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15/ENG04/1056

ELECT/ELECT

(1)
$$\begin{bmatrix} T_1 + T_2 - 2T_3 + T_4 + 3T_5 - T_6 = 4 \\ 2T_1 - T_2 + T_3 + 2T_4 + T_5 - 3T_6 = 20 \\ T_1 + 3T_2 - 3T_3 - T_4 + 2T_5 + T_6 = -15 \\ 5T_1 + 2T_2 - T_3 - T_4 + 2T_5 + T_6 = -3 \\ -3T_1 - T_2 + 2T_3 + 3T_4 + T_5 + 5T_6 = 16 \\ 4T_1 + 3T_2 + T_3 - 6T_4 - 3T_5 - 2T_6 = -21 \end{bmatrix}$$

The Augmented Matrix

$$\begin{bmatrix} 1 & 1 & -2 & 1 & 3 & -1 \\ 2 & -1 & 1 & 2 & 1 & -3 \\ 1 & 3 & -3 & -1 & 2 & 1 \\ 5 & 2 & -1 & -1 & 2 & 1 \\ -3 & -1 & 2 & 3 & 1 & 3 \\ 4 & 3 & 1 & -6 & -3 & -2 \end{bmatrix} \begin{bmatrix} T_1 \\ T_2 \\ T_3 \\ T_4 \\ T_5 \\ T_6 \end{bmatrix} = \begin{bmatrix} 4 \\ 20 \\ -15 \\ -3 \\ 16 \\ -21 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 1 & -2 & 1 & 3 & -1 \\ 2-(2/1)\cdot & -1-(2/1) & 1-(2/1)\cdot -2 & 2-(2/1)\cdot & 1-(2/1)\cdot 3 & -3-(2/1)\cdot -1 \\ 1-(1/1)\cdot & 3-(1/1)\cdot & -3-(1/1)\cdot -2 & -1-(1/1)\cdot & 2-(1/1)\cdot 3 & 4-(1/1)\cdot -1 \\ 5-(5/1)\cdot & 2-(5/1)\cdot & -1-(5/1)\cdot -2 & -1-(5/1)\cdot & 2-(5/1)\cdot 3 & 1-(5/1)\cdot -1 \\ -3-(-3/1)\cdot & -1-(-3/1)\cdot & 2-(-3/1)\cdot -2 & 3-(-3/1)\cdot & 1-(-3/1)\cdot 3 & 3-(-3/1)\cdot -1 \\ 4-(4/1)\cdot & 3-(4/1)\cdot & 1-(4/1)\cdot -2 & -6-(4/1)\cdot & -3-(4/1)\cdot 3 & 2-(4/1)\cdot -1 \end{bmatrix} \begin{bmatrix} T_1 \\ T_2 \\ T_3 \\ T_4 \\ T_5 \\ T_6 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 1 & -2 & 1 & 3 & -1 \\ 0 & -3 & 5 & 0 & -5 & -1 \\ 0 & 2 & -1 & -2 & -1 & 2 \\ 0 & -5 & 9 & -6 & -18 & 6 \\ 0 & 2 & -4 & 6 & 10 & 0 \\ 0 & 1 & 9 & -10 & -15 & 2 \end{bmatrix} \begin{bmatrix} T_1 \\ T_2 \\ T_3 \\ T_4 \\ T_5 \\ T_6 \end{bmatrix} = \begin{bmatrix} 4 \\ 12 \\ -19 \\ -28 \\ 28 \\ 42 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 1 & -2 & 1 & 3 & -1 \\ 0 & -3 & 5 & 0 & -5 & -1 \\ 0 & 2-(-\frac{2}{3})-3 & -5-(-\frac{2}{3})5 & -2-(-\frac{2}{3})0 & -1-(-\frac{2}{3})-5 & 2-(-\frac{2}{3})-1 \\ 0 & -3-(\frac{-3}{-3})-3 & 7-(\frac{-3}{-5})5 & -6-(\frac{-3}{-3})0 & -13-(\frac{-3}{-3})-5 & 6-(\frac{-3}{-3})-1 \\ 0 & 2-(\frac{2}{3})-3 & -4-(\frac{2}{-3})5 & 6-(\frac{2}{-3})0 & 16-(\frac{2}{-3})-5 & 0-(\frac{2}{-3})-1 \\ 0 & -1-(\frac{-1}{-3})-3 & 9-(\frac{-1}{-3})5 & -10-(\frac{-1}{-3}) & -15-(\frac{-1}{-3})-5 & 2-(\frac{-1}{-3})-1 \end{bmatrix} \begin{bmatrix} T_1 \\ T_2 \\ T_3 \\ T_4 \\ T_5 \\ T_6 \end{bmatrix}$$

$$= \begin{bmatrix} 4 \\ 12 \\ -19-(-\frac{2}{3})12 \\ -23-(\frac{-3}{-3})12 \\ 28-(\frac{-2}{3})12 \\ -43-(\frac{-1}{3})12 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 1 & -2 & 1 & 3 & -1 \\ 0 & -3 & 5 & 0 & -5 & -1 \\ 0 & 0 & 2.4 & -2 & -4.4 & 1.4 \\ 0 & 0 & 4 & -6 & -8 & 7 \\ 0 & 0 & -0.7 & 6 & 6.7 & -0.7 \\ 0 & 0 & 7.4 & -10 & -13.4 & 2.4 \end{bmatrix} \begin{bmatrix} T_1 \\ T_2 \\ T_3 \\ T_4 \\ T_5 \\ T_6 \end{bmatrix} = \begin{bmatrix} 4 \\ 12 \\ -11 \\ -35 \\ 36 \\ -47 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 1 & -2 & 1 & 3 & -1 \\ 0 & -3 & 5 & 0 & -5 & -1 \\ 0 & 0 & 2.4 & -2 & -4.4 & 1.4 \\ 0 & 0 & 4-(\frac{4}{2.4})2.4 & -6-(\frac{4}{2.4})\cdot 2 & -8-(\frac{4}{2.4})\cdot 4.4 & 7-(\frac{4}{2.4})1.4 \\ 0 & 0 & -0.7-(\frac{0.7}{2.4})2.4 & -6-(\frac{-0.7}{2.4})\cdot 2 & 6.7-(\frac{-0.7}{2.4}) & -0.7-(\frac{0.7}{2.4})1.4 \\ 0 & 0 & 7.4-(\frac{7.4}{2.4})2.4 & -6-(\frac{7.4}{2.4})\cdot 2 & -13.4-(\frac{7.4}{2.4}) & 2.4-(\frac{7.4}{2.4})1.4 \end{bmatrix}$$

$$\begin{bmatrix} T_1 \\ T_2 \\ T_3 \\ T_4 \\ T_5 \\ T_6 \end{bmatrix} = \begin{bmatrix} 4 \\ 12 \\ -11 \\ -35-(\frac{4}{2.4})(-11) \\ 36-(\frac{-0.7}{2.4})(-11) \\ -47-(\frac{7.4}{2.4})(-11) \end{bmatrix}$$

$$\begin{bmatrix} 1 & 1 & -2 & 1 & 3 & -1 \\ 0 & -3 & 5 & 0 & -5 & -1 \\ 0 & 0 & 2.4 & -2 & -4.4 & 1.4 \\ 0 & 0 & 0 & -2.7 & -0.7 & 4.7 \\ 0 & 0 & 0 & 5.42 & 5.42 & -0.29 \\ 0 & 0 & 0 & -3.82 & 0.17 & -1.91 \end{bmatrix} \begin{bmatrix} T_1 \\ T_2 \\ T_3 \\ T_4 \\ T_5 \\ T_6 \end{bmatrix} = \begin{bmatrix} 4 \\ 12 \\ -11 \\ -16.7 \\ 32.79 \\ -13.08 \end{bmatrix}$$

II/

$$\begin{bmatrix} 1 & 1 & -2 & 1 & 3 & -1 \\ 0 & -3 & 5 & 0 & -5 & -1 \\ 0 & 0 & 2.4 & -2 & -4.4 & 1.4 \\ 0 & 0 & 0 & -2.7 & -0.7 & 4.7 \\ 0 & 0 & 0 & 5.42 & -\left(\frac{5.42}{-2.7}\right)(-0.7) - 2.7 & 5.42 - \left(\frac{5.42}{-2.7}\right)(-0.7) - 0.29 - \left(\frac{5.42}{-2.7}\right)4.7 \\ 0 & 0 & 0 & -3.82 & -\left(\frac{-3.82}{-2.7}\right)(-0.7) - 2.7 & 0.17 - \left(\frac{-3.82}{-2.7}\right)(-0.7) - 1.91 - \left(\frac{-3.82}{-2.7}\right)4.7 \end{bmatrix}$$

$$\begin{bmatrix} T_1 \\ T_2 \\ T_3 \\ T_4 \\ T_5 \\ T_6 \end{bmatrix} = \begin{bmatrix} 4 \\ 12 \\ -11 \\ -16.7 \\ 32.79 - \left(\frac{5.42}{-2.7}\right)(-16.7) \\ -13.08 - \left(\frac{-3.82}{-2.7}\right)(-16.7) \end{bmatrix}$$

II/

$$\begin{bmatrix} 1 & 1 & -2 & 1 & 3 & -1 \\ 0 & -3 & 5 & 0 & -5 & -1 \\ 0 & 0 & 2.4 & -2 & -4.4 & 1.4 \\ 0 & 0 & 0 & -2.7 & -0.7 & 4.7 \\ 0 & 0 & 0 & 0 & 4.01 & 9.2 \\ 0 & 0 & 0 & 0 & 1.16 & 8.59 \end{bmatrix} \begin{bmatrix} T_1 \\ T_2 \\ T_3 \\ T_4 \\ T_5 \\ T_6 \end{bmatrix} = \begin{bmatrix} 4 \\ 12 \\ -11 \\ -16.7 \\ -0.79 \\ 10.7 \end{bmatrix}$$

IV/

$$\begin{bmatrix} 1 & 1 & -2 & 1 & 3 & -1 \\ 0 & -3 & 5 & 0 & -5 & -1 \\ 0 & 0 & 2.4 & -2 & -4.4 & 1.4 \\ 0 & 0 & 0 & -2.7 & -0.7 & 4.7 \\ 0 & 0 & 0 & 0 & 4.01 & 9.2 \\ 0 & 0 & 0 & 0 & 1.16 - \left(\frac{1.16}{4.01}\right)4.01 & 8.59 - \left(\frac{1.16}{4.01}\right)9.2 \end{bmatrix} \begin{bmatrix} T_1 \\ T_2 \\ T_3 \\ T_4 \\ T_5 \\ T_6 \end{bmatrix}$$

$$\begin{bmatrix} 4 \\ 12 \\ -11 \\ -16.7 \\ -0.74 \\ 107 - \left(\frac{1.16}{4.01}\right)(-0.74) \end{bmatrix}$$

The final matrix will be;

$$\begin{bmatrix} 1 & 1 & -2 & 1 & 3 & -1 \\ 0 & -3 & 5 & 0 & -5 & -1 \\ 0 & 0 & 2.4 & -2 & -4.4 & 1.4 \\ 0 & 0 & 0 & -2.7 & -0.7 & 4.7 \\ 0 & 0 & 0 & 0 & 4.01 & 9.2 \\ 0 & 0 & 0 & 0 & 0 & -11.3 \end{bmatrix} \begin{bmatrix} T_1 \\ T_2 \\ T_3 \\ T_4 \\ T_5 \\ T_6 \end{bmatrix} = \begin{bmatrix} 4 \\ 12 \\ -11 \\ -16.7 \\ -0.74 \\ 10.92 \end{bmatrix}$$

From the above matrix we can solve for the temperatures $T_1, T_2, T_3, T_4, T_5, T_6$ resp.

$$-11.36\, T_6 = 10.92$$

$$T_6 = -\frac{10.92}{11.3}$$

$$T_6 = -0.966 \quad \text{——} (1)$$

$$4.01 T_5 + 9.2 T_6 = -0.74$$

$$T_5 = \frac{-0.74 - 9.2(-0.966)}{4.01}$$

$$T_5 = \frac{8.1372}{4.01} = 2.031 \quad \text{——} (2)$$

$$-2.7T_4 - 0.7T_5 + 4.7T_6 = -16.7$$

$$-2.7T_4 - 0.7(2.031) + 4.7(-0.966) = -16.7$$

$$-2.7T_4 - 1.4217 - 4.5402 = -16.7$$

$$2.7T_4 = -16.7 + 1.4217 + 4.5402$$

$$-2.7T_4 = -10.7381$$

$$T_4 = \frac{10.7381}{2.7} = 3.977 \quad \cdots (3)$$

$2.4T_3 - 2T_4 - 4.4T_5 + 1.4T_6 = -11$

$2.4T_3 - 2(3.977) - 4.4(2.031) + 1.4(-0.966) = -11$

$2.4T_3 - 7.954 - 8.9364 - 1.3524 = -11$

$2.4T_3 = -11 + 18.2428$

$T_3 = \frac{7.2428}{2.4}$

$T_3 = 3.017 \quad \cdots \quad (4)$

$-3T_2 + 5T_3 + 0T_4 - 5T_5 - 1T_6 = 12$

$-3T_2 + 5(3.017) + 0 - 5(2.031) - 1(-0.966) = 12$

$-3T_2 + 15.085 - 10.155 + 0.966 = 12$

$-3T_2 = 6.104$

$T_2 = 6.104/3$

$T_2 = -2.034 \quad \cdots \quad (5)$

$T_1 + T_2 - 2T_3 + T_4 + 3T_5 - 3T_6 = 4$

$T_1 + (-2.034) - 2(3.017) + (3.977 + 3(2.031) + 0.966 = 4$

$T_1 - 2.034 - 6.034 + 3.977 + 6.093 + 0.966 = 4$

$T_1 = 1.032 \quad \cdots \quad (6)$

From eqn (1) to (6) resp.

$T_1 = 1.032°C$

$T_2 = -2.034°C$

$T_3 = 3.017°C$

$T_4 = 3.977°C$

$T_5 = 2.031°C$

$T_6 = -0.966°C$