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EE505 Optimization Theory
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Homework 1

Problem 1:

Find out which of the following sets are convex.

(a) A set of the form $\{x \in R^3 \mid x_1 \leq x_2 \leq x_3\}$.
(b) A set of the form $\{x \in R^2 \mid x_1 x_2 \geq 1,\ x_1 + x_2 \leq 2\}$.

Problem 2:

Show that the intersection of a convex set with an arbitrary line is also convex.

Problem 3:

Find the largest connected domain (find one if there exists more than one) on which the function $f(x) = e^{-x^2/2}$ is convex, concave or neither.

Problem 4:

For each of the following functions, determine whether it is convex, concave, quasi-convex, or quasi-concave.
(a) $f(x_1, x_2) = (x_1 + x_2)^2 + \|x\|$ on R^2_{++}.
(b) $f(x_1, x_2) = \frac{x_1^2}{x_1 - 2x_2} x \in R^2,\ x_1 \geq 2x_2$.