Exercise 5.2

5.5 a

5.2 (a) False, the dual can also be infeasible.

(b) True

5.5 (a) Counterexample:

(P) $\min \; 0x_1 + 0x_2$

s.t $x_1 + x_2 = 2$

$x_1 - x_2 = 0$

$x_1, x_2 \geq 0$

Unique solution:

$\begin{pmatrix} x_1^* \\ x_2^* \end{pmatrix} = \begin{pmatrix} 1 \\ 1 \end{pmatrix}, \; z^* = 0$

(D) $\max \; 2\pi_1$

s.t $\pi_1 + \pi_2 \leq 0$

$\pi_1 - \pi_2 \leq 0$

$\pi_1, \pi_2 \in \mathbb{R}$

Unique opt. sol.

$\begin{pmatrix} \pi_1^* \\ \pi_2^* \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$

$w^* = 0$