Problem Set 1:

1. A publisher has orders for 600 copies of a certain text from San Francisco and 400 copies from Sacramento. The company has 700 copies in a warehouse in Novato and 800 copies in a warehouse in Lodi. It costs \$5 to ship a text from Novato to San Francisco, but it costs \$10 to ship it to Sacramento. It costs \$15 to ship a text from Lodi to San Francisco, but it costs \$4 to ship it from Lodi to Sacramento. The publisher wants to fill both orders at minimal cost.

   (a) Express this as a linear program in canonical form.

   (b) Rewrite it in the standard form.

2. Consider the linear program

$$\begin{aligned} v_P(b) = \max\, & c_x x + c_y y \\ \text{subject to} \quad & x \leq 1 \\ & x \geq 0 \end{aligned}$$

   (a) Rewrite this in the canonical form.

   (b) Rewrite this in the standard form.

3. Consider the primal problem

$$\begin{aligned} v_p(b) = \max\, & x_1 + 2x_2 \\ \text{s.t.}\ & x_1 + x_2 \leq 4 \\ & x_1 + 3x_2 \leq b \end{aligned}$$

   (a) Write down the dual.

   (b) For $b = 1$, plot the constraint sets for both problems, and solve them.

   (c) Describe $v_P(b)$, and compute $\partial v_P(b)$ on the range $0 \leq b \leq 14$.