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Task-1

Implement a linear regression model to predict the prices of houses based on their square footage and the number of bedrooms and bathrooms.

In [1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_absolute_error, mean_squared_error, r2_score
```

In [2]:
```
train_data = pd.read_csv('C:/Users/Shejal Sanas/Downloads/train.csv')
test_data = pd.read_csv('C:/Users/Shejal Sanas/Downloads/test.csv')
```

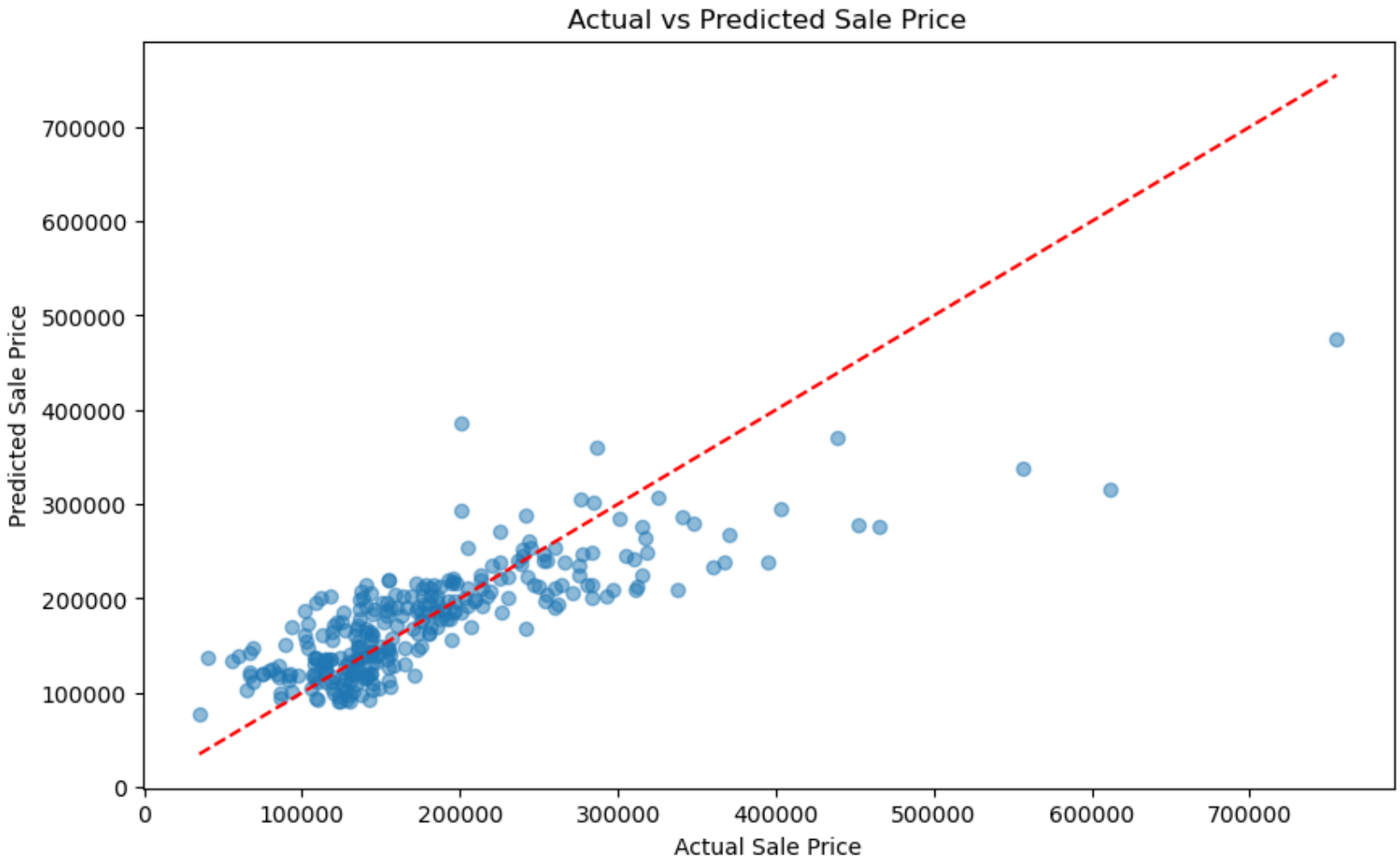
In [3]:
```
for column in train_data.columns:
    if train_data[column].dtype == 'object':
        train_data[column].fillna(train_data[column].mode()[0], inplace=True)
        if column in test_data.columns:
            test_data[column].fillna(test_data[column].mode()[0], inplace=True)
    else:
        train_data[column].fillna(train_data[column].mean(), inplace=True)
        if column in test_data.columns:
            test_data[column].fillna(test_data[column].mean(), inplace=True)
features = ['GrLivArea', 'BedroomAbvGr', 'FullBath', 'HalfBath', 'TotRmsAbvGrd']
X = train_data[features]
y = train_data['SalePrice']
X_train, X_val, y_train, y_val = train_test_split(X, y, test_size=0.2, random_state=42)
model = LinearRegression()
model.fit(X_train, y_train)
```

Out[3]:
```
LinearRegression()
```

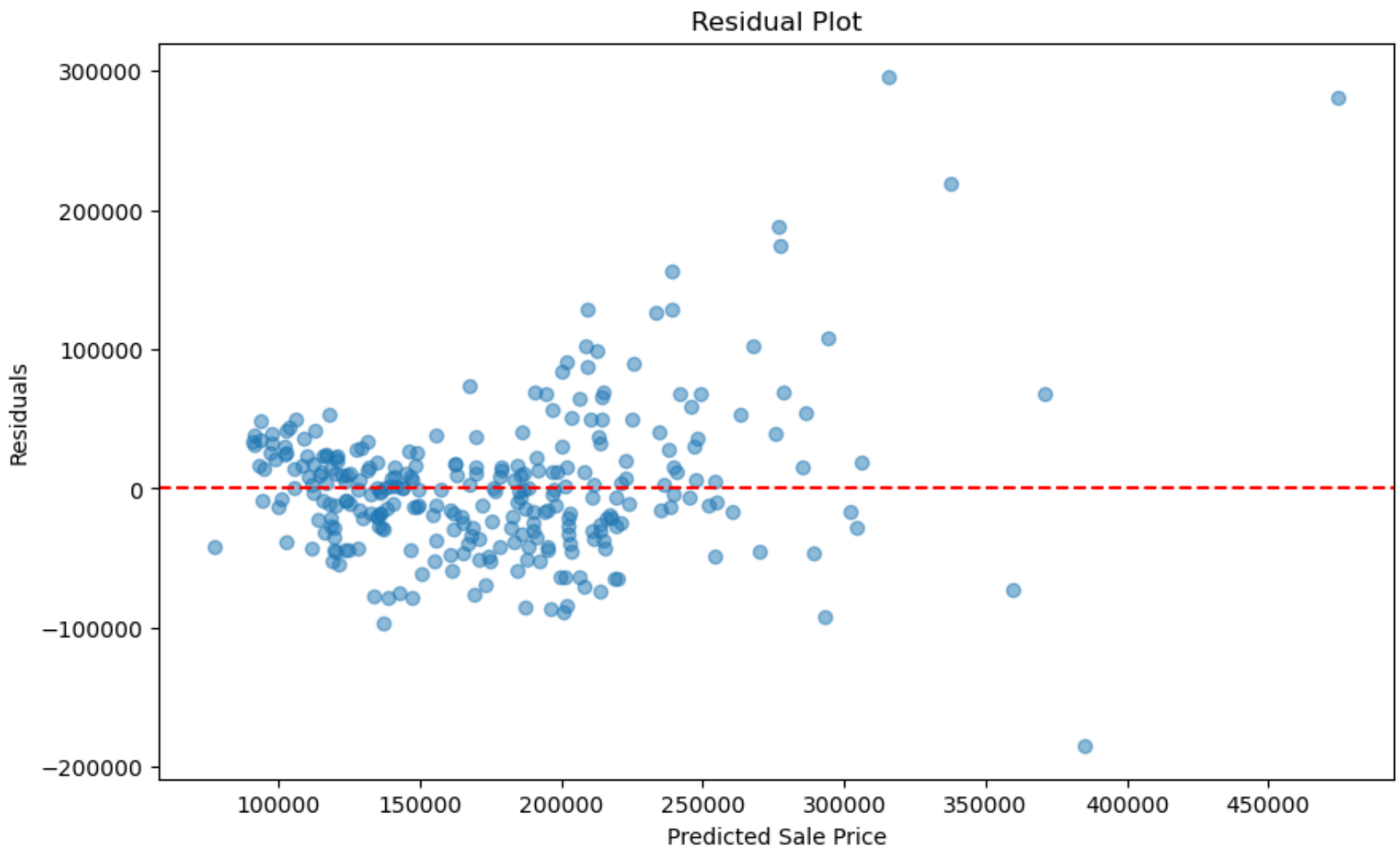
In a Jupyter environment, please rerun this cell to show the HTML representation or trust the notebook.
On GitHub, the HTML representation is unable to render, please try loading this page with nbviewer.org.

In [4]:
```
y_pred = model.predict(X_val)
mae = mean_absolute_error(y_val, y_pred)
mse = mean_squared_error(y_val, y_pred)
r2 = r2_score(y_val, y_pred)
```

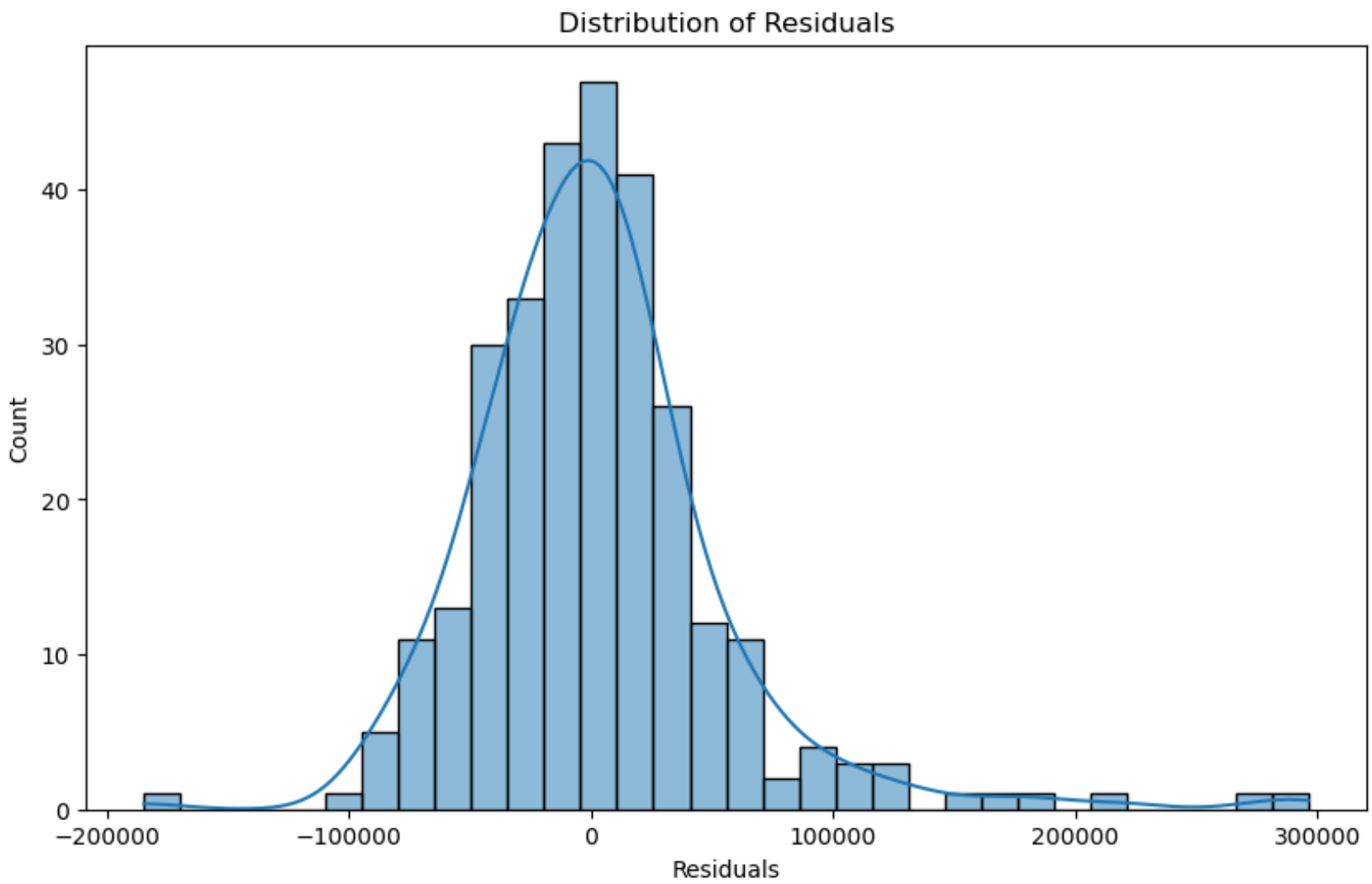
In [5]:
```
plt.figure(figsize=(10, 6))
plt.scatter(y_val, y_pred, alpha=0.5)
plt.xlabel('Actual Sale Price')
plt.ylabel('Predicted Sale Price')
plt.title('Actual vs Predicted Sale Price')
plt.plot([y.min(), y.max()], [y.min(), y.max()], 'r--')
plt.show()
```



In [6]:
```
residuals = y_val - y_pred
plt.figure(figsize=(10, 6))
plt.scatter(y_pred, residuals, alpha=0.5)
plt.xlabel('Predicted Sale Price')
plt.ylabel('Residuals')
plt.title('Residual Plot')
plt.axhline(y=0, color='r', linestyle='--')
plt.show()
```

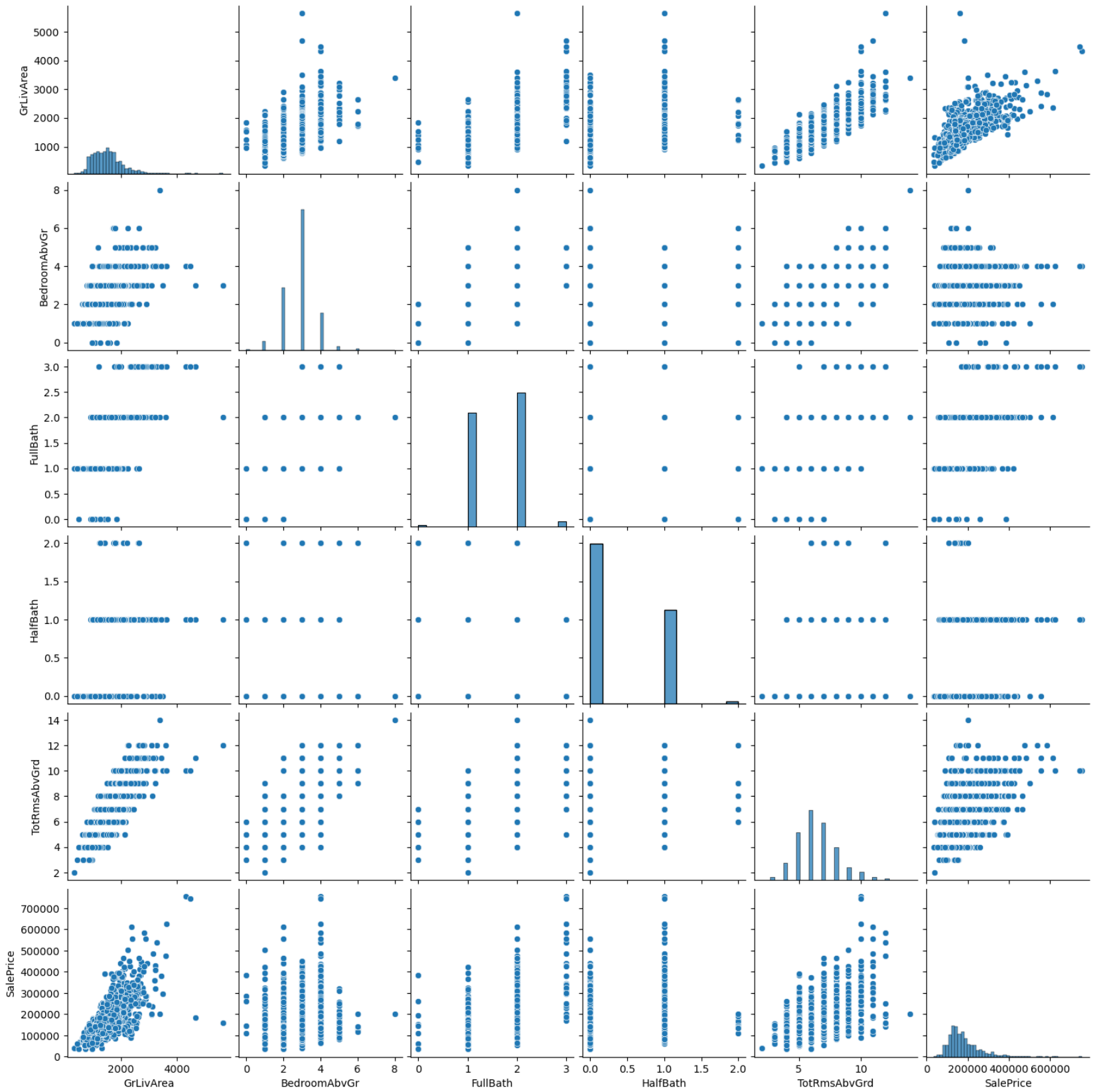


In [7]:
```
plt.figure(figsize=(10, 6))
sns.histplot(residuals, kde=True)
plt.xlabel('Residuals')
plt.title('Distribution of Residuals')
plt.show()
```



In [8]:
```
plt.figure(figsize=(12, 8))
sns.pairplot(train_data[features + ['SalePrice']])
plt.show()
```

```
<Figure size 1200x800 with 0 Axes>
```



In [9]:
```
example = pd.DataFrame({
    'GrLivArea': [2000],
    'BedroomAbvGr': [3],
    'FullBath': [2],
    'HalfBath': [1],
    'TotRmsAbvGrd': [7]
})
example_prediction = model.predict(example)
print(f'Example Prediction: ${example_prediction[0]:,.2f}')

# Prepare the test data and make predictions
X_test = test_data[features]
test_predictions = model.predict(X_test)

# Save predictions
submission = pd.DataFrame({'Id': test_data['Id'], 'SalePrice': test_predictions})
submission.to_csv('submission.csv', index=False)
```

```
Example Prediction: $240,896.28
```