

## Theoretical task 8.

*Recommendations: all solutions should be short, mathematically strict (unless qualitative explanation is needed), precise with respect to the stated question and clearly written.*

1. Consider a binary classification task with a linearly separable dataset. To solve this task we use SVM with polynomial kernel  $K(x, y) = (x^\top y + 1)^d$  and obtain some decision boundary. Is that right, that for any  $d > 1$  the decision boundary representation in **initial feature space** will be the error-free hyperplane (linear decision boundary).
2. Find the computational complexity of the linear and kernel SVM classification procedure of a single object (SVM is already trained).
3. Consider a binary classification task with class labels from  $\{+1, -1\}$ . In feature space associated with kernel  $K_1(x_1, x_2)$  training dataset is linearly separable, while in another feature space associated with  $K_2(x_1, x_2)$  it is not. Would the dataset be linearly separable in feature space associated with  $K(x_1, x_2) = K_1(x_1, x_2) + K_2(x_1, x_2)$ ?