1.1 Exercise 2 (Equipment purchasing Problem)

	15,000 x = #A	20,000 y = #B
boxes/min	30	50
attendant	1	2

Minimize: $z = 15{,}000x + 20{,}000y$

subject to: $30x + 50y \geq 320$

$1 \cdot x + 2 \cdot y \leq 12$

$x \geq 0,\ y \geq 0.$

Changed to standard form:

maximize: $z' = -15{,}000x - 20{,}000y$

subject to: $-30x - 50y \leq -320$

$x + 2y \leq 12$

$x \geq 0,\ y \geq 0.$

5. (Blending problem)

	20 x = Super	30 cents y = Deluxe
Brazilian	0.5	0.25
Columbian	0.5	0.75

Maximize $z = 20x + 30y$

subject to $0.5x + 0.25y \leq 120$

$0.5x + 0.75y \leq 160$

$x \geq 0,\ y \geq 0$

This is in standard form.

• Example 3 (Transportation Problem)

	LA	Chicago	NY
SLC	5; x_{11}	7; x_{12}	9; x_{13}
Denver	6; x_{21}	7; x_{22}	10; x_{23}

Minimize: $z = 5x_{11} + 7x_{12} + 9x_{13} + 6x_{21} + 7x_{22} + 10x_{23}$

subject to:
$$\left.\begin{aligned} x_{11} + x_{12} + x_{13} &\le 120 \\ x_{21} + x_{22} + x_{23} &\le 140 \end{aligned}\right\} \text{ supply constraint}$$

$$\left.\begin{aligned} x_{11} + x_{21} &\ge 100 \\ x_{12} + x_{22} &\ge 60 \\ x_{13} + x_{23} &\ge 80 \end{aligned}\right\} \text{ demand constraint}$$

$x_{ij} \ge 0, \quad i = 1, 2; \quad j = 1, 2, 3.$

Not in standard form.

• Example: Minimize $z = 2x_1 + 3x_2 + x_3$

subject to $2x_1 + x_2 - x_3 = 4 \iff \begin{cases} 2x_1 + x_2 - x_3 \le 4 \\ 2x_1 + x_2 - x_3 \ge 4 \end{cases}$

$x_1 - x_2 \le 6$

$x_1 \ge 0, x_2 \ge 0$. x_3 unconstrained

Changed to standard form: Let $x_3 = u - v$ with $u \ge 0, v \ge 0$.

Maximize $z' = -2x_1 - 3x_2 - u + v$

subject to $2x_1 + x_2 - u + v \le 4$

$-2x_1 - x_2 + u - v \le -4$

$x_1 - x_2 \le 6$

$x_1 \ge 0, x_2 \ge 0, u \ge 0, v \ge 0$.