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Subject differential
equation

Submitted to:

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Quiz No 1

$$\begin{aligned} \text{Q No 1} \quad & x + 3y + 5z + 2t = 2 \\ & -y + 3z + 4t = 0 \end{aligned}$$

$$\begin{aligned} 2x + y + 9z + 6t &= -3 \\ 3x + 2y + 4z + 8t &= -1 \end{aligned}$$

Sol:

Using Guass Jordan method

$$\begin{aligned} x + 3y + 5z + 2t &= 2 \\ -y + 3z + x &= 0 \\ 2x + y + 9z + 6t &= -3 \\ 3x + 2y + 4z + 8t &= -1 \end{aligned}$$

Writing in matrix form system:

$$\begin{aligned} 2t + x + 3y + 5z &= 2 \\ x - y + 3z &= 0 \\ 6t + 2x + y + 9z &= -3 \\ 8t + 3x + 2y + 4z &= -1 \end{aligned}$$

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

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

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

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

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

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

$$\Rightarrow \begin{bmatrix} 1 & 1 & 2 & 1 & 1 \\ 0 & 0 & -1 & 3 & 0 \\ 0 & 0 & -3 & -1 & -3 \\ 8 & 0 & 5 & -5 & -1 \end{bmatrix} \begin{array}{l} \text{xing row} \\ \text{by 2 and} \\ \text{it to row 3} \end{array}$$

$$\Rightarrow \begin{bmatrix} 1 & 0 & 2 & 1 & 1 \\ 0 & 1 & -1 & 3 & 0 \\ 0 & 0 & -3 & -1 & -3 \\ 0 & 0 & -11 & -13 & -9 \end{bmatrix} \begin{array}{l} \text{xing row} \\ \text{by -8 and} \\ \text{add it to} \\ \text{row 4} \end{array}$$

$$\Rightarrow \begin{bmatrix} 1 & 0 & 2 & 1 & 1 \\ 0 & 1 & -1 & 3 & 0 \\ 0 & 0 & 3 & 1 & -3 \\ 0 & 0 & 11 & 13 & -9 \end{bmatrix} \begin{array}{l} \text{xing the} \\ \text{row 3} \\ \text{by -1} \end{array}$$

$$\Rightarrow \begin{bmatrix} 1 & 0 & 2 & 1 & 1 \\ 0 & 1 & -1 & 3 & 0 \\ 0 & 0 & 3 & 1 & 3 \\ 0 & 0 & 11 & 13 & 9 \end{bmatrix} \begin{array}{l} \text{xing the} \\ \text{row by} \\ -1 \end{array}$$

$$\Rightarrow \begin{bmatrix} 1 & 0 & -1 & 0 & -2 \\ 0 & 1 & -1 & 3 & 0 \\ 0 & 0 & 3 & 1 & 3 \\ 0 & 0 & 11 & 13 & 9 \end{bmatrix} \begin{array}{l} \text{xing row} \\ 3 \text{ by } -1 \\ \text{and add} \\ \text{to row} \end{array}$$

Day: MTWTFSS

Date: ___/___/___


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

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

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

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

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

Checked By: Parents: Excellent Good 

Convert the augmented matrix into a system of linear equation

$$t = -13/14$$

$$x = 12/17$$

$$z = +3/14$$

$$y = 15/14$$

this possible solution of system is the ordered -4 type

$$(t, x, y, z) = \left(-13/14, 12/17, 15/14, +3/14\right)$$

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

$$\begin{aligned} & 12/17 + 3x \cdot 15/14 + 5x \cdot (-3/14) + 2x \cdot (-13/14) \\ & -13/14 + 3x \cdot (-3/14) + 12/17 \\ & 2x \cdot 12/17 + 15/14 + 9x \cdot (-3/14) + 6x \cdot (-13/14) = 3 \\ & 3x \cdot 12/17 + 2x \cdot 15/14 + 4x \cdot (-3/14) + 8x \cdot (-13/14) = 1 \end{aligned}$$

Simplify the equation

$$2 = 2$$

$$0 = 0$$

$$-3 = -3$$

$$-1 = -1$$

Since all the equalities are true so ordered 4-tuple is the solution of system

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

True