In [3]:

```
import matplotlib.pyplot as plt
import numpy as np
import random
import math
from sklearn.model_selection import train_test_split

# My imports
import pandas as pd
```

In [29]:

```
class MyLinReg(object):

    def __init__ (self, n_weights):
        self.weights = np.zeros([(n_weights+1),])

    def fit(self,X,y):
        X_1s = np.c_[np.ones([X.shape[0],1]),X]
        X_1s_dagger = np.linalg.pinv(X_1s)
        self.weights = np.matmul(X_1s_dagger,y)

    def predict(self,X):
        X_1s = np.c_[np.ones([X.shape[0],1]),X]
        #yhat = np.sign(np.matmul(X_1s,self.weights)) # <-- Used for classifier
        yhat = np.matmul(X_1s,self.weights)            # <-- Used for regression

        return yhat

    # For reference and comparison from sklearn classifier classes
    #def score(self,X,y):
    #    from sklearn.metrics import accuracy_score
    #    return accuracy_score(y, self.predict(X), sample_weight=None)

    def score(self,X,y):
        yhat = self.predict(X)
        errors = 0
        for i in range(len(y)):
            if(y[i]!=yhat[i]):
                errors+=1

        return 1-(errors/len(y))
```

In [5]:

```
df = pd.read_csv("./Task4.csv")

print("Number of Samples  in Dataset:\t",df.shape[0])
print("Number of Features in Dataset:\t",df.shape[1])
```

```
Number of Samples  in Dataset:   100
Number of Features in Dataset:   2
```

In [6]:

```
# Print statistical summary for all attributes
df.describe(include='all')
```

Out[6]:

	X	y
count	100.000000	100.000000
mean	0.499995	0.786404
std	0.293037	0.396402
min	0.000000	-0.347000
25%	0.250250	0.639750
50%	0.500000	0.928000
75%	0.749750	1.075000
max	1.000000	1.270000

In [57]:

```
X = df['X']
X = np.expand_dims(X, axis=1)
y = df['y']
```

In [58]:

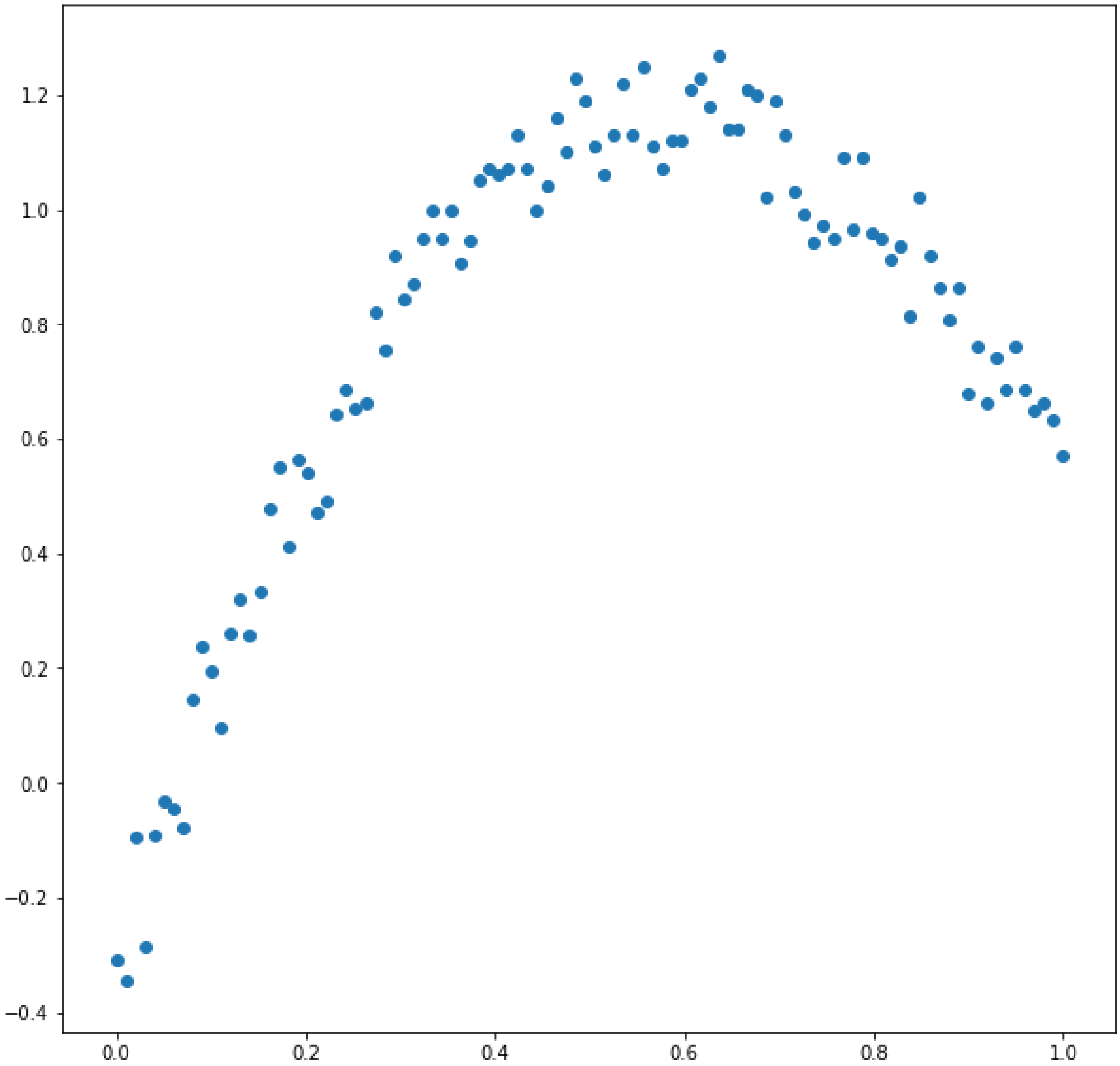
```
print(X.shape)
print(y.shape)
```

```
(100, 1)
(100,)
```

In [59]:

```
# Plot Training Data
plt.rcParams["figure.figsize"] = (10, 10)
#plt.title("Dataset with Decision Boundary")
plt.scatter(X, y)


plt.show()
```



In [60]:

```
df['Xsqrd'] = (X)**2
```

In [61]:

```
df.describe(include='all')
```

Out[61]:

	X	y	Xsqrd
count	100.000000	100.000000	100.000000
mean	0.499995	0.786404	0.335007
std	0.293037	0.396402	0.302833
min	0.000000	-0.347000	0.000000
25%	0.250250	0.639750	0.062648
50%	0.500000	0.928000	0.250025
75%	0.749750	1.075000	0.562148
max	1.000000	1.270000	1.000000

In [62]:

```
df.head()
```

Out[62]:

	X	y	Xsqrd
0	0.0000	-0.3080	0.000000
1	0.0101	-0.3470	0.000102
2	0.0202	-0.0937	0.000408
3	0.0303	-0.2860	0.000918
4	0.0404	-0.0927	0.001632

In [63]:

```
X_parab = df[['X','Xsqrd']].values
```

In [49]:

```
print(X_parab)
```

```
[[0.00000e+00 0.00000e+00]
 [1.01000e-02 1.02010e-04]
 [2.02000e-02 4.08040e-04]
 [3.03000e-02 9.18090e-04]
 [4.04000e-02 1.63216e-03]
 [5.05000e-02 2.55025e-03]
 [6.06000e-02 3.67236e-03]
 [7.07000e-02 4.99849e-03]
 [8.08000e-02 6.52864e-03]
 [9.09000e-02 8.26281e-03]
 [1.01000e-01 1.02010e-02]
 [1.11000e-01 1.23210e-02]
 [1.21000e-01 1.46410e-02]
 [1.31000e-01 1.71610e-02]
 [1.41000e-01 1.98810e-02]
 [1.52000e-01 2.31040e-02]
 [1.62000e-01 2.62440e-02]
 [1.72000e-01 2.95840e-02]
 [1.82000e-01 3.31240e-02]
 [1.92000e-01 3.68640e-02]
 [2.02000e-01 4.08040e-02]
 [2.12000e-01 4.49440e-02]
 [2.22000e-01 4.92840e-02]
 [2.32000e-01 5.38240e-02]
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 [2.53000e-01 6.40090e-02]
 [2.63000e-01 6.91690e-02]
 [2.73000e-01 7.45290e-02]
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 [3.43000e-01 1.17649e-01]
 [3.54000e-01 1.25316e-01]
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 [3.74000e-01 1.39876e-01]
 [3.84000e-01 1.47456e-01]
 [3.94000e-01 1.55236e-01]
 [4.04000e-01 1.63216e-01]
 [4.14000e-01 1.71396e-01]
 [4.24000e-01 1.79776e-01]
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 [4.44000e-01 1.97136e-01]
 [4.55000e-01 2.07025e-01]
 [4.65000e-01 2.16225e-01]
 [4.75000e-01 2.25625e-01]
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 [5.15000e-01 2.65225e-01]
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 [5.45000e-01 2.97025e-01]
 [5.56000e-01 3.09136e-01]
 [5.66000e-01 3.20356e-01]
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 [5.96000e-01 3.55216e-01]
 [6.06000e-01 3.67236e-01]
```

```
 [6.16000e-01 3.79456e-01]
 [6.26000e-01 3.91876e-01]
 [6.36000e-01 4.04496e-01]
 [6.46000e-01 4.17316e-01]
 [6.57000e-01 4.31649e-01]
 [6.67000e-01 4.44889e-01]
 [6.77000e-01 4.58329e-01]
 [6.87000e-01 4.71969e-01]
 [6.97000e-01 4.85809e-01]
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 [7.78000e-01 6.05284e-01]
 [7.88000e-01 6.20944e-01]
 [7.98000e-01 6.36804e-01]
 [8.08000e-01 6.52864e-01]
 [8.18000e-01 6.69124e-01]
 [8.28000e-01 6.85584e-01]
 [8.38000e-01 7.02244e-01]
 [8.48000e-01 7.19104e-01]
 [8.59000e-01 7.37881e-01]
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 [8.79000e-01 7.72641e-01]
 [8.89000e-01 7.90321e-01]
 [8.99000e-01 8.08201e-01]
 [9.09000e-01 8.26281e-01]
 [9.19000e-01 8.44561e-01]
 [9.29000e-01 8.63041e-01]
 [9.39000e-01 8.81721e-01]
 [9.49000e-01 9.00601e-01]
 [9.60000e-01 9.21600e-01]
 [9.70000e-01 9.40900e-01]
 [9.80000e-01 9.60400e-01]
 [9.90000e-01 9.80100e-01]
 [1.00000e+00 1.00000e+00]]
```

In [64]:

```
mlr_orig = MyLinReg(X.shape[1])
mlr_orig.fit(X,y)
```

In [65]:

```
yhat_orig = mlr_orig.predict(X)
```

In [66]:

```
mlr_parab = MyLinReg(X_parab.shape[1])
mlr_parab.fit(X_parab,y)
```

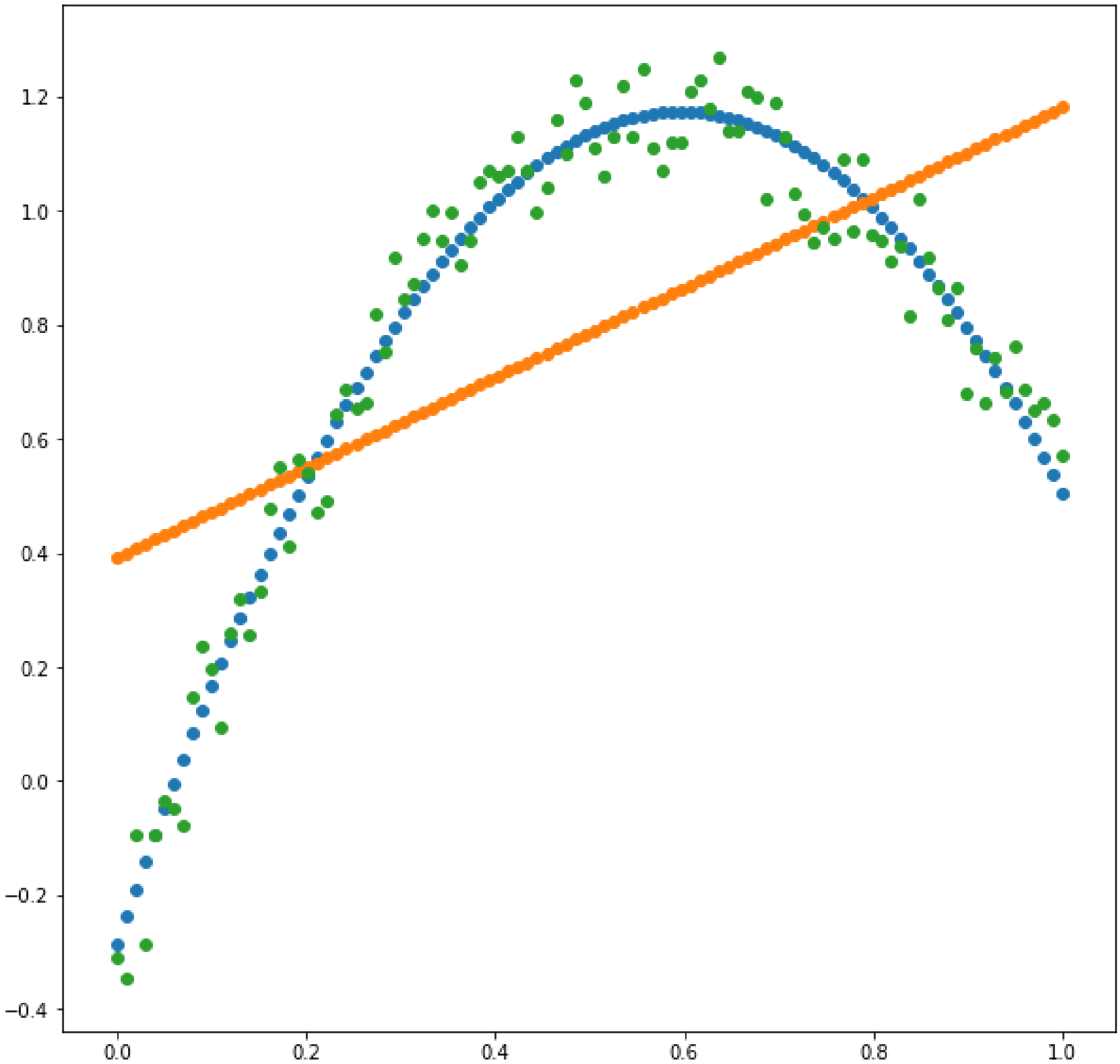
In [67]:

```
yhat_parab = mlr_parab.predict(X_parab)
```

In [69]:

```
# Plot Training Data
plt.rcParams["figure.figsize"] = (10, 10)
#plt.title("Dataset with Decision Boundary")
plt.scatter(X, yhat_parab)
plt.scatter(X, yhat_orig)
plt.scatter(X, y)


plt.show()
```



In [ ]: