Assignment 5

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1) The perpendicular from the origin to the line $y = mx + c$ meets it at the point $(-1, 2)$. Find the values of m and c.
Solution: The given problem can be expressed as

$$\min_{\mathbf{x}} g(\mathbf{x}) = \|\mathbf{x} - \mathbf{P}\|^2 \tag{0.0.1}$$

$$\text{s.t.} \quad \mathbf{n}^T\mathbf{x} + c = 0 \tag{0.0.2}$$

where

$$\mathbf{P} = \begin{pmatrix} 0 \\ 0 \end{pmatrix} \tag{0.0.3}$$

$$\mathbf{n} = \begin{pmatrix} m \\ -1 \end{pmatrix} \tag{0.0.4}$$

From the question, the solution to the optimization problem (0.0.1) is given by

$$\mathbf{x} = \begin{pmatrix} -1 \\ 2 \end{pmatrix} \tag{0.0.5}$$

This problem cannot be solved using CVXPY, because in this case we know the solution for $\mathbf{x}$ which minimizes the function $g(\mathbf{x})$. And even if we write the value of $\mathbf{x}$ in terms of m and c, we cannot solve the problem since the cost function according to the constraints ends up being a constant.