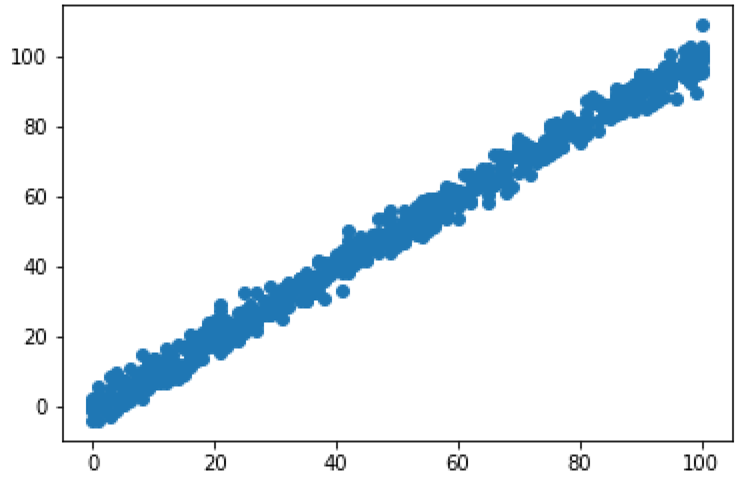
In [1]:

```
from numpy import *
from matplotlib import pyplot as plt
%matplotlib inline

#Getting data from file and spliting it into x axis and y axis
def getdata(datafile,delimiter_in_file,header_skiping):
    training_data = genfromtxt(datafile,delimiter=delimiter_in_file,
skip_header = header_skiping,dtype=str)
    x = [] # x-axis data
    y = [] # y-axis data
    for i in range(0,len(training_data)):
        x.append(float(training_data[i][0]))
        y.append(float(training_data[i][1]))
    return x,y


#Error Finder
#formula : 1/2n{summition from i=1 to n (y[i] - (m * x[i] + b))}
def error(m,b,x,y):
    total_error = 0.0
    for i in range(0,len(x)):
        total_error+= ((m * x[i] + b) - y[i]) ** 2
    return total_error/float(len(x))

#Function by which we can get new values of m and b
#Using gradient descent ( Partial Derivative )
#Having Formula :
# curl/curl{m} = {summition from i = 1 to n of -x[i] * (y[i] - (m *
 x[i] + b))}
# curl/curl{b} = {summition from i = 1 to n of -(y[i] - (m * x[i] +
 b))}
def step_gradient(m,b,x,y,learning_rate):
    m_gradient = 0.0 #initial gradient
    b_gradient = 0.0 #initial intercept
    for i in range(0,len(x)):
        m_gradient+=(-x[i] * (y[i]- (m * x[i]) + b))
        b_gradient+=(-(y[i] - ((m * x[i]) + b)))
    #new m using formula of gradient descent
    #new path point = old path point - (alpha) * gradient
    #alpha = learning rate , as what the speed at which we go downwa
rd in graph
    #to find minima
    new_m = m - (learning_rate * (m_gradient)/float(len(x)))
    new_b = b - (learning_rate * (b_gradient)/float(len(x)))
    return new_m,new_b

#running gradient descent upto num of iteration say 10,000 time we g
et
#different m and b and after last we found m and b
def gradient_descent_run(old_m,old_b,num_iterations,x,y,learning_rat
e):
    m = old_m # getting old b
    b = old_b # getting old m
    for i in range(num_iterations):
        #calling step gradient upto num iterations time
        #in this m and b get change again and again upto num iterati
ons
        m,b = step_gradient(m,b,x,y,learning_rate)
    return m,b
```

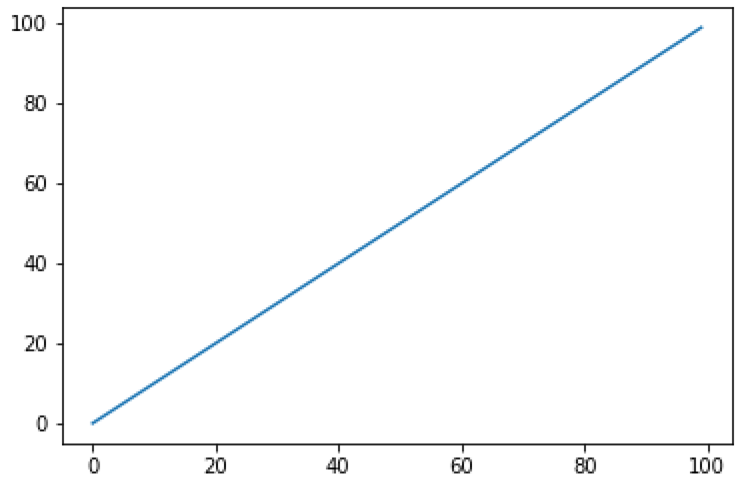
```
#Test file data to run Test on calculated final m and b
#and predict the y
def test(m,b,x):
    y_new = [] #creating empty list of y_new
    print()
    for i in range(0,len(x)):
        #appending y_new list with y_new = mx+b have x input and y o
utput
        y_new.append(m * x[i] + b)
    return y_new


def train(datafile,delimiter_in_file,skiping_header,num,alpha):

    #Getting X and Y values from File of training data
    x,y = getdata(datafile,delimiter_in_file,skiping_header)
    m_initial = 0 #initial slope
    b_initial = 0 #initial intercept
    num_iterations = num #num of iterations
    learning_rate = alpha #learning rate
    print()
    print('Training Data Scatter Plot')
    plot_graph(x,y) #plotting Training Data
    print()
    print('Starting Linear Regression with m = '+str(m_initial)+' b
 = '+str(b_initial)+' error = ' + str(error(m_initial,b_initial,x,y
)))
    print('Starting...')
    print()
    m,b = gradient_descent_run(m_initial,b_initial,num_iterations,x,
y,learning_rate)
    print()
    print('Ending Linear Regression with m = '+str(m)+' b = '+str(b)
+' error = ' + str(error(m,b,x,y)))
    print()
    print('Plotting Best Fit Line')
    plot_final_line(m,b) #Plotting Best Fit Line
    return m,b,error(m,b,x,y)

#plotting Scatter Graph Function
def plot_graph(x,y):
    print('Scatter Plot')
    plt.scatter(x,y)
    plt.show()

#plotting Best Fit Line Function
def plot_final_line(m,b):
    print('Printing Best fit Line')
    x = []
    y = []
    for i in range(0,100):
        x.append(float(i))
    for i in range(0,len(x)):
        y.append(m * x[i] + b)
    plt.plot(x,y)
    plt.show()

def run(trainfile,testfile,delimiter,skip_header,num,alpha):
    #getting m , b ,error from training data main function
    m,b,e = train(trainfile,delimiter,skip_header,num,alpha)
    #getting x and y from test data file
```

```python
    x,y = getdata(testfile,delimiter,skip_header)
    #plotting graph of actual dataset in test
    print('Ploting actual Data from test file')
    plot_graph(x,y)
    print()
    #Calculating Prediction of y
    y_new = test(m,b,x)
    print()
    #plotting graph of Predicted y with actual x
    print('Ploting Predicted data of Y ')
    plot_graph(x,y_new)
    print()
    #printing y actual and corresponding to its y_new
    for i in range(0,len(y)):
        print('Y actual = ' + str(y[i]),end = ' | ')
        print('Y Predicted = ' + str(y_new[i]))
    print()
    print('Ending Linear Regression with m = '+str(m)+' b = '+str(b)
+' error = ' + str(e))
    print()

# --------------Main---------------- #

run('data/train.csv','data/test.csv',',',1,5000,0.0001)
```

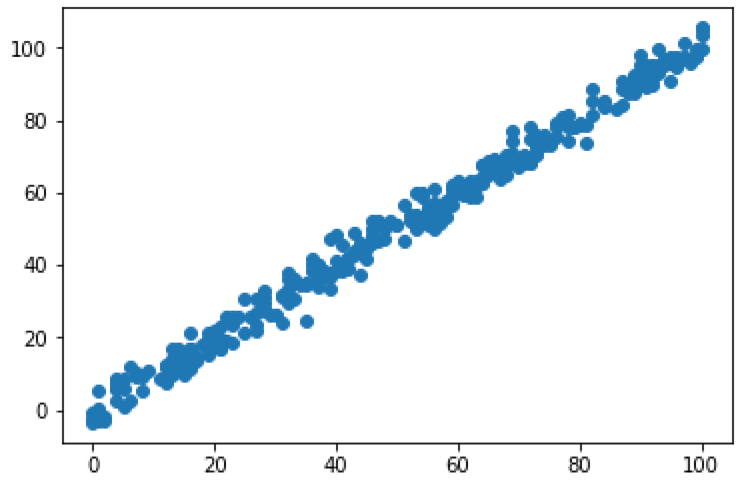
```
Training Data Scatter Plot
Scatter Plot
```



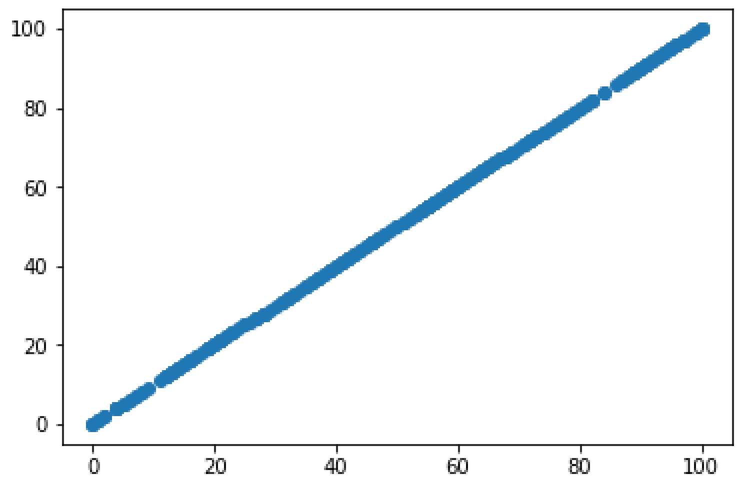

```
Starting Linear Regression with m = 0 b = 0 error = 3336.65245773449
49
Starting...


Ending Linear Regression with m = 0.99892060904202362 b = -0.0037952
402952288961 error = 7.89223762352437 67

Plotting Best Fit Line
Printing Best fit Line
```




```
Ploting actual Data from test file
Scatter Plot
```



Ploting Predicted data of Y
Scatter Plot



```
Y actual = 79.775152009999999 | Y Predicted = 76.91309165594059
Y actual = 23.177278869999999 | Y Predicted = 20.973537549587267
Y actual = 25.60926156 | Y Predicted = 21.972458158629291
Y actual = 17.85738813 | Y Predicted = 19.974616940545243
Y actual = 41.84986439 | Y Predicted = 35.957346685217622
Y actual = 9.8052348760000001 | Y Predicted = 14.980013895335125
Y actual = 58.87465933 | Y Predicted = 61.929282520310238
Y actual = 97.617937010000006 | Y Predicted = 94.893662618697007
Y actual = 18.395127469999998 | Y Predicted = 19.974616940545243
Y actual = 8.746747654 | Y Predicted = 4.9908078049148887
Y actual = 2.8114158260000002 | Y Predicted = 3.9918871958728657
Y actual = 17.09537241 | Y Predicted = 18.975696331503219
Y actual = 95.149071759999998 | Y Predicted = 95.892583227739038
Y actual = 61.38800663 | Y Predicted = 61.929282520310238
Y actual = 40.247017159999999 | Y Predicted = 35.957346685217622
Y actual = 14.822485889999999 | Y Predicted = 14.980013895335125
Y actual = 66.958068690000005 | Y Predicted = 64.926044347436303
Y actual = 16.63507984 | Y Predicted = 13.981093286293101
Y actual = 90.655137359999998 | Y Predicted = 86.902297746360816
Y actual = 77.229826360000004 | Y Predicted = 68.921726783604399
Y actual = 92.119062779999993 | Y Predicted = 88.900138964444864
Y actual = 46.91387709 | Y Predicted = 50.941155820847982
Y actual = 89.826344419999998 | Y Predicted = 88.900138964444864
Y actual = 21.713803469999998 | Y Predicted = 26.967061203839407
Y actual = 97.412069810000006 | Y Predicted = 96.891503836781055
Y actual = 57.016313629999999 | Y Predicted = 57.933600084142142
Y actual = 78.310565420000003 | Y Predicted = 78.910932874024638
Y actual = 19.131509699999999 | Y Predicted = 20.973537549587267
Y actual = 93.034833879999994 | Y Predicted = 92.895821400612959
Y actual = 26.591123960000001 | Y Predicted = 26.967061203839407
Y actual = 97.551553440000006 | Y Predicted = 98.889345054865103
Y actual = 31.435248219999998 | Y Predicted = 30.962743640007503
Y actual = 35.127247769999997 | Y Predicted = 32.960584858091551
Y actual = 78.610424320000007 | Y Predicted = 79.909853483066655
Y actual = 33.071128250000001 | Y Predicted = 27.965981812881431
Y actual = 51.699671719999998 | Y Predicted = 46.945473384679886
Y actual = 53.622352249999999 | Y Predicted = 52.93899703893203
Y actual = 69.463060720000001 | Y Predicted = 68.921726783604399
Y actual = 27.424972369999999 | Y Predicted = 27.965981812881431
Y actual = 36.346441890000001 | Y Predicted = 32.960584858091551
Y actual = 95.061408580000005 | Y Predicted = 90.897980182528912
Y actual = 68.167247570000001 | Y Predicted = 70.91956800168847
Y actual = 50.961555320000002 | Y Predicted = 49.942235211805958
Y actual = 78.042374539999997 | Y Predicted = 75.914171046898559
Y actual = 5.6076648650000003 | Y Predicted = 3.9918871958728657
Y actual = 36.113347789999999 | Y Predicted = 36.956267294259646
Y actual = 67.235215499999995 | Y Predicted = 69.920647392646416
Y actual = 65.013240350000004 | Y Predicted = 67.922806174562368
Y actual = 38.147538709999999 | Y Predicted = 39.953029121385718
Y actual = 34.311414460000002 | Y Predicted = 34.958426076175598
Y actual = 95.285039370000007 | Y Predicted = 93.894742009654991
Y actual = 87.847499119999995 | Y Predicted = 87.901218355402847
Y actual = 54.081706349999997 | Y Predicted = 51.940076429890006
Y actual = 31.930635150000001 | Y Predicted = 30.962743640007503
Y actual = 59.612470850000001 | Y Predicted = 58.932520693184166
Y actual = -1.040114209 | Y Predicted = -0.0037952402952288961
Y actual = 47.493747650000003 | Y Predicted = 38.954108512343694
Y actual = 62.60089773 | Y Predicted = 63.927123738394286
Y actual = 70.914643400000003 | Y Predicted = 68.921726783604399
Y actual = 56.148341129999999 | Y Predicted = 56.934679475100118
Y actual = 14.05572877 | Y Predicted = 12.982172677251079
```

```
Y actual = 68.11367147 | Y Predicted = 71.918488610730464
Y actual = 75.597013459999999 | Y Predicted = 75.914171046898559
Y actual = 59.225745000000003 | Y Predicted = 60.930361911268214
Y actual = 85.455041570000006 | Y Predicted = 81.907694701150703
Y actual = 17.761971160000002 | Y Predicted = 17.976775722461195
Y actual = 38.68888682 | Y Predicted = 40.951949730427742
Y actual = 50.963436369999997 | Y Predicted = 49.942235211805958
Y actual = 51.83503872 | Y Predicted = 54.93683825701607
Y actual = 17.076110700000001 | Y Predicted = 12.982172677251079
Y actual = 46.561417730000002 | Y Predicted = 45.946552775637862
Y actual = 10.34754461 | Y Predicted = 12.982172677251079
Y actual = 77.910329689999998 | Y Predicted = 78.910932874024638
Y actual = 50.170086220000002 | Y Predicted = 52.93899703893203
Y actual = 13.256906470000001 | Y Predicted = 14.980013895335125
Y actual = 31.32274932 | Y Predicted = 27.965981812881431
Y actual = 73.930876400000002 | Y Predicted = 80.908774092108686
Y actual = 74.451143790000003 | Y Predicted = 68.921726783604399
Y actual = 52.019322860000003 | Y Predicted = 51.940076429890006
Y actual = 83.688204990000003 | Y Predicted = 83.905535919234751
Y actual = 70.369874800000005 | Y Predicted = 67.922806174562368
Y actual = 23.444791609999999 | Y Predicted = 26.967061203839407
Y actual = 49.830518009999999 | Y Predicted = 55.935758866058094
Y actual = 49.882265930000003 | Y Predicted = 47.94439399372191
Y actual = 41.045255830000002 | Y Predicted = 39.953029121385718
Y actual = 33.378343909999998 | Y Predicted = 38.954108512343694
Y actual = 81.297501330000003 | Y Predicted = 81.907694701150703
Y actual = 105.5918375 | Y Predicted = 99.888265663907134
Y actual = 56.824570129999998 | Y Predicted = 58.932520693184166
Y actual = 48.672526449999999 | Y Predicted = 42.94979094851179
Y actual = 67.021506130000006 | Y Predicted = 66.923885565520351
Y actual = 38.430763890000001 | Y Predicted = 37.95518790330167
Y actual = 58.614668870000003 | Y Predicted = 62.928203129352262
Y actual = 89.123775089999995 | Y Predicted = 90.897980182528912
Y actual = 60.910542700000001 | Y Predicted = 59.93144130222619
Y actual = 13.839598779999999 | Y Predicted = 13.981093286293101
Y actual = 16.890851850000001 | Y Predicted = 20.973537549587267
Y actual = 84.066768179999997 | Y Predicted = 86.902297746360816
Y actual = 70.349697719999995 | Y Predicted = 72.917409219772495
Y actual = 33.384741380000001 | Y Predicted = 31.961664249049527
Y actual = -1.63296825 | Y Predicted = 1.9940459777888184
Y actual = 88.544758950000002 | Y Predicted = 81.907694701150703
Y actual = 17.440476220000001 | Y Predicted = 18.975696331503219
Y actual = 75.692985539999995 | Y Predicted = 73.916329828814511
Y actual = 41.976071070000003 | Y Predicted = 41.950870339469766
Y actual = 12.59244741 | Y Predicted = 11.983252068209055
Y actual = 0.27530726100000003 | Y Predicted = 0.99512536874679469
Y actual = 98.132580050000001 | Y Predicted = 89.899059573486895
Y actual = 87.457215550000001 | Y Predicted = 88.900138964444864
Y actual = -2.344738542 | Y Predicted = -0.0037952402952288961
Y actual = 39.329415300000001 | Y Predicted = 40.951949730427742
Y actual = 16.68715211 | Y Predicted = 15.978934504377149
Y actual = 96.588886009999996 | Y Predicted = 93.894742009654991
Y actual = 97.703422009999997 | Y Predicted = 96.891503836781055
Y actual = 67.017159550000002 | Y Predicted = 65.92496495647832
Y actual = 25.634762569999999 | Y Predicted = 23.970299376713339
Y actual = 13.413107569999999 | Y Predicted = 16.977855113419171
Y actual = 95.156472840000006 | Y Predicted = 89.899059573486895
Y actual = 9.7441642579999996 | Y Predicted = 12.982172677251079
Y actual = -3.467883789 | Y Predicted = -0.0037952402952288961
Y actual = 62.828163549999999 | Y Predicted = 63.927123738394286
Y actual = 97.274054609999993 | Y Predicted = 95.892583227739038
```

```
Y actual = 95.580171849999999 | Y Predicted = 97.890424445823086
Y actual = 7.468501839 | Y Predicted = 11.983252068209055
Y actual = 45.445995910000001 | Y Predicted = 40.951949730427742
Y actual = 46.690139680000001 | Y Predicted = 46.945473384679886
Y actual = 74.499359900000002 | Y Predicted = 77.912012264982607
Y actual = 21.63500655 | Y Predicted = 19.974616940545243
Y actual = 91.595488509999996 | Y Predicted = 88.900138964444864
Y actual = 26.494879610000002 | Y Predicted = 28.964902421923455
Y actual = 67.386547030000003 | Y Predicted = 63.927123738394286
Y actual = 74.253628370000001 | Y Predicted = 74.915250437856542
Y actual = 12.07991648 | Y Predicted = 11.983252068209055
Y actual = 21.322737279999998 | Y Predicted = 24.969219985755363
Y actual = 29.31770045 | Y Predicted = 27.965981812881431
Y actual = 26.487136830000001 | Y Predicted = 29.963823030965479
Y actual = 68.94699774 | Y Predicted = 64.926044347436303
Y actual = 59.105989950000001 | Y Predicted = 58.932520693184166
Y actual = 64.375210870000004 | Y Predicted = 63.927123738394286
Y actual = 60.207583489999998 | Y Predicted = 52.93899703893203
Y actual = 70.343297059999998 | Y Predicted = 70.919568001688447
Y actual = 97.1082562 | Y Predicted = 96.891503836781055
Y actual = 75.758417800000004 | Y Predicted = 72.917409219772495
Y actual = 10.804627269999999 | Y Predicted = 8.9864902410829828
Y actual = 12.112199410000001 | Y Predicted = 11.983252068209055
Y actual = 63.28312382 | Y Predicted = 62.928203129352262
Y actual = 98.030177210000005 | Y Predicted = 98.889345054865103
Y actual = 63.19354354 | Y Predicted = 59.93144130222619
Y actual = 34.853482300000003 | Y Predicted = 34.958426076175598
Y actual = -2.8199139739999999 | Y Predicted = 1.9940459777888184
Y actual = 59.831396599999998 | Y Predicted = 59.93144130222619
Y actual = 29.385050240000002 | Y Predicted = 31.961664249049527
Y actual = 97.001483719999996 | Y Predicted = 93.894742009654991
Y actual = 85.186572749999996 | Y Predicted = 83.905535919234751
Y actual = 61.740631919999998 | Y Predicted = 62.928203129352262
Y actual = 18.84798163 | Y Predicted = 21.972458158629291
Y actual = 78.790085250000004 | Y Predicted = 80.908774092108686
Y actual = 95.124004810000002 | Y Predicted = 92.895821400612959
Y actual = 30.48881287 | Y Predicted = 32.960584858091551
Y actual = 10.414680949999999 | Y Predicted = 6.9886490229989358
Y actual = 38.98317436 | Y Predicted = 41.950870339469766
Y actual = 46.110210619999997 | Y Predicted = 45.946552775637862
Y actual = 52.451036279999997 | Y Predicted = 53.937917647974047
Y actual = 21.165239450000001 | Y Predicted = 15.978934504377149
Y actual = 52.286206110000002 | Y Predicted = 48.943314602763934
Y actual = 44.188639449999997 | Y Predicted = 42.94979094851179
Y actual = 97.138320179999994 | Y Predicted = 94.893662618697007
Y actual = 67.220080010000004 | Y Predicted = 65.92496495647832
Y actual = 18.98322306 | Y Predicted = 20.973537549587267
Y actual = 24.388459900000001 | Y Predicted = 34.958426076175598
Y actual = 79.447695229999994 | Y Predicted = 79.909853483066655
Y actual = 40.035048619999998 | Y Predicted = 36.956267294259646
Y actual = 53.320057640000002 | Y Predicted = 53.937917647974047
Y actual = 54.554469789999999 | Y Predicted = 55.935758866058094
Y actual = -2.7611825950000002 | Y Predicted = 0.99512536874679469
Y actual = 37.801827950000003 | Y Predicted = 31.961664249049527
Y actual = 57.487414350000002 | Y Predicted = 57.933600084142142
Y actual = 36.062929939999997 | Y Predicted = 31.961664249049527
Y actual = 49.835381669999997 | Y Predicted = 45.946552775637862
Y actual = 74.689532760000006 | Y Predicted = 71.918488610730464
Y actual = 14.861594009999999 | Y Predicted = 16.977855113419171
Y actual = 101.06978789999999 | Y Predicted = 96.891503836781055
Y actual = 99.435778760000005 | Y Predicted = 92.895821400612959
```

```
Y actual = 91.69240745999998 | Y Predicted = 90.897980182528912
Y actual = 34.12473247999999 | Y Predicted = 36.956267294259646
Y actual = 6.0793900729999999 | Y Predicted = 3.9918871958728657
Y actual = 59.07247173999997 | Y Predicted = 53.937917647974047
Y actual = 56.430460220000001 | Y Predicted = 50.941155820847982
Y actual = 30.49412933 | Y Predicted = 26.967061203839407
Y actual = 48.35172635 | Y Predicted = 45.946552775637862
Y actual = 89.731536109999993 | Y Predicted = 91.896900791570943
Y actual = 72.862825279999996 | Y Predicted = 72.917409219772495
Y actual = 80.971442850000003 | Y Predicted = 76.91309165594059
Y actual = 91.365663740000002 | Y Predicted = 90.897980182528912
Y actual = 60.07137496 | Y Predicted = 60.930361911268214
Y actual = 99.873827070000004 | Y Predicted = 98.889345054865103
Y actual = 8.6557141719999997 | Y Predicted = 3.9918871958728657
Y actual = 69.398585049999994 | Y Predicted = 71.918488610730464
Y actual = 19.387801339999999 | Y Predicted = 18.975696331503219
Y actual = 53.116284329999999 | Y Predicted = 56.934679475100118
Y actual = 78.396830059999999 | Y Predicted = 77.912012264982607
Y actual = 25.756125140000002 | Y Predicted = 25.968140594797386
Y actual = 75.074846829999998 | Y Predicted = 73.916329828814511
Y actual = 92.887722819999993 | Y Predicted = 89.899059573486895
Y actual = 69.454984980000006 | Y Predicted = 65.92496495647832
Y actual = 13.121098419999999 | Y Predicted = 12.982172677251079
Y actual = 48.098431339999998 | Y Predicted = 39.953029121385718
Y actual = 79.314254800000001 | Y Predicted = 76.91309165594059
Y actual = 68.488207489999994 | Y Predicted = 66.923885565520351
Y actual = 73.230084599999998 | Y Predicted = 74.915250437856542
Y actual = 24.683627120000001 | Y Predicted = 22.971378767671315
Y actual = 41.90368917 | Y Predicted = 44.947632166595838
Y actual = 62.226356840000001 | Y Predicted = 58.932520693184166
Y actual = 45.963968770000001 | Y Predicted = 43.948711557553814
Y actual = 23.526471529999998 | Y Predicted = 22.971378767671315
Y actual = 51.800358660000001 | Y Predicted = 54.93683825701607
Y actual = 51.107742729999998 | Y Predicted = 54.93683825701607
Y actual = 95.797473449999998 | Y Predicted = 94.893662618697007
Y actual = 9.2411389770000003 | Y Predicted = 11.983252068209055
Y actual = 7.6465297630000002 | Y Predicted = 3.9918871958728657
Y actual = 9.2816997529999998 | Y Predicted = 6.9886490229989358
Y actual = 103.52661620000001 | Y Predicted = 99.888265663907134
Y actual = 47.410067249999997 | Y Predicted = 47.94439399372191
Y actual = 42.038357730000001 | Y Predicted = 41.950870339469766
Y actual = 96.11982476 | Y Predicted = 95.892583227739038
Y actual = 38.057664080000002 | Y Predicted = 38.954108512343694
Y actual = 105.4503788 | Y Predicted = 99.888265663907134
Y actual = 88.803069109999996 | Y Predicted = 86.902297746360816
Y actual = 15.493011409999999 | Y Predicted = 13.981093286293101
Y actual = 12.42624606 | Y Predicted = 13.981093286293101
Y actual = 40.007095980000003 | Y Predicted = 36.956267294259646
Y actual = 5.6340309020000001 | Y Predicted = 4.9908078049148887
Y actual = 87.369389310000003 | Y Predicted = 87.901218355402847
Y actual = 89.73951993 | Y Predicted = 90.897980182528912
Y actual = 66.614996430000005 | Y Predicted = 64.926044347436303
Y actual = 72.913885300000004 | Y Predicted = 73.916329828814511
Y actual = 57.191035059999997 | Y Predicted = 55.935758866058094
Y actual = 11.217104770000001 | Y Predicted = 15.978934504377149
Y actual = 0.67607674900000003 | Y Predicted = 4.9908078049148887
Y actual = 28.15668543 | Y Predicted = 27.965981812881431
Y actual = 95.395800300000005 | Y Predicted = 91.896900791570943
Y actual = 52.054907030000003 | Y Predicted = 45.946552775637862
Y actual = 59.708645769999997 | Y Predicted = 53.937917647974047
Y actual = 36.792247619999998 | Y Predicted = 38.954108512343694
```

```
Y actual = 37.084576980000001 | Y Predicted = 43.948711557553814
Y actual = 24.184379759999999 | Y Predicted = 30.962743640007503
Y actual = 67.287253320000005 | Y Predicted = 67.922806174562368
Y actual = 82.870593999999997 | Y Predicted = 85.903377137318799
Y actual = 89.899991 | Y Predicted = 89.899059573486895
Y actual = 36.941731779999998 | Y Predicted = 37.95518790330167
Y actual = 19.875622419999999 | Y Predicted = 20.973537549587267
Y actual = 90.714816540000001 | Y Predicted = 94.893662618697007
Y actual = 61.093677620000001 | Y Predicted = 55.935758866058094
Y actual = 60.111349580000002 | Y Predicted = 59.93144130222619
Y actual = 64.832963160000006 | Y Predicted = 64.926044347436303
Y actual = 81.403817689999997 | Y Predicted = 77.912012264982607
Y actual = 92.402176859999997 | Y Predicted = 88.900138964444864
Y actual = 2.576625376 | Y Predicted = 5.9897284139569127
Y actual = 63.807681719999998 | Y Predicted = 66.923885565520351
Y actual = 38.67780759 | Y Predicted = 35.957346685217622
Y actual = 16.82839701 | Y Predicted = 15.978934504377149
Y actual = 99.786872520000003 | Y Predicted = 99.888265663907134
Y actual = 44.689134330000002 | Y Predicted = 44.947632166595838
Y actual = 71.003778240000003 | Y Predicted = 72.917409219772495
Y actual = 51.573267180000002 | Y Predicted = 56.934679475100118
Y actual = 19.878464789999999 | Y Predicted = 19.974616940545243
Y actual = 79.503414950000007 | Y Predicted = 75.914171046898559
Y actual = 34.588764910000002 | Y Predicted = 33.959505467133575
Y actual = 55.738346700000001 | Y Predicted = 54.93683825701607
Y actual = 68.197219050000001 | Y Predicted = 71.918488610730464
Y actual = 55.816285090000001 | Y Predicted = 54.93683825701607
Y actual = 9.3914167979999998 | Y Predicted = 7.9875696320409597
Y actual = 56.014481109999998 | Y Predicted = 55.935758866058094
Y actual = 77.996947700000007 | Y Predicted = 71.918488610730464
Y actual = 55.370499529999996 | Y Predicted = 57.933600084142142
Y actual = 11.89457829 | Y Predicted = 5.9897284139569127
Y actual = 94.79081712 | Y Predicted = 95.892583227739038
Y actual = 25.690415460000001 | Y Predicted = 22.971378767671315
Y actual = 53.520423190000002 | Y Predicted = 57.933600084142142
Y actual = 18.31396758 | Y Predicted = 22.971378767671315
Y actual = 21.426377850000002 | Y Predicted = 18.975696331503219
Y actual = 30.413032820000002 | Y Predicted = 24.969219985755363
Y actual = 67.681421490000005 | Y Predicted = 63.927123738394286
Y actual = 17.085478299999998 | Y Predicted = 20.973537549587267
Y actual = 60.917927069999998 | Y Predicted = 58.932520693184166
Y actual = 14.99514319 | Y Predicted = 18.975696331503219
Y actual = 16.749239370000002 | Y Predicted = 15.978934504377149
Y actual = 41.469238830000002 | Y Predicted = 41.950870339469766
Y actual = 42.84526108 | Y Predicted = 42.94979094851179
Y actual = 59.129129740000003 | Y Predicted = 60.930361911268214
Y actual = 91.308636730000003 | Y Predicted = 91.896900791570943
Y actual = 8.6733363570000002 | Y Predicted = 10.984331459167031
Y actual = 39.31485292 | Y Predicted = 40.951949730427742
Y actual = 5.3136862049999998 | Y Predicted = 0.99512536874679469
Y actual = 5.4052205180000001 | Y Predicted = 7.9875696320409597
Y actual = 68.545887899999997 | Y Predicted = 70.919568001688447
Y actual = 47.334876289999997 | Y Predicted = 45.946552775637862
Y actual = 54.090636859999996 | Y Predicted = 54.93683825701607
Y actual = 63.29717058 | Y Predicted = 61.929282520310238
Y actual = 52.459466880000001 | Y Predicted = 46.945473384679886

Ending Linear Regression with m = 0.99892060904202362 b = -0.0037952
402952288961 error = 7.8922376235243767
```