

Problem 4.2:

In this problem we explore descent directions for the linear function $f(x) = x_1 - 2x_2 + 3x_3$ and determine whether our solutions depend on the value of x . Let us consider the gradient of our linear function:

$$\nabla f(x) = \begin{bmatrix} 1 \\ -2 \\ 3 \end{bmatrix}$$

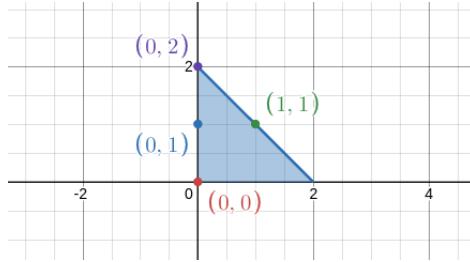
We let d be the descent direction

Problem 4.3: Consider the following problem:

$$\begin{aligned} &\text{minimize} && f(x) = -x_1 - x_2 \\ &\text{subject to} && x_1 + x_2 \leq 2 \\ &&& x_1, x_2 \geq 0 \end{aligned}$$

We will do the following:

- {i} Determine the feasible directions at $x = (0, 0)^T, (0, 1)^T, (1, 1)^T$ and $(0, 2)^T$
- {ii} Determine whether there exist feasible descent direction at these points, and hence determine which (if any) of the point can be local minimizers.



{i} Solution, below we let p be a set of vectors.

$$\begin{aligned} \bar{x} = (0, 0)^T : & \{p \in \mathbb{R}^2 | p_1 \geq 0, p_2 \geq 0\} \\ \bar{x} = (0, 1)^T : & \{p \in \mathbb{R}^2 | p_1 \geq 0, p_2 \leq 1\} \\ \bar{x} = (1, 1)^T : & \{p \in \mathbb{R}^2 | p_1 + p_2 \leq 0\} \\ \bar{x} = (0, 2)^T : & \{p \in \mathbb{R}^2 | p_1 + p_2 \leq 2\}, \text{ where } \{p_2 < 0\} \end{aligned}$$