In [23]:
```
import numpy as np
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error
import warnings
warnings.filterwarnings('ignore')
```

In [56]:
```
X = np.array([1,2,3,4,5]).reshape(-1, 1)
y = np.array([52,55,61,70,82])
```

Model A

In [57]:
```
model_1 = LinearRegression()
model_1.fit(X, y)
```

Out[57]:
```
▾ LinearRegression (https://scikit-learn.org/1.7/modules/generated/sklearn.linear_model.LinearRegression.html)

Parameters
```

In [58]:
```
y_pred_model_a = model_1.predict(X)
print("\nTraining Predictions (Model A):")
print(y_pred_model_a)
```

```
Training Predictions (Model A):
[49.  56.5 64.  71.5 79. ]
```

Model B

In [59]:
```
x_flat = np.array([1, 2, 3, 4, 5])
y_data = np.array([52, 55, 61, 70, 82])
coeff = np.polyfit(x_flat, y_data, 4)
```

In [60]:
```
poly = np.poly1d(coeff)
y_pred_model_b = poly(x_flat)
print("\nTraining Predictions (Model B):")
print(y_pred_model_b)
```

```
Training Predictions (Model B):
[52. 55. 61. 70. 82.]
```

Prediction Comparison

In [61]:
```
x_test = 6
# Model A
y_pred_a_at_6 = model_1.predict([[x_test]])[0]
# Model B
y_pred_b_at_6 = poly(x_test)
```

In [62]:
```
print(f"Model A (Linear) Prediction: {y_pred_a_at_6:.4f} marks")
print(f"Model B (Polynomial) Prediction: {y_pred_b_at_6:.4f} marks")
```

```
Model A (Linear) Prediction: 86.5000 marks
Model B (Polynomial) Prediction: 97.0000 marks
```

Mean Squared Error for Model A and Model B

In [63]:
```
mse_model_a = mean_squared_error(y_data, y_pred_model_a)
mse_model_b = mean_squared_error(y_data, y_pred_model_b)
print(f"\n Model A (Linear):")
print(f"  Mean Squared Error (MSE): {mse_model_a:.6f}")
print(f"\nModel B (Polynomial Degree 4):")
print(f"  Mean Squared Error (MSE): {mse_model_b:.6f}")
print(f"  Polynomial Coefficients: {coeff}")
```

```
 Model A (Linear):
  Mean Squared Error (MSE): 6.300000

Model B (Polynomial Degree 4):
  Mean Squared Error (MSE): 0.000000
  Polynomial Coefficients: [ 2.81787389e-15 -3.20469691e-14  1.50000000e+00 -1.50000000e+00
  5.20000000e+01]
```

Bias , Variance comparison

In [ ]:
```
Model A (Linear Regression): Higher bias, lower variance - underfits due to simplicity.

Model B (Polynomial Degree 4): Higher variance, lower bias - overfits, captures noise.
```