1.Importing Libraries

In [1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import matplotlib.axes as ax
```

2.Loading Data

In [2]:
```
data = pd.read_csv(r'C:\Users\G.SAI KRISHNA\Desktop\ML_Projects\ML_GFG\train.csv')
```

In [3]:
```
data.head()
```

Out[3]:

	x	y
0	24.0	21.549452
1	50.0	47.464463
2	15.0	17.218656
3	38.0	36.586398
4	87.0	87.288984

In [4]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 700 entries, 0 to 699
Data columns (total 2 columns):
 #   Column  Non-Null Count  Dtype  
---  ------  --------------  -----  
 0   x       700 non-null    float64
 1   y       699 non-null    float64
dtypes: float64(2)
memory usage: 11.1 KB
```

3.Data Preprocessing

In [5]:
```
#Handling Null Values
data = data.dropna(axis=0)
```

In [6]:
```
data['x'].max()
```

Out[6]:
```
100.0
```

In [7]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 699 entries, 0 to 699
Data columns (total 2 columns):
 #   Column  Non-Null Count  Dtype  
---  ------  --------------  -----  
 0   x       699 non-null    float64
 1   y       699 non-null    float64
dtypes: float64(2)
memory usage: 16.4 KB
```

4.Data Splitting

In [8]:
```
train_input = np.array(data.iloc[0:500,0]).reshape(500,1)
train_output = np.array(data.iloc[0:500,1]).reshape(500,1)

test_input = np.array(data.iloc[500:700,0]).reshape(199,1)
test_output = np.array(data.iloc[500:700,1]).reshape(199,1)
```

In [9]:
```
train_input.shape
```

Out[9]:
```
(500, 1)
```

In [10]:
```
train_output.shape
```

Out[10]:
```
(500, 1)
```

In [11]:
```
test_input.shape
```

Out[11]:
```
(199, 1)
```

In [12]:
```
test_output.shape
```

Out[12]:
```
(199, 1)
```

5.Linear Regression

Train the Data

we should follow the sequence of steps:

- Forward Propagation
- Cost Function
- Backward Propagation
- Update Parameters

In [ ]:
```

```

Forward Propagation

f(x) = mx+c

where m & c are the parameters that model will learn through training

In [13]:
```
def forward_propagation(train_input,parameters):
    m=parameters['m']
    c=parameters['c']

    predictions = np.multiply(m,train_input) + c
    return predictions
```

Cost Function

cost = ((y - f(x))^2)/2n

where y is the actual value and f(x) is the predicted value

In [14]:
```
def cost_function(predictions,train_output):
    cost = np.mean((predictions - train_output)**2) * 0.5
    return cost
```

Back Propagation

Using Chain Rule

- cost
- f=f(x)

Partial Derivative of cost wrt m is dcost/dm = dcost/df * df/dm Partial Derivative of cost wrt c is dcost/dc = dcost/df * df/dc

- dcost/df = f-y
- df/dm = x
- df/dc = 1

In [15]:
```
def backward_propagation(train_input,train_output,predictions):
    derivatives = dict()
    df = predictions - train_output
    dm = np.mean(np.multiply(df,train_input))
    dc = np.mean(df)

    derivatives['dm']=dm
    derivatives['dc']=dc
    return derivatives
```

Updating the parameters

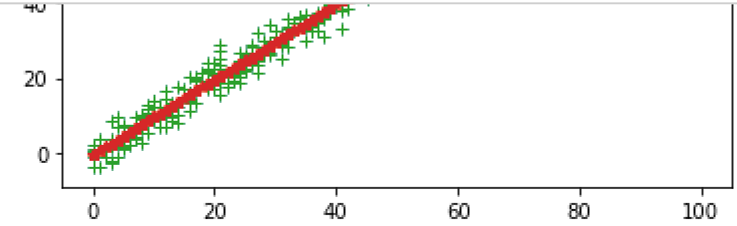
- m' = m - learning_rate * dm
- c' = c - learning_rate * dc

In [16]:
```
def update_parameters(parameters,derivatives,learning_rate):
    parameters['m'] = parameters['m'] - learning_rate * derivatives['dm']
    parameters['c'] = parameters['c'] - learning_rate * derivatives['dc']
    return parameters
```

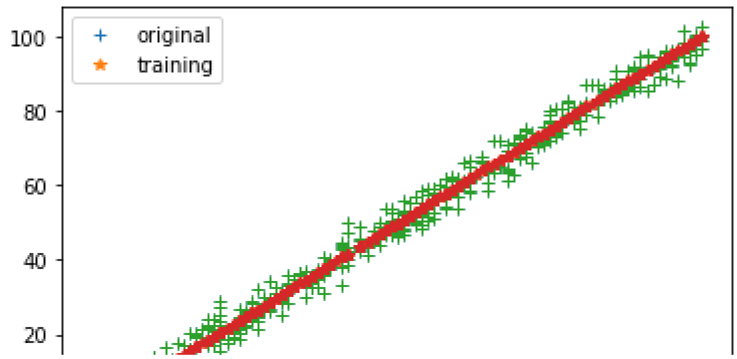
Training

In [17]:
```
def train(train_input,train_output,learning_rate,iters):
    parameters = dict()
    parameters['m'] = np.random.uniform(0,1) * -1
    parameters['c'] = np.random.uniform(0,1) * -1

    plt.figure()
    loss = list()
    for i in range(iters):
        predictions = forward_propagation(train_input,parameters)

        cost = cost_function(predictions,train_output)

        loss.append(cost)

        #Plotting the graph
        fig,ax = plt.subplots()
        ax.plot(train_input,train_output,'+',label='original')
        ax.plot(train_input,predictions,'*',label='training')
        legend = ax.legend()
        plt.plot(train_input,train_output,'+')
        plt.plot(train_input,predictions,'*')
        plt.show()
        print('Iterations :'+str(i+1)+' Loss : '+str(cost))

        derivatives = backward_propagation(train_input,train_output,predictions)

        parameters = update_parameters(parameters,derivatives,learning_rate)
    return parameters,loss
```

In [18]:
```
parameters,loss = train(train_input,train_output,0.0001,20)
```



```
Iterations :17 Loss : 3.949239507365849
```

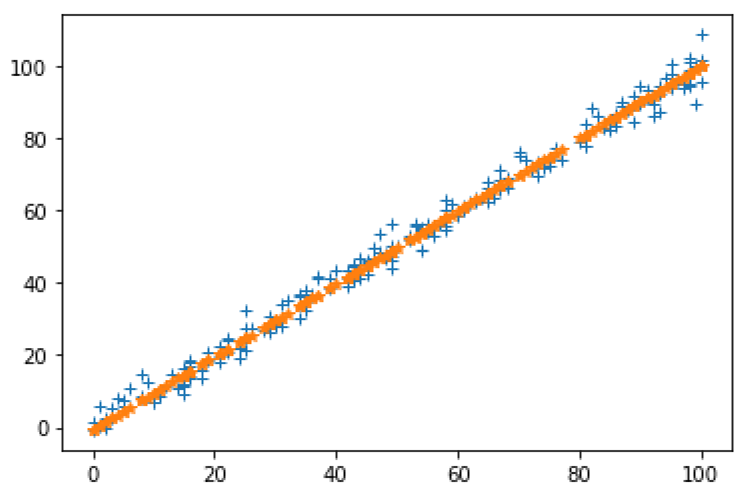


In [19]:
```
parameters
```

Out[19]:
```
{'m': 1.0081519282056082, 'c': -0.7370844700656352}
```

Predictions

In [20]:
```
test_predictions = parameters['m'] * test_input + parameters['c']

plt.figure()
plt.plot(test_input,test_output,'+')
plt.plot(test_input,test_predictions,'*')
plt.show()
```



Cost for test data

In [21]:
```
cost = cost_function(test_predictions,test_output)
print("Accuracy : "+str(100 - cost)+"%")
```

```
Accuracy : 95.89051369152943%
```