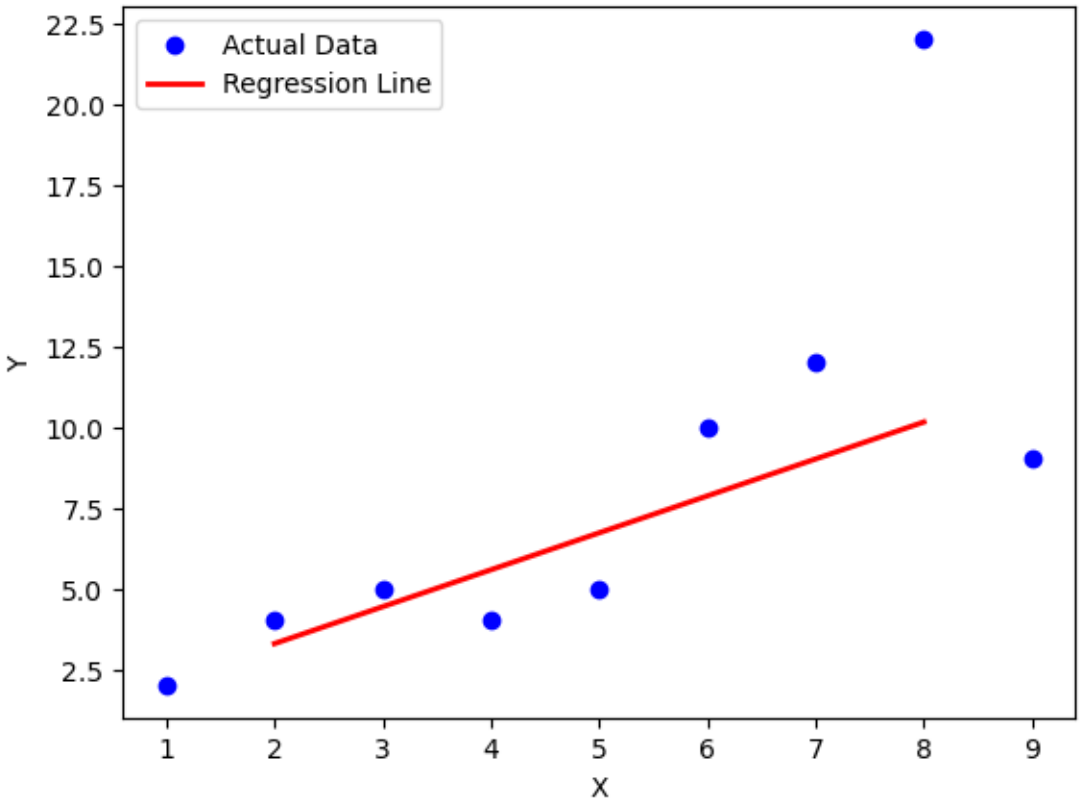
Activity - Answers

November 13, 2023

[3]:
```
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error
import matplotlib.pyplot as plt

data = {
    'X': [1, 2, 3, 4, 5, 6, 7, 8, 9],
    'Y': [2, 4, 5, 4, 5, 10, 12, 22, 9]
}

df = pd.DataFrame(data)

X = df[['X']]
y = df['Y']

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2,␣
 ↪random_state=42)

model = LinearRegression()
model.fit(X_train, y_train)
y_pred = model.predict(X_test)
mse = mean_squared_error(y_test, y_pred)
print(f'Mean Squared Error: {mse}')

plt.scatter(X, y, color='blue', label='Actual Data')
plt.plot(X_test, y_pred, color='red', linewidth=2, label='Regression Line')
plt.xlabel('X')
plt.ylabel('Y')
plt.legend()
plt.show()
```

```
Mean Squared Error: 70.5510204081633
```

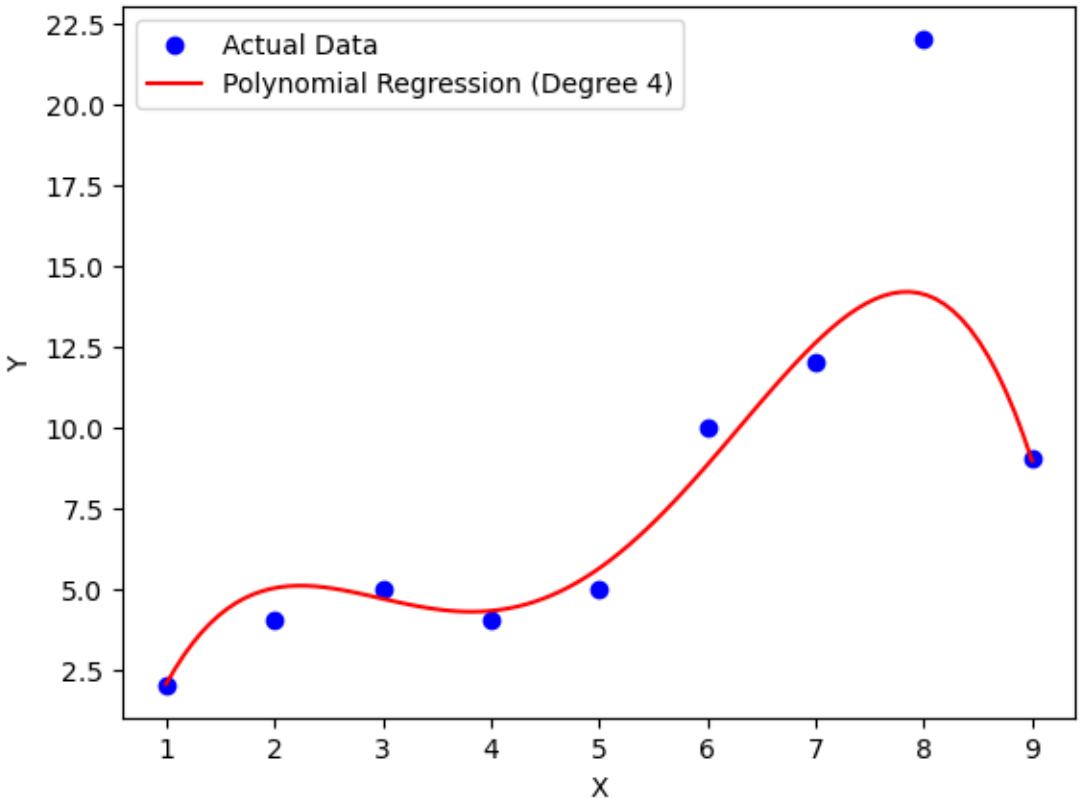


[6]:
```
import pandas as pd
import numpy as np
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import PolynomialFeatures
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error
import matplotlib.pyplot as plt


data = {
    'X': [1, 2, 3, 4, 5, 6, 7, 8, 9],
    'Y': [2, 4, 5, 4, 5, 10, 12, 22, 9]
}

df = pd.DataFrame(data)

X = df[['X']]
y = df['Y']
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2,␣
 ↪random_state=42)
```

```
degree = 4
poly_features = PolynomialFeatures(degree=degree)
X_train_poly = poly_features.fit_transform(X_train)
X_test_poly = poly_features.transform(X_test)

model = LinearRegression()

model.fit(X_train_poly, y_train)

y_pred = model.predict(X_test_poly)

mse = mean_squared_error(y_test, y_pred)
print(f'Mean Squared Error: {mse}')

X_plot = np.linspace(min(X['X']), max(X['X']), 100).reshape(-1, 1)
X_plot_poly = poly_features.transform(X_plot)
y_plot = model.predict(X_plot_poly)

plt.scatter(X['X'], y, color='blue', label='Actual Data')
plt.plot(X_plot, y_plot, color='red', label=f'Polynomial Regression (Degree␣
  ↪{degree})')
plt.xlabel('X')
plt.ylabel('Y')
plt.legend()
plt.show()
```

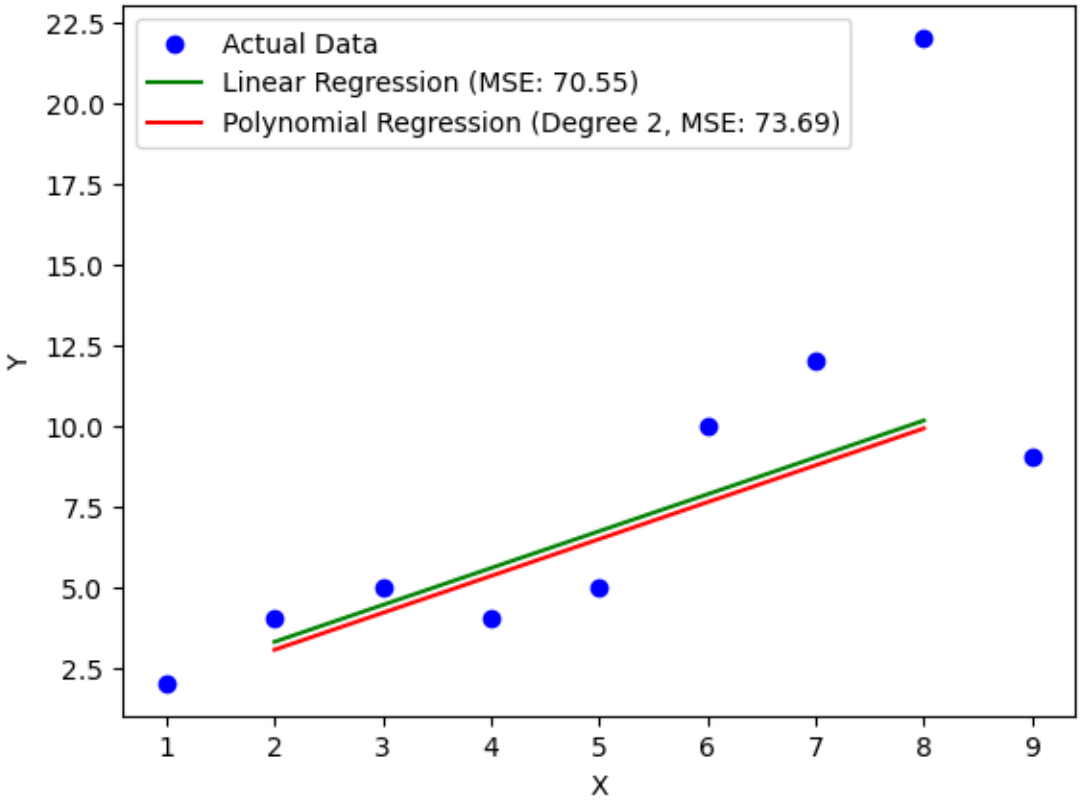
```
Mean Squared Error: 31.724021761840493
```

```
D:\YSJ_Applications\Lib\site-packages\sklearn\base.py:464: UserWarning: X does
not have valid feature names, but PolynomialFeatures was fitted with feature
names
  warnings.warn(
```



[8]:
```
import pandas as pd
import numpy as np
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.preprocessing import PolynomialFeatures
from sklearn.metrics import mean_squared_error
import matplotlib.pyplot as plt

data = {
    'X': [1, 2, 3, 4, 5, 6, 7, 8, 9],
    'Y': [2, 4, 5, 4, 5, 10, 12, 22, 9]
}

df = pd.DataFrame(data)

X = df[['X']]
y = df['Y']

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2,␣
 ↪random_state=42)
```

```
linear_model = LinearRegression()
linear_model.fit(X_train, y_train)
y_linear_pred = linear_model.predict(X_test)
mse_linear = mean_squared_error(y_test, y_linear_pred)

degree = 2
poly_features = PolynomialFeatures(degree=degree)
X_train_poly = poly_features.fit_transform(X_train)
X_test_poly = poly_features.transform(X_test)
poly_model = LinearRegression()
poly_model.fit(X_train_poly, y_train)
y_poly_pred = poly_model.predict(X_test_poly)
mse_poly = mean_squared_error(y_test, y_poly_pred)

plt.scatter(X['X'], y, color='blue', label='Actual Data')
plt.plot(X_test, y_linear_pred, color='green', label=f'Linear Regression (MSE:␣
 ↪{mse_linear:.2f})')
plt.plot(X_test, y_poly_pred, color='red', label=f'Polynomial Regression␣
 ↪(Degree {degree}, MSE: {mse_poly:.2f})')
plt.xlabel('X')
plt.ylabel('Y')
plt.legend()
plt.show()
```



[9]:

```
Requirement already satisfied: nbconvert in d:\ysj_applications\lib\site-
packages (6.5.4)
Requirement already satisfied: lxml in d:\ysj_applications\lib\site-packages
(from nbconvert) (4.9.3)
Requirement already satisfied: beautifulsoup4 in d:\ysj_applications\lib\site-
packages (from nbconvert) (4.12.2)
Requirement already satisfied: bleach in d:\ysj_applications\lib\site-packages
(from nbconvert) (4.1.0)
Requirement already satisfied: defusedxml in d:\ysj_applications\lib\site-
packages (from nbconvert) (0.7.1)
Requirement already satisfied: entrypoints>=0.2.2 in
d:\ysj_applications\lib\site-packages (from nbconvert) (0.4)
Requirement already satisfied: jinja2>=3.0 in d:\ysj_applications\lib\site-
packages (from nbconvert) (3.1.2)
Requirement already satisfied: jupyter-core>=4.7 in
d:\ysj_applications\lib\site-packages (from nbconvert) (5.3.0)
Requirement already satisfied: jupyterlab-pygments in
d:\ysj_applications\lib\site-packages (from nbconvert) (0.1.2)
Requirement already satisfied: MarkupSafe>=2.0 in d:\ysj_applications\lib\site-
packages (from nbconvert) (2.1.1)
Requirement already satisfied: mistune<2,>=0.8.1 in
d:\ysj_applications\lib\site-packages (from nbconvert) (0.8.4)
Requirement already satisfied: nbclient>=0.5.0 in d:\ysj_applications\lib\site-
packages (from nbconvert) (0.5.13)
Requirement already satisfied: nbformat>=5.1 in d:\ysj_applications\lib\site-
packages (from nbconvert) (5.9.2)
Requirement already satisfied: packaging in d:\ysj_applications\lib\site-
packages (from nbconvert) (23.1)
Requirement already satisfied: pandocfilters>=1.4.1 in
d:\ysj_applications\lib\site-packages (from nbconvert) (1.5.0)
Requirement already satisfied: pygments>=2.4.1 in d:\ysj_applications\lib\site-
packages (from nbconvert) (2.15.1)
Requirement already satisfied: tinycss2 in d:\ysj_applications\lib\site-packages
(from nbconvert) (1.2.1)
Requirement already satisfied: traitlets>=5.0 in d:\ysj_applications\lib\site-
packages (from nbconvert) (5.7.1)
Requirement already satisfied: platformdirs>=2.5 in
d:\ysj_applications\lib\site-packages (from jupyter-core>=4.7->nbconvert)
(3.10.0)
Requirement already satisfied: pywin32>=300 in d:\ysj_applications\lib\site-
packages (from jupyter-core>=4.7->nbconvert) (305.1)
Requirement already satisfied: jupyter-client>=6.1.5 in
d:\ysj_applications\lib\site-packages (from nbclient>=0.5.0->nbconvert) (7.4.9)
```

```
Requirement already satisfied: nest-asyncio in d:\ysj_applications\lib\site-
packages (from nbclient>=0.5.0->nbconvert) (1.5.6)
Requirement already satisfied: fastjsonschema in d:\ysj_applications\lib\site-
packages (from nbformat>=5.1->nbconvert) (2.16.2)
Requirement already satisfied: jsonschema>=2.6 in d:\ysj_applications\lib\site-
packages (from nbformat>=5.1->nbconvert) (4.17.3)
Requirement already satisfied: soupsieve>1.2 in d:\ysj_applications\lib\site-
packages (from beautifulsoup4->nbconvert) (2.4)
Requirement already satisfied: six>=1.9.0 in d:\ysj_applications\lib\site-
packages (from bleach->nbconvert) (1.16.0)
Requirement already satisfied: webencodings in d:\ysj_applications\lib\site-
packages (from bleach->nbconvert) (0.5.1)
Requirement already satisfied: attrs>=17.4.0 in d:\ysj_applications\lib\site-
packages (from jsonschema>=2.6->nbformat>=5.1->nbconvert) (22.1.0)
Requirement already satisfied: pyrsistent!=0.17.0,!=0.17.1,!=0.17.2,>=0.14.0 in
d:\ysj_applications\lib\site-packages (from
jsonschema>=2.6->nbformat>=5.1->nbconvert) (0.18.0)
Requirement already satisfied: python-dateutil>=2.8.2 in
d:\ysj_applications\lib\site-packages (from jupyter-
client>=6.1.5->nbclient>=0.5.0->nbconvert) (2.8.2)
Requirement already satisfied: pyzmq>=23.0 in d:\ysj_applications\lib\site-
packages (from jupyter-client>=6.1.5->nbclient>=0.5.0->nbconvert) (23.2.0)
Requirement already satisfied: tornado>=6.2 in d:\ysj_applications\lib\site-
packages (from jupyter-client>=6.1.5->nbclient>=0.5.0->nbconvert) (6.3.2)
Note: you may need to restart the kernel to use updated packages.
```