① $Q \begin{bmatrix} 5 & 7 & 12 \end{bmatrix}$ $R \begin{bmatrix} 5 & 20 & 16 & 7 & 17 \\ 7 & 18 & 12 & 9 & 21 \\ 6 & 25 & 8 & 5 & 13 \end{bmatrix}$

$QR = 5(5) + 7(7) + 12(6), \quad 5(20) + 7(18) + 12(25)$
$\quad\quad 5(16) + 7(12) + 12(8), \quad 5(7) + 7(9) + 12(5)$
$\quad\quad 5(17) + 7(21) + 12(13)$

a) $\begin{bmatrix} 146 & 526 & 260 & 158 & 388 \end{bmatrix}$

$C \begin{bmatrix} 1500 \\ 800 \\ 500 \\ 100 \\ 1000 \end{bmatrix}$ $\begin{array}{l} RC = 5(1500) \\ \quad\quad +20(800) \\ \quad\quad 16(500) \\ \quad\quad 7(100) \\ \quad\quad 17(1000) \\ \hline \quad\quad 49\,200 \end{array}$ $\begin{array}{l} 7(1500) \\ +18(800) \\ 12(500) \\ 9(100) \\ 21(1000) \\ \hline 52\,800 \end{array}$ $\begin{array}{l} 6(1500) \\ +25(800) \\ 8(500) \\ 5(100) \\ 13(1000) \\ \hline 46\,500 \end{array}$

b) $\begin{bmatrix} 49\,200 \\ 52\,800 \\ 46\,500 \end{bmatrix}$

$Q(RC)$
$5(49\,200) + 7(52\,800) + 12(46\,500)$

c) $\begin{bmatrix} 1\,173\,600 \end{bmatrix}$

②

$$A + B + C = 100$$
$$20000A + 8000B + 10000C = 1360000$$
$$20000A - 40000B + 1000C = 410000$$

$$K = 1000$$

$$\begin{bmatrix} 1 & 1 & 1 & | & 100 \\ 20K & 8K & 10K & | & 1360K \\ 20K & -40K & 1K & | & 40K \end{bmatrix} \begin{array}{l} R_2 = R_2 - 20K(R_1) \\ R_3 = R_3 - 20K(R_1) \end{array}$$

$$\begin{bmatrix} 1 & 1 & 1 & | & 100 \\ 0 & -12K & -10K & | & -640K \\ 0 & -60K & -19K & | & 1960K \end{bmatrix} R_2 = R_2 / -12000$$

$$\begin{bmatrix} 1 & 1 & 1/6 & | & 100 \\ 0 & 1 & 5/6 & | & 160/3 \\ 0 & -60K & 19K & | & 1960K \end{bmatrix} \begin{array}{l} R_1 = R_1 - R_2 \\ \\ R_3 = R_3 + 60K(R_2) \end{array}$$

$$\begin{bmatrix} 1 & 0 & 1/6 & | & 140/3 \\ 0 & 1 & 5/6 & | & 160/3 \\ 0 & 0 & 31K & | & 1240K \end{bmatrix} R_3 = R_3 / 31k$$

$$\begin{bmatrix} 1 & 0 & 1/6 & | & 140/3 \\ 0 & 1 & 5/6 & | & 160/3 \\ 0 & 0 & 1 & | & 40 \end{bmatrix}$$

$$A + C/6 = 140/3$$
$$B + 5/6 c = 160/3$$
$$C = 40$$

$$B + 5/6 (40) =$$
$$B = 160/3 - 100/3 = 20$$

$$A + 40/6 = 140/3$$
$$A = 140/3 - 20/3 = 40$$

③ $\begin{bmatrix} 2 & 3 & 3 & | & 25 \\ 3 & 2 & 3 & | & 24 \\ 4 & 1 & 2 & | & 21 \end{bmatrix}$ $R_1 = R_1 / 2$

$\begin{bmatrix} 1 & 3/2 & 3/2 & | & 25/2 \\ 3 & 2 & 3 & | & 24 \\ 4 & 1 & 2 & | & 21 \end{bmatrix}$ $\begin{array}{l} R_2 = R_2 + R_1 (-3) \\ \\ R_3 = R_3 + (R_1 - 4) \end{array}$

$\begin{bmatrix} 1 & 3/2 & 3/2 & | & 25/2 \\ 0 & -5/2 & -3/2 & | & -27/2 \\ 0 & -5 & -4 & | & -29 \end{bmatrix}$ $R_2 = R_2 (-2/5)$

$\begin{bmatrix} 1 & 3/2 & 3/2 & | & 25/2 \\ 0 & 1 & 3/5 & | & 27/5 \\ 0 & -5 & -4 & | & -29 \end{bmatrix}$ $\begin{array}{l} R_1 = R_1 + R_2 (-3/2) \\ \\ R_3 = R_3 + R_2 (5) \end{array}$

$\begin{bmatrix} 1 & 0 & 3/5 & | & 22/5 \\ 0 & 1 & 3/2 & | & 27/5 \\ 0 & 0 & -1 & | & -2 \end{bmatrix}$ $\begin{array}{l} R_1 = R_1 + R_3 (-3/5) \\ \\ R_3 = R_3 (-1) \end{array}$

$\begin{bmatrix} 1 & 0 & 0 & | & 16/5 \\ 0 & 1 & 3/5 & | & 27/5 \\ 0 & 0 & 1 & | & 2 \end{bmatrix}$ $R_2 = R_2 + R_3 (-3/5)$

$\begin{bmatrix} 1 & 0 & 0 & | & 16/5 \\ 0 & 1 & 0 & | & 21/5 \\ 0 & 0 & 1 & | & 2 \end{bmatrix}$ $\begin{array}{l} X_1 = 16/5 = 3.2 \\ X_2 = 21/5 = 4.2 \\ X_3 = 2 = 2 \end{array}$

$2(3.2) + 3(4.2) + 3(2) = 25$ ✓
$3(3.2) + 2(4.2) + 3(2) = 24$ ✓
$4(3.2) + 1(4.2) + 2(2) = 21$ ✓