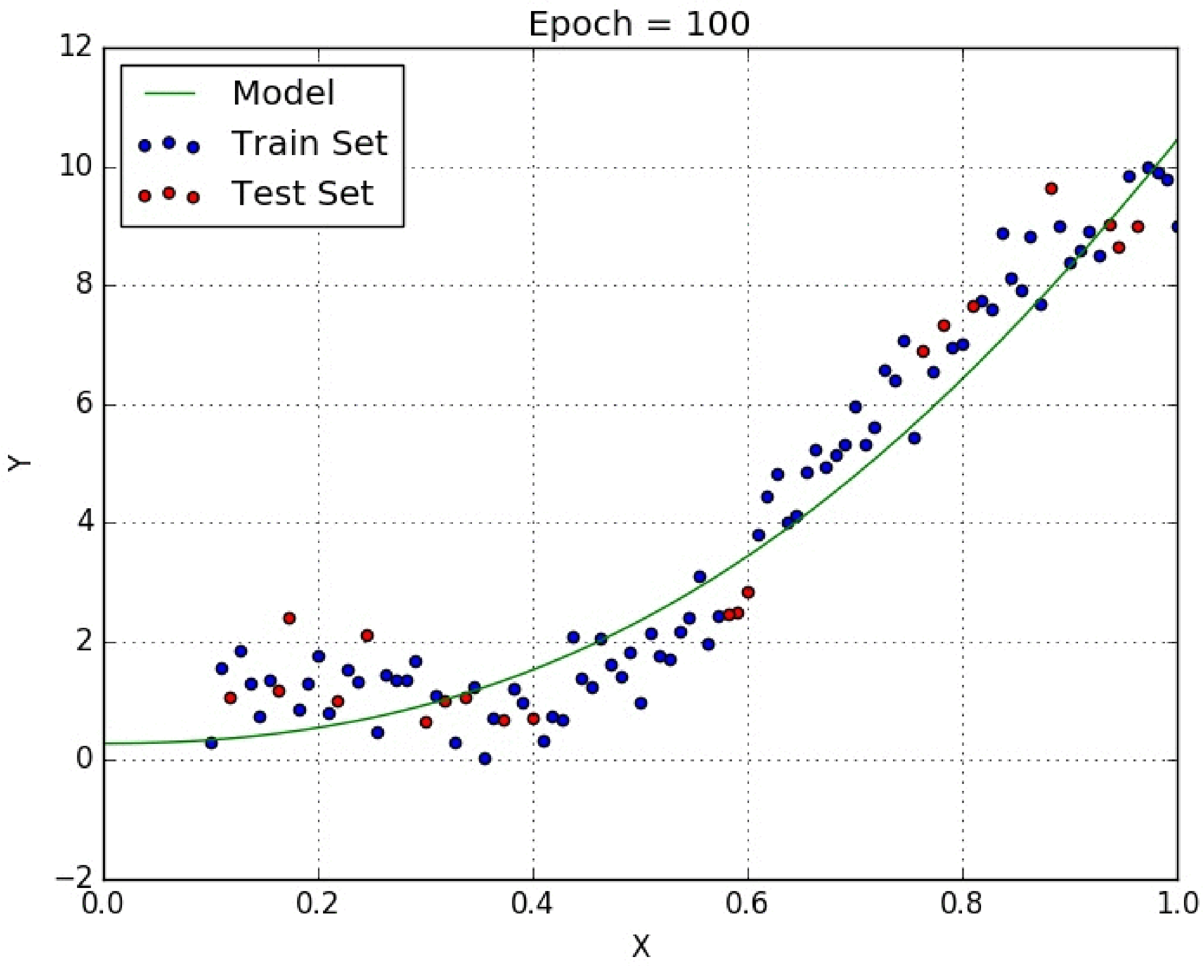
# Polynomial Regression on Random Values

## Polynomial Regression

In statistics, polynomial regression is a form of regression analysis in which the relationship between the independent variable x and the dependent variable y is modelled as an nth degree polynomial in x. Polynomial regression fits a nonlinear relationship between the value of x and the corresponding conditional mean of y

**Further Reference** [Click Here (https://en.wikipedia.org/wiki/Polynomial_regression)](https://en.wikipedia.org/wiki/Polynomial_regression)



In [1]:

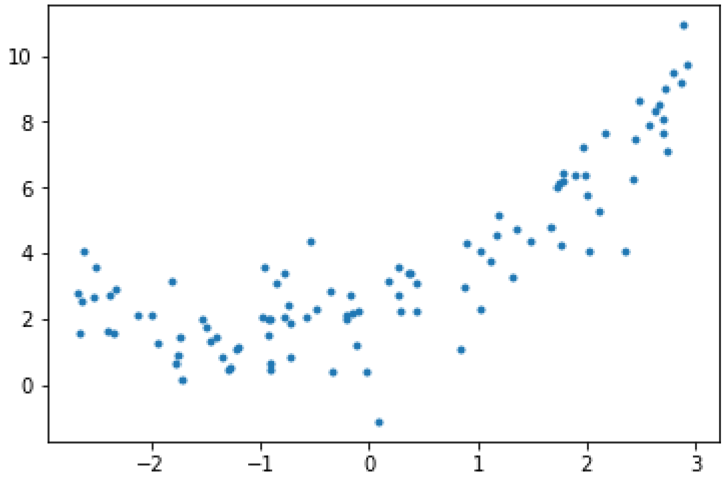
```
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd
import seaborn as sns
```

In [2]:

```
#Let's look at the following example
import numpy as np
m = 100
X= 6 * np.random.rand(m,1)-3
y = 0.5 * X**2 + X + 2 + np.random.randn(m,1)

import matplotlib.pyplot as plt
plt.plot(X,y,'.')
```

Out[2]:

```
[<matplotlib.lines.Line2D at 0x21eb1dca128>]
```



In [3]:

```
from sklearn.model_selection import train_test_split

X_train,X_test,Y_train,Y_test = train_test_split(X,y,test_size = 0.3, random_state = 4
```

In [4]:

```
from sklearn.linear_model import LinearRegression

reg = LinearRegression()

reg.fit(X_train,Y_train)
Y_pred = reg.predict(X_test)
reg.score(X_test,Y_test)
```

Out[4]:

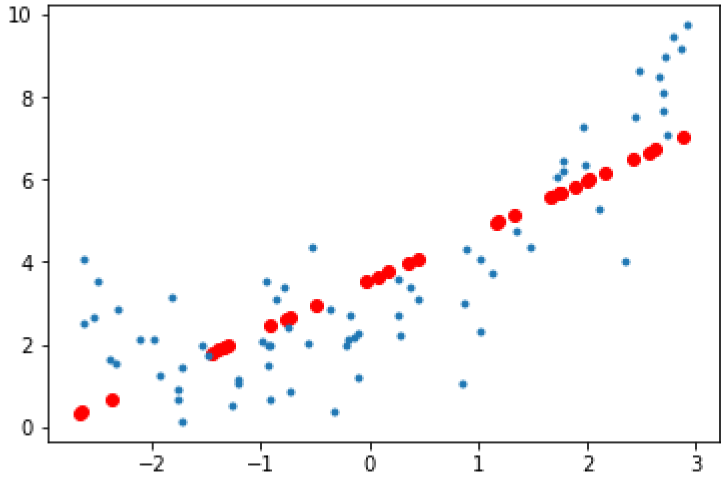
```
0.6032492213239631
```

In [5]:

```
plt.scatter(X_test,Y_pred,color = 'r')
plt.plot(X_train,Y_train,'.')
```

Out[5]:

```
[<matplotlib.lines.Line2D at 0x21eb3710320>]
```



We can see that the straight line is unable to capture the patterns in the data. This is an example of **under-fitting**.

In [6]:

```
from sklearn.preprocessing import PolynomialFeatures
poly_features = PolynomialFeatures(degree = 2,include_bias = False)

X_poly = poly_features.fit_transform(X)
```

In [7]:

```
X[0]
```

Out[7]:

```
array([-2.64905042])
```

In [8]:

```
X_poly[0]
```

Out[8]:

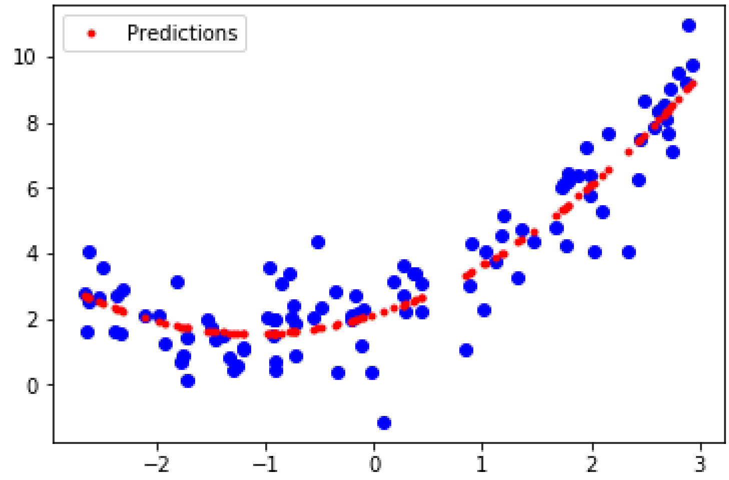
```
array([-2.64905042,  7.01746815])
```

In [9]:

```python
from sklearn.linear_model import LinearRegression
lin_reg = LinearRegression()

lin_reg.fit(X_poly,y)

plt.scatter(X, y, color = 'blue')

plt.plot(X, lin_reg.predict(poly_features.fit_transform(X)),'.',color = 'r',label = 'P
plt.legend()
```

Out[9]:

```
<matplotlib.legend.Legend at 0x21eb394c5f8>
```



In [10]:

```python
print('C:',lin_reg.intercept_,'A: ',lin_reg.coef_[0][1],'B:',lin_reg.coef_[0][0])
```

```
C: [2.12690149] A:  0.47017793620363607 B: 1.0394659015836516
```

In [11]:

```python
lin_reg.score(X_poly, y)
```

Out[11]:

```
0.8459978117318867
```