In [2]:

```
############################################################################
#LINEAR REGRESSION
#Basic numpy, pandas and matplotlib imports
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import os
from sklearn import metrics
from sklearn.linear_model import LinearRegression

#getting the directory
THIS_FOLDER = os.path.abspath('')


#setting the training and testing dataset path
class Dataset:
  train=os.path.join(THIS_FOLDER, 'wineQualityRed_train.csv')
  test=os.path.join(THIS_FOLDER, 'wineQualityRed_test.csv')

fields=["fixed acidity","volatile acidity","citric acid","residual sugar","ch
fields1=["fixed acidity","volatile acidity","citric acid","residual sugar","c

#X_TRAINING DATASET
train = pd.read_csv(Dataset.train, delimiter=';', header=None, skiprows=1,  r
#X_TESTING DATASET
test = pd.read_csv(Dataset.test, delimiter=';', header=None, skiprows=1,  nam

train.head()
```

Out[2]:

	fixed acidity	volatile acidity	citric acid	residual sugar	chlorides	free sulfur dioxide	total sulfur dioxide	density	pH	sulphates	alcohol
0	10.6	0.28	0.39	15.5	0.069	6.0	23.0	1.0026	3.12	0.66	9.2
1	9.4	0.30	0.56	2.8	0.080	6.0	17.0	0.9964	3.15	0.92	11.7
2	10.6	0.36	0.59	2.2	0.152	6.0	18.0	0.9986	3.04	1.05	9.4
3	10.6	0.36	0.60	2.2	0.152	7.0	18.0	0.9986	3.04	1.06	9.4
4	10.6	0.44	0.68	4.1	0.114	6.0	24.0	0.9970	3.06	0.66	13.4

In [3]:

```
test.head()
```

Out[3]:

	fixed acidity	volatile acidity	citric acid	residual sugar	chlorides	free sulfur dioxide	total sulfur dioxide	density	pH	sulphates	alcohol
0	7.4	0.70	0.00	1.9	0.076	11.0	34	0.9978	3.51	0.56	9.4
1	7.8	0.88	0.00	2.6	0.098	25.0	67	0.9968	3.20	0.68	9.8
2	7.8	0.76	0.04	2.3	0.092	15.0	54	0.9970	3.26	0.65	9.8
3	11.2	0.28	0.56	1.9	0.075	17.0	60	0.9980	3.16	0.58	9.8
4	7.4	0.70	0.00	1.9	0.076	11.0	34	0.9978	3.51	0.56	9.4

In [4]:

```
############################################################################
##LINEAR REGRESSION FOR SINGLE ATTRIBUTE

 #considering only 'fixed acidity' attribute
x_train=train.iloc[:,0:1].values
```

```
y_train=train.iloc[:,-1].values
regressor = LinearRegression()
regressor.fit(x_train, y_train)

#taking all test data for regression
x_test=test.iloc[:,0:1].values
y_test=test.iloc[:,-1].values

#predict y for test data
y_pred = regressor.predict(x_test)
df = pd.DataFrame({'Actual': y_test, 'Predicted': y_pred})
df.head()
```

Out[4]:

	Actual	Predicted
0	5	5.646777
1	5	5.657007
2	5	5.657007
3	6	5.743954
4	5	5.646777

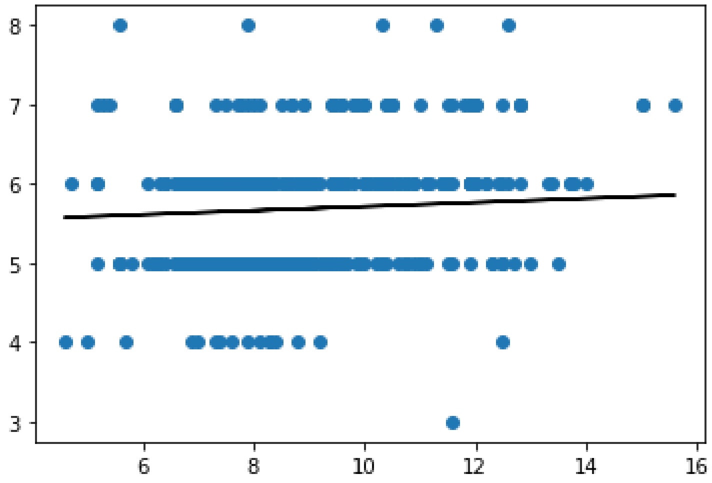
In [7]:

```
print('Mean Squared Error:', metrics.mean_squared_error(y_test, y_pred))

#intercept
print("Intercept:", regressor.intercept_)
#slope
print("Slope:", regressor.coef_)

#plot the values for fixed acidity feature
plt.scatter(x_test, y_test)
plt.plot(x_test, y_pred, color='black')
print("*********************************************************************"
print("fixed acidity x_test vs y_pred")
plt.show()
```

```
Mean Squared Error: 0.5839186420366159
Intercept: 5.457538106303752
Slope: [0.02557288]
*********************************************************************
fixed acidity x_test vs y_pred
```



In [8]:

```
############################################################################
##LINEAR REGRESSION FOR ALL ATTRIBUTES

x_train_all = np.array(train.drop(['quality'], axis=1))
```

```
y_train_all = np.array(train['quality'])

x_test_all = np.array(test.drop(['quality'], axis=1))
y_test_all = np.array(test['quality'])


regressor_all = LinearRegression()
regressor_all.fit(x_train_all,y_train_all)

#intercept
print("Intercept:", regressor_all.intercept_)
#slope
print("Slope:", regressor_all.coef_)

test_pred = regressor_all.predict(x_test_all)
print(test_pred[:10])

predicted_data = np.round_(test_pred)
print(predicted_data[:10])
```

```
Intercept: 31.741831140740295
Slope: [-5.73100144e-03 -1.07148926e+00 -6.30475021e-02  1.02337212e-02
 -1.94044757e+00  3.51582257e-03 -2.15501378e-03 -2.68912590e+01
 -6.34244261e-01  1.24194845e+00  2.67754540e-01]
[4.94084106 5.16790302 5.214698   5.64933519 4.94084106 4.97871927
 5.05868681 5.26228712 5.26138255 5.75318328]
[5. 5. 5. 6. 5. 5. 5. 5. 5. 6.]
```

In [4]:

```
#mean absolute, mean squared, and root mean squared error calculation

print('Mean Absolute Error:', metrics.mean_absolute_error(y_test_all, test_pr
print('Mean Squared Error:', metrics.mean_squared_error(y_test_all, test_pred
print('Root Mean Squared Error:', np.sqrt(metrics.mean_squared_error(y_test_a
```

```
Mean Absolute Error: 0.5224781243375761
Mean Squared Error: 0.4463021333444595
Root Mean Squared Error: 0.6680584804824047
```