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| Quiz # | 01 |
| Subject | Differential Equation |
| Submitted to | Mam. Shomaila Mazhar |
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| Department | BS Civil |
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Q: 1



Given data:-

$$x + 3y + 5z + 2t = 2$$
$$-y + 3z + 4t = 0$$
$$2x + y + 9z + 6t = -3$$
$$3x + 2y + 4z + 8t = -1$$

Required data:

To Solve the following Systems of equation?

Solution:-

Writing in Matrix form

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

A X B

The Augmented Matrix is

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

$R_3 - 2R_1$, $R_4 - 3R_1$ $\sim$

$$\left[\begin{array}{cccc|c} 1 & 3 & 5 & 2 & 2 \\ 0 & -1 & 3 & 4 & 0 \\ 0 & -5 & -1 & 2 & -7 \\ 0 & -7 & -11 & 2 & -7 \end{array}\right]$$

$R_2 \div (-1)$ $\sim$

$$\left[\begin{array}{cccc|c} 1 & 3 & 5 & 2 & 2 \\ 0 & 1 & -3 & -4 & 0 \\ 0 & -5 & -1 & 2 & -7 \\ 0 & -7 & -11 & 2 & -7 \end{array}\right]$$

$R_3 + 5R_2$, $R_4 + 7R_2$ $\sim$

$$\left[\begin{array}{cccc|c} 1 & 3 & 5 & 2 & 2 \\ 0 & 1 & -3 & -4 & 0 \\ 0 & 0 & -16 & -18 & -7 \\ 0 & 0 & -33 & -26 & -7 \end{array}\right]$$

$$R_3 \div (-16) \sim \left[\begin{array}{cccc|c} 1 & 3 & 5 & 2 & 2 \\ 0 & 1 & -3 & -4 & 0 \\ 0 & 0 & 1 & \frac{9}{8} & 7/16 \\ 0 & 0 & -33 & -26 & -7 \end{array}\right]$$

$$R_4 \div 33R_3 \sim \left[\begin{array}{cccc|c} 1 & 3 & 5 & 2 & 2 \\ 0 & 1 & -3 & -4 & 0 \\ 0 & 0 & 1 & 9/8 & 7/16 \\ 0 & 0 & 0 & 89/8 & 119/16 \end{array}\right]$$

$$R_4 \div \frac{8}{89} \sim \left[\begin{array}{cccc|c} 1 & 3 & 5 & 2 & 2 \\ 0 & 1 & -3 & -4 & 0 \\ 0 & 0 & 1 & 9/8 & 7/16 \\ 0 & 0 & 0 & 1 & 119/78 \end{array}\right]$$

Using backward Substitution

$$\boxed{t = \frac{119}{78}}$$

$$Z + \frac{9}{8}t = \frac{7}{16}$$

$$Z + \frac{9}{8}\left(\frac{119}{78}\right) = \frac{7}{16}$$

$$z + \frac{1071}{624} \overset{④}{=} \frac{7}{16}$$

$$z = \frac{7}{16} - \frac{1071}{624}$$

$$z = \frac{273 - 1071}{624}$$

$$z = \frac{-798}{624}$$

$$z = \frac{-399}{312}$$

$$\boxed{z = \frac{-133}{104}}$$

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

$$y - 3\left(\frac{-133}{104}\right) - 4\left(\frac{119}{78}\right) = 0$$

$$y + \frac{399}{104} - \frac{476}{78} = 0$$

$$y + \frac{15561 - 24752}{4056} = 0$$

$$y \cdot - \frac{9191}{4056} = 0 \quad (5)$$

$$\boxed{y = \frac{9191}{4056}}$$

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

$$x + 3\left(\frac{9191}{4056}\right) + 5\left(\frac{-133}{104}\right) + 2\left(\frac{119}{78}\right) = 2$$

$$x + \frac{27573}{4056} - \frac{665}{104} + \frac{238}{78} = 2$$

$$x + 6.7980 - 6.3942 + 3.0513 = 2$$

$$x + 3.4551 = 2$$

$$x = 2 - 3.4551$$

$$\boxed{x = -1.4551}$$

$$x = -1.4551$$

$$y = \frac{9191}{4056} = 2.266$$

$$Z = \frac{-133}{104} = -1.2788$$

$$t = \frac{119}{78} = 1.52564$$

Result:

Hence

$x = -1.4551$

$y = 2.266$

$Z = -1.2788$

$t = 1.52564$

Ans: