Assignment 1

(Due date: March 6, 2020)

1. Generate 100 2D-samples X that belongs to a Gaussian distribution, i.e. $X_i \in \mathbb{R}^2 \sim \mathcal{N}((0,0), \begin{matrix} 1 & 0 \\ 0 & 1 \end{matrix})$, write code to find the sample mean and sample variance of the data set.
   Tips: In Python, you can generate these samples with the following script:

```
import numpy as np
X = np.random.multivariate_normal([0, 0], [[1, 0], [0, 1]], 100)
```

2. Generate 100 samples X that belongs to an uniformly distribution, i.e. $X_i \in U[-4,4]$. For each sample X_i, compute $Y_i = f(x_i)$ for f is a 3rd-degree polynomial function $f(x) = x^3 + 2x^2 - 4x + 5$. Generate 100 random noise $e \sim \mathcal{N}(0,1)$. Let $\hat{Y}$ is the dataset formed from each point Y_i plus its respective noise ($\hat{Y}_i = Y_i + e_i$). Write code to compute the mean of square error (MSE) between Y and $\hat{Y}$. The MSE is defined as:

$$MSE(Y, \hat{Y}) = \frac{1}{N}\sum_{i=1}^{N}(Y_i - \hat{Y}_i)^2$$

3. Write code to plot (X, Y) and $(X, \hat{Y})$ on the sample figure.
   Tips: You can refer this tutorial to learn how to use *matplotlib* for plotting functions in Python