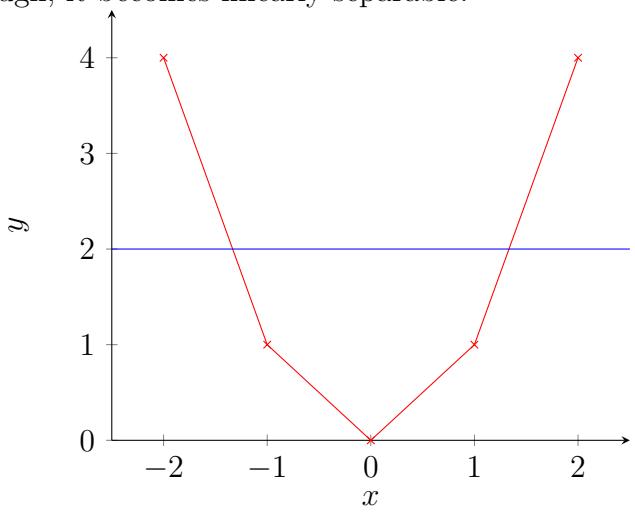
CMPS 142 Machine Learning
Spring 2018, Homework #2

Aaron Steele, atsteele@ucsc.edu
Tommy Tran, ttran56@ucsc.edu

Problem 2: Kernels and SVMs

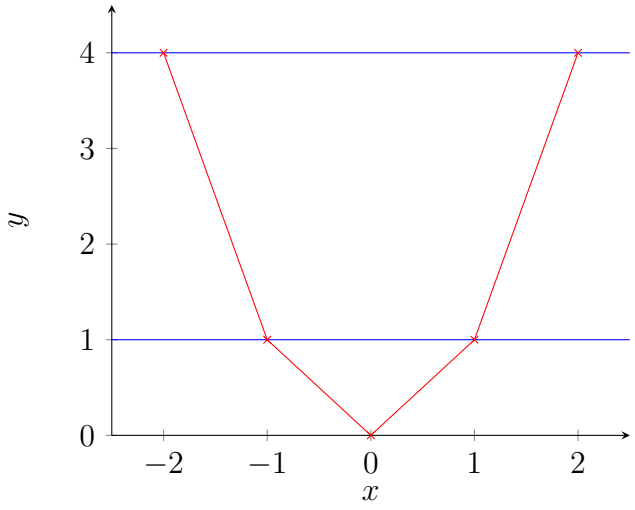
1

This data is not linearly separable. If we convert it to the form $f(x) = x^2$, though, it becomes linearly separable.



2

The hard-margin hyperplanes are at y=4 and y=1, visualized in blue.



3

Translating this decision boundary back into 1D space it would have to be four vertical lines, one at -2, one at -1, one at 1, and the last at 2. This is the only way to project the margins given in the 2D graph onto the 1D one.

4

This kernel function must be a linear one, given that the boundaries are lines in the higher-dimensional space.

The kernel function should be the same one discussed in class, namely

$$\phi(x).\phi(z) = (x \cdot z)^2$$

Which translates into the kernel function

$$K(x, z) = (x \cdot z)^2$$