In [1]:

```
import matplotlib.pyplot as plt
import pandas as pd
import numpy as np
```

In [3]:

```
df=pd.read_csv('canada_per_capita_income.csv')
```

In [4]:

```
df.head()
```

Out[4]:

	year	per capita income (US$)
0	1970	3399.299037
1	1971	3768.297935
2	1972	4251.175484
3	1973	4804.463248
4	1974	5576.514583

by sklearn

In [5]:

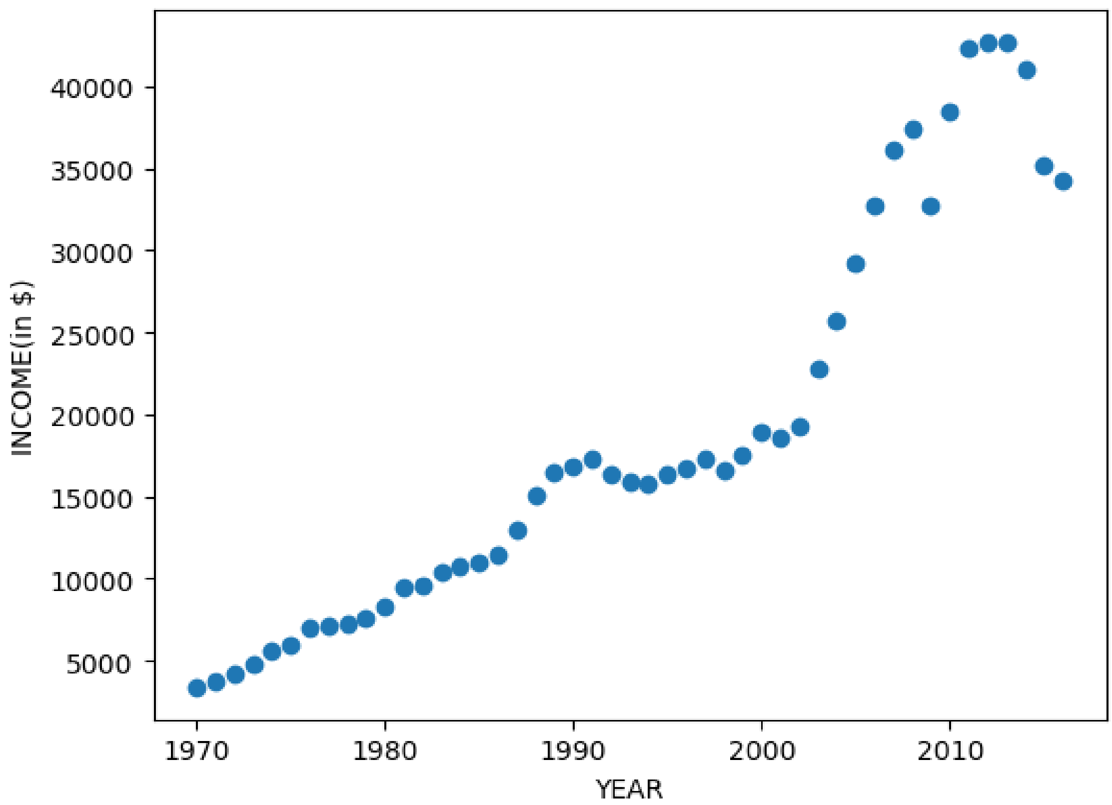
```
df.info()
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 47 entries, 0 to 46
Data columns (total 2 columns):
 #   Column                   Non-Null Count  Dtype
---  ------                   --------------  -----
 0   year                     47 non-null     int64
 1   per capita income (US$)  47 non-null     float64
dtypes: float64(1), int64(1)
memory usage: 884.0 bytes
```

In [7]:

```
plt.scatter(df['year'],df['per capita income (US$)'])
plt.xlabel('YEAR')
plt.ylabel('INCOME(in $)')
```

Out[7]:

```
Text(0, 0.5, 'INCOME(in $)')
```



In [8]:

```
X = df.iloc[:,0:1]
y = df.iloc[:,-1]
```

In [9]:

```
y.head()
```

Out[9]:

```
0    3399.299037
1    3768.297935
2    4251.175484
3    4804.463248
4    5576.514583
Name: per capita income (US$), dtype: float64
```

In [11]:

```
X.head()
```

Out[11]:

	year
0	1970
1	1971
2	1972
3	1973
4	1974

In [12]:

```
from sklearn.model_selection import train_test_split
X_train,X_test,y_train,y_test =
train_test_split(X,y,test_size=0.2,random_state=2)
```

In [13]:

```
from sklearn.linear_model import LinearRegression
```

In [14]:

```
lr = LinearRegression()
```

In [15]:

```
lr.fit(X_train,y_train)
```

Out[15]:

```
LinearRegression
LinearRegression()
```

In [16]:

```
X_test.head()
```

Out[16]:

	year
23	1993
12	1982
42	2012
16	1986
35	2005

In [17]:

```
y_test.head()
```

Out[17]:

```
23    15875.586730
12     9619.438377
42    42665.255970
16    11482.891530
35    29198.055690
Name: per capita income (US$), dtype: float64
```

In [18]:

```
lr.predict(X_test.iloc[0].values.reshape(1,1))
```

```
D:\ProgramData\anaconda3\Lib\site-packages\sklearn\base.py:464:
UserWarning: X does not have valid feature names, but LinearRegression was
fitted with feature names
  warnings.warn(
```

Out[18]:

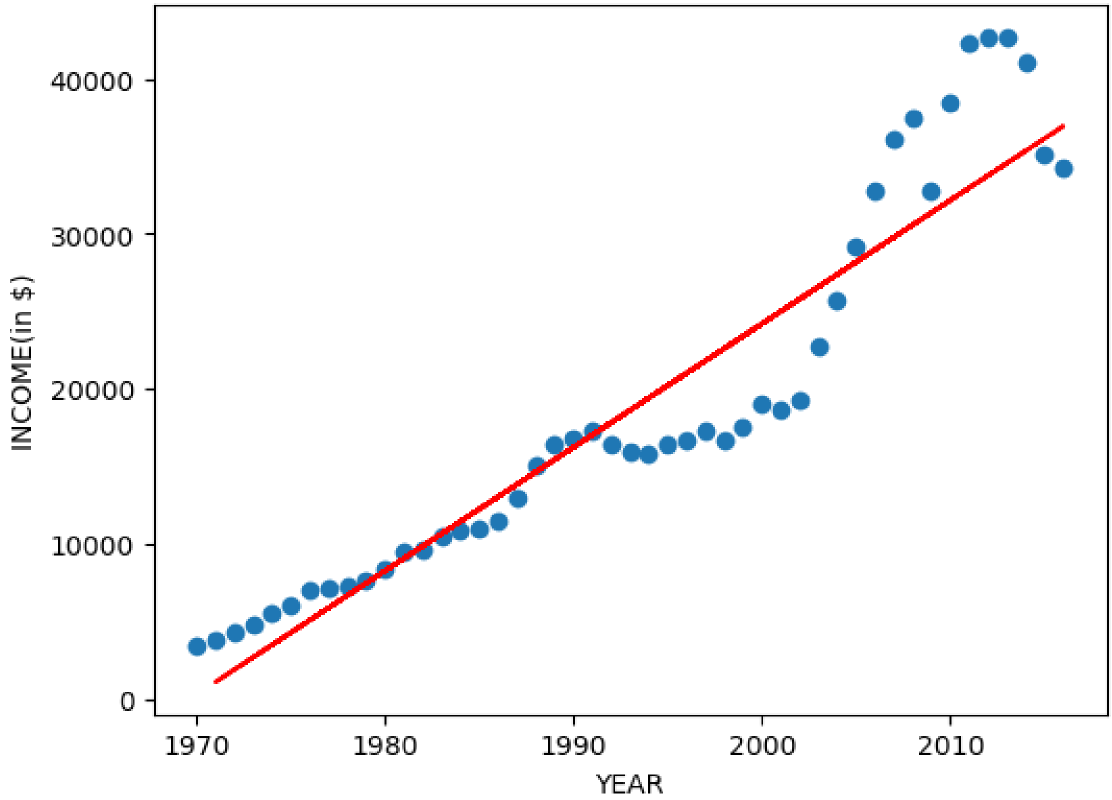
```
array([18602.90731472])
```

In [20]:

```
plt.scatter(df['year'],df['per capita income (US$)'])
plt.plot(X_train,lr.predict(X_train),color='red')
plt.xlabel('YEAR')
plt.ylabel('INCOME(in $)')
```

Out[20]:

```
Text(0, 0.5, 'INCOME(in $)')
```



In [21]:

```
m = lr.coef_
```

In [23]:

```
m
```

Out[23]:

```
array([796.93681988])
```

In [24]:

```
b = lr.intercept_
```

In [25]:

```
b
```

Out[25]:

```
-1569692.1747126186
```

by formula

In [27]:

```
dm=pd.read_csv('canada_per_capita_income.csv')
```

In [28]:

```
dm.head()
```

Out[28]:

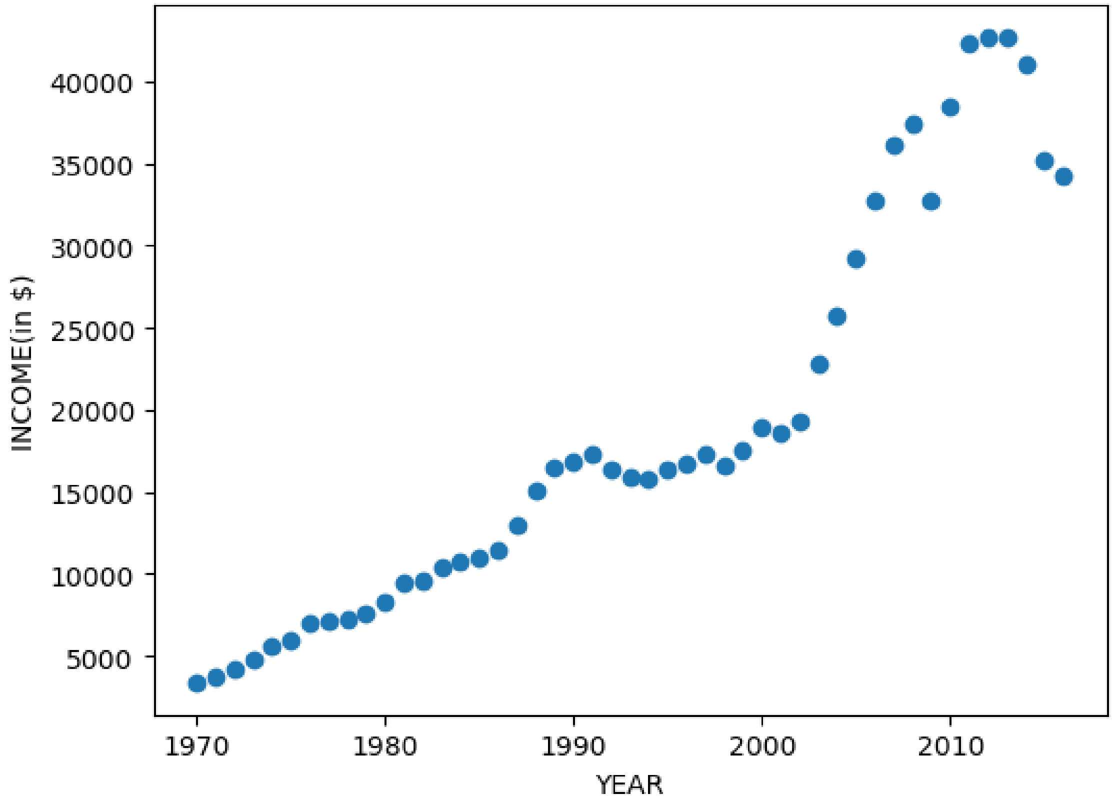
	year	per capita income (US$)
0	1970	3399.299037
1	1971	3768.297935
2	1972	4251.175484
3	1973	4804.463248
4	1974	5576.514583

In [29]:

```
plt.scatter(dm['year'],dm['per capita income (US$)'])
plt.xlabel('YEAR')
plt.ylabel('INCOME(in $)')
```

Out[29]:

```
Text(0, 0.5, 'INCOME(in $)')
```



In [35]:

```
X = dm.iloc[:,0].values
y = dm.iloc[:,1].values
```

In [38]:

```
X
```

Out[38]:

```
array([[1970],
       [1971],
       [1972],
       [1973],
       [1974],
       [1975],
       [1976],
       [1977],
       [1978],
       [1979],
       [1980],
       [1981],
       [1982],
       [1983],
       [1984],
       [1985],
       [1986],
```

```
       [1987],
       [1988],
       [1989],
       [1990],
       [1991],
       [1992],
       [1993],
       [1994],
       [1995],
       [1996],
       [1997],
       [1998],
       [1999],
       [2000],
       [2001],
       [2002],
       [2003],
       [2004],
       [2005],
       [2006],
       [2007],
       [2008],
       [2009],
       [2010],
       [2011],
       [2012],
       [2013],
       [2014],
       [2015],
       [2016]], dtype=int64)
```

In [39]:

```
y
```

Out[39]:

```
array([ 3399.299037,  3768.297935,  4251.175484,  4804.463248,
        5576.514583,  5998.144346,  7062.131392,  7100.12617 ,
        7247.967035,  7602.912681,  8355.96812 ,  9434.390652,
        9619.438377, 10416.53659 , 10790.32872 , 11018.95585 ,
       11482.89153 , 12974.80662 , 15080.28345 , 16426.72548 ,
       16838.6732  , 17266.09769 , 16412.08309 , 15875.58673 ,
       15755.82027 , 16369.31725 , 16699.82668 , 17310.75775 ,
       16622.67187 , 17581.02414 , 18987.38241 , 18601.39724 ,
       19232.17556 , 22739.42628 , 25719.14715 , 29198.05569 ,
       32738.2629  , 36144.48122 , 37446.48609 , 32755.17682 ,
       38420.52289 , 42334.71121 , 42665.25597 , 42676.46837 ,
       41039.8936  , 35175.18898 , 34229.19363 ])
```

In [40]:

```
class MeraLR:

    def __init__(self):
```

```
        self.m = None
        self.b = None

    def fit(self,X_train,y_train):

        num = 0
        den = 0

        for i in range(X_train.shape[0]):

            num = num + ((X_train[i] - X_train.mean())*(y_train[i] - 
y_train.mean()))
            den = den + ((X_train[i] - X_train.mean())*(X_train[i] - 
X_train.mean()))

        self.m = num/den
        self.b = y_train.mean() - (self.m * X_train.mean())
        print(self.m)
        print(self.b)

    def predict(self,X_test):

        print(X_test)

        return self.m * X_test + self.b
```

In [41]:

```
from sklearn.model_selection import train_test_split
X_train,X_test,y_train,y_test = 
train_test_split(X,y,test_size=0.2,random_state=2)
```

In [42]:

```
X_train.shape
```

Out[42]:

```
(37, 1)
```

In [43]:

```
lr = MeraLR()
```

In [44]:

```
lr.fit(X_train,y_train)
[796.93681988]
[-1569692.17471262]
```

In [45]:

```
X_train.shape[0]
```

Out[45]:

```
37
```

In [46]:

```
X_train[0]
```

Out[46]:

```
array([1972], dtype=int64)
```

In [47]:

```
X_train.mean()
```

Out[47]:

```
1992.6486486486488
```

In [48]:

```
X_test[0]
```

Out[48]:

```
array([1993], dtype=int64)
```

In [49]:

```
print(lr.predict(X_test[0]))
```

```
[1993]
[18602.90731472]
```

In [ ]: