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Sec	C
Quiz no	1
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<u>Dep</u>	Civil Engg.
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Subject	Differential Eq

Solve the following system of equations. ①

$$\begin{aligned}x + 3y + 5z + 2w &= 2 \\ -y + 3z + 4w &= 0\end{aligned}$$

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

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

Sol writing in the matrix form

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

A

X

B

The augmented matrix is

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

(2)

$$\begin{array}{l} R_3 - 2R_1 \\ R_4 - 3R_1 \end{array} \left[\begin{array}{cccc|c} 4 & 3 & 5 & 2 & 2 \\ 0 & -1 & 3 & 2 & 0 \\ 0 & -5 & -1 & 4 & -7 \\ 0 & -7 & -11 & 2 & -7 \end{array} \right]$$

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

$$R_2 \div (-1) \left[\begin{array}{cccc|c} 1 & 3 & 5 & 2 & 2 \\ 0 & -1 & -3 & -4 & 0 \\ 0 & -5 & -1 & 2 & -7 \\ 0 & -7 & -11 & 2 & -7 \end{array} \right]$$

$$\begin{array}{l} R_3 + 5R_2 \\ R_4 + 7R_2 \end{array} \left[\begin{array}{cccc|c} 1 & 3 & 5 & 2 & 2 \\ 0 & 1 & -3 & -4 & 0 \\ 0 & 0 & -16 & -18 & -7 \\ 0 & 0 & -33 & -26 & -7 \end{array} \right]$$

(3)

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

$$R_4 + 33R_3 \left[\begin{array}{cccc|c} 1 & 3 & 5 & 2 & 2 \\ 0 & 1 & -3 & -4 & \frac{7}{16} \\ 0 & 0 & 1 & \frac{9}{8} & \frac{7}{16} \\ 0 & 0 & 0 & \frac{39}{8} & \frac{119}{16} \end{array} \right]$$

$$R_4 \div \frac{39}{8} \left[\begin{array}{cccc|c} 1 & 3 & 5 & 2 & 2 \\ 0 & 1 & -3 & -4 & \frac{7}{16} \\ 0 & 0 & 1 & \frac{9}{8} & \frac{7}{16} \\ 0 & 0 & 0 & 1 & \frac{119}{78} \end{array} \right]$$

using Backward Substitution:

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

$$w = \frac{9}{8} u = \frac{7}{16}$$

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

$$v + \frac{1071}{624} = \frac{7}{16}$$

(4)

$$17 = \frac{7}{16} - \frac{1071}{624}$$

$$17 = \frac{273 - 1071}{624}$$

$$17 = \frac{-798}{624}$$

$$17 = \frac{-370}{372}$$

$$\boxed{17 = \frac{-133}{104}}$$

$$y - 37x - 4z = 0$$

$$y - 37\left(\frac{-133}{104}\right) - 4\left(\frac{119}{78}\right) = 0$$

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

$$y + 15561 - 24752 = 0$$

$$y - \frac{9191}{4056} = 0$$

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

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

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

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

(5)

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

$$x + 3.4551 = 2$$

$$x = 2 - 3.4551$$

$$x = -1.4551$$

$$x = -1.4551$$

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

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

$$u = \frac{119}{78} = 1.5264 \quad \text{Ans!}$$