7.14

(a) The canonical form of (a) is

$$\begin{aligned} \max \quad & 3x + 2y \\ \text{s.t.} \quad & 2x - y + s_1 = 6 \\ & 2x + y + s_2 = 10 \\ & x, \quad y, \quad s_1, \quad s_2 \geq 0 \end{aligned}$$

(b) The canonical form of (b) is

$$\begin{aligned} \max \quad & x + y \\ \text{s.t.} \quad & -2x + y + s_1 = 0 \\ & x - 2y + s_2 = 0 \\ & x + y + s_3 = 9 \\ & x, \quad y, \quad s_1, \quad s_2, \quad s_3 \geq 0 \end{aligned}$$

(c) The canonical form of (c) is

$$\begin{aligned} \max \quad & 4x_1 + 2x_2 + 7x_3 \\ \text{s.t.} \quad & 2x_1 - x_2 + 4x_3 + s_1 = 18 \\ & 4x_1 + 2x_2 + 5x_3 - s_2 = 10 \\ & x_1, \quad x_2, \quad x_3, \quad s_1, \quad s_2 \geq 0. \end{aligned}$$

(d) We use the variable substitution $y_2 = -x_2$. Then, the canonical form of (d) is

$$\begin{aligned} \min \quad & 2x_1 + y_2 + 3x_3 \\ \text{s.t.} \quad & x_1 + y_2 + 4x_3 + s_1 = 18 \\ & 2x_1 - 2y_2 - 5x_3 = 4 \\ & x_1 + x_3 - s_2 = 6 \\ & x_1, \quad y_2, \quad x_3, \quad s_1, \quad s_2 \geq 0 \end{aligned}$$

(e) The canonical form of (e) is

$$\begin{aligned} \max \quad & x_1 + 2x_2 \\ \text{s.t.} \quad & 4x_1 - 2x_2 + 3x_3^+ - 3x_3^- + s_1 = 13 \\ & 5x_1 - 2x_2 - s_2 = 10 \\ & x_1, \quad x_2, \quad x_3^+, \quad x_3^-, \quad s_1, \quad s_2 \geq 0 \end{aligned}$$