```
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.ensemble import RandomForestRegressor
from sklearn.metrics import mean_absolute_error, mean_squared_error, r2_score
import statsmodels.api as sm
```

```
from google.colab import files
uploaded = files.upload()
```

Choose Files advertising.csv

- **advertising.csv**(text/csv) - 4062 bytes, last modified: 8/21/2025 - 100% done

```
Saving advertising.csv to advertising.csv
```

Gemini

```
import pandas as pd
df= pd.read_csv("advertising.csv")
```

```
df.head()
```

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

Next steps: Generate code with df View recommended plots New interactive sheet

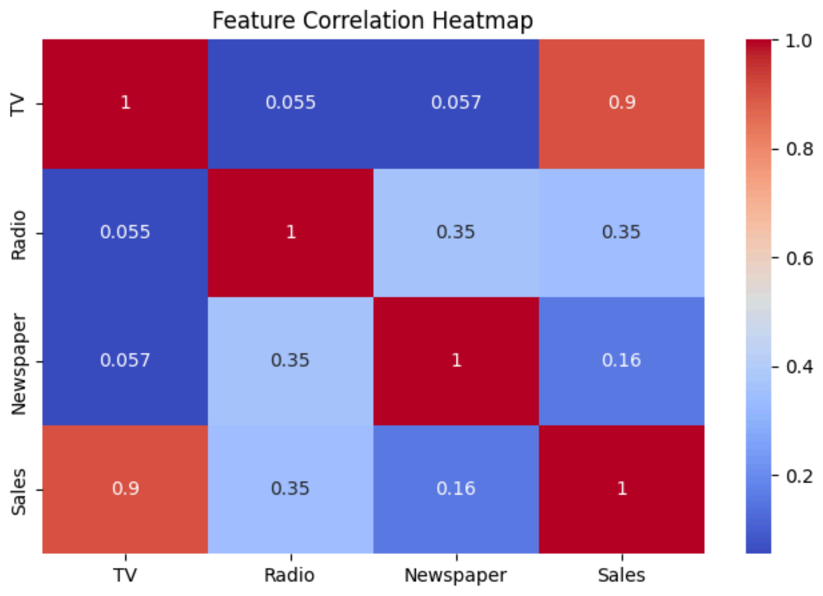
```
print("\nDataset Info:")
print(df.info())
```

```
Dataset Info:
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 200 entries, 0 to 199
Data columns (total 4 columns):
 #   Column     Non-Null Count  Dtype
---  ------     --------------  -----
 0   TV         200 non-null    float64
 1   Radio      200 non-null    float64
 2   Newspaper  200 non-null    float64
 3   Sales      200 non-null    float64
dtypes: float64(4)
memory usage: 6.4 KB
None
```

```
print("\nStatistical Summary:\n",df.describe())
```

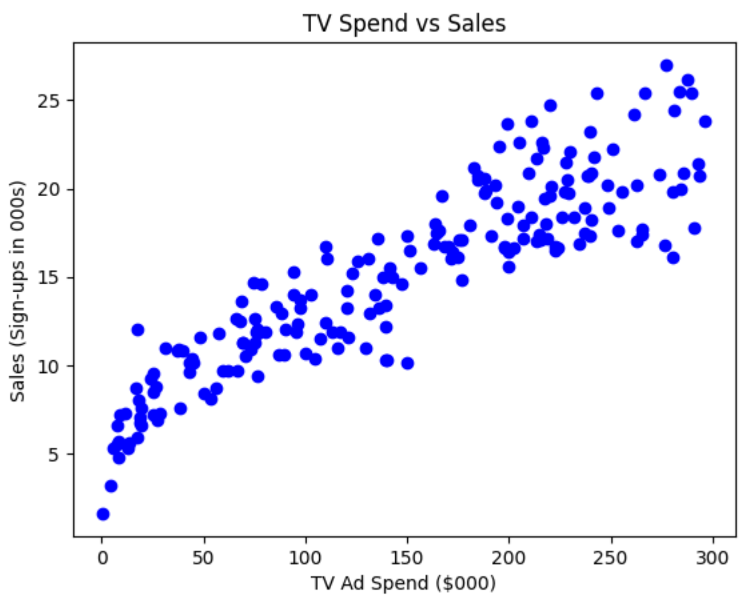
```
Statistical Summary:
                TV       Radio   Newspaper       Sales
count  200.000000  200.000000  200.000000  200.000000
mean   147.042500   23.264000   30.554000   15.130500
std     85.854236   14.846809   21.778621    5.283892
min      0.700000    0.000000    0.300000    1.600000
25%     74.375000    9.975000   12.750000   11.000000
50%    149.750000   22.900000   25.750000   16.000000
75%    218.825000   36.525000   45.100000   19.050000
max    296.400000   49.600000  114.000000   27.000000
```

```
plt.figure(figsize=(8,5))
sns.heatmap(df.corr(), annot=True, cmap='coolwarm')
plt.title('Feature Correlation Heatmap')
plt.show()
```



	TV	Radio	Newspaper	Sales
TV	1	0.055	0.057	0.9
Radio	0.055	1	0.35	0.35
Newspaper	0.057	0.35	1	0.16
Sales	0.9	0.35	0.16	1

```
plt.scatter(df['TV'], df['Sales'], color='blue')
plt.xlabel("TV Ad Spend ($000)")
plt.ylabel("Sales (Sign-ups in 000s)")
plt.title("TV Spend vs Sales")
plt.show()
```



```
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)
```

```
lr = LinearRegression()
lr.fit(X_train, y_train)
```

```
▾ LinearRegression
LinearRegression()
```

```
rf = RandomForestRegressor(n_estimators=100, random_state=42)
rf.fit(X_train, y_train)
```

```
▾ RandomForestRegressor
RandomForestRegressor(random_state=42)
```

```
def evaluate_model(model, X_train, y_train, X_test, y_test, name="Model"):
    y_pred_train = model.predict(X_train)
    y_pred_test = model.predict(X_test)

    print(f"\n{name} Performance:")
    print("Train R2 Score:", round(r2_score(y_train, y_pred_train), 3))
    print("Test R2 Score :", round(r2_score(y_test, y_pred_test), 3))
    print("MAE (Test)    :", round(mean_absolute_error(y_test, y_pred_test), 2))
    print("RMSE (Test)   :", round(np.sqrt(mean_squared_error(y_test, y_pred_test)), 2))


evaluate_model(lr, X_train, y_train, X_test, y_test, "Linear Regression")
evaluate_model(rf, X_train, y_train, X_test, y_test, "Random Forest")
```

```
Linear Regression Performance:
Train R2 Score: 0.9
Test R2 Score : 0.906
MAE (Test)    : 1.27
RMSE (Test)   : 1.71

Random Forest Performance:
Train R2 Score: 0.991
Test R2 Score : 0.953
MAE (Test)    : 0.92
RMSE (Test)   : 1.2
```

```
def forecast_signups(tv_spend, radio_spend, newspaper_spend, model=rf):
    """
    Predict new credit card sign-ups based on marketing spend.
    Default model = Random Forest (more accurate).
    """
    spend_data = np.array([[tv_spend, radio_spend, newspaper_spend]])
    prediction = model.predict(spend_data)[0]
    return round(prediction, 2)


print("\n--- Example Automation ---")
predicted_signups = forecast_signups(tv_spend=200, radio_spend=50, newspaper_spend=30)
print(f"If Company spends 200k on TV, 50k on Radio, 30k on Newspaper → Predicted sign-ups = {predicted_signups}k customers")
```

```
--- Example Automation ---
If Company spends 200k on TV, 50k on Radio, 30k on Newspaper → Predicted sign-ups = 22.93k customers
/usr/local/lib/python3.12/dist-packages/sklearn/utils/validation.py:2739: UserWarning: X does not have valid feature names, but Ranc
  warnings.warn(
```

Start coding or generate with AI.