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DIFFERENTIAL EQUATION

QUIZ # 1<sup>st</sup>

SEMS: SUMMER.

# QUESTION- 1

①

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

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

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

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

**SOLUTION:-**

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.

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

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

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

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

(2)

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

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

imp row 2 by -1 and add to row 1.

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

multi row 2 by -2 and add to row 3.

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

multi by row 2 and -3 and add row 4

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

divide row 3 by 2.

$$\begin{pmatrix} 1 & 0 & 2 & 1 \\ 0 & 1 & -1 & 3 \\ 2 & 0 & 1 & 1 \\ 8 & 0 & 5 & -5 \end{pmatrix} \begin{pmatrix} 1 \\ 0 \\ -1 \\ -1 \end{pmatrix} \rightarrow \text{The row 3 by 3}$$

(3)

$$\begin{pmatrix} 1 & 0 & 2 & 1 \\ 0 & 1 & -1 & 3 \\ 0 & 0 & -3 & -1 \\ 8 & 0 & 5 & -5 \end{pmatrix} \begin{pmatrix} 1 \\ 0 \\ -3 \\ -1 \end{pmatrix} \begin{matrix} \times \text{ly row 1 by 2} \\ \text{and add it to row 3} \end{matrix}$$

$$\begin{pmatrix} 1 & 0 & 2 & 1 \\ 0 & 1 & -1 & 3 \\ 0 & 0 & -3 & -1 \\ 0 & 0 & -11 & -13 \end{pmatrix} \begin{pmatrix} 1 \\ 0 \\ -3 \\ -9 \end{pmatrix} \begin{matrix} \times \text{ly row 1 by } -8 \text{ and} \\ \text{add it to row 4} \end{matrix}$$

$$\begin{pmatrix} 1 & 0 & 2 & 1 \\ 0 & 1 & -1 & 3 \\ 0 & 0 & 3 & 1 \\ 0 & 0 & -11 & -13 \end{pmatrix} \begin{pmatrix} 1 \\ 0 \\ 3 \\ 9 \end{pmatrix} \text{multiply row 3 by } -1.$$

$$\begin{pmatrix} 1 & 0 & -1 & 0 \\ 0 & 1 & -1 & 3 \\ 0 & 0 & 3 & 1 \\ 0 & 0 & 11 & 13 \end{pmatrix} \begin{pmatrix} 1 \\ 0 \\ 3 \\ 9 \end{pmatrix} \begin{matrix} \times \text{ly row 4 by } -1 \end{matrix}$$

(4)

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

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

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

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

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

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

$$\left[ \begin{array}{cccc|c} 1 & 0 & 0 & 0 & -13/14 \\ 0 & 1 & 0 & 0 & 12/7 \\ 0 & 0 & 0 & 1 & -3/14 \\ 0 & 0 & 1 & 0 & 15/14 \end{array} \right] \text{ multiply row 4 by } -3 \text{ and add it to row 3} \quad (5)$$

convert the augmented matrix into a system of linear eq

$$t = -13/14$$

$$x = 12/7$$

$$z = -3/14$$

$$y = 15/14$$

The possible solution of system is the order 4 type

$$(t, x, y, z) \left( -13/14, 12/7, 15/14, -3/14 \right)$$

Check if the given order 4 type is a solution of system of equation.

⑥

$$\left[ \begin{array}{l} 12/7 + 3x + 15/14 + 5(-3/14) + 2z(-13/14) = 2 \\ -15/14 + 3x(-3/14) + 12/7 = 0 \\ 7x + 12/7 + 15/14 + \cancel{12/9} + (-3/14) + 6(-13/14) = -13 \\ 3x + 12/7 + 2 \times 15/14 + 4x(-3/14) + 8 \times (-13/14) = -1 \end{array} \right]$$

Simplify the equalities

$$7 = 7$$

$$0 = 0$$

$$-3 = -3$$

$$-1 = -1$$

Since all the equalities are so ordered 4 type is the solution of system.

$$(x, y, z, w) = \left( -13/14, 12/7, 15/14, -3/14 \right)$$