

Homework 1-HW1

Instructor: Dr. Bharath B.N*Teaching Assistant:* Sawan S. M**Problem 1**

Is the solution set of a system of linear equations, $C = \{x \mid Ax = b\}$, where $A \in \mathbb{R}^{m \times n}$ and $b \in \mathbb{R}^m$, an affine set? Justify your answer.

Problem 2

Consider a square in the (x_1, x_2) -plane in \mathbb{R}^3 , defined as

$$C = \{x \in \mathbb{R}^3 \mid -1 \leq x_1 \leq 1, -1 \leq x_2 \leq 1, x_3 = 0\}$$

1. What is the affine hull of this set?
2. What is the convex hull of this set?
3. What is the interior of this set?
4. What is the relative interior of this set?

A single line answer in set notation for each would suffice.

Problem 3

Is the set

$$\left\{x \mid x^T P x \leq (c^T x)^2, c^T x \geq 0\right\}$$

$\forall c, x \in \mathbb{R}^n$ $P \in \mathbb{R}^{n \times n}$ convex? Justify your answer.

Problem 4

In any programming language of your choice, create a plot of the following functions, shading the regions above single variable functions only.

1. $f(x) = x^2 \quad \forall x \in [-10, 10]$
2. $f(x) = \sin(x) \quad \forall x \in [-2\pi, 2\pi]$
3. $f(x, y) = (xy)^2 \quad \forall x, y \in [-10, 10]$
4. $f(x, y) = (xy)^2 \quad \forall x, y \in [-10, 10]$. Make a contour plot

Submission Link



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Submission format: HW1_<Roll Number>_<First Name>.pdf

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