

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141. Using vectors, find the value of x such that the four points $A(x, 5, -1)$, $B(3, 2, 1)$, $C(4, 5, 5)$ and $D(4, 2, -2)$ are coplanar.

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142. Differentiate $\tan^{-1}\left(\frac{3x - x^3}{1 - 3x^2}\right)$, $|x| < \frac{1}{\sqrt{3}}$ w.r.t

$$\tan^{-1}\left(\frac{x}{\sqrt{1 - x^2}}\right)$$

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143. If $\sqrt{1 - x^2} + \sqrt{1 - y^2} = a(x - y)$, show $\frac{dy}{dx} = \sqrt{\frac{1 - y^2}{1 - x^2}}$

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144. Prove that the relation R in the set $A = \{1, 2, 3, 4, 5, 6, 7\}$ given by $R = \{(a, b) : |a - b| \text{ is even}\}$ is an equivalence relation.

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145. Show that the function f in $A = R - \left\{\frac{2}{3}\right\}$ defined as $f(x) = \frac{4x + 3}{6x - 4}$ is one one and onto. Hence find f^{-1}

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146. Find the particular solution of the differential equation:

$$(1 + e^2x)dy + (1 + y^2)e^x dx = 0, \text{ given that } y(0) = 1$$



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147. Solve the following differential equation:

$$x \frac{dy}{dx} \sin\left(\frac{y}{x}\right) + x - y \sin\left(\frac{y}{x}\right) = 0$$



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148. If $y = (\sin x)^x + \sin^{-1} \sqrt{1 - x^2}$ then find $\frac{dy}{dx}$



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149. $\int \cos 2x \cdot \cos 4x \cdot \cos 6x dx$



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150. Find the interval in which the function f given by $f(x) = \sin 2x + \cos 2x, 0 \leq x \leq \pi$ is strictly decreasing.

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151. Obtain the inverse of the following matrix, using elementary

operations: $A = \begin{bmatrix} 3 & 0 & -1 \\ 2 & 3 & 0 \\ 0 & 4 & 1 \end{bmatrix}$

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152. Using matrices solve the following system of linear equations:

$$\begin{cases} 2x + 3y + 10z = 4 \\ 4x - 6y + 5z = 1 \\ 6x + 9y - 20z = 2 \end{cases} .$$

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153. Find the area of the region $\{(x, y): y^2 \leq 6ax \text{ and } x^2 + y^2 \leq 16a^2\}$ using method of integration .



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154. Using integration, find the area of the region bounded by the lines, $4x - y + 5 = 0$; $x + y - 5 = 0$ and $x - 4y + 5 = 0$



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155. A company manufactures two types of novelty souvenirs made of plywood. Souvenirs of type A require 5 minutes each for cutting and 10 minutes each for assembling. Souvenirs of type B require 8 minutes each for cutting and 8 minutes each for assembling. There are 3 hours 20 minutes available for cutting and 4 hours for assembling. The profit is Rs 5 each for type A and Rs 6 each for type B souvenirs. How many

souvenirs of each type should the company manufacture in order to maximise the profit?



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156. Find the vector equation of the line passing through $(2, 1, -1)$ and parallel to the line $\vec{r} = (\hat{i} + \hat{j}) + \lambda(2\hat{i} - \hat{j} + \hat{k})$. Also, find the distance between these two lines.



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157. Find the image of the point $(1, 3, 4)$ in the plane $2x - y + z + 3 = 0$.



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158. A card from a pack of 52 cards is lost. From the remaining cards of the pack, two cards are drawn at random and are found to be both clubs. Find the probability of the lost card being of clubs.

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159. Prove that the radius of the right circular cylinder of greatest curved surface area which can be inscribed in a given cone is half of that of the cone.

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160. The relation R in the set $\{1, 2, 3\}$ given by $R = \{(1, 2), (2, 1), (1, 1)\}$ is

- A) symmetric and transitive, but not reflexive
- B) reflexive and symmetric, but not transitive
- C) symmetric, but neither reflexive nor transitive
- D) an equivalence relation

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161. $\tan^{-1} 3 + \tan^{-1} \lambda = \tan^{-1} \left\{ \frac{3 + \lambda}{1 - 3\lambda} \right\}$ is valid for what values of λ ?

A) $\lambda \in \left(-\frac{1}{3}, \frac{1}{3} \right)$

B) $\lambda > \left(\frac{1}{3} \right)$

C) $\lambda < \left(\frac{1}{3} \right)$

D) all real values of λ



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162. If A is a non-singular square matrix of order 3 such that $A^2 = 3A$, then value of $|A|$ is

A) (-3)

B) 3

C) 9

D) 27



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163. The function $f: R \rightarrow R$ given by $f(x) = -|x - 1|$ is

- (a) continuous as well as differentiable at $x = 1$
- (b) not continuous but differentiable at $x = 1$
- (c) continuous but not differentiable at $x = 1$
- (d) neither continuous nor differentiable at $x = 1$



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164. If $A = \{1, 3, 5\}$, then the number of equivalence relations on A containing $(1, 3)$ is



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165. the interval in which the function f given by $f(x) = x^2 e^{-x}$ is strictly increasing, is

- (a) $(-\infty, \infty)$
- (b) $(-\infty, 0)$
- (c) $(2, \infty)$
- (d) $(0, 2)$

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166. If $|\vec{a}| = 4$ and $-3 \leq \lambda \leq 2$, then $|\lambda \vec{a}|$ lies in

(A) $[0, 12]$

(B) $[2, 3]$

(C) $[8, 12]$

(D) $[-12, 8]$

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167. The vectors $3\hat{i} - \hat{j} + 2\hat{k}$, $2\hat{i} + \hat{j} + 3\hat{k}$ and $\hat{i} + \lambda\hat{j} - \hat{k}$ are coplanar if value of λ is

(A) -2

(B) 0

(C) 2

(D) any real number

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168. The area of the triangle formed by the vertices O, A, and B, where

$$\vec{OA} = \hat{i} + 2\hat{j} + 3\hat{k} \text{ and } \vec{OB} = -3\hat{i} - 2\hat{j} + \hat{k} \text{ is}$$

(A) $3\sqrt{5} \text{ units}^2$

(B) $5\sqrt{5} \text{ units}^2$

(C) $6\sqrt{5} \text{ unit}^2$

(D) 4 unit^2



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169. The coordinates of the foot of the perpendicular drawn from the point $(-2, -3, 4)$ on the y-axis is

(A) $(2, 3, 4)$

(B) $(-2, -3, -4)$

(C) $(0, -3, 0)$

(D) $(2, 0, 4)$



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170. The range of the principal value branch of the function $y = \sec^{-1} x$ is

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171. The principle value of $\cos^{-1}\left(-\frac{1}{2}\right)$ is

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172. Given a skew symmetric matrix $A = \begin{bmatrix} 0 & a & 1 \\ -1 & b & 1 \\ -1 & c & 0 \end{bmatrix}$, the value of $(a + b + c)^2$ is

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173. The distance between parallel planes $2x + y - 2z - 6 = 0$ and $4x + 2y - 4z = 0$ is _____ units.

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174. If $P(1,0,-3)$ is the foot of the perpendicular from the origin to the plane then the Cartesian equation of the plane is_____.



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175. If the radius of circle is increasing at the rate of 0.5 cm/s , then the rate of increase of its circumference is_____



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176. The corner points of the feasible region of an LPP are $(0,0)$, $(0,8)$, $(2,7)$, $(5,4)$, and $(6,4)$. the maximum profit $P = 3x + 2y$ occurs at the point_____.



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177. Differentiate $\sec^2(x^2)$ with respect to x^2



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178. If $y = f(x^2)$ and $f'(x) = e^{\sqrt{x}}$, then find $\frac{dy}{dx}$



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179. Find the value of k , so that the function

$$f(x) = \begin{cases} kx^2 + 5 & \text{if } x \leq 1 \\ 2 & \text{if } x > 1 \end{cases} \text{ is continuous at } x = 1$$



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180. Evaluate : $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} x \cos^2 x dx$



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181. Find the general solution of the differential equation

$$e^{y-x} \frac{dy}{dx} = 1.$$



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182. Find the coordinates of the point where the line

$$\frac{x-1}{3} = \frac{y+4}{7} = \frac{z+4}{2} \text{ cuts the } xy \text{ plane}$$



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183. If $A = \begin{bmatrix} -3 & 2 \\ 1 & -1 \end{bmatrix}$ and $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, find the scalar k so that $A^2 + I = kA$.



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184. If $f(x) = \sqrt{\frac{\sec x - 1}{\sec x + 1}}$, find $f'\left(\frac{\pi}{3}\right)$



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185. Find $f'(x)$ if $f(x) = \tan x^{\tan x}$



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186. Find:

$$\int \left(\frac{\tan^3 x}{\cos^3 x} \right) dx$$



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187. Find a vector $\vec{r}$ equally inclined to the three axes and whose magnitude is $3\sqrt{3}$ units.



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188. Find the angle between unit vector $\vec{a}$ and $\vec{b}$ so that $\sqrt{3} \vec{a} - \vec{b}$ is also a unit vector.



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189. Find the points of intersection of the line $\vec{r} = (2\hat{i} - \hat{j} + 2\hat{k}) + \lambda(3\hat{i} + 4\hat{j} + 2\hat{k})$ and the plane $\vec{r} \cdot (\hat{i} - \hat{j} + \hat{k}) = 5$

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190. A purse contains 3 silver and 6 copper coins a second purse contains 4 silver and 3 copper coins. If a coin is drawn at random from one of the two purses, find the probability that it is a silver coin.

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191. check whether the relation R in the set N of natural numbers given by

$$R = \{ (a,b) : a \text{ is divisor of } b \}$$

is reflexive, symmetric or transitive. Also determine whether R is an equivalence relation

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192. Prove that $\tan^{-1}\left(\frac{1}{4}\right) + \tan^{-1}\left(\frac{2}{9}\right) = \frac{1}{2}\sin^{-1}\left(\frac{4}{5}\right)$

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193. If $\tan^{-1}\left(\frac{Y}{X}\right) = \log\left(\sqrt{X^2 + Y^2}\right)$, prove that $\left(\frac{dy}{dx}\right) = \left(\frac{X + Y}{X - Y}\right)$

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194. If $y = e^{a \cos^{-1} x}$, $-1 \leq x < 1$, show that $(1 - x^2) \frac{d^2 y}{dx^2} - x \frac{dy}{dx} - a^2 y = 0$

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195. Find :

$$\int \left\{ \frac{x^3 + 1}{x^3 - x} \right\} dx$$



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196. Solve the following differential equation:

$$\left(1 + e^{\frac{y}{x}}\right) dy + e^{\frac{y}{x}} \left(1 - \frac{y}{x}\right) dx = 0 \quad (x \neq 0)$$



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197. Find the shortest distance between the lines

$$\vec{r} = 2\hat{i} - \hat{j} + \hat{k} + \lambda(3\hat{i} - 2\hat{j} + 5\hat{k}), \quad \vec{r} = 3\hat{i} + 2\hat{j} - 4\hat{k} + \mu(4\hat{i} - \hat{j} + \hat{k})$$



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198. A cottage industry manufactures pedestal lamps and wooden shades. Both the products require machine time as well as craftsman time in the making. The number of hours required for producing 1 unit of each and the corresponding profit is given in the following table : In a day, the factory has availability of not more than 42 hours of machine time and 24 hours of craftsman time, Assuming that all items manufactured manufacturer schedule his daily production in order to maximize profit ? Formulate it as an LPP and solve it graphically.

Item	Machine Time	Craftsman time	Profit (in ₹)
Pedestal lamp	1.5 hours	3 hours	30
Wooden shades	3 hours	1 hour	20

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199. If $A = \begin{bmatrix} 5 & -1 & 4 \\ 2 & 3 & 5 \\ 5 & -2 & 6 \end{bmatrix}$, find A^{-1} and use it to solve the following system of equation

$$5x - y + 4z = 5, 2x + 3y + 5z = 2, 5x - 2y + 6z = -1$$

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200. If x, y, z are different and $\Delta = \begin{vmatrix} x & x^2 & 1 + x^3 \\ y & y^2 & 1 + y^3 \\ z & z^2 & 1 + z^3 \end{vmatrix} = 0$ then show that $1 + xyz = 0$

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201. Amongst all open (from the top) right circular cylindrical boxes of volume $125\pi \text{ cm}^3$, find the dimensions of the box which has the least surface area

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202. Find the area, lying above the x -axis and included between the circle $x^2 + y^2 = 8x$ and the parabola $y^2 = 4x$.

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203. Using the method of integration find the area of the triangle ABC, coordinates of whose vertices are A(2, 0), B (4, 5) and C (6, 3).

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204. Find the probability distribution of the random variable x , which denotes the number of doublets in four throws of a pair of dice. Hence, find the mean of the number of doublets (X).

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205. Find the area of the triangle formed by O, A, B when $\vec{OA} = \hat{i} + 2\hat{j} + 3\hat{k}$, $\vec{OB} = -3\hat{i} - 2\hat{j} + \hat{k}$.

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206. If $\cos \left(\sin^{-1} \left(\frac{2}{\sqrt{5}} \right) + \cos^{-1} x \right) = 0$, then x is equal to

A) $\frac{1}{\sqrt{5}}$

B) $\left(-\frac{2}{\sqrt{5}} \right)$

C) $\left(\frac{2}{\sqrt{5}} \right)$

D) 1



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207. The interval in which the function f given by $f(x) = x^2 e^{-x}$ is strictly increasing is

(a) $(-\infty, \infty)$

(b) $(-\infty, 0)$

(c) $(2, \infty)$

(d) $(0, 2)$



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208. The function $f(x) : \frac{x-1}{x(x^2-1)}$ is discontinuous at

- (a) exactly one point
- (b) exactly two points
- (c) exactly three points
- (d) no point



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209. The function $f: R \rightarrow [-1, 1]$ defined by $f(x) = \cos x$ is

- (a) both one-one and onto
- (b) not one-one, but onto
- (c) one-one, but not onto
- (d) neither one-one, nor onto



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210. the coordinates of the foot of the perpendicular drawn from the point (2,-3,4) on the y-axis is

(a) (2,3,4)

(b) (-2,-3,-4)

(c) (0,-3,0)

(d) (2,0,4)



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211. The relation R in the set $\{1, 2, 3\}$ given by $R = \{(1, 2), (2, 1), (1, 1)\}$ is

a) symmetric and transitive, but not reflexive

b) reflexive and symmetric, but not transitive

c) symmetric, but neither reflexive nor transitive

d) an equivalence relation



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212. The angle between the vectors $\hat{i} - \hat{j}$ and $\hat{j} - \hat{k}$ is

(A) $-\frac{\pi}{3}$

(B) 0

(C) $\frac{\pi}{3}$

(D) $2\frac{\pi}{3}$



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213. If A is a non-singular square matrix of the order 3×3 such that

$$A^2 = 3A \text{ then}$$

(A) -3

(B) 3

(C) 9

(D) 27



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214. If $|\vec{a}| = 4$ and $-3 \leq \lambda \leq 2$, then $|\lambda \vec{a}|$ lies in (A) $[0, 12]$ (B) $[2, 3]$

(C) $[8, 12]$ (D) $[-12, 8]$



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215. If the radius of the circle is increasing at the rate of 0.5 cm/s , then the rate of increase of its circumference is

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216. If $\begin{vmatrix} 2x & -9 \\ -2 & x \end{vmatrix} = \begin{vmatrix} -4 & 8 \\ 1 & -2 \end{vmatrix}$, then value of x is

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217. The corner points of the feasible region of an LPP are (0,0), (0,8), (2,7),(5,4),and (6,4). the maximum profit $P= 3x + 2y$ occurs at the point_____.

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218. The range of the principal value branch of the function $y = \sec^{-1} x$ is _____

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219. Find the principal value of: $\cos^{-1}\left(-\frac{1}{2}\right)$

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220. The distance between parallel planes $2x+y-2z-6=0$ and $4x+2y-4z=0$ is _____ units.

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221. If $P(1,0,-3)$ is the foot of the perpendicular from the origin to the plane then the Cartesian equation of the plane is _____.

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222. Evaluate : $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} x \cos^2 x dx$

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223. Find the coordinates of the point where the line

$$\frac{x-1}{3} = \frac{y+4}{7} = \frac{z+4}{2} \text{ cuts the } XY \text{ plane}$$

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224. Find the value of k , so that the function

$$f(x) = \begin{cases} kx^2 + 5 & \text{if } x \leq 1 \\ 2 & \text{if } x > 1 \end{cases} \text{ is continuous at } x = 1$$

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225. The Integrating Factor of the differential equation

$$x \frac{dy}{dx} - y = 2x^2 \text{ is (A) } e^{-x} \text{ (B) } e^{-y} \text{ (C) } \frac{1}{x} \text{ (D) } x$$

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226. Differentiate $\sec^2(x^2)$ with respect to x^2

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227. If $y = f(x^2)$ and $f'(x) = e^{\sqrt{x}}$, then find $\frac{dy}{dx}$

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228. Find the angle between unit vector $\vec{a}$ and $\vec{b}$ so that $\sqrt{3} \vec{a} - \vec{b}$ is also a unit vector.

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229. If $A = \begin{bmatrix} -3 & 2 \\ 1 & -1 \end{bmatrix}$ and $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, find the scalar k so that $A^2 + I = kA$.

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230. Find $f'(x)$ if $f(x) = \tan x^{\tan x}$



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231. If $f(x) = \sqrt{\frac{\sec x - 1}{\sec x + 1}}$, find $f'\left(\frac{\pi}{3}\right)$



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232. Find:

$$\int \left(\frac{\tan^3 x}{\cos^3 x} \right) dx$$



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233. Show that the plane $x - 5y - 2z = 1$ contains the line

$$\frac{x - 5}{3} = y = 2 - z$$



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234. A fair dice is thrown two times. Find the probability distribution of the number of sixes. Also determine the mean of the number of sixes

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235. Solve the following differential equation:

$$\left(1 + e^{\frac{y}{x}}\right)dy + e^{\frac{y}{x}}\left(1 - \frac{y}{x}\right)dx = 0 (x \neq 0)$$

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236. A cottage industry manufactures pedestal lamps and wooden shades. Both the products require machine time as well as craftsman time in the making. The number of hours required for producing 1 unit of each and the corresponding profit is given in the following table:

In a day, the factory has availability of not more than 42 hours of machine time and 24 hours of craftsman time.

Assuming that all items manufactured are sold, how should the

manufacturer schedule his daily production in order to maximise the profit? Formulate it as an LPP and solve it graphically

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237. Evaluate: $\int_0^{\frac{\pi}{2}} (\sin 2x \tan^{-1}(\sin x)) dx$

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238. Check whether the relation R in the set N of natural numbers given by

$$R = \{(a, b) : a \text{ is a divisor of } b\}$$

is reflexive, symmetric or transitive. Also determine whether R is an equivalence relation

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239. Prove that $\tan^{-1}\left(\frac{1}{4}\right) + \tan^{-1}\left(\frac{2}{9}\right) = \frac{1}{2}\sin^{-1}\left(\frac{4}{5}\right)$

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240. If $\tan^{-1}\left(\frac{y}{x}\right) = \log \sqrt{x^2 + y^2}$, prove that $\frac{dy}{dx} = \frac{x+y}{x-y}$

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241. If $y = e^{a \cos^{-1} x}$, $-1 \leq x \leq 1$, show that

$$(1 - x^2) \frac{d^2 y}{dx^2} - x \frac{dy}{dx} - a^2 y = 0.$$
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242. Amongst all open (from the top) right circular cylindrical boxes of volume $125 \pi \text{ cm}^3$, find the dimensions of the box which has the least surface area

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243. Find the area, lying above the x -axis and included between the circle $x^2 + y^2 = 8x$ and the parabola $y^2 = 4x$.

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244. Using the method of integration find the area of the triangle ABC, coordinates of whose vertices are A(2, 0), B (4, 5) and C (6, 3).

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245. If x, y, z are different and $\Delta = \begin{vmatrix} x & x^2 & 1 + x^3 \\ y & y^2 & 1 + y^3 \\ z & z^2 & 1 + z^3 \end{vmatrix} = 0$ then show

that $1 + xyz = 0$

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246. A card from a pack of 52 cards is lost. From the remaining cards of the pack, two cards are drawn and are found to be both diamonds. Find

the probability of the lost card being a diamond.

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247. the domain of the function $f(x) = \sin^{-1}(2x)$ is

- (a) $[0,1]$
- (b) $[-1,1]$
- (c) $[(-1/2), (1/2)]$
- (d) $[-2,2]$

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248. the interval in which the function f given by $f(x) = x^2 e^{-x}$ is strictly increasing, is

- (a) $(-\infty, \infty)$
- (b) $(-\infty, 0)$
- (c) $(2, \infty)$
- (d) $(0, 2)$

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249. Form the differential equation representing the family of curves $y = mx$, where, m is arbitrary constant.

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250. Find the angle between unit vector $\vec{a}$ and $\vec{b}$ so that $\sqrt{3} \vec{a} - \vec{b}$ is also a unit vector.

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251. If $A = \begin{bmatrix} -3 & 2 \\ 1 & -1 \end{bmatrix}$ and $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, find the scalar k so that $A^2 + I = kA$.

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252. If $f(x) = \sqrt{\frac{\sec x - 1}{\sec x + 1}}$, find $f'\left(\frac{\pi}{3}\right)$



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253. Find $f'(x)$ if $f(x) = (\tan x)^{\tan x}$



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254. Amongst all open (from the top) right circular cylindrical boxes of volume $125\pi \text{ cm}^3$, find the dimensions of the box which has the least surface area



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255. Using the method of integration find the area of the triangle ABC, coordinates of whose vertices are A(2, 0), B (4, 5) and C (6, 3).



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