(3) (A) $Q_1^D = 60 - P_1 - 0.5 P_2$

(B) $Q_1^S = 2 P_1 - P_2$

• In eq., $Q_1^D = Q_1^S \Rightarrow$ (A) = (B)

$\Rightarrow 60 - P_1 - 0.5 P_2 = 2 P_1 - P_2$

$\boxed{3P_1 - 0.5 P_2 = 60}$ (1)

(C) $Q_2^D = 80 - P_1 - 2 P_2$

(D) $Q_2^S = -3 P_1 + 5 P_2$

• In eq, Q_2^D and Q_2^S are equal: $Q_2^D = Q_2^S \Rightarrow$ (C) = (D)

$\Rightarrow 80 - P_1 - 2 P_2 = -3 P_1 + 5 P_2$

$\boxed{80 = -2 P_1 + 7 P_2}$ (2)

a) write in matrix form:

$$\begin{pmatrix} 3 & -0.5 \\ -2 & 7 \end{pmatrix} \begin{pmatrix} P_1 \\ P_2 \end{pmatrix} = \begin{pmatrix} 60 \\ 80 \end{pmatrix}$$

b) Solve the system:

• inverse of $\begin{pmatrix} 3 & -0.5 \\ -2 & 7 \end{pmatrix} \rightarrow C = \begin{pmatrix} 7 & 2 \\ 0.5 & 3 \end{pmatrix} \rightarrow C' = \begin{pmatrix} 7 & 0.5 \\ 2 & 3 \end{pmatrix}$

det $\Rightarrow 21 - (-0.5)(-2) = 21 - 1 = 20$

$\rightarrow \boxed{\frac{1}{20} \cdot \begin{pmatrix} 7 & 0.5 \\ 2 & 3 \end{pmatrix}}$

$$\frac{1}{20} \cdot \begin{pmatrix} 7 & 0.5 \\ 2 & 3 \end{pmatrix} \begin{pmatrix} 60 \\ 80 \end{pmatrix} = \begin{pmatrix} P_1 \\ P_2 \end{pmatrix} = \frac{1}{20} \cdot \begin{pmatrix} (60)\cdot(7) + (0.5)\cdot(80) \\ (2)(60) + (3)(80) \end{pmatrix} =$$

$$= \frac{1}{20} \cdot \begin{pmatrix} 420 + 40 \\ 120 + 240 \end{pmatrix} = \frac{1}{20} \cdot \begin{pmatrix} 460 \\ 360 \end{pmatrix} = \boxed{\begin{pmatrix} 23 \\ 18 \end{pmatrix} = \begin{pmatrix} P_1 \\ P_2 \end{pmatrix}}$$

$Q_1 = 2(P_1^*) - P_2^* = (2)(23) - 18 = 46 - 18 = \boxed{28 = Q_1}$

$Q_2 = 80 - P_1^* - 2 P_2^* = 80 - 23 - 2(18) = 80 - 23 - 36 = 80 - 59 =$

$= \boxed{21 = Q_2}$

$$\boxed{\begin{matrix} P_1 = 23, & Q_1 = 28 \\ P_2 = 18, & Q_2 = 21 \end{matrix}}$$