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BS CS - 2B (IRREGULAR)

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DISCRETE STRUCTURE 2

1.) $3x_1 + 6x_2 - 9x_3 = 15$
$2x_1 + 4x_2 - 6x_3 = 10$
$-2x_1 - 3x_2 + 4x_3 = -6$ →

2.) $\left[\begin{array}{ccc|c} 3 & 6 & -9 & 15 \\ 2 & 4 & -6 & 10 \\ -2 & -3 & 4 & -6 \end{array}\right]$ → R1/3

3. $\left[\begin{array}{ccc|c} 1 & 2 & -3 & 5 \\ 2 & 4 & -6 & 10 \\ -2 & -3 & 4 & -6 \end{array}\right]$ → $R_2 - 2R_1$

4.) $\left[\begin{array}{ccc|c} 1 & 2 & -3 & 5 \\ 0 & 0 & 0 & 0 \\ -2 & -3 & 4 & -6 \end{array}\right]$ → $R_3 + 2R_1$

5.) $\left[\begin{array}{ccc|c} 1 & 2 & -3 & 5 \\ 0 & 0 & 0 & 0 \\ 0 & -1 & -2 & 4 \end{array}\right]$ - $R_2 \downarrow R_3 \downarrow$

6. $\left[\begin{array}{ccc|c} 1 & 2 & -3 & 5 \\ 0 & 1 & -2 & 4 \\ 0 & 0 & 0 & 0 \end{array}\right]$ → $R_1 - 2R_2$

7.) $\left[\begin{array}{ccc|c} 1 & 0 & 1 & -3 \\ 0 & 1 & -2 & 4 \\ 0 & 0 & 0 & 0 \end{array}\right]$ FINAL ANSWER $(-3, 4, 0)$

CHECKING

$3(-3) + 6(4) - 9(0) = 15$
$-9 + 24 - 0 = 15$
$-9 + 24 = 15$
$15 = 15$

$2(-3) + 4(4) + 6(0) = 10$
$-6 + 16 - 0 = 10$
$-6 + 16 = 10$
$10 = 10$

$-2(-3) + 3(4) + (4)(0) = -6$
$6 - 12 + 0 = -6$
$6 - 12 = -6$
$-6 = -6$

#12

1.) $2x_1 - 2x_2 - 4x_3 = -2$
$3x_1 - 3x_2 - 6x_3 = -3$
$-2x_1 + 3x_2 + x_3 = 7$

2.) $\left[\begin{array}{ccc|c} 2 & -2 & -4 & -2 \\ 3 & -3 & -6 & -3 \\ -2 & 3 & 1 & 7 \end{array}\right] \rightarrow R1/2$

3.) $\left[\begin{array}{ccc|c} 1 & -1 & -2 & -1 \\ 3 & -3 & -6 & -3 \\ -2 & 3 & 1 & 7 \end{array}\right] \rightarrow R_2 - 3R_1$

4.) $\left[\begin{array}{ccc|c} 1 & -1 & -2 & -1 \\ 0 & 0 & 0 & 0 \\ -2 & 3 & 1 & 7 \end{array}\right] \rightarrow R_3 + 2R_1$

5.) $\left[\begin{array}{ccc|c} 1 & -1 & -2 & -1 \\ 0 & 0 & 0 & 0 \\ 0 & 1 & -3 & 5 \end{array}\right] \rightarrow R_2 \uparrow R_3 \downarrow$

6.) $\left[\begin{array}{ccc|c} 1 & -1 & -2 & -1 \\ 0 & 1 & -3 & 5 \\ 0 & 0 & 0 & 0 \end{array}\right] \rightarrow R_1 + R_2$

7.) $\left[\begin{array}{ccc|c} 1 & 0 & -5 & 4 \\ 0 & 1 & -3 & 5 \\ 0 & 0 & 0 & 0 \end{array}\right] \rightarrow$ FINAL ANSWER $(4, 5, 0)$

CHECKING:

$2(4) - 2(5) - 4(0) = -2$
$8 - 10 - 0 = -2$
$8 - 10 = -2$
$-2 = -2$

$3x_1(4) - 3(5) - 6(0) = -3$
$12 - 15 - 6 = -3$
$17 - 15 = -3$
$-3 = -3$

$-2(4) + (3)(5) + 1(0) = 7$
$-8 + 15 = 7$
$7 = 7$

#3

1) $2x_1 - 6x_2 + 15x_3 = -12$
$4x_1 - 7x_2 + 13x_3 = -10$
$3x_1 + 6x_2 + 12x_3 = -9$

$$\left[\begin{array}{ccc|c} 2 & -6 & 15 & -12 \\ 4 & -7 & 13 & -10 \\ 3 & 6 & 12 & -9 \end{array}\right] \quad -R_1/2$$

3.) $$\left[\begin{array}{ccc|c} 1 & -3 & 15/2 & -6 \\ 4 & -7 & 13 & -10 \\ 3 & 6 & 12 & -9 \end{array}\right] \quad -R_2 - 4R_1$$

4.) $$\left[\begin{array}{ccc|c} 1 & -3 & 15/2 & -6 \\ 0 & 5 & -17 & 14 \\ 3 & 6 & 12 & -9 \end{array}\right] \quad \to R_3 - 3R_1$$

5.) $$\left[\begin{array}{ccc|c} 1 & -3 & 15/2 & -6 \\ 0 & 5 & -17 & 14 \\ 0 & 15 & -21/2 & 9 \end{array}\right] \quad \to R_2/5$$

6 $$\left[\begin{array}{ccc|c} 1 & -3 & 15/2 & -6 \\ 0 & 1 & -17/5 & 14/5 \\ 0 & 15 & -21/2 & 9 \end{array}\right] \quad \to R_1 + 3R_3$$

7.) $$\left[\begin{array}{ccc|c} 1 & 0 & -27/10 & 12/5 \\ 0 & 1 & -17/5 & 14/5 \\ 0 & 15 & -21/2 & 9 \end{array}\right] \quad \to R_3 - 15R_2$$

8.) $$\left[\begin{array}{ccc|c} 1 & 0 & -27/10 & 12/5 \\ 0 & 1 & -17/5 & 14/5 \\ 0 & 0 & 81/2 & -33 \end{array}\right] \quad \to 2R_3/81$$

9.) $$\left[\begin{array}{ccc|c} 10 & -27/10 & & 12/5 \\ 0 & 1 & -17/5 & 14/5 \\ 0 & 0 & 1 & -22/27 \end{array}\right] \quad \to R_1 + 27R_3/10$$

10. $$\left[\begin{array}{ccc|c} 1 & 0 & 0 & \\ 0 & 1 & -17/5 & 12/5 \\ 0 & 0 & 1 & 14/5 \\ & & & -22/27 \end{array}\right] \quad \to R_2 + 17R_3/5$$

11.) $$\left[\begin{array}{ccc|c} 1 & 0 & 0 & 1/5 \\ 0 & 1 & 0 & 4/135 \\ 0 & 0 & 1 & -22/27 \end{array}\right]$$ - FINAL ANSWER $(1/5, 4/135, -22/27)$

CHECKING:

$2(1/5) - 6(4/135) + 15(-22/27) = -12$
$0.40 - 0.18 - 12.22 = -12$
$0.22 - 12.22 = -12$
$-12 = -12$

$4(1/5) - 7(4/135) + 13(-22/27) = -10$
$0.80 - 0.21 - 10.59 = -10$
$0.59 - 10.59 = -10$
$-10 = -10$

$3(1/5) + 6(4/135) + 12(-22/27) = -9$
$0.60 + 0.18 - 9.78 = -9$
$0.78 - 9.78 = -9$
$-9 = -9$

#14

1.) $x_1 + 2x_2 + 4x_3 + x_4 - x_5 = 1$
$2x_1 + 4x_2 + 8x_3 + 3x_4 - 4x_5 = 2$
$x_1 + 3x_2 + 7x_3 + \quad + 3x_5 = -2$

2. $\left[\begin{array}{ccccc|c} 1 & 2 & 4 & 1 & -1 & 1 \\ 2 & 4 & 3 & 3 & -4 & 2 \\ 1 & 3 & 7 & 0 & 3 & -2 \end{array}\right] \rightarrow R_2 - 2R_1$

3. $\left[\begin{array}{ccccc|c} 1 & 2 & 4 & 1 & -1 & 1 \\ 0 & 0 & -5 & 1 & -2 & 0 \\ 1 & 3 & 7 & 0 & 3 & -2 \end{array}\right] \rightarrow R_3 - R_1$

4. $\left[\begin{array}{ccccc|c} 1 & 2 & 4 & 1 & -1 & 1 \\ 0 & 0 & -5 & 1 & -2 & 0 \\ 0 & 1 & 3 & -1 & 4 & -3 \end{array}\right] \rightarrow R_2 \leftrightarrow R_3$

5. $\left[\begin{array}{ccccc|c} 1 & 2 & 4 & 1 & -1 & 1 \\ 0 & 1 & 3 & -1 & 4 & -3 \\ 0 & 0 & -5 & 1 & -2 & 0 \end{array}\right] R_1 - 2R_2$

6) $\left[\begin{array}{ccccc|c} 1 & 0 & -2 & 3 & -9 & 7 \\ 0 & 1 & 3 & -1 & 4 & -3 \\ 0 & 0 & -5 & 1 & -2 & 0 \end{array}\right] \rightarrow R_3 \div -5$

7 $\left[\begin{array}{ccccc|c} 1 & 0 & -2 & 3 & -9 & 7 \\ 0 & 1 & 3 & -1 & 4 & -3 \\ 0 & 0 & 1 & -1/5 & 2/5 & 0 \end{array}\right] \rightarrow R_1 + 2R_3$

8 $\left[\begin{array}{ccccc|c} 1 & 0 & 0 & 13/5 & -41/5 & 7 \\ 0 & 1 & 3 & -1 & 4 & -3 \\ 0 & 0 & 1 & -1/5 & 2/5 & 0 \end{array}\right] \rightarrow R_2 - 3R_3$

9. $\left[\begin{array}{ccccc|c} 1 & 0 & 0 & 13/5 & -41/5 & 7 \\ 0 & 1 & 0 & -2/5 & 14/5 & -3 \\ 0 & 0 & 1 & -1/5 & 2/5 & 0 \end{array}\right]$ FINAL ANSWER $(7, -3, 0)$

CHECKING:

$(7) + 2(-3) + 4(0) = 1$
$7 - 6 + 0 = 1$
$1 = 1$

$2(7) + 4(-3) + 8(0) = 2$
$14 - 12 + 0 = 2$
$2 = 2$

$(7) + 3(-3) + 7(0) = -2$
$7 - 9 + 0 = -2$
$-2 = -2$