

# Tutorial 3

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## Question 1

Let  $x \in R^n$ . Its p-norm is defined as

$$\|x\|_p = [\sum_{i=1}^n |x_i|^p]^{1/p}$$

Prove it is a norm when  $p \geq 1$ .

## Question 2

Let  $p(x)$  and  $q(x)$  are two probability distributions of a discrete random variable  $x$  on  $X$ . That is, both  $p(x)$  and  $q(x)$  sum up to 1, and  $p(x) > 0$  and  $q(x) > 0$ . The Kullback-Leibler divergence is defined as

$$DKL(p(x), q(x)) = \sum_{x \in X} p(x) \log\left(\frac{p(x)}{q(x)}\right) \geq 0$$

Prove

$$DKL(p(x), q(x)) \geq 0.$$