1. 给定如下训练数据集，

   $\boldsymbol{x}^1$=[3 3], $\boldsymbol{x}^2$=[4 3], y^1=1, y^2=1

   $\boldsymbol{x}^3$=[1 1],y^3=-1

通过求解 SVM 的原始问题来求解最大间隔的分离超平面。

2. 给定如下训练数据集，

$\boldsymbol{x}^1$=[3 3], $\boldsymbol{x}^2$=[4 3], y^1=1, y^2=1

$\boldsymbol{x}^3$=[1 1],y^3=-1

通过求解 SVM 的对偶问题来求解最大间隔的分离超平面。

3. 推导软间隔SVM的对偶形式。
4. Show that, irrespective of the dimensionality of the data space, a data set consisting of just two data points (call them **x**(1) and **x**(2), one from each class) is sufficient to determine the maximum-margin hyperplane. Fully explain your answer, including giving an explicit formula for the solution to the hard margin SVM (i.e., **w**) as a function of **x**(1)and **x**(2).

5. Gaussian kernel takes the form:

   $$K(\boldsymbol{x},\boldsymbol{z})=\exp\left(-\frac{\|\boldsymbol{x}-\boldsymbol{z}\|^2}{2}\right)$$

   Try to show that the Gaussian kernel can be expressed as the inner product of an infinite-dimensional feature vector.

   Hint: Making use of the following expansion, and then expanding the middle factor as a power series.

   $$K(\boldsymbol{x},\boldsymbol{z})=\exp\left(-\frac{\boldsymbol{x}^T\boldsymbol{x}}{2\sigma^2}\right)\exp\left(-\frac{\boldsymbol{x}^T\boldsymbol{z}}{2\sigma^2}\right)\exp\left(-\frac{\boldsymbol{z}^T\boldsymbol{z}}{2\sigma^2}\right)$$