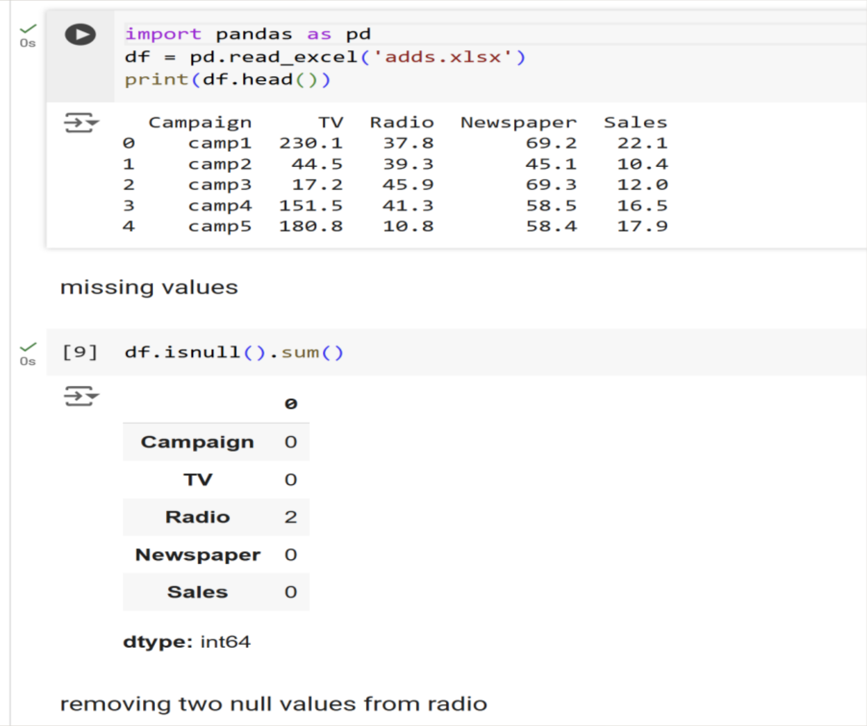
FINLATICS PROJECT 1

SALES DATASET

PREPROCESSING OF DATASET



```
import pandas as pd
df = pd.read_excel('adds.xlsx')
print(df.head())
```

```
  Campaign     TV  Radio  Newspaper  Sales
0    camp1  230.1   37.8       69.2   22.1
1    camp2   44.5   39.3       45.1   10.4
2    camp3   17.2   45.9       69.3   12.0
3    camp4  151.5   41.3       58.5   16.5
4    camp5  180.8   10.8       58.4   17.9
```

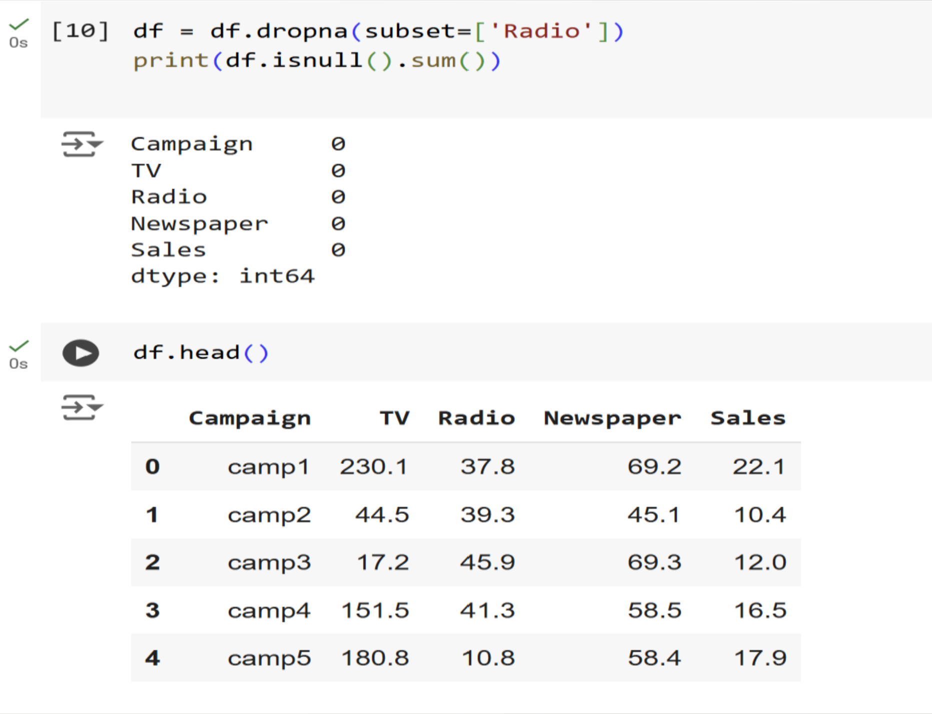
missing values

```
[9] df.isnull().sum()
```

	0
Campaign	0
TV	0
Radio	2
Newspaper	0
Sales	0

dtype: int64

removing two null values from radio



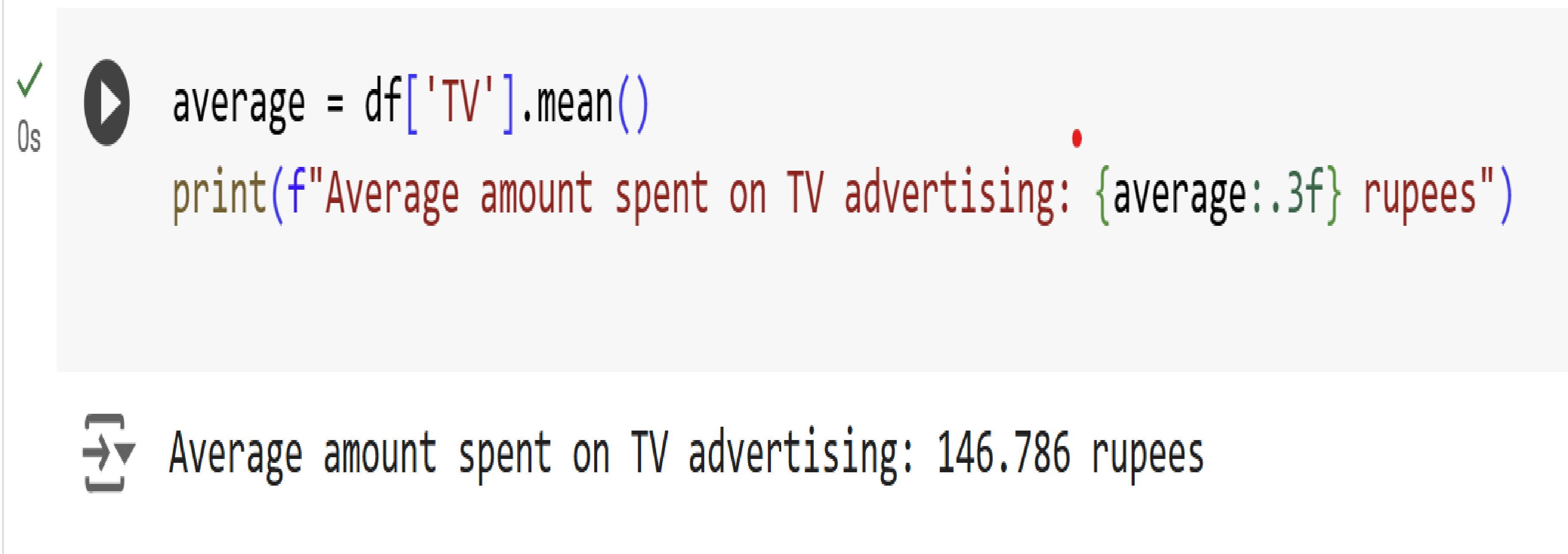
```
[10] df = df.dropna(subset=['Radio'])
     print(df.isnull().sum())
```

```
Campaign     0
TV           0
Radio        0
Newspaper    0
Sales        0
dtype: int64
```

```
df.head()
```

	Campaign	TV	Radio	Newspaper	Sales
0	camp1	230.1	37.8	69.2	22.1
1	camp2	44.5	39.3	45.1	10.4
2	camp3	17.2	45.9	69.3	12.0
3	camp4	151.5	41.3	58.5	16.5
4	camp5	180.8	10.8	58.4	17.9

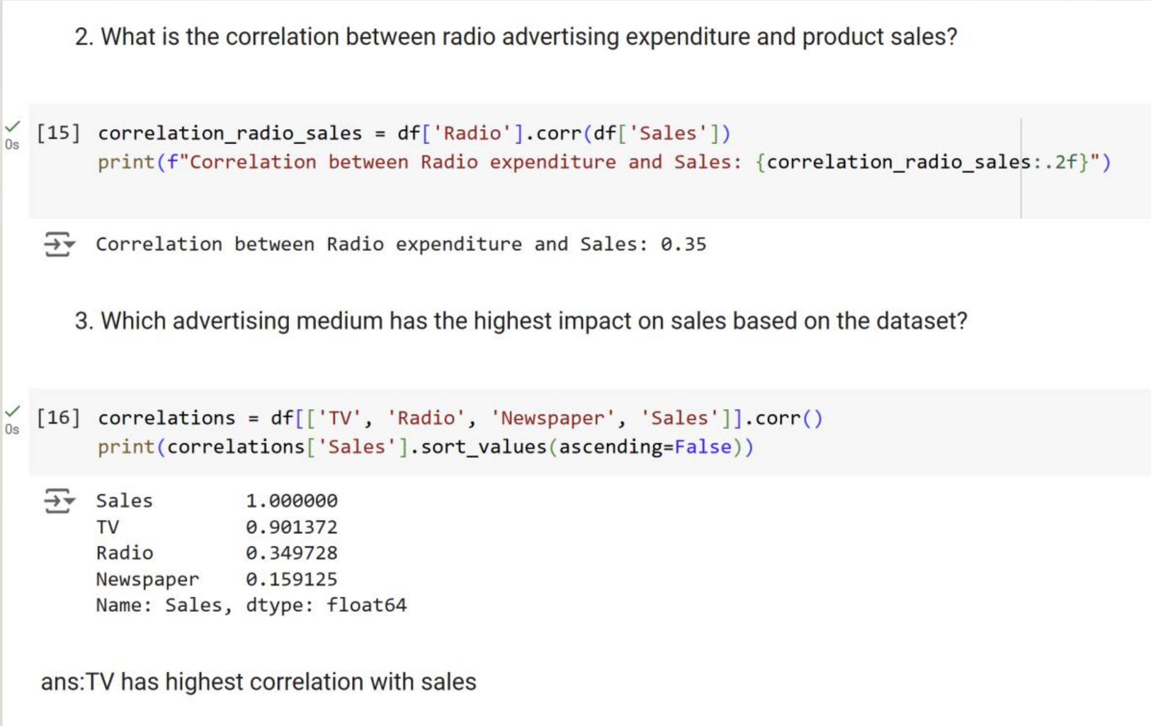
1)WHAT IS THE AVERAGE AMOUNT SPENT ON TV ADVERTISING IN THE DATASET?



```
average = df['TV'].mean()
print(f"Average amount spent on TV advertising: {average:.3f} rupees")
```

```
Average amount spent on TV advertising: 146.786 rupees
```

TV HAS HIGHEST CORRELATION WITH SALES



2. What is the correlation between radio advertising expenditure and product sales?

```
[15] correlation_radio_sales = df['Radio'].corr(df['Sales'])
     print(f"Correlation between Radio expenditure and Sales: {correlation_radio_sales:.2f}")
```

```
Correlation between Radio expenditure and Sales: 0.35
```

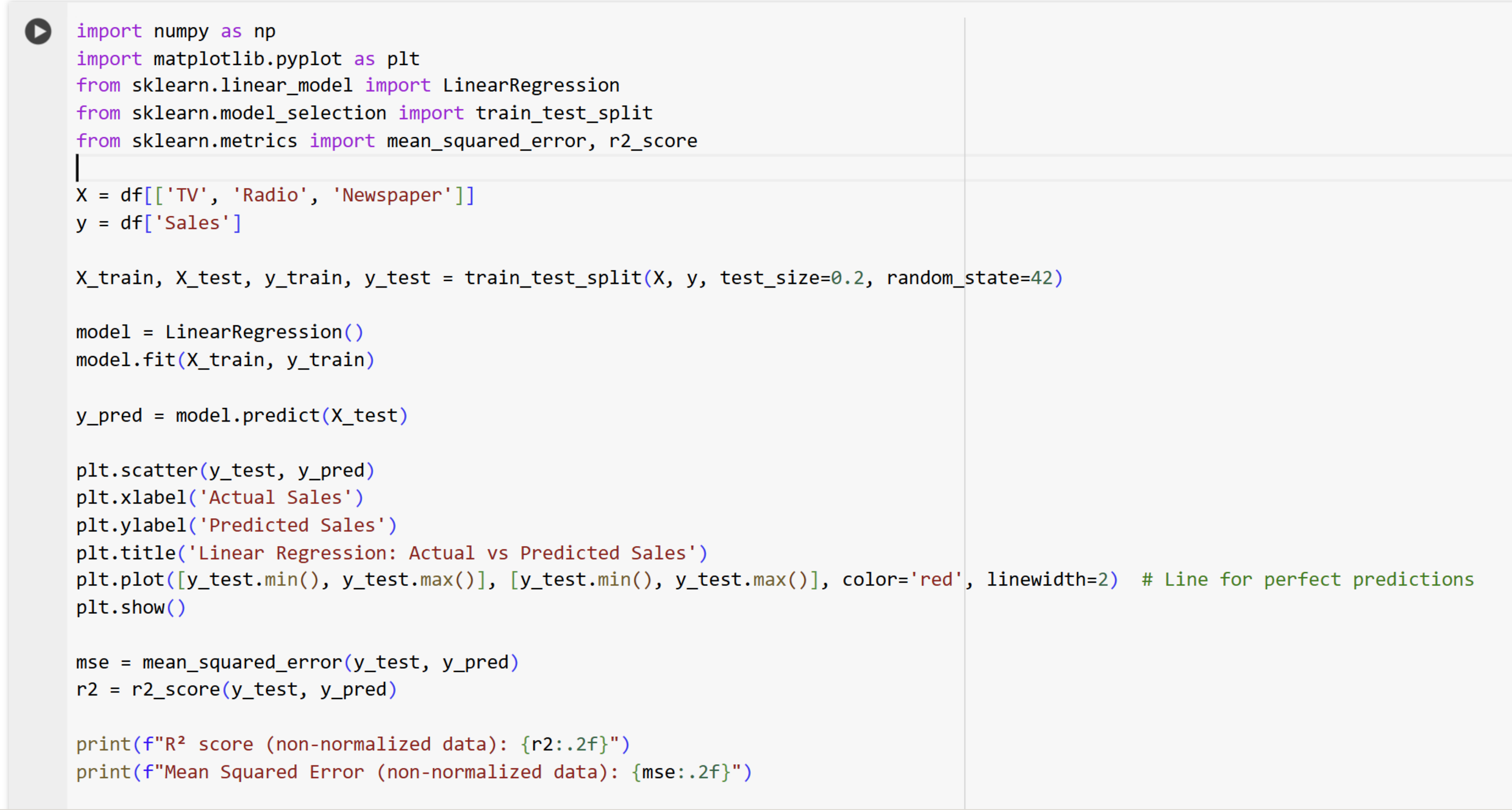
3. Which advertising medium has the highest impact on sales based on the dataset?

```
[16] correlations = df[['TV', 'Radio', 'Newspaper', 'Sales']].corr()
     print(correlations['Sales'].sort_values(ascending=False))
```

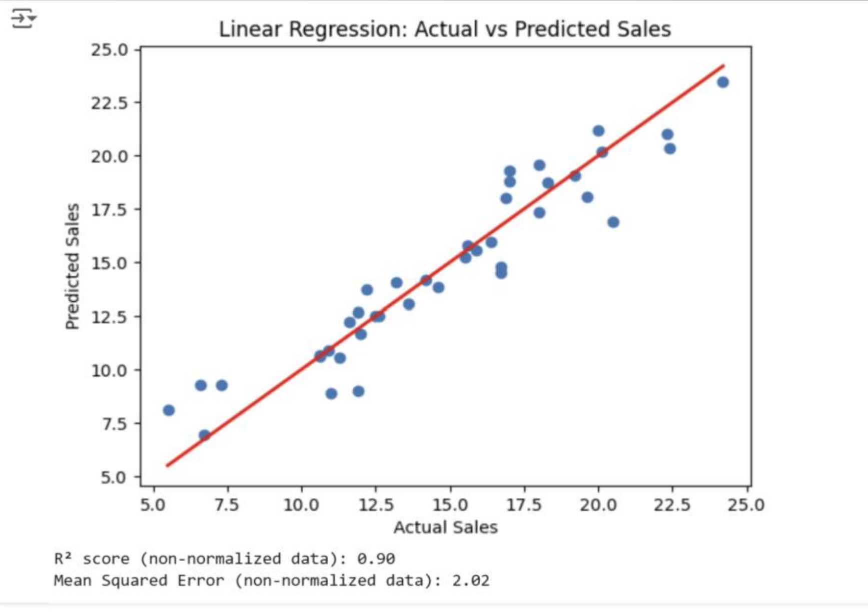
```
Sales        1.000000
TV           0.901372
Radio        0.349728
Newspaper    0.159125
Name: Sales, dtype: float64
```

ans:TV has highest correlation with sales

4)PLOT A LINEAR REGRESSION LINE THAT INCLUDES ALL VARIABLES (TV, RADIO, NEWSPAPER) TO PREDICT SALES, AND VISUALIZE THE MODEL'S PREDICTIONS AGAINST THE ACTUAL SALES VALUES.

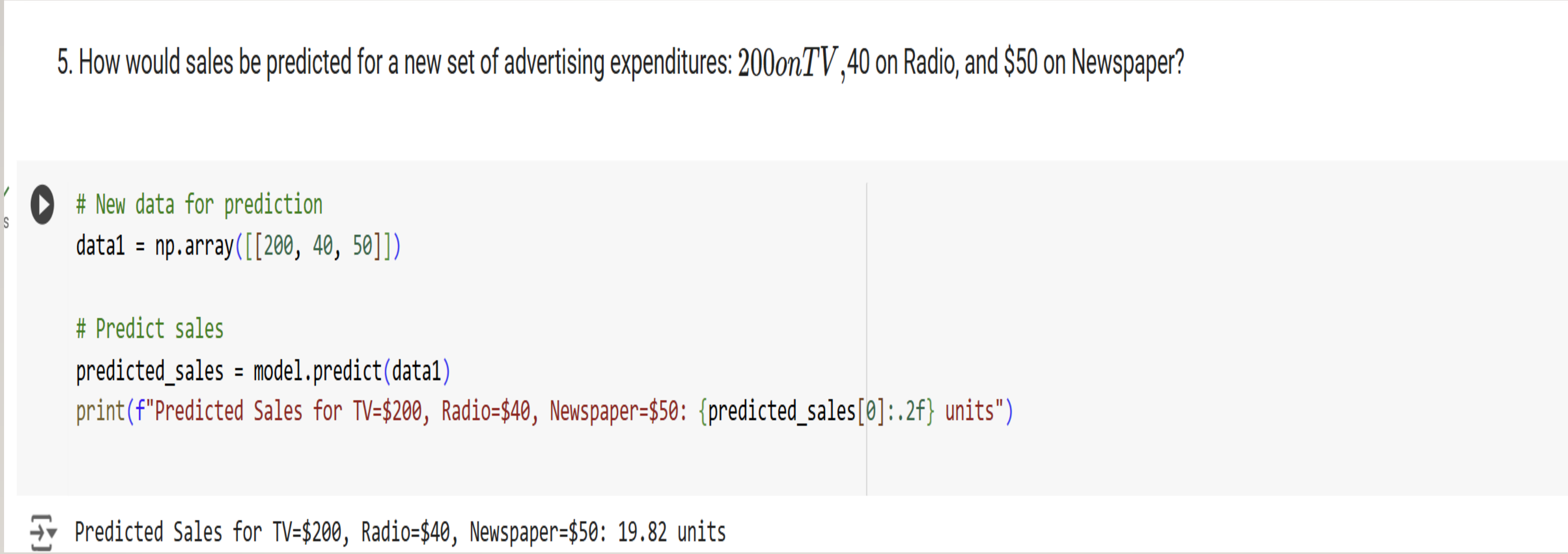


```python
import numpy as np
import matplotlib.pyplot as plt
from sklearn.linear_model import LinearRegression
from sklearn.model_selection import train_test_split
from sklearn.metrics import mean_squared_error, r2_score

X = df[['TV', 'Radio', 'Newspaper']]
y = df['Sales']

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)

plt.scatter(y_test, y_pred)
plt.xlabel('Actual Sales')
plt.ylabel('Predicted Sales')
plt.title('Linear Regression: Actual vs Predicted Sales')
plt.plot([y_test.min(), y_test.max()], [y_test.min(), y_test.max()], color='red', linewidth=2)  # Line for perfect predictions
plt.show()

mse = mean_squared_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print(f"R² score (non-normalized data): {r2:.2f}")
print(f"Mean Squared Error (non-normalized data): {mse:.2f}")
```



```
R² score (non-normalized data): 0.90
Mean Squared Error (non-normalized data): 2.02
```

SALES WILL BE 19.82 DOLLARS

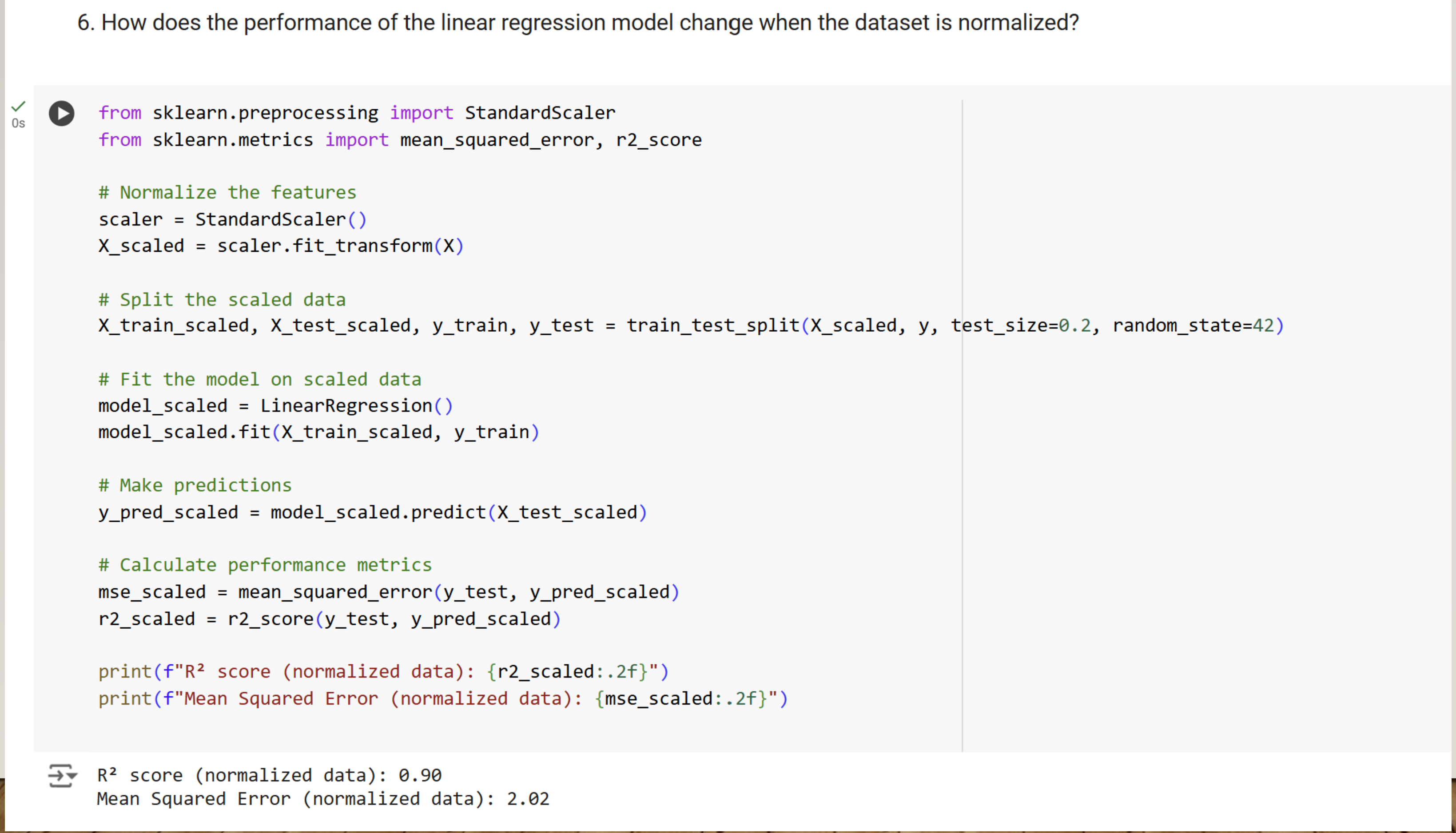


5. How would sales be predicted for a new set of advertising expenditures: $200onTV$,40 on Radio, and $50 on Newspaper?

```python
# New data for prediction
data1 = np.array([[200, 40, 50]])

# Predict sales
predicted_sales = model.predict(data1)
print(f"Predicted Sales for TV=$200, Radio=$40, Newspaper=$50: {predicted_sales[0]:.2f} units")
```

```
Predicted Sales for TV=$200, Radio=$40, Newspaper=$50: 19.82 units
```

NO MUCH CHANGE IN PREFORMANCE AS PERFORMANCE METRICS IS ALMOST SIMILAR

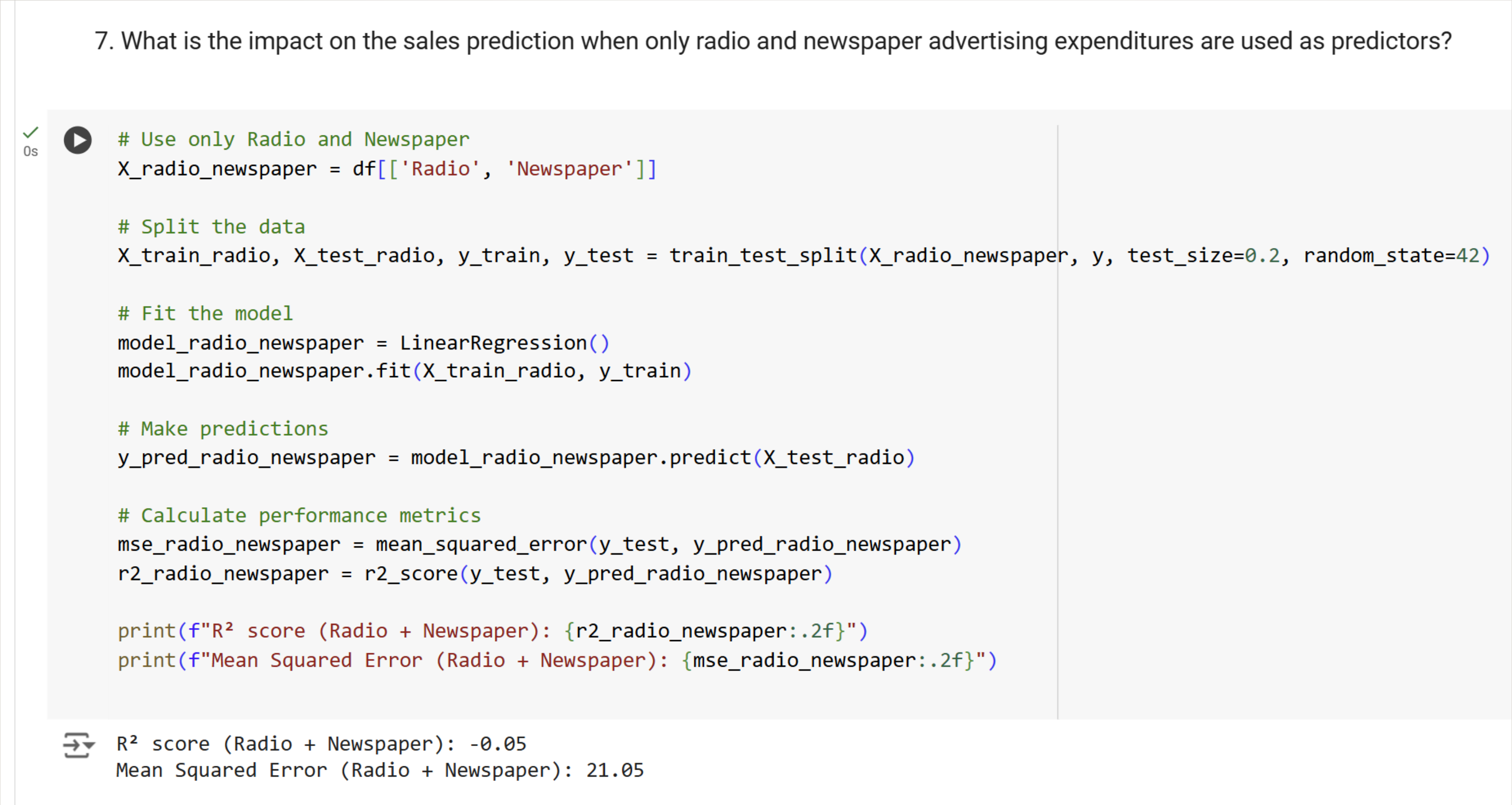


6. How does the performance of the linear regression model change when the dataset is normalized?

```python
from sklearn.preprocessing import StandardScaler
from sklearn.metrics import mean_squared_error, r2_score

# Normalize the features
scaler = StandardScaler()
X_scaled = scaler.fit_transform(X)

# Split the scaled data
X_train_scaled, X_test_scaled, y_train, y_test = train_test_split(X_scaled, y, test_size=0.2, random_state=42)

# Fit the model on scaled data
model_scaled = LinearRegression()
model_scaled.fit(X_train_scaled, y_train)

# Make predictions
y_pred_scaled = model_scaled.predict(X_test_scaled)

# Calculate performance metrics
mse_scaled = mean_squared_error(y_test, y_pred_scaled)
r2_scaled = r2_score(y_test, y_pred_scaled)

print(f"R² score (normalized data): {r2_scaled:.2f}")
print(f"Mean Squared Error (normalized data): {mse_scaled:.2f}")
```

```
R² score (normalized data): 0.90
Mean Squared Error (normalized data): 2.02
```

THIS MODEL PERFORMS POORLY, AS EVIDENCED BY THE NEGATIVE R^2 SCORE AND HIGH MSE



7. What is the impact on the sales prediction when only radio and newspaper advertising expenditures are used as predictors?

```
# Use only Radio and Newspaper
X_radio_newspaper = df[['Radio', 'Newspaper']]

# Split the data
X_train_radio, X_test_radio, y_train, y_test = train_test_split(X_radio_newspaper, y, test_size=0.2, random_state=42)

# Fit the model
model_radio_newspaper = LinearRegression()
model_radio_newspaper.fit(X_train_radio, y_train)

# Make predictions
y_pred_radio_newspaper = model_radio_newspaper.predict(X_test_radio)

# Calculate performance metrics
mse_radio_newspaper = mean_squared_error(y_test, y_pred_radio_newspaper)
r2_radio_newspaper = r2_score(y_test, y_pred_radio_newspaper)

print(f"R² score (Radio + Newspaper): {r2_radio_newspaper:.2f}")
print(f"Mean Squared Error (Radio + Newspaper): {mse_radio_newspaper:.2f}")
```

```
R² score (Radio + Newspaper): -0.05
Mean Squared Error (Radio + Newspaper): 21.05
```