

Name:

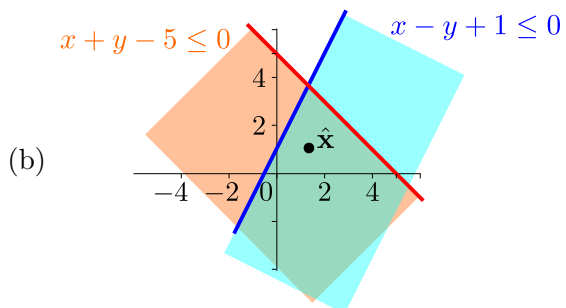
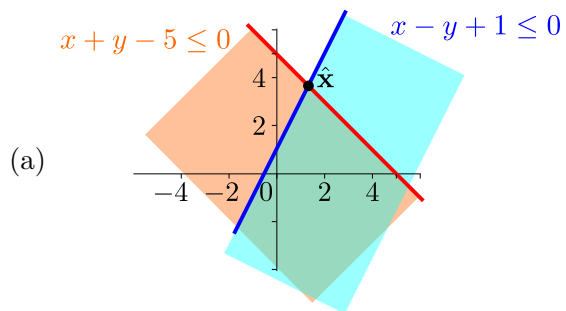
Present group members:

Worksheet 10-2: Q1 Consider the problem

$$\begin{aligned} & \underset{\mathbf{x} \in \mathbb{R}^n}{\text{minimize}} && f(\mathbf{x}) \\ & \text{subject to} && x + y - 5 \leq 0, \\ & && x - y + 1 \leq 0 \end{aligned}$$

(a) What are the function(s) g_i for this problem in Slater's condition?

(b) For each of the following, does the shown $\hat{\mathbf{x}}$ satisfy Slater's condition?

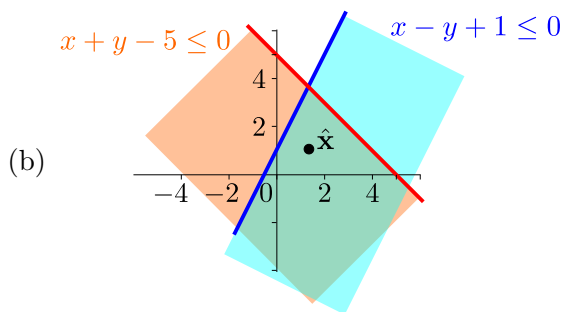
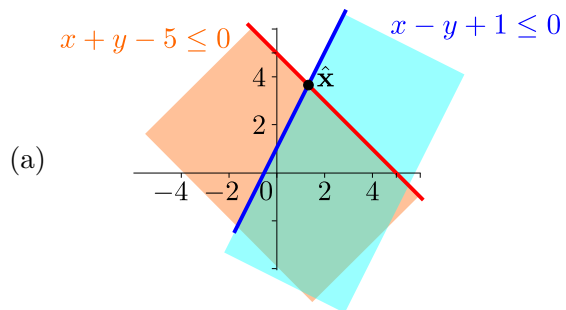


Worksheet 10-2: Q2 Consider the **same** problem

$$\begin{aligned} & \underset{\mathbf{x} \in \mathbb{R}^n}{\text{minimize}} && f(\mathbf{x}) \\ & \text{subject to} && x + y - 5 \leq 0, \\ & && x - y + 1 \leq 0 \end{aligned}$$

(a) What are the function(s) g_i , h_j , and s_k in the **generalized** Slater's condition for this problem?

(b) For each of the following, does the shown $\hat{\mathbf{x}}$ satisfy the **generalized** Slater's condition?

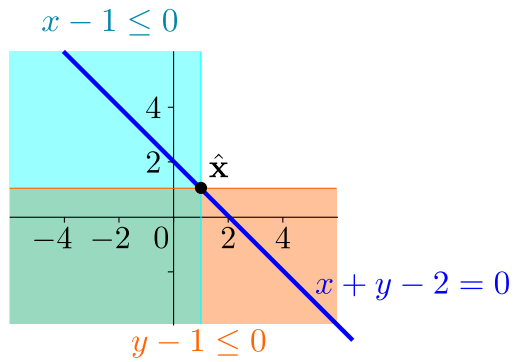


Worksheet 10-2: Q3 Consider the problem

$$\begin{aligned} & \underset{\mathbf{x} \in \mathbb{R}^n}{\text{minimize}} && f(\mathbf{x}) \\ & \text{subject to} && x - 1 \leq 0, \\ & && y - 1 \leq 0, \\ & && x + y - 2 = 0 \end{aligned}$$

(a) What are the function(s) g_i , h_j , and s_k in the generalized Slater's condition for this problem?

(b) For the following, does the shown $\hat{\mathbf{x}}$ satisfy the generalized Slater conditions?



Worksheet 10-2: Q4 For each of the following problems, draft a solution strategy for obtaining the optimal solution, if it exists. That is, describe the steps you would take to solve the problem without actually solving, with a particular focus on whether the KKT conditions are necessary and/or sufficient for optimality, and if so, how you would use them to find the optimal solution.

1. $\min x_1^2 - x_2$ s.t. $x_2 = 0$.

2. $\min x_1^2 - x_2$ s.t. $x_2^2 \leq 0$.

Worksheet 10-2: Q5 Consider the problem

$$\begin{aligned} & \underset{\mathbf{x} \in \mathbb{R}^n}{\text{minimize}} && 4x_1^2 + x_2^2 - x_1 - 2x_2 \\ & \text{subject to} && 2x_1 + x_2 \leq 1, \\ & && x_1^2 \leq 1 \end{aligned}$$

(a) Does this problem satisfy Slater's condition?

(b) Are the KKT conditions necessary for optimality for this problem? Are the KKT conditions sufficient for optimality for this problem?

- (c) Time permitting, solve the problem using the KKT conditions. *Hint: Check the case where $\lambda_1 > 0$ and $\lambda_2 = 0$ first.*