MATHS

BOOKS - RD SHARMA MATHS (HINGLISH)

SOLUTION OF SIMULTANEOUS LINEAR EQUATIONS

Solved Examples And Exercises

1. Solve the following system of equations by matrix method : $\frac{2}{x}-\frac{3}{y}+\frac{3}{z}=10, \frac{1}{x}+\frac{1}{y}+\frac{1}{z}=10 \frac{3}{x}-\frac{1}{y}+\frac{2}{z}=13;$

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2. Show that each of the following systems of linear equations is consistent and also find their solutions: $6x+4y=2\ 9x+6y=3$

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3. Solve the following system of equations by matrix method :

$5x + 7y + 2 = 0 \quad 4x + 6y + 3 = 0 \quad 5x + 2y = 3 \quad 3x + 2y = 5$

$3x + 4y - 5 = 0 \quad x - y + 3 = 0 \quad 3x + y = 19 \quad 3x - y = 23$

$3x + 7y = 4\ x + 2y = -1\ 3x + y = 7\ 5x + 3y = 12$

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4. If $A = \begin{pmatrix} 2 & -3 & 5 \\ 3 & 2 & -4 \\ 1 & 1 & -2 \end{pmatrix}$ 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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5. For the system of equitions: $x+2y+3z=1$ $2x+y+3z=2$ $5x+5y+9z=4$ there is only one solutions there exists infinitely many solution there is no solution (d) none of these

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6. Let a, b, c be the real numbers. The following system of equations in $x, y, andz$

$$\frac{x^2}{a^2}+\frac{y^2}{b^2}-\frac{z^2}{a^2}=1, \frac{x^2}{a^2}-\frac{y^2}{b^2}+\frac{z^2}{a^2}=1, -\frac{x^2}{a^2}+\frac{y^2}{b^2}+\frac{z^2}{a^2}=1$$

has a. no solution b. unique solution c. infinitely many solutions d. finitely many solutions

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7. The existence of the unique solution of the system of equations:

$x+y+z=\lambda$

$5x-y+\mu z=2$

$2x + 3y - z = 6$ d e p e n d s on $\mu only$ (b) $\lambda only$ $\lambda and \mu \perp h$ (d) $neither \lambda \|u\|$

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8. Let $x = [x_1 x_2 x_3], A = [1 - 12201321] and B = [321] \dot{I} f AX = B,$ Then X is equal to $[123]$ (b) $[-1-2-3]$ (c) $[-1-2-3]$ (d) $[-123]$ (e) $[021]$

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9. The system of equations: $x + y + z = 5 \quad x + 2y + 3z = 9$ $x + 3y + \lambda z = \mu$ has a unique solution, if $\lambda = 5, \mu = 13$ (b) $\lambda \neq 5$ $\lambda = 5, \mu \neq 13$ (d) $\mu \neq 13$

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10. The number of solution of the system of equations: $2x + y - z = 7\ x - 3y + 2z = 1,$ is $3x + 2y + kz = 4$ has a unique solution if $k \neq 0$ (b) `-1

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11. The system of equation $x + y + z = 2, 3x - y + 2z = 6 and 3x + y + z = -18$ has a unique solution (b) no solution an infinite number of solutions zero solution as the only solution

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12. Solve the following system of homogeneous equations: $2x + 3y - z = 0\ x - y - 2z = 0\ 3x + y + 3z = 0$

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13. Given $A = \begin{bmatrix} 1 & -1 & 0 \\ 2 & 3 & 4 \\ 0 & 1 & 2 \end{bmatrix}, B = \begin{bmatrix} 2 & 2 & -4 \\ -4 & 2 & -4 \\ 2 & -1 & 5 \end{bmatrix}$ find AB and use this to solve the system of equations:

$y + 2x = 7, x - y = 3, 2x + 3y + 4z = 17$

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14. If

$a_1x + b_1y + c_1z = 0, a_2x + b_2y + c_2z = 0, a_3x + b_3y + c_3z = 0$

and $\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix} = 0$, then the given system then

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15. Solve the following system of homogeneous equations:

$x + y - z = 0\ x - 2y + z = 0\ 3x + 6y - 5z = 0$

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16. If $A = [1 - 1121 - 3111]$, find A^{-1} and hence solve the system of linear equation.

$x + 2y + z = 4, \ -x + y + z = 0, x - 3y + z = 2$

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17. Show that the following system of equation is consistent.

$2x - y + 3z = 5, 3x + 2y - z = 7, 4x + 5y - 5z = 0$

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18. Solve the following system of equations, using matrix method.

$x + 2y + z = 7, x + 3z = 11, 2x - 3y = 1$

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19. The number of solutions of the system of equations: $2x + y - z = 7\ x - 3y + 2z = 1, is\ x + 4y - 3z = 5$ 3 (b) 2 (c) 1 (d) 0

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20. An amount of Rs 5000 is put into three investments at the rate of interest of $6\%, 7\%$ and 8% per annum respectively. The total annual income is Rs 358. If the combined income from the first taoinvestments is Rs 70 more than the income from the third, find the amount of each investment by matrirx method

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21. The sum of three numbers is 6. If we multiply the third number 2 and add the first number to the result, we get 7. Be adding second

and third numbers to three times the first number we get 12. Use determinants to find the numbers.

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22. 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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23. Express the following system of simultaneous linear equation as a matrix equation:

$2x+3y-z=1, \quad x+y+2z=2, \quad 2x-y+z=3$

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24. Use matrix method to solve the equations $5x - 7y = 2$ and $7x - 5y = 3$

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25. Use matrix method to solve the following system of equations: $x - 2y - 4 = 0, \quad -3x + 5y + 7 = 0$

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26. Solve the following system of equations, using matrix method. $x + 2y + z = 7, x + 3z = 11, 2x - 3y = 1$

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27. Use matrix method to examine the following system of equations for consistency or inconsistency $4x - 2y = 3$ and $6x - 3y = 5$

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28. Show that the following system of equation is consistent.

$2x - y + 3z = 5, 3x + 2y - z = 7, 4x + 5y - 5z = 0$

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29. If $A = \begin{bmatrix} 1 & 2 & 1 \\ -1 & 1 & 1 \\ 1 & -3 & 1 \end{bmatrix}$, find A^{-1} and hence solve the system of linear equation. $x + 2y + z = 4, \ -x + y + z = 0, x - 3y + z = 2$

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30. If $A = \begin{bmatrix} 1 & 2 & -3 \\ 2 & 3 & 2 \\ 3 & -3 & -4 \end{bmatrix}$ then find A^{-1} and hence solve the follwoing equations:

$x + 2y - 3z = 4, 2x + 3y + 2z = 2$ and $3x - 3y - 4z = 11$

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31. The sum of three numbers is 6. If we multiply the third number 2 and add the first number to the result, we get 7. Be adding second and third numbers to three times the first number we get 12. Use determinants to find the numbers.

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32. An amount of Rs 5000 is put into three investments at the rate of interest of $6\%, 7\%$ and 8% per annum respectively. The total annual income is Rs 358. If the combined income from the first taoinvestments is Rs 70 more than the income from the third, find the amount of each investment by matrirx method

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33. Solve the following system of equations by matrix method:

$5x + 7y + 2 = 0, \quad 4x + 6y + 3 = 0$

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34. Solve the following system of equations by matrix method:

$5x + 2y = 3, \quad 3x + 2y = 5$

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35. Solve the following system of equations by matrix method:

$3x + 4y - 5 = 0, \quad x - y + 3 = 0$

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36. Solve the following system of equations by matrix method:

$3x + y = 19, \quad 3x - y = 23$

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37. Solve the following system of equations by matrix method:

$3x + 7y = 4, \quad x + 2y = -1$

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38. Solve the following system of equations by matrix method:

$3x + y = 7, \quad 5x + 3y = 12$

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39. Solve the following system of equations by matrix method :

$x + y - z = 3, 2x + 3y + z = 10, 3x - y - 7z = 1$

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40. Solve the following system of equations by matrix method:

$x + y + z = 3, \quad 2x - y + z = -1, \quad 2x + y - 3z = -9$

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41. Solve the following system of equations by matrix method :

$x + y - 2 = 3 \quad 2x + 3y + z = 10 \quad 3x - y - 7z = 1 \quad x + y + z = 3$

$2x - y + z = -1 \qquad 2x + y - 3z = -9 \qquad 6x - 12y + 25z = 4$

$4x + 15y - 20z = 3 \qquad 2x + 18y + 15z = 10 \qquad 3x + 4y + 7z = 14$

$2x - y + 3z = 4 \qquad x + 2y - 3z = 0 \qquad \frac{2}{x} - \frac{3}{y} + \frac{3}{z} = 10$

$\frac{1}{x} + \frac{1}{y} + \frac{1}{z} = 10 \qquad \frac{3}{x} - \frac{1}{y} + \frac{2}{z} = 13 \qquad 5x + 3y + z = 16$

$2x + y + 3z = 19 \; x + 2y + 4z = 25 \; 3x + 4y + 2z = 8 \; 2y - 3z = 3$

$x - 2y + 6z = -2$ $2x + y + z = 2$ $x + 3y - z = 5$

$3x + y - 2z = 6$ $2x + 6y = 2$ $3x - z = -8$ $2x - y + z = -3$

$2y - z = 1$ $x - y + z = 2$ $2x - y = 0$ $8x + 4y + 3z = 18$

$2x + y + z = 5$ $x + 2y + z = 5$ $x + y + z = 6$ $x + 2z = 7$

$3x + y + z = 12$ $\frac{2}{x} + \frac{3}{y} + \frac{10}{z} = 4,$ $\frac{4}{x} - \frac{6}{y} + \frac{5}{z} = 1$

$\frac{6}{x} + \frac{9}{y} - \frac{20}{z} = 2; x, y, z \neq 0$ $x - y + 2z = 7$

$3x + 4y - 5z = -5$ $2x - y + 3z = 12$

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42. Using matrix method, solve the following system of linear equations. $3x + 4y + 2z = 8, 2y - 3z = 3$ and $x - 2y + 6z = -2$

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43. Using matrix method, solve the following system of equations:

$\frac{2}{x} + \frac{3}{y} + \frac{10}{z} = 4, \frac{4}{x} - \frac{6}{y} + \frac{5}{z} = 1, \frac{6}{x} + \frac{9}{y} - \frac{20}{z} = 2; x, y, z \neq 0$

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44. Using matrices, solve the following system of linear equations:

$x - y + 2z = 7\ 3x + 4y - 5z = -5\ 2x - y + 3z = 12$

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45. Show that each of the following systems of linear equations is consistent and also find their solutions: $6x + 4y = 2\ 9x + 6y = 3$

$2x + 3y = 5\ \ 6x + 9y = 15\ \ 5x + 3y + 7z = 4\ \ 3x + 26y + 2z = 9$

$7x + 2y + 10z = 5 \qquad x - y + z = 3 \qquad 2x + y - z = 2$

$-x - 2y + 2z = 1 \qquad x + y + z = 6 \qquad x + 2y + 3z = 14$

$x + 4y + 7z = 30 \qquad 2x + 2y - 2z = 1 \qquad 4x + 4y - z = 2$

$6x + 6y + 2z = 3$

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46. Show that the following system of equations is consistent. $x - y + z = 3, 2x + y - z = 2, \ -x - 2y + 2z = 1$ Also, find the solution.

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47. Show that following system of linear equations is inconsistent: $2x + 5y = 7, \ \ 6x + 15y = 13$

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48. Show that following system of linear equations is inconsistent: $2x + 3y = 5, \ \ 6x + 9y = 10$

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49. Use matrix method to examine the following system of equations for consistency or inconsistency $4x - 2y = 3$ and $6x - 3y = 5$

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50. Show that following system of linear equations is inconsistent:

$4x - 5y - 2z = 2, \quad 5x - 4y + 2z = -2, \quad 2x + 2y + 8z = -1$

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51. Show that following system of linear equations is inconsistent:

$3x - y - 2z = 2, \quad 2y - z = -1, \quad 3x - 5y = 3$

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52. Show that following system of linear equations is inconsistent:

$x + y - 2z = 5, \quad x - 2y + z = -2, \quad -2x + y + z = 4$

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53. If $A \begin{vmatrix} 1 & 2 & 0 \\ -2 & -1 & -2 \\ 0 & -1 & 1 \end{vmatrix}$, then find the value of A^{-1}

Using A^{-1}, solve the system of linear equations

$x - 2y = 10, 2xy - z = 8$ and $-2y + z = 7$

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54. If $A = \begin{vmatrix} 2 & 2 & -4 \\ -4 & 2 & -4 \\ 2 & -1 & 5 \end{vmatrix}$ and $B = \begin{vmatrix} 1 & -1 & 0 \\ 2 & 3 & 4 \\ 0 & 1 & 2 \end{vmatrix}$ then find BA and

use ths to sovle the system of equations $y + 2z = 7, x - y = 3$ and

$2x + 3y + 4z = 17.$

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55. A school wants to award its students for the value of honesty, regularity and hard work will total cash award of Rs. 6000. Three times the award money for hard work added to that added to that given for honesty amounts to Rs. 11000. The award money given for honesty and hard work together is double the one given for regularity. Represent the above situation algebraically and find the award money for each value, using matrix method.

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56. Two schools P and Q want to award their selected students on the values of Tolerance, Kindness and Leadership. The school P wants to award Rs. x each, Rs. y each and Rs. z each for the three respective values to 3, 2 and 1 students respectively with a total award money of Rs. 2,200. School Q wants to spend Rs. 3,100 to award its 4, 1 and 3 students on the respective values (by giving the same award money

to the three values as school P). If the total amount of award for one prize on each value is Rs. 1,200, using matrices, find the award money for each value. Apart from these three values, suggest one more value which should be considered for award.

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57. Two schools P and Q want to award their selected students on the values of Discipline, politeness and punctuality. The school P wants to awards Rs. x each, Rs. y each and Rs. z each for the three respective values to its 3, 2 and 1 students with a total award money of Rs. 1000. School Q wants to spend Rs 1500 to award its 4, l and 3 students on the respective values (by giving the same award money for the three values before) If the total amount of awards for one prize on each value is Rs. 600, using matrices, find the award money for each value. Apart from the above three values suggest one more value for awards.

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58. A shopkeeper has 3 varieties of pens $'A'$, $'B'$ and $'C'$. Meenu purchased 1 pen of each variety for a total of Rs 21. Jeen purchased 4 pens of $'A'$ variety, 3 pens of $'B'$ variety and 2 pens of $'C'$ ariety for Rs 60. While Shikha purchased 6 pens of $'A'$ variety, 2 pens of $'B'$ variety and 3 pens of $'C'$ variety for Rs 70. Using matrix method find the cost of each pen.

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59. Solve the following system of homogeneous equations:

$2x + 3y - z = 0\ x - y - 2z = 0\ 3x + y + 3z = 0$

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60. Find the solution of homogeneous system of equations:

$x - 2y + z = 0;\ x + y = z$ and $3x + 6y = 5z$

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61. Solve the following system of homogeneous linear equations by matrix method:

$2x - y + z = 0, \quad 3x + 2y - z = 0, \quad x + 4y + 3z = 0$

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62. Solve the following system of homogeneous linear equations by matrix method:

$2x - y + 2z = 0, \quad 5x + 3y - z = 0, \quad x + 5y - 5z = 0$

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63. Solve the following system of homogeneous linear equations by matrix method:

$x + y - 6z = 0, \quad x - y + 2z = 0, \quad -3x + y + 2z = 0$

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64. Solve the following system of homogeneous linear equations by matrix method: $x + y + z = 0, \quad x - y - 5z = 0, \quad x + 2y + 4z = 0$

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65. Solve the following system of homogeneous equations: $x + y + z = 0\ x - 2y + z = 0\ 3x + 6y - 5z = 0$

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66. Solve the following system of homogeneous linear equations by matrix method: $3x + y - 2z = 0, \quad x + y + z = 0, \quad x - 2y + z = 0$

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67. Solve the following system of homogeneous equations:

$2x + 3y - z = 0\ x - y - 2z = 0\ 3x + y + 3z = 0$

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68. If $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 \\ -1 \\ 0 \end{bmatrix}$, find $x,\ y\ and\ z$.

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69. If $\begin{bmatrix} 1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & -1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}$, find $x,\ y\ and\ z$.

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70. If $\begin{bmatrix} 1 & 0 & 0 \\ 0 & y & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ -1 \\ z \end{bmatrix} = \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}$, find $x,\ y\ and\ z$.

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71. Solve $[3 - 492][xy] = [102]$ for $x \; and \; y$.

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72. If $A = [2443], \; X = [n1]$, $B = [811]$ and $AX = B$, then find n.

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73. The system of equation $x + y + z = 2$, $3x - y + 2z = 6$ and $3x + y + z = -18$ has (a) a unique solution (b) no solution (c) an infinite number of solutions (d) zero solution as the only solution

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74. The number of solutions of the system of equations: $2x + y - z = 7,\ \ x - 3y + 2z = 1,\ \ x + 4y - 3z = 5$ is (a) 3 (b) 2 (c) 1 (d) 0

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75. Let $x = [x_1 x_2 x_3], A = [1 - 12201321] and B = [321] \dot{I} f AX = B,$ Then X is equal to $[123]$ (b) $[-1-2-3]$ (c) $[-1-2-3]$ (d) $[-123]$ (e) $[021]$

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76. The number of solutions of the system of equations: $2x + y - z = 7\, x - 3y + 2z = 1, is\ x + 4y - 3z = 5$ 3 (b) 2 (c) 1 (d) 0

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77. The system of linear equations $x+y+z=2, 2x=y-z=3, 3x+2y+kz=4$ has a unique solution if (A) $k \neq 0$ (B) $-1<k<1$ (C) $-2<k<2$ (D) $k=0$

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78. I $|a_1, b_1, c_1), (a_2, b_2, c_2), (a_3, b_3, c_3) = 0$ then the system of equations

$a_1x+b_1y+c_1z=0, a_2x+b_2y+c_2z=0, a_3x+b_3y+c_3z=0$

has (A) no solution (B) one trivial and one non trivial solutions (C) only the trivial solution (0,0,0) (D) more than two solution

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79. Let a, b, c be the real numbers. The following system of equations in $x, y, andz$

$$\frac{x^2}{a^2}+\frac{y^2}{b^2}-\frac{z^2}{a^2}=1, \frac{x^2}{a^2}-\frac{y^2}{b^2}+\frac{z^2}{a^2}=1, -\frac{x^2}{a^2}+\frac{y^2}{b^2}+\frac{z^2}{a^2}=1$$

has a. no solution b. unique solution c. infinitely many solutions d. finitely many solutions

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80. For the system of equitions: $x+2y+3z=1\ 2x+y+3z=2$ $5x+5y+9z=4$ there is only one solutions there exists infinitely many solution there is no solution (d) none of these

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81. The existence of the unique solution of the system $x+y+z=\lambda, 5x$â€“$y+\mu z=10, 2x+3y-Z=6$ depends on

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82. The system of equations: $x + y + z = 5 \quad x + 2y + 3z = 9$ $x + 3y + \lambda z = \mu$ has a unique solution, if $\lambda = 5, \mu = 13$ (b) $\lambda \neq 5$ $\lambda = 5, \mu \neq 13$ (d) $\mu \neq 13$

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Others

1. A mixture is to be made of three foods A, B, C. The three food A,B,C contain nutrients P.Q.R as shown below: Ounces FOOD P Q R A B C 1 3 4 2 1 2 5 1 1 How to form a mixture which will have 8 ounces of P, 5 ounces of Q and 7 ounces of R?

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2. Determine the product $[(-444), (-713) \text{ and } (5-3-1)][(1-11), (1-2-2) \text{ and } (213)]$ 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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3. A mixture is to be made of three foods A, B, C. The three foods A, B, C contain nutrients P, Q, R as shown below: Ounces per pound of Nutrient Food P Q R A 1 2 5 B 3 1 1 C 4 2 1 How to form a mixture which will have 8 ounces of P, 5 ounces of Q and 7 ounces of R?

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4. Solve the following system of equations by matrix method: $6x-12y+25z=4, \quad 4x+15y-20z=3, \quad 2x+18y+15z=10$

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5. Solve the following system of equations by matrix method:

$3x + 4y + 7z = 14, \quad 2x - y + 3z = 4, \quad x + 2y - 3z = 0$

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6. Solve the following system of equations by matrix method:

5x+3y+z=16,2x+y+3z=19,x+2y+4z=25

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7. Solve the following system of equations by matrix method:

$2x + y + z = 2, \quad x + 3y - z = 5, \quad 3x + y - 2z = 6$

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8. Solve the following system of equations by matrix method:

$2x + 6y = 2, \quad 3x - z = -8, \quad 2x - y + z = -3$

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9. Solve the following system of equations by matrix method:

$x - y + z = 2, \quad 2x - y = 0, \quad 2y - z = 1$

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10. Solve the following system of equations by matrix method:

$8x + 4y + 3z = 18, \quad 2x + y + z = 5, \quad x + 2y + z = 5$

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11. Solve the following system of equations by matrix method:

$x + y + z = 6, \quad x + 2z = 7, \quad 3x + y + z = 12$

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12. Show that following system of linear equations is consistent and also find their solution: $2x + 3y = 5, \quad 6x + 9y = 15$

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13. Show that following system of linear equations is consistent and also find their solution:

$5x + 3y + 7z = 4, \quad 3x + 26y + 2z = 9, \quad 7x + 2y + 10z = 5$

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14. Show that following system of linear equations is consistent and also find their solution:

$x + y + z = 6, \quad x + 2y + 3z = 14, \quad x + 4y + 7z = 30$

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15. Show that following system of linear equations is consistent and also find their solution:

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

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16. If $A = [1 - 10234012]$ and $B = [22 - 4 - 42 - 42 - 15]$ are two square matrices, find AB and hence solve the system of linear equations: $x - y = 3, \quad 2x + 3y + 4z = 17, \quad y + 2z = 7$

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17. If $A = [2 - 3532 - 411 - 2]$, find A^{-1} and hence solve the system of linear equations: $2x - 3y + 5z = 11, \quad 3x + 2y - 4z = 5,$ $x + y - 2z = -3$

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18. Find A^{-1}, if $A = [1251 - 1 - 123 - 1]$. Hence, solve the following system of linear equations:

$x + 2y + 5z = 10, \quad x - y - z = -2, \quad 2x + 3y - z = -11$

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19. If $A = \begin{bmatrix} 1 & 2 & 0 \\ 2 & 1 & 3 \\ 0 & -2 & 1 \end{bmatrix}$, find A^{-1}. Using A^{-1}, solve the system of linear equations: $x - 2y = 10, \quad 2x + y + 3z = 8, \quad -2y + z = 7$

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20. $A = \begin{bmatrix} 3 & -4 & 2 \\ 2 & 3 & 5 \\ 1 & 0 & 1 \end{bmatrix}$, find A^{-1} and hence solve the following system of equations:

$3x - 4y + 2z = -1,\ \ 2x + 3y + 5z = 7,\ \ x + z = 2$

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21. If $A = \begin{bmatrix} 1 & -2 & 0 \\ 2 & 1 & 3 \\ 0 & -2 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 7 & 2 & -6 \\ -2 & 1 & -3 \\ -4 & 2 & 5 \end{bmatrix}$, find AB

Hence , solve the system of equation

x-2y=10, 2x+y+3z=8 and -2y+z=7.

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