Machine Learning TD 1

For the first basic question about the identity matrix, here is what I get with my code np.eyes(5) :

```
5x5 Identity Matrix:
[[1. 0. 0. 0. 0.]
 [0. 1. 0. 0. 0.]
 [0. 0. 1. 0. 0.]
 [0. 0. 0. 1. 0.]
 [0. 0. 0. 0. 1.]]
```

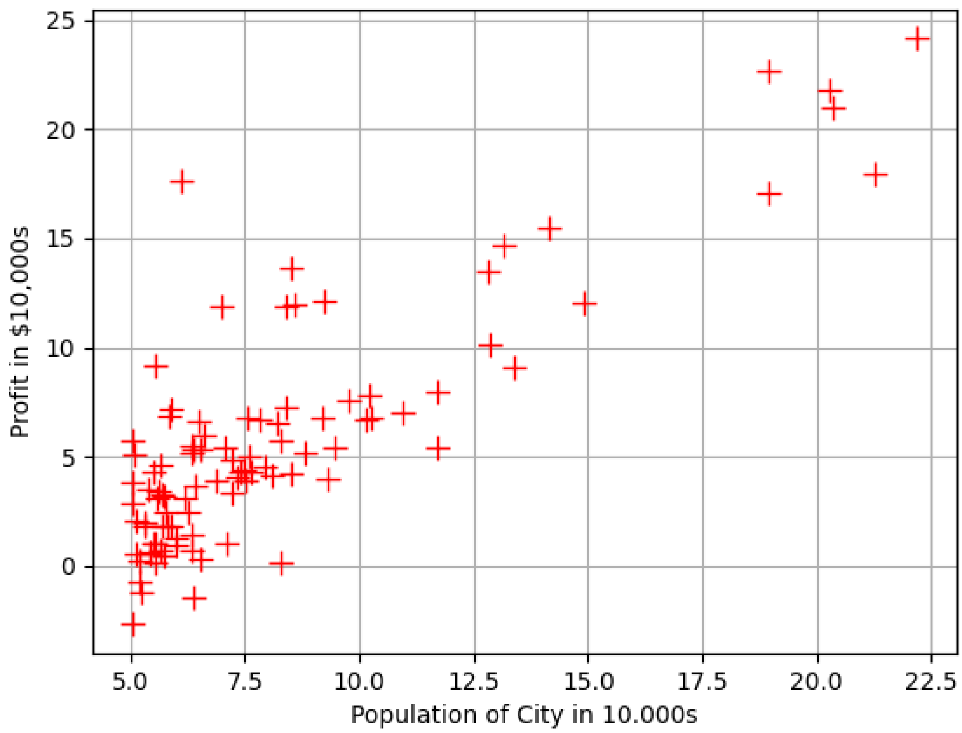
Then for the estimation of the cost value fot theta = (0,0) is :

```
cost: 32.0727
Expected cost value (approx) 32.07
```

And with theta = (-1, 2) :

```
With theta = [-1 ; 2] Cost computed = 54.242455
Expected cost value (approx) 54.24
```

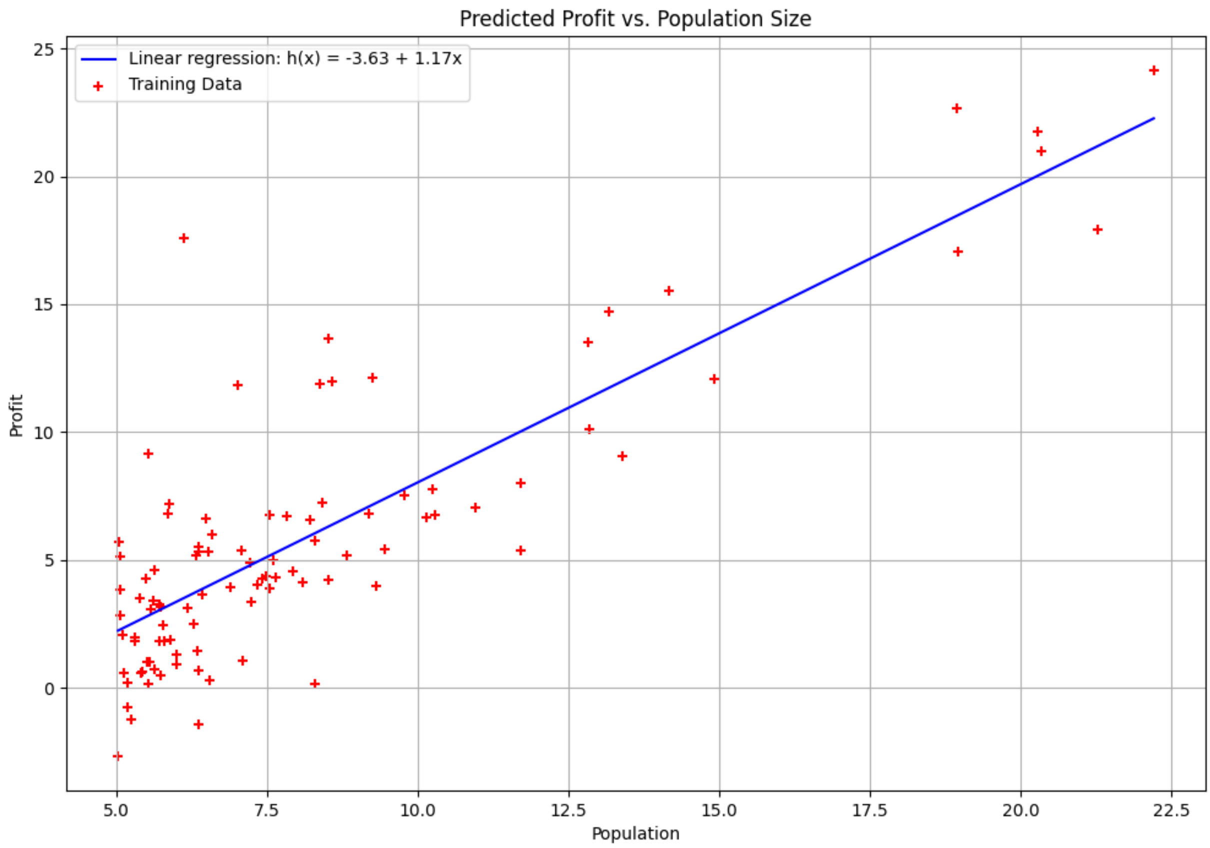
I also plotted the points represeting the data :



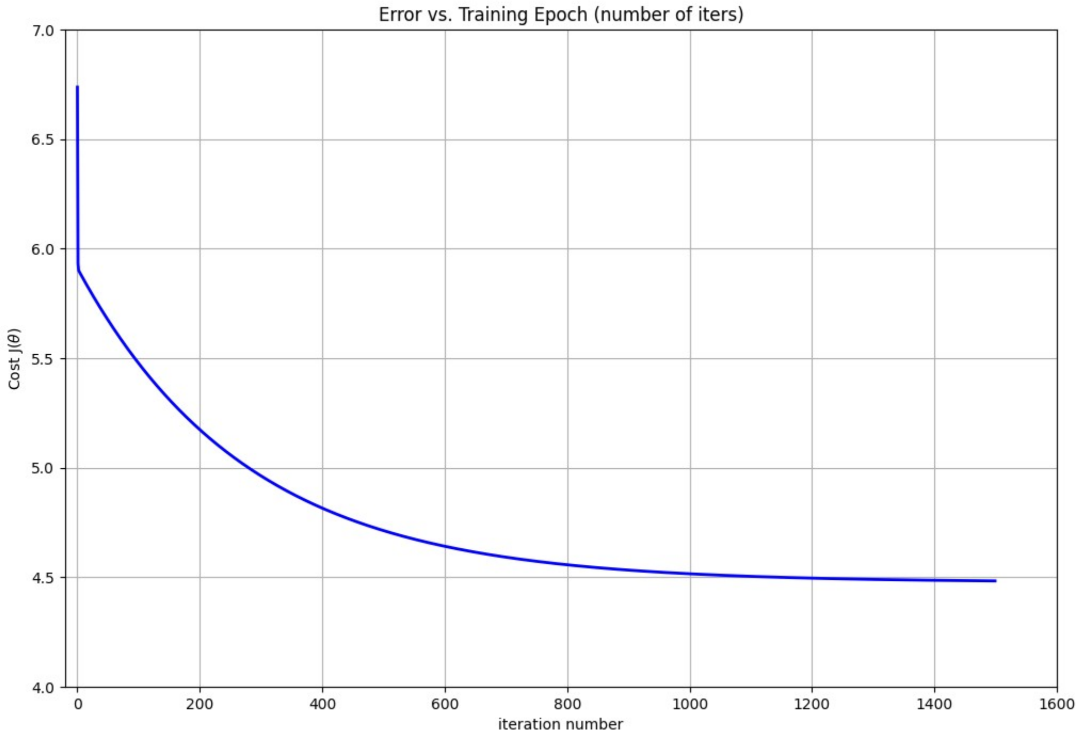
When I performed my gradient descent, I obtained these values for theta :

```
Theta found by gradient descent:
-3.6302914394043593 1.1663623503355818
Expected theta values (approx)
 -3.6303  1.1664
```

The linear regression gives this result, which seems reliable :

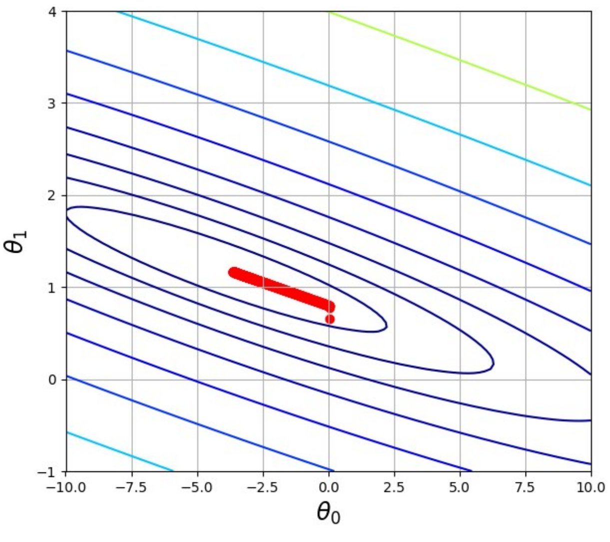


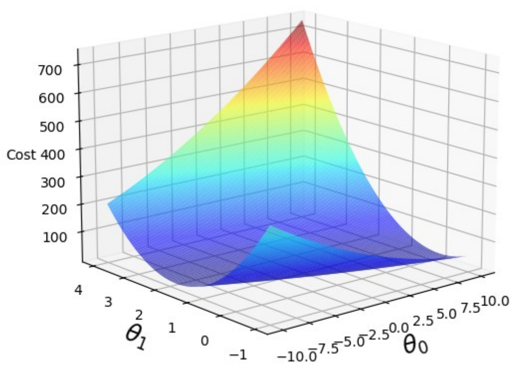
To be sure of my result, here is the evolution of the cost J(theta) :



It is decreasing since the first step, which points towards a succes of the gradient descent.

The visualisation of the gradient descent gave me this plot, which is what we expect to have. I added on the same graph the values of theta_0 and theta_1 :





The profits predicted are :

```
For population = 35,000, we predict a profit of 4519.7679
For population = 70,000, we predict a profit of 45342.4501
For population = 70,000, we predict a profit of 45342.4501
```

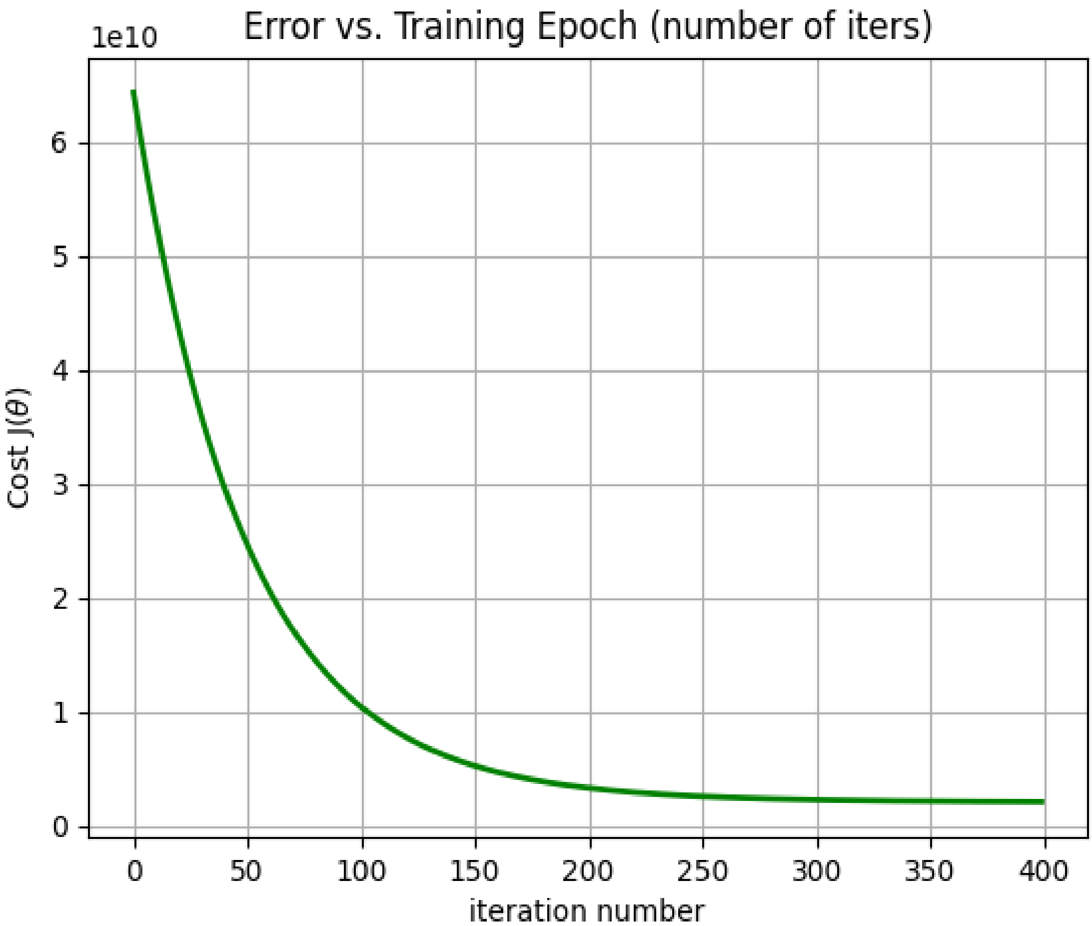
In the multidimensionnal case after modifying my function, I got this result for theta :

```
Theta computed from the normal equations:
[[89597.9095428 ]
[  139.21067402]
[-8738.01911233]]
```

And the price estimated is :

```
Predicted price of a 1650 sq-ft, 3 br house
(using normal equations):
 $293081.464335
```

The evolution of the error is given by :



My code is availaible on this git repository :
https://github.com/Gougaaate/Machine_Learning/tree/main

Optionnal task :

1. Supervised Approaches (Supervised Learning): Supervised approaches are a type of machine learning where the algorithm is trained on a labeled training dataset that contains both inputs (features) and associated outputs (labels or targets). The goal is to learn a relationship or function between the features and labels so that the algorithm can make accurate predictions on new data for which the labels are not yet known.

2. Unsupervised Approaches (Unsupervised Learning): Unsupervised approaches are a type of machine learning where the algorithm is tasked with exploring data that is not pre-labeled or categorized. The primary objective is to discover patterns, structures, or inherent groupings within the data. This can include techniques such as dimensionality reduction, unsupervised clustering, data segmentation, and more.

3. Regression (Regression): Regression is a statistical technique used to model the relationship between a continuous dependent variable (the variable being predicted) and one or more predictors (independent variables or features). The goal of regression is to find a mathematical function that best describes this relationship. There are different types of regression, including linear regression (for linear predictions), logistic regression (for binary predictions), and other more advanced techniques for more complex modeling. Regression is often used in supervised approaches to predict continuous values.

In machine learning, learning involves improving a model by adjusting its parameters through an iterative process. This is done by minimizing a cost function, which assesses the difference between the model's predictions and the actual values. The gradient descent method guides the parameter adjustments to reduce this difference. Other approaches include using different neural network architectures and augmenting the training data.

Descriptor normalization in machine learning aims to prevent descriptors with different units from dominating the learning process, thus enabling faster convergence of optimization algorithms.