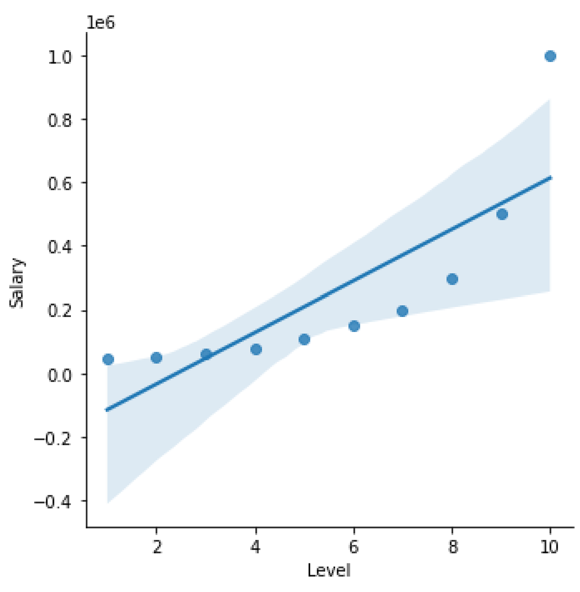
In [3]:
```
import pandas as pd
import numpy as np
import seaborn as sb
import matplotlib.pyplot as plt
```

In [4]:
```
ds=pd.read_csv(r"C:\Users\sojwa\Downloads\archive\Position_Salaries.csv")
```

In [5]:
```
sb.lmplot(x='Level',y='Salary',data=ds)
```

Out[5]:
```
<seaborn.axisgrid.FacetGrid at 0x1cd9e6e9760>
```




In [6]:
```
ds
```

Out[6]:

| | Position | Level | Salary |
|---|---|---|---|
| 0 | Business Analyst | 1 | 45000 |
| 1 | Junior Consultant | 2 | 50000 |
| 2 | Senior Consultant | 3 | 60000 |
| 3 | Manager | 4 | 80000 |
| 4 | Country Manager | 5 | 110000 |
| 5 | Region Manager | 6 | 150000 |
| 6 | Partner | 7 | 200000 |
| 7 | Senior Partner | 8 | 300000 |
| 8 | C-level | 9 | 500000 |
| 9 | CEO | 10 | 1000000 |

In [7]:
```
from sklearn.model_selection import train_test_split
```

In [8]:
```
X=ds['Level']
y=ds['Salary']
```

In [9]:
```
X = X.values.reshape(-1, 1)
```

In [10]:
```
X_train,X_test,y_train,y_test =train_test_split(X,y, test_size=0.3 ,random_state=42)
```

In [11]:
```
print("Shape of X_train:", X_train.shape)
print("Shape of y_train:", y_train.shape)
print("Shape of X_test:", X_test.shape)
print("Shape of y_test:", y_test.shape)
```

```
Shape of X_train: (7, 1)
Shape of y_train: (7,)
Shape of X_test: (3, 1)
Shape of y_test: (3,)
```

In [12]:
```
X_train
```

Out[12]:
```
array([[ 1],
       [ 8],
       [ 3],
       [10],
       [ 5],
       [ 4],
       [ 7]], dtype=int64)
```

In [13]:
```
X_test
```

Out[13]:
```
array([[9],
       [2],
       [6]], dtype=int64)
```

In [14]:
```
y_train
```

Out[14]:
```
0      45000
7     300000
2      60000
9    1000000
4     110000
3      80000
6     200000
Name: Salary, dtype: int64
```

In [15]:
```
y_test
```

Out[15]:
```
8    500000
1     50000
5    150000
Name: Salary, dtype: int64
```

In [16]:
```
from sklearn.linear_model import LinearRegression #importing linearRegree algo
from sklearn.model_selection import train_test_split
from sklearn.metrics import mean_squared_error,r2_score
```

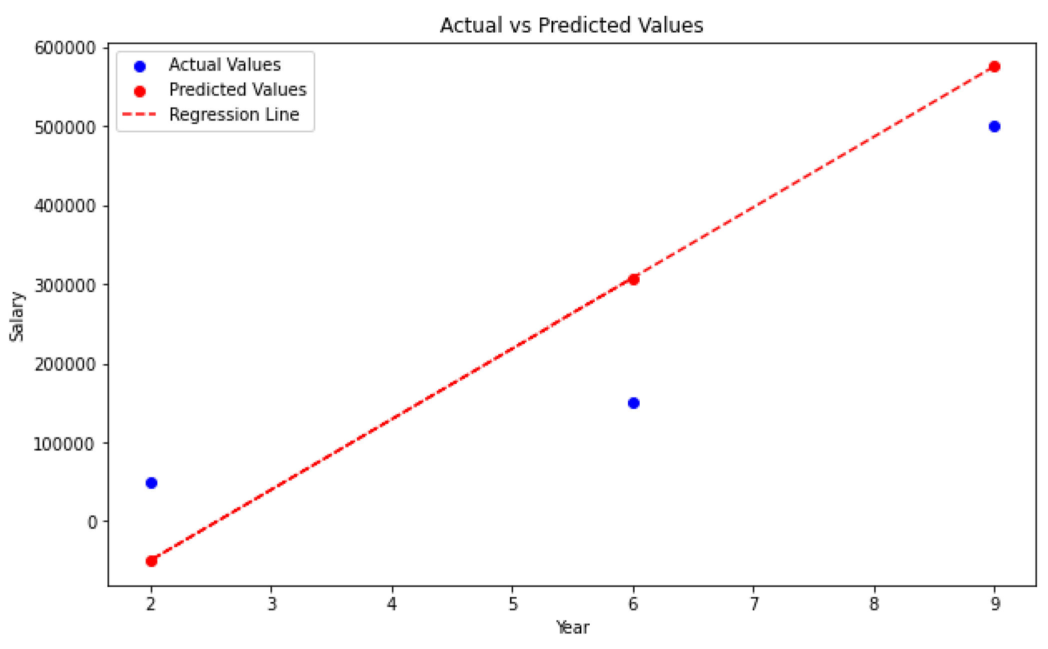
In [17]:
```
model1=LinearRegression()
```

In [18]:
```
model1.fit(X_train,y_train)
```

Out[18]:
```
LinearRegression()
```

In [19]:
```
y_pred=model1.predict(X_test)
```

In [20]:
```
plt.figure(figsize=(10, 6))
plt.scatter(X_test, y_test, color='blue', label='Actual Values')  # Actual values
plt.scatter(X_test, y_pred, color='red', label='Predicted Values')  # Predicted values
plt.plot(X_test, y_pred, color='red', linestyle='--', label='Regression Line')  # Regression line
plt.title('Actual vs Predicted Values')
plt.xlabel('Year')
plt.ylabel('Salary')
plt.legend()
plt.show()
```




In [21]:
```
mse=mean_squared_error(y_test,y_pred)
r2=r2_score(y_test,y_pred)
```

In [22]:
```
print(f"Mean Squared Error:{mse}")
print(f"R2 Score: {r2}")
```

```
Mean Squared Error:13447704524.474731
R2 Score: 0.6387183859096339
```

In [23]:
```
model1.predict([[6.5]])
```

Out[23]:
```
array([352048.26732673])
```

In [24]:
```
#Therefore the error is very high and we cannot get good results with linear Regression
```

In [25]:
```
from sklearn.preprocessing import PolynomialFeatures
```

In [26]:
```
poly=PolynomialFeatures(degree=3)
```

In [27]:
```
#x_poly=poly.fit_transform(X)       #Transforms x in the degree making it non-linear equation
X_train_poly = poly.fit_transform(X_train)
X_test_poly = poly.transform(X_test)
```

In [28]:
```
reg2=LinearRegression()
```

In [29]:
```
reg2.fit(X_train_poly,y_train)
```

Out[29]:
```
LinearRegression()
```

In [30]:
```
reg2.predict(poly.fit_transform([[6.5]])) #compare 45th cell
```

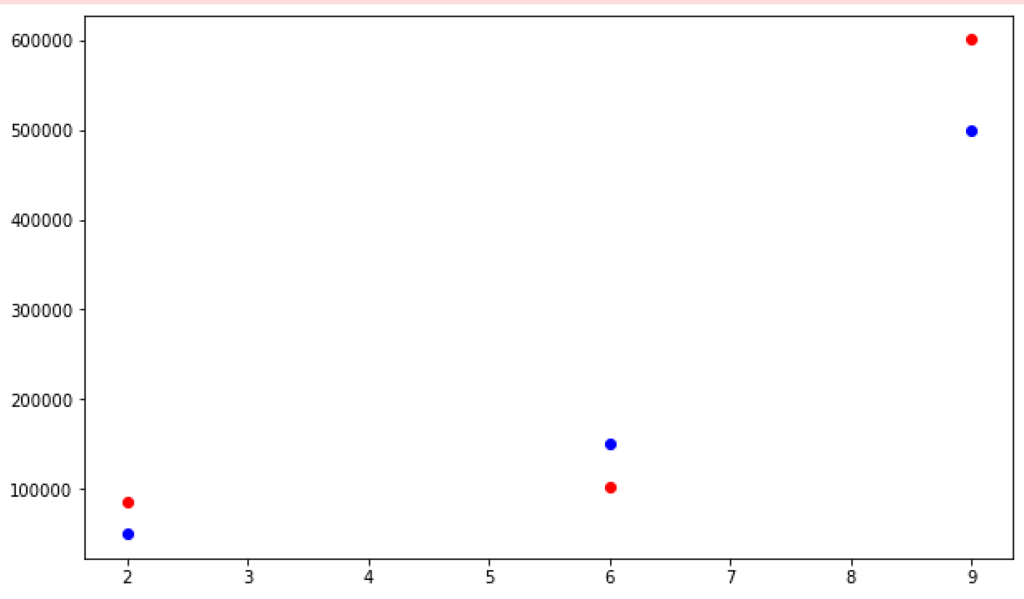
Out[30]:
```
array([132461.20101472])
```

In [31]:
```
y_pred = reg2.predict(X_test_poly)
```

In [32]:
```
# Plotting the results
plt.figure(figsize=(10, 6))
plt.scatter(X_test, y_test, color='blue', label='Actual Values')  # Actual values
plt.scatter(X_test, y_pred, color='red', label='Predicted Values')  # Predicted values
plt.plot(x, y_pred, color='blue')
```

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
Input In [32], in <cell line: 5>()
      3 plt.scatter(X_test, y_test, color='blue', label='Actual Values')  # Actual values
      4 plt.scatter(X_test, y_pred, color='red', label='Predicted Values')  # Predicted values
----> 5 plt.plot(x, y_pred, color='blue')

NameError: name 'x' is not defined
```



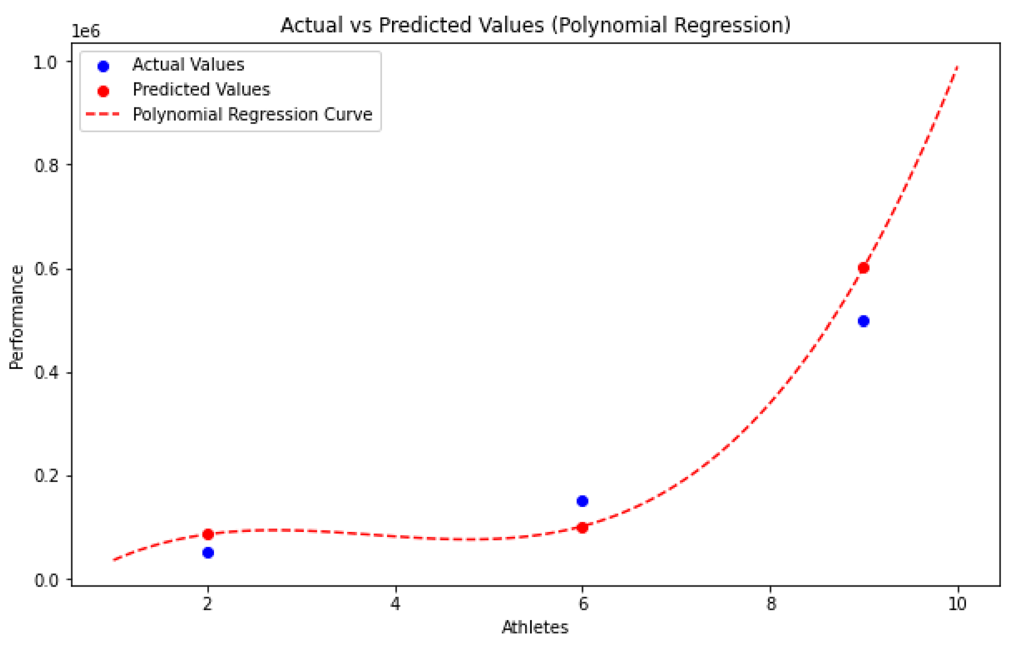

In [33]:
```
# To plot a smooth curve, use the entire range of X values
plt.figure(figsize=(10, 6))
plt.scatter(X_test, y_test, color='blue', label='Actual Values')  # Actual values
plt.scatter(X_test, y_pred, color='red', label='Predicted Values')  # Predicted values
X_range = np.linspace(X.min(), X.max(), 100).reshape(-1, 1)  # Create a smooth range of X values
X_range_poly = poly.transform(X_range)  # Transform the X range using the same polynomial transformation
y_range_pred = reg2.predict(X_range_poly)  # Predict using the polynomial model

# Plot the polynomial regression curve
plt.plot(X_range, y_range_pred, color='red', linestyle='--', label='Polynomial Regression Curve')

# Add title and labels
plt.title('Actual vs Predicted Values (Polynomial Regression)')
plt.xlabel('Athletes')
plt.ylabel('Performance')

# Show legend
plt.legend()

# Show the plot
plt.show()
```




In [38]:
```
r2=r2_score(y_test,y_pred)
```

In [39]:
```
r2
```

Out[39]:
```
0.8765474238100401
```