

Date \_\_\_\_\_

Day MTWTFS

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Section B

Subject Differential equation

Submitted To Moam Shomaila

Date 19-9/2020

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Q.No. \_\_\_\_\_

$$x + 3y + 5z + 2t = 2$$

$$-y + 3z + 4t = 0$$

$$2x + y + 9z + 6t = -3$$

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

Sol: Using Gauss-jordan method

$$x + 3y + 5z + 2t = 2$$

$$-y + 3z + 4t = 0$$

$$2x + y + 9z + 6t = -3$$

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

Writing system in matrix form

$$2t + x + 3y + 5z = 2$$

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

$$6t + 2x + y + 9z = -3$$

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

$$= \left[ \begin{array}{cccc|c} 2 & 1 & 3 & 5 & 2 \\ 0 & 1 & -1 & 3 & 0 \\ 6 & 2 & 1 & 9 & -3 \\ 8 & 3 & 2 & 4 & -1 \end{array} \right]$$

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$$= \left[ \begin{array}{cccc|c} 2 & 0 & 4 & 2 & 2 \\ 0 & 1 & -1 & 3 & 0 \\ 6 & 2 & 1 & 9 & -3 \\ 8 & 3 & 2 & 4 & -1 \end{array} \right] \begin{array}{l} \text{xing row 2 by} \\ -1 \text{ and add} \\ \text{t row 1} \end{array}$$

$$= \left[ \begin{array}{cccc|c} 2 & 0 & 4 & 2 & 2 \\ 0 & 1 & -1 & 3 & 0 \\ 6 & 0 & 3 & 3 & -3 \\ 8 & 3 & 2 & 4 & -1 \end{array} \right] \begin{array}{l} \text{Multi row 2} \\ \text{by } -2 \text{ and} \\ \text{add to row 3} \end{array}$$

$$= \left[ \begin{array}{cccc|c} 2 & 0 & 4 & 2 & 2 \\ 0 & 1 & -1 & 3 & 0 \\ 6 & 0 & 3 & 3 & -3 \\ 8 & 0 & 5 & -5 & -1 \end{array} \right] \begin{array}{l} \text{Mult row 2} \\ \text{by } -3 \text{ and} \\ \text{add it to} \\ \text{row 4} \end{array}$$

$$= \left[ \begin{array}{cccc|c} 1 & 0 & 2 & 1 & 1 \\ 0 & 1 & -1 & 3 & 0 \\ 6 & 0 & 3 & 3 & -3 \\ 8 & 0 & 5 & -5 & -1 \end{array} \right] \begin{array}{l} \text{Divide the} \\ \text{row 1 by 2} \end{array}$$

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$$= \left[ \begin{array}{cccc|c} 1 & 0 & 2 & 1 & 1 \\ 0 & 1 & -1 & 3 & 0 \\ 2 & 0 & 1 & 1 & -1 \\ 8 & 0 & 5 & -5 & -1 \end{array} \right] \begin{array}{l} \\ \text{Divide row 3} \\ \text{by 3} \end{array}$$

$$= \left[ \begin{array}{cccc|c} 1 & 0 & 2 & 1 & 1 \\ 0 & 1 & -1 & 3 & 0 \\ 0 & 0 & -3 & -1 & -3 \\ 8 & 0 & 5 & -5 & -1 \end{array} \right] \begin{array}{l} \text{Mult row 1} \\ \text{by 2 and} \\ \text{add it to row 3} \end{array}$$

$$= \left[ \begin{array}{cccc|c} 1 & 0 & 2 & 1 & 1 \\ 0 & 1 & -1 & 3 & 0 \\ 0 & 0 & -3 & -1 & -3 \\ 0 & 0 & -11 & -13 & -9 \end{array} \right] \begin{array}{l} \text{mult row 1} \\ \text{by -8 and} \\ \text{add it to} \\ \text{row 4} \end{array}$$

$$= \left[ \begin{array}{cccc|c} 1 & 0 & 2 & 1 & 1 \\ 0 & 1 & -1 & 3 & 0 \\ 0 & 0 & 3 & 1 & 3 \\ 0 & 0 & -11 & -13 & 9 \end{array} \right] \begin{array}{l} \text{multi the rows} \\ \text{by -} \end{array}$$

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$$= \left[ \begin{array}{cccc|c} 1 & 0 & 2 & 1 & 1 \\ 0 & 1 & -1 & 3 & 0 \\ 0 & 0 & 3 & 1 & 3 \\ 0 & 0 & 11 & 13 & 9 \end{array} \right] \begin{array}{l} \text{mult the row 4} \\ \text{by } -1 \end{array}$$

$$= \left[ \begin{array}{cccc|c} 1 & 0 & -1 & 0 & -2 \\ 0 & 1 & -1 & 3 & 0 \\ 0 & 0 & 3 & 1 & 3 \\ 0 & 0 & 11 & 13 & 9 \end{array} \right] \begin{array}{l} \text{mult row 3} \\ \text{by } -1 \text{ and} \\ \text{add it to} \\ \text{row 1} \end{array}$$

$$= \left[ \begin{array}{cccc|c} 1 & 0 & -1 & 0 & -2 \\ 0 & 1 & -10 & 0 & -9 \\ 0 & 0 & 3 & 1 & 3 \\ 0 & 0 & 11 & 13 & 9 \end{array} \right] \begin{array}{l} \text{mult row 3} \\ \text{by } -3 \text{ and} \\ \text{add it to} \\ \text{row 2} \end{array}$$

$$= \left[ \begin{array}{cccc|c} 1 & 0 & -1 & 0 & -2 \\ 0 & 1 & -10 & 0 & -9 \\ 0 & 0 & 3 & 1 & 3 \\ 0 & 0 & -28 & 0 & -30 \end{array} \right] \begin{array}{l} \text{mult row 3} \\ \text{by } -13 \text{ and} \\ \text{add it to} \\ \text{row 4} \end{array}$$

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$$= \left[ \begin{array}{cccc|c} 1 & 0 & -1 & 0 & -2 \\ 0 & 1 & -10 & 0 & -9 \\ 0 & 0 & 3 & 1 & 3 \\ 0 & 0 & 1 & 0 & \frac{15}{14} \end{array} \right] \begin{array}{l} \\ \text{Divide row 4} \\ \text{by } -28 \end{array}$$

$$= \left[ \begin{array}{cccc|c} 1 & 0 & 0 & 0 & -\frac{13}{14} \\ 0 & 1 & -10 & 0 & -9 \\ 0 & 0 & 3 & 1 & 3 \\ 0 & 0 & 1 & 0 & \frac{15}{14} \end{array} \right] \begin{array}{l} \\ \text{Add row 4} \\ \text{to row 1} \end{array}$$

$$= \left[ \begin{array}{cccc|c} 1 & 0 & 0 & 0 & -\frac{13}{14} \\ 0 & 1 & 0 & 0 & \frac{12}{7} \\ 0 & 0 & 3 & 1 & 3 \\ 0 & 0 & 1 & 0 & \frac{15}{14} \end{array} \right] \begin{array}{l} \\ \text{Mult row 4} \\ \text{by 10 and} \\ \text{add it to} \\ \text{row 2} \end{array}$$

$$= \left[ \begin{array}{cccc|c} 1 & 0 & 0 & 0 & -\frac{13}{14} \\ 0 & 1 & 0 & 0 & \frac{12}{7} \\ 0 & 0 & 0 & 1 & -\frac{3}{14} \\ 0 & 0 & 1 & 0 & \frac{15}{14} \end{array} \right] \begin{array}{l} \\ \text{Mult row 4} \\ \text{by } -3 \text{ and} \\ \text{add it to} \\ \text{row 3} \end{array}$$

Convert the augmented matrix into a system of linear equation

$$t = \frac{-13}{14}$$

$$x = \frac{12}{7}$$

$$z = \frac{3}{14}$$

$$y = \frac{15}{14}$$

The possible solution of system is the ordered 4 type

$$(t, x, y, z) = \left( \frac{-13}{14}, \frac{12}{7}, \frac{15}{14}, \frac{3}{14} \right)$$

check if the given order 4 type is a solution

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of system of equation

$$\frac{12}{7} + 3 \times \frac{15}{14} + 5 \times \left( \frac{-3}{14} \right) + 2 \times \left( \frac{-13}{14} \right) = 2$$

$$\frac{-15}{14} + 3 \times \left( \frac{-3}{14} \right) + \frac{12}{7} = 0$$

$$2 \times \frac{12}{7} + \frac{15}{14} + 9 \times \left( \frac{-3}{14} \right) + 6 \times \left( \frac{-13}{14} \right) = -3$$

$$3 \times \frac{12}{7} + 2 \times \frac{15}{14} + 4 \times \left( \frac{-3}{14} \right) + 8 \times \left( \frac{-13}{14} \right) = -1$$

Simplify the equation

$$2 = 2$$

$$0 = 0$$

$$-3 = -3$$

$$-1 = -1$$

Since all the equalities are

Here SO ordered 4 type  
's solution of system

$$(t, x, y, z) = \left( \frac{-13}{14}, \frac{12}{7}, \frac{15}{14}, \right)$$

-3/14) Ans