In [ ]:
```
from google.colab import drive
drive.mount('/content/drive')
```

```
Mounted at /content/drive
```

In [ ]:
```
#upload the dataset on the left side in the folder for google collab first collected school data - http
s://docs.google.com/spreadsheets/d/1nnxghnlQG2ZtCIplWtgLhrakPdrW0Uem5rewHSeRN2c/edit?usp=sharing

import pandas as pd
data = pd.read_csv("/content/school.csv")
```

In [ ]:
```
data.drop("Index", axis=1, inplace=True)
```

In [ ]:
```
data
```

Out[ ]:

	School Name	Total Enrolments	Student Teacher Ratio	One AP Test	Math Scoring	English Scoring	Graduation Rate	Minority Enrolment	Free Lunch Program	College Readiness
0	AAEC: Paradise Valley	322.0	NaN	NaN	42.0	NaN	97	28.6	NaN	NaN
1	AAEC: South Mountain	499.0	NaN	NaN	12.0	NaN	100	93.8	18.0	NaN
2	Accelarated :Learning Center	151.0	NaN	NaN	NaN	NaN	62	25.8	NaN	NaN
3	Alhambra High School	2395.0	18:1	5.0	21.0	NaN	70	95.8	78.0	14.5
4	Arcadia High School	1625.0	23:1	21.0	29.0	NaN	94	49.0	12.0	29.6
...	...	...	...	...	...	...	...	...	...	...
110	Roadrunner School	16.0	4:1	NaN	30.0	30	NaN	52.0	25.0	NaN
111	Ridgeline Academy Inc.	138.0	NaN	NaN	30.0	30	100	29.0	5.0	NaN
112	Pxu Digital Academy	1232.0	79:1	NaN	30.0	30	29	95.0	NaN	NaN
113	Pvonline	247.0	20:1	NaN	37.0	47	82	50.0	NaN	NaN
114	Premier Charter High School	146.0	NaN	NaN	30.0	30%	35	99.0	39.0	NaN

115 rows × 10 columns

In [ ]:
```
missing_values_per_column = data.isnull().sum()

print("Number of missing values in each column:")
print(missing_values_per_column)
```

```
Number of missing values in each column:
School Name               0
Total Enrolments          1
Student Teacher Ratio    71
One AP Test              69
Math Scoring             38
English Scoring          54
Graduation Rate          10
Minority Enrolment        1
Free Lunch Program       35
College Readiness        70
dtype: int64
```

In [ ]:
```
columns_to_check = ['School Name',      'Total Enrolments',     'Student Teacher Ratio',        'One AP Te
st',    'Math Scoring', 'English Scoring',      'Graduation Rate',      'Minority Enrolment',   'Free Lunc
h Program',     'College Readiness']

for col in columns_to_check:
    if data[col].astype(str).str.contains('%').any():
        print(f"Column '{col}' contains '%' signs.")
    else:
        print(f"{col} coloumn has non numeric characters.")
```

```
School Name coloumn has non numeric characters.
Total Enrolments coloumn has non numeric characters.
Student Teacher Ratio coloumn has non numeric characters.
One AP Test coloumn has non numeric characters.
Math Scoring coloumn has non numeric characters.
Column 'English Scoring' contains '%' signs.
Column 'Graduation Rate' contains '%' signs.
Minority Enrolment coloumn has non numeric characters.
Free Lunch Program coloumn has non numeric characters.
College Readiness coloumn has non numeric characters.
```

In [ ]:
```
from sklearn.preprocessing import MinMaxScaler

first_transform_df = data.copy()

first_transform_df['Graduation Rate'] = first_transform_df['Graduation Rate'].replace('%', '', regex=Tru
e).astype(float)
first_transform_df['English Scoring'] = first_transform_df['English Scoring'].replace('%', '', regex=Tru
e).astype(float)

numerical_columns = ['Total Enrolments','One AP Test',  'Math Scoring', 'English Scoring',      'Graduatio
n Rate',        'Minority Enrolment',   'Free Lunch Program',   'College Readiness']

scaler = MinMaxScaler()
first_transform_df[numerical_columns] = scaler.fit_transform(first_transform_df[numerical_columns])
```

In [ ]:
```
first_transform_df
```

Out[ ]:

	School Name	Total Enrolments	Student Teacher Ratio	One AP Test	Math Scoring	English Scoring	Graduation Rate	Minority Enrolment	Free Lunch Program	College Readiness
0	AAEC: Paradise Valley	0.106201	NaN	NaN	0.428571	NaN	0.97	0.286	NaN	NaN
1	AAEC: South Mountain	0.164578	NaN	NaN	0.122449	NaN	1.00	0.938	0.181818	NaN
2	Accelarated :Learning Center	0.049802	NaN	NaN	NaN	NaN	0.62	0.258	NaN	NaN
3	Alhambra High School	0.789908	18:1	0.05	0.214286	NaN	0.70	0.958	0.787879	0.145
4	Arcadia High School	0.535950	23:1	0.21	0.295918	NaN	0.94	0.490	0.121212	0.296
...	...	...	...	...	...	...	...	...	...	...
110	Roadrunner School	0.005277	4:1	NaN	0.306122	0.38961	NaN	0.520	0.252525	NaN
111	Ridgeline Academy Inc.	0.045515	NaN	NaN	0.306122	0.38961	1.00	0.290	0.050505	NaN
112	Pxu Digital Academy	0.406332	79:1	NaN	0.306122	0.38961	0.29	0.950	NaN	NaN
113	Pvonline	0.081464	20:1	NaN	0.377551	0.61039	0.82	0.500	NaN	NaN
114	Premier Charter High School	0.048153	NaN	NaN	0.306122	0.38961	0.35	0.990	0.393939	NaN

115 rows × 10 columns

In [ ]:
```
columns_to_drop = ['Student Teacher Ratio']

second_df = first_transform_df.drop(columns=columns_to_drop)
```

In [ ]:
```
second_df
```

Out[ ]:

	School Name	Total Enrolments	One AP Test	Math Scoring	English Scoring	Graduation Rate	Minority Enrolment	Free Lunch Program	College Readiness
0	AAEC: Paradise Valley	0.106201	NaN	0.428571	NaN	0.97	0.286	NaN	NaN
1	AAEC: South Mountain	0.164578	NaN	0.122449	NaN	1.00	0.938	0.181818	NaN
2	Accelarated :Learning Center	0.049802	NaN	NaN	NaN	0.62	0.258	NaN	NaN
3	Alhambra High School	0.789908	0.05	0.214286	NaN	0.70	0.958	0.787879	0.145
4	Arcadia High School	0.535950	0.21	0.295918	NaN	0.94	0.490	0.121212	0.296
...	...	...	...	...	...	...	...	...	...
110	Roadrunner School	0.005277	NaN	0.306122	0.38961	NaN	0.520	0.252525	NaN
111	Ridgeline Academy Inc.	0.045515	NaN	0.306122	0.38961	1.00	0.290	0.050505	NaN
112	Pxu Digital Academy	0.406332	NaN	0.306122	0.38961	0.29	0.950	NaN	NaN
113	Pvonline	0.081464	NaN	0.377551	0.61039	0.82	0.500	NaN	NaN
114	Premier Charter High School	0.048153	NaN	0.306122	0.38961	0.35	0.990	0.393939	NaN

115 rows × 9 columns

In [ ]:
```
duplicate = second_df[second_df.duplicated(subset='School Name', keep=False)]
print("Duplicate Values:")
duplicate
```

```
Duplicate Values:
```

Out[ ]:

	School Name	Total Enrolments	One AP Test	Math Scoring	English Scoring	Graduation Rate	Minority Enrolment	Free Lunch Program	College Readiness
83	Premier Charter High School	0.048153	0.0	0.000000	0.00000	0.35	0.993	0.393939	0.0
114	Premier Charter High School	0.048153	NaN	0.306122	0.38961	0.35	0.990	0.393939	NaN

In [ ]:
```
third_df = second_df.groupby('School Name').agg(lambda x: x.max()).reset_index()
```

In [ ]:
```
duplicate = third_df[third_df.duplicated(subset='School Name', keep=False)]
print("Duplicate Values:")
duplicate
```

```
Duplicate Values:
```

Out[ ]:

School Name	Total Enrolments	One AP Test	Math Scoring	English Scoring	Graduation Rate	Minority Enrolment	Free Lunch Program	College Readiness

In [ ]:
```
mean_columns = ['One AP Test', 'English Scoring', 'College Readiness']
for column in mean_columns:
    mean_value = third_df[column].mean()
    third_df[column].fillna(mean_value, inplace=True)
```

In [ ]:
```
third_df
```

Out[ ]:

	School Name	Total Enrolments	One AP Test	Math Scoring	English Scoring	Graduation Rate	Minority Enrolment	Free Lunch Program	College Readiness
0	AAEC: Paradise Valley	0.106201	0.251522	0.428571	0.391991	0.97	0.286	NaN	0.219622
1	AAEC: South Mountain	0.164578	0.251522	0.122449	0.391991	1.00	0.938	0.181818	0.219622
2	ASU Preparatory Academy-Phoenix High School	0.108509	0.040000	0.275510	0.391991	0.97	0.933	0.181818	0.074000
3	Accelarated :Learning Center	0.049802	0.251522	NaN	0.391991	0.62	0.258	NaN	0.219622
4	Alhambra High School	0.789908	0.050000	0.214286	0.391991	0.70	0.958	0.787879	0.145000
...	...	...	...	...	...	...	...	...	...
109	West-Mec - Paradise Valley High School	0.008245	0.251522	0.306122	0.389610	0.00	0.640	0.000000	0.219622
110	West-Mec - Pinnacle High School	0.008575	0.251522	0.306122	0.389610	0.00	0.346	0.000000	0.219622
111	Western School of Science and Technology	0.114116	0.430000	0.173469	0.415584	0.95	0.991	0.262626	0.135000
112	Westland School	0.023747	0.251522	0.306122	0.389610	0.50	0.831	0.767677	0.219622
113	e-Institute at Metro	0.019129	0.251522	NaN	0.391991	0.05	0.931	NaN	0.219622

114 rows × 9 columns

In [ ]:
```
third_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 114 entries, 0 to 113
Data columns (total 9 columns):
 #   Column              Non-Null Count  Dtype  
---  ------              --------------  -----  
 0   School Name         114 non-null    object 
 1   Total Enrolments    113 non-null    float64
 2   One AP Test         114 non-null    float64
 3   Math Scoring        76 non-null     float64
 4   English Scoring     114 non-null    float64
 5   Graduation Rate     104 non-null    float64
 6   Minority Enrolment  113 non-null    float64
 7   Free Lunch Program  79 non-null     float64
 8   College Readiness   114 non-null    float64
dtypes: float64(8), object(1)
memory usage: 8.1+ KB
```

In [ ]:
```
cols_to_drop_na = ['Total Enrolments', 'Math Scoring', 'Graduation Rate', 'Minority Enrolment', 'Free Lunch Program']
third_df.dropna(subset=cols_to_drop_na, inplace=True)
```

In [ ]:
```
print("Dimensions of the DataFrame after being cleaned and transformed as per the Plan: {}".format(third_df.shape))
```

```
Dimensions of the DataFrame after being cleaned and transformed as per the Plan: (62, 9)
```

In [ ]:
```
final_df = third_df
```

In [ ]:
```
final_df.to_csv('final_df_extra_credit.csv', index=False)
```

In [ ]:
```
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error, r2_score

X = final_df[['Total Enrolments','One AP Test','English Scoring','Graduation Rate','Minority Enrolment','F
ree Lunch Program','College Readiness']]
y = final_df['Math Scoring']

model = LinearRegression()

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.4, random_state=42)

model.fit(X_train, y_train)

y_pred = model.predict(X_test)
```

In [ ]:
```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
r2 = r2_score(y_test, y_pred)
print('Mean Squared Error (MSE) - Measures the average of the squares of the errors')
print(mse,'\n')
print('Root Mean Squared Error (RMSE)- Represents the square root of the MSE')
print(rmse,'\n')
print('R-squared (R²) - Indicates the proportion of variance in the dependent variable that is predictable
from the independent variables')
print(r2,'\n')

print("Coefficient Interpretation:")
for feature, coefficient in zip(X.columns, model.coef_):
    if coefficient > 0:
        print(f"A one-unit increase in {feature} is associated with an increase of in Math Scoring by -
{coefficient:.4f}")
    elif coefficient < 0:
        print(f"A one-unit increase in {feature} is associated with a decrease of in Math Scoring by - {ab
s(coefficient):.4f}")
    else:
        print(f"The {feature} does not have a significant impact on Math Scoring.")

print('\nIntercept (baseline Math Scoring when all other factors are zero):', model.intercept_)
```

```
Mean Squared Error (MSE) - Measures the average of the squares of the errors
0.027787678827900356

Root Mean Squared Error (RMSE)- Represents the square root of the MSE
0.1666963671706746

R-squared (R²) - Indicates the proportion of variance in the dependent variable that is predictable from t
he independent variables
0.09742671988922114

Coefficient Interpretation:
A one-unit increase in Total Enrolments is associated with a decrease of in Math Scoring by - 0.0586
A one-unit increase in One AP Test is associated with a decrease of in Math Scoring by - 0.0260
A one-unit increase in English Scoring is associated with an increase of in Math Scoring by -  0.6945
A one-unit increase in Graduation Rate is associated with a decrease of in Math Scoring by - 0.0412
A one-unit increase in Minority Enrolment is associated with a decrease of in Math Scoring by - 0.0545
A one-unit increase in Free Lunch Program is associated with an increase of in Math Scoring by -  0.0170
A one-unit increase in College Readiness is associated with an increase of in Math Scoring by -  0.1118

Intercept (baseline Math Scoring when all other factors are zero): 0.043759542802430995
```

In [ ]:
```
from sklearn.ensemble import BaggingRegressor

base_model = LinearRegression()

bagging_model = BaggingRegressor(estimator=base_model, n_estimators=10, random_state=42)

bagging_model.fit(X_train, y_train)

y_pred = bagging_model.predict(X_test)
```

In [ ]:
```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
r2 = r2_score(y_test, y_pred)
print('Mean Squared Error (MSE) - Measures the average of the squares of the errors')
print(mse,'\n')
print('Root Mean Squared Error (RMSE)- Represents the square root of the MSE')
print(rmse,'\n')
print('R-squared (R²) - Indicates the proportion of variance in the dependent variable that is predictable
from the independent variables')
print(r2,'\n')

print("Coefficient Interpretation:")
for feature, coefficient in zip(X.columns, model.coef_):
    if coefficient > 0:
        print(f"A one-unit increase in {feature} is associated with an increase of in Math Scoring by -
{coefficient:.4f} increase")
    elif coefficient < 0:
        print(f"A one-unit increase in {feature} is associated with a decrease of in Math Scoring by - {ab
s(coefficient):.4f} decrease")
    else:
        print(f"The {feature} does not have a significant impact on Math Scoring.")

print('\nIntercept (baseline Math Scoring when all other factors are zero):', model.intercept_)
```

Mean Squared Error (MSE) - Measures the average of the squares of the errors
0.027787678827900356

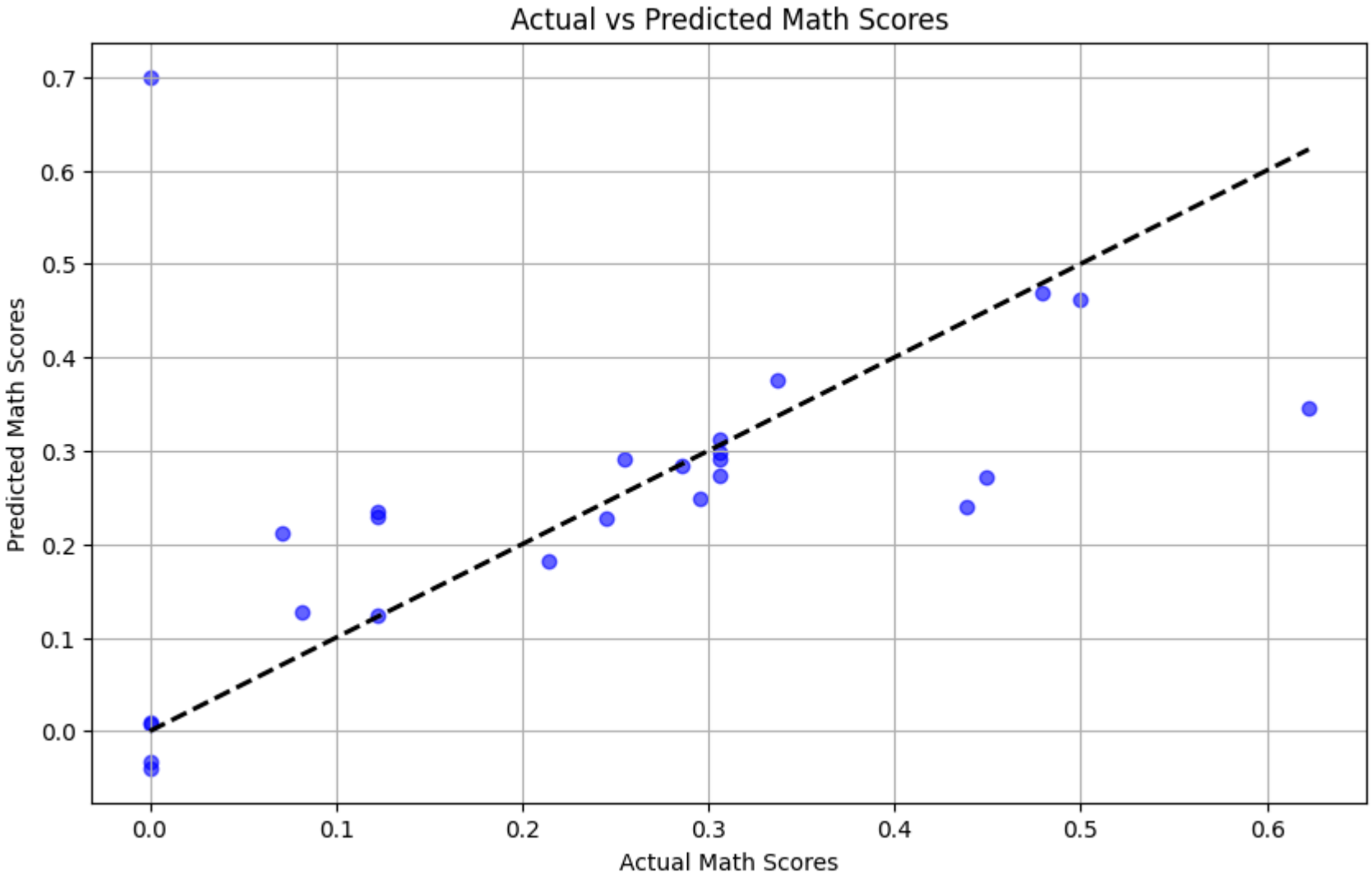
Root Mean Squared Error (RMSE)- Represents the square root of the MSE
0.1666963671706746

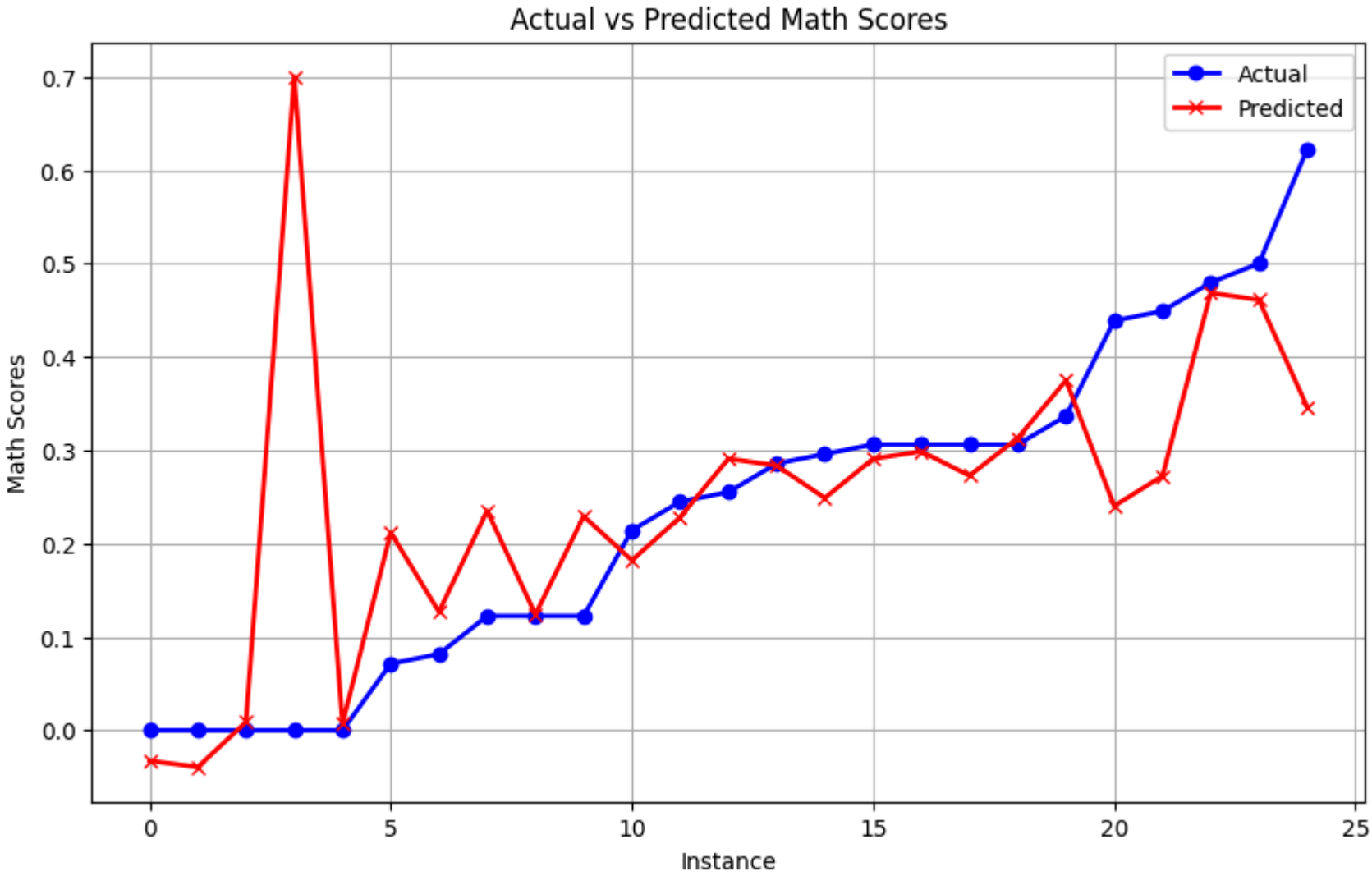
R-squared (R^2) - Indicates the proportion of variance in the dependent variable that is predictable from the independent variables
0.09742671988922114

Coefficient Interpretation:
A one-unit increase in Total Enrolments is associated with a decrease of in Math Scoring by - 0.0586 decrease
A one-unit increase in One AP Test is associated with a decrease of in Math Scoring by - 0.0260 decrease
A one-unit increase in English Scoring is associated with an increase of in Math Scoring by - 0.6945 increase
A one-unit increase in Graduation Rate is associated with a decrease of in Math Scoring by - 0.0412 decrease
A one-unit increase in Minority Enrolment is associated with a decrease of in Math Scoring by - 0.0545 decrease
A one-unit increase in Free Lunch Program is associated with an increase of in Math Scoring by - 0.0170 increase
A one-unit increase in College Readiness is associated with an increase of in Math Scoring by - 0.1118 increase

Intercept (baseline Math Scoring when all other factors are zero): 0.043759542802430995

In [ ]:
```
import matplotlib.pyplot as plt

plt.figure(figsize=(10, 6))
plt.scatter(y_test, y_pred, c='blue', alpha=0.6)
plt.plot([y_test.min(), y_test.max()], [y_test.min(), y_test.max()], 'k--', lw=2)
plt.xlabel('Actual Math Scores')
plt.ylabel('Predicted Math Scores')
plt.title('Actual vs Predicted Math Scores')
plt.grid(True)
plt.show()

import matplotlib.pyplot as plt

sorted_indices = np.argsort(y_test)
y_test_sorted = y_test.iloc[sorted_indices]
y_pred_sorted = y_pred[sorted_indices]

plt.figure(figsize=(10, 6))
plt.plot(range(len(y_test)), y_test_sorted, marker='o', color='blue', label='Actual', linewidth=2)
plt.plot(range(len(y_test)), y_pred_sorted, marker='x', color='red', label='Predicted', linewidth=2)
plt.xlabel('Instance')
plt.ylabel('Math Scores')
plt.title('Actual vs Predicted Math Scores')
plt.legend()
plt.grid(True)
plt.show()
```


Actual vs Predicted Math Scores
Predicted Math Scores
Actual Math Scores
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7


Actual vs Predicted Math Scores
Actual
Predicted
Math Scores
Instance
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0
5
10
15
20
25