

MTH 377/577 Convex Optimization

Problem Set 2

Feb 10, 2024

1. Let $A \in R^{m \times n}$ and $C = \{x \in R^n : Ax \leq 0\}$. Is C a convex cone? Show why/why not.
2. Is the intersection of affine sets (i) affine (ii) convex? Provide a formal argument.
3. A function $f : R^n \rightarrow R$ is convex if and only if its epigraph is a convex set. True/False? Provide a formal argument/proof.
4. Let $P = \{(x_1, x_2) : x_1 + x_2 \leq 4\}$ and $Q = \{(2, 2)\}$. Let C be the finite cone generated by vectors $(-1, 1), (1, -1), (-1, -1)$. Show that if $x \in Q + C$, then $x \in P$.
5. Suppose C is a convex set. Is the following function convex?

$$G(x) = \begin{cases} 0 & \text{if } x \in C \\ \infty, & \text{if } x \notin C \end{cases}$$