Question 1: Explain what is meant by a convex OP and how to determine an OP is convex.

- Local minimum = global minimum (All minimizers are global)

* $\min_{x \in R_c} f(x)$ (1), $R_c \subset \mathbb{R}^n$

$f(x)$: Objective function

$x \in R_c$: x tilhøre feasible set (R_c)

* $\nabla f(x')^T (x - x') \geq 0$ (2)

x' = global minimizer (2) shows any direction does not decrease f from x' (x' = minimum)

* $H_f(x)$ (3)

(3) If PSD then it is Convex

* $R_{c_1} \cap R_{c_2}$ (4)

(4) Intersection of two convex set result in also convex

* Objective function = Convex
  feasible set = convex
  $\geq$ = convex, = affine (linear)

: then OP convex

* Least squares problem

$\min_x \|b - Ax\|_2^2$; $\|x\|_2 = \sqrt{x_1^2 \dots x_n^2}$

* $\arg\min_{x \in R} f(x)$ (5)

  $\min_{x \in R} f(x)$ (6)

(5) Finding Minimizers (point)

(6) finding Minimaz (value)

PSD: Positive Semi-definite

OP: Optimization Problem