Name:

CS 3190: Foundations of Data Analysis (practice)
# Quiz 3: Cross-Validation, Gradient Descent, and PCA

Instructions: You may use any notes that you like, but plan on not using calculators, computers, or phones. **Be sure to show all of your work.** It is not necessary to simplify your answers.
This is a practice quiz

1. [**30 points**] *iid* stands for *identically and independently distributed*. Why do we need to assume data is iid to be able to perform **cross validation**?

2. [**30 points**] For each function shown, label it as **convex** and/or **strongly convex** when it satisfies those conditions.
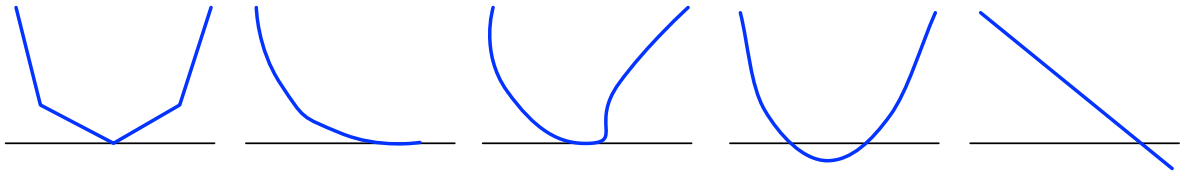
3. [**40 points**] Consider a matrix $A \in \mathbb{R}^{n \times d}$ and a unit vector $x \in \mathbb{R}^d$. Let $U, S, V^T = \mathsf{svd}(A)$ be the SVD of A. If we know that $\|Ax\| = 7.2$, then report the following values

   (a) $\|x\| =$

   (b) $\|V^T x\| =$

   (c) $\|SV^T x\| =$

   (d) $\|USV^T x\| =$

   and answer

   (e) What is the resulting dimensions of Ax?

   (f) If the right singular vectors are $v_1, v_2, \ldots, v_d$, then use them to describe the first coordinate of $V_k^T x$.