In [1]:
```
import pandas as pd
import numpy as np
```

In [4]:
```
df = pd.read_csv('Advertising.csv')
```

In [5]:
```
df
```

Out[5]:

| | Unnamed: 0 | TV | Radio | Newspaper | Sales |
|---|---|---|---|---|---|
| **0** | 1 | 230.1 | 37.8 | 69.2 | 22.1 |
| **1** | 2 | 44.5 | 39.3 | 45.1 | 10.4 |
| **2** | 3 | 17.2 | 45.9 | 69.3 | 9.3 |
| **3** | 4 | 151.5 | 41.3 | 58.5 | 18.5 |
| **4** | 5 | 180.8 | 10.8 | 58.4 | 12.9 |
| **...** | ... | ... | ... | ... | ... |
| **195** | 196 | 38.2 | 3.7 | 13.8 | 7.6 |
| **196** | 197 | 94.2 | 4.9 | 8.1 | 9.7 |
| **197** | 198 | 177.0 | 9.3 | 6.4 | 12.8 |
| **198** | 199 | 283.6 | 42.0 | 66.2 | 25.5 |
| **199** | 200 | 232.1 | 8.6 | 8.7 | 13.4 |

200 rows × 5 columns

In [ ]:
```
## DATA PREPROCESSING ##
```

In [6]:
```
df.head()
```

Out[6]:

| | Unnamed: 0 | TV | Radio | Newspaper | Sales |
|---|---|---|---|---|---|
| **0** | 1 | 230.1 | 37.8 | 69.2 | 22.1 |
| **1** | 2 | 44.5 | 39.3 | 45.1 | 10.4 |
| **2** | 3 | 17.2 | 45.9 | 69.3 | 9.3 |
| **3** | 4 | 151.5 | 41.3 | 58.5 | 18.5 |
| **4** | 5 | 180.8 | 10.8 | 58.4 | 12.9 |

In [7]:
```
df.tail()
```

Out[7]:

| | Unnamed: 0 | TV | Radio | Newspaper | Sales |
|---|---|---|---|---|---|
| **195** | 196 | 38.2 | 3.7 | 13.8 | 7.6 |
| **196** | 197 | 94.2 | 4.9 | 8.1 | 9.7 |
| **197** | 198 | 177.0 | 9.3 | 6.4 | 12.8 |
| **198** | 199 | 283.6 | 42.0 | 66.2 | 25.5 |
| **199** | 200 | 232.1 | 8.6 | 8.7 | 13.4 |

In [8]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 200 entries, 0 to 199
Data columns (total 5 columns):
 #   Column      Non-Null Count  Dtype  
---  ------      --------------  -----  
 0   Unnamed: 0  200 non-null    int64  
 1   TV          200 non-null    float64
 2   Radio       200 non-null    float64
 3   Newspaper   200 non-null    float64
 4   Sales       200 non-null    float64
dtypes: float64(4), int64(1)
memory usage: 7.9 KB
```

In [9]:
```
df.shape
```

Out[9]:
```
(200, 5)
```

In [10]:
```
df.columns
```

Out[10]:
```
Index(['Unnamed: 0', 'TV', 'Radio', 'Newspaper', 'Sales'], dtype='objec
t')
```

In [11]:
```
df.isnull().sum()
```

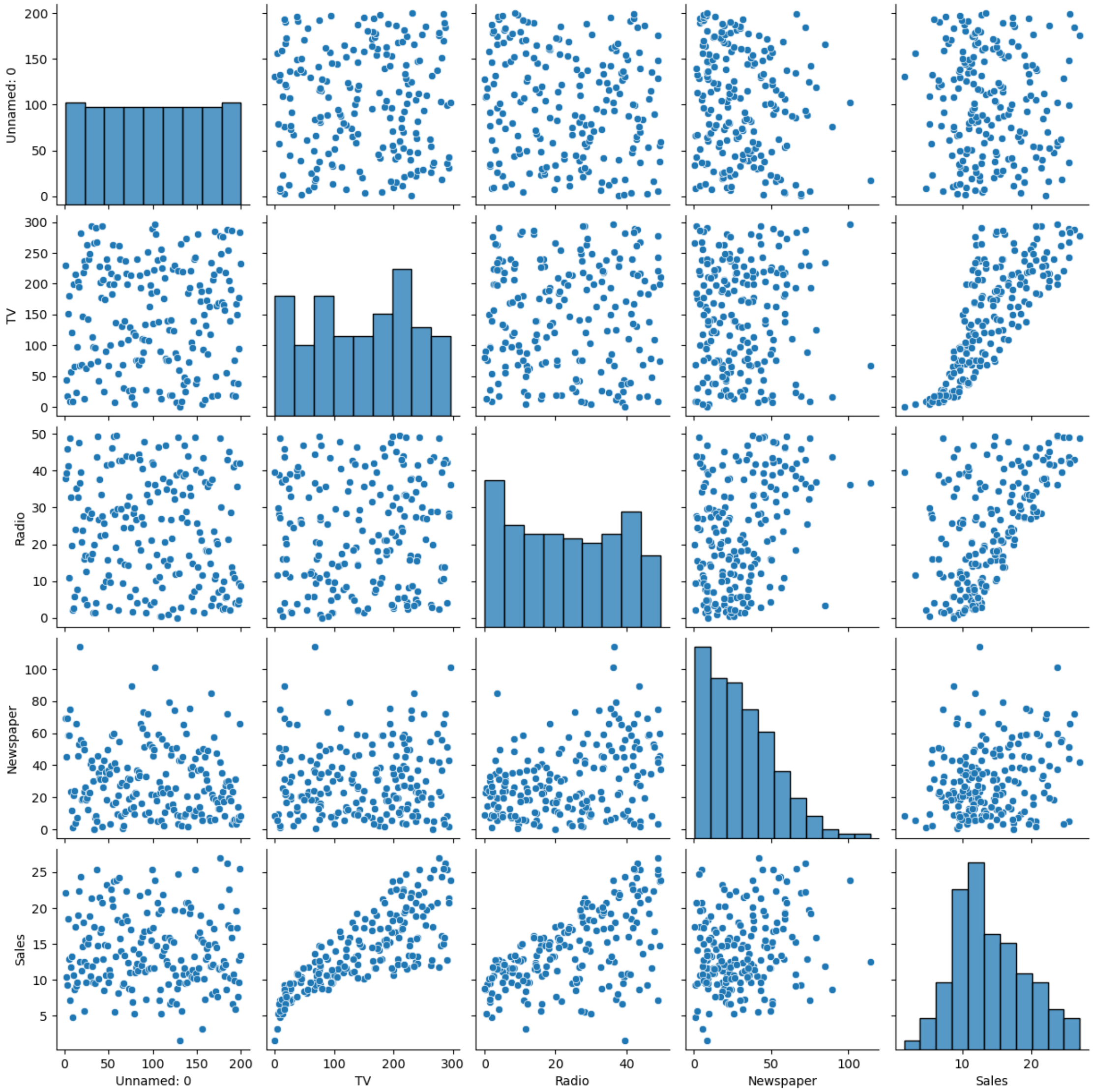
Out[11]:
```
Unnamed: 0    0
TV            0
Radio         0
Newspaper     0
Sales         0
dtype: int64
```

In [12]:

```
## VISUALIZATION ##

import matplotlib.pyplot as plt
import seaborn as sns

sns.pairplot(df)
```

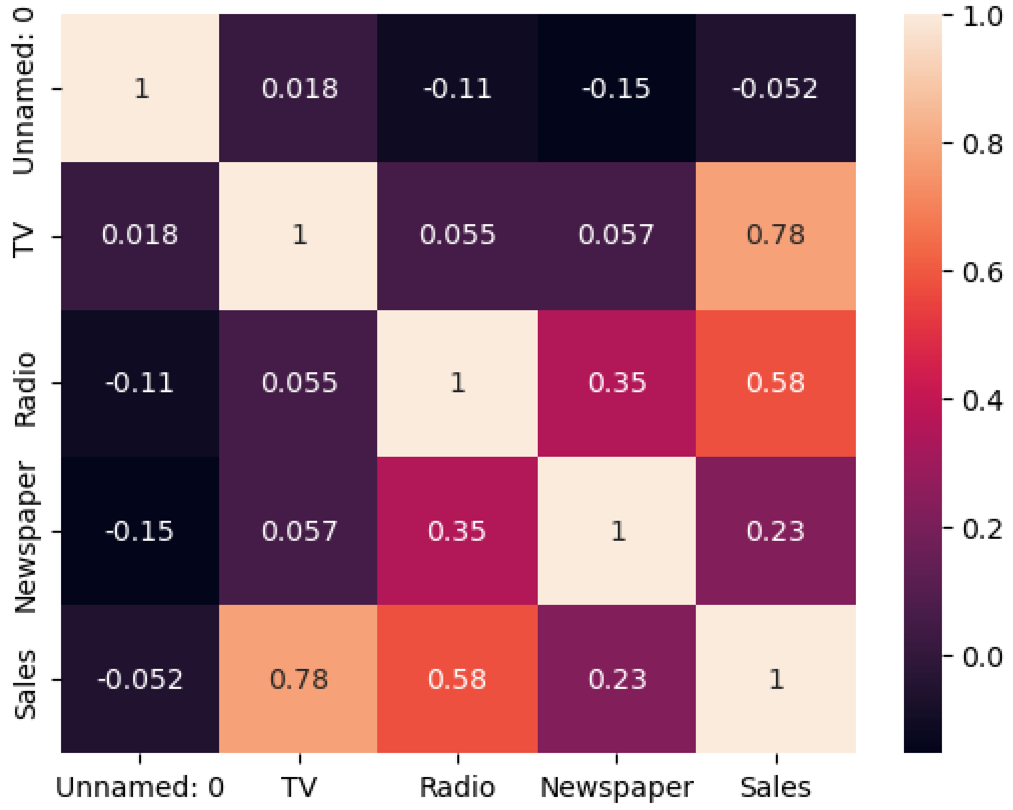
Out[12]:

```
<seaborn.axisgrid.PairGrid at 0x20ccec45b20>
```



In [22]:

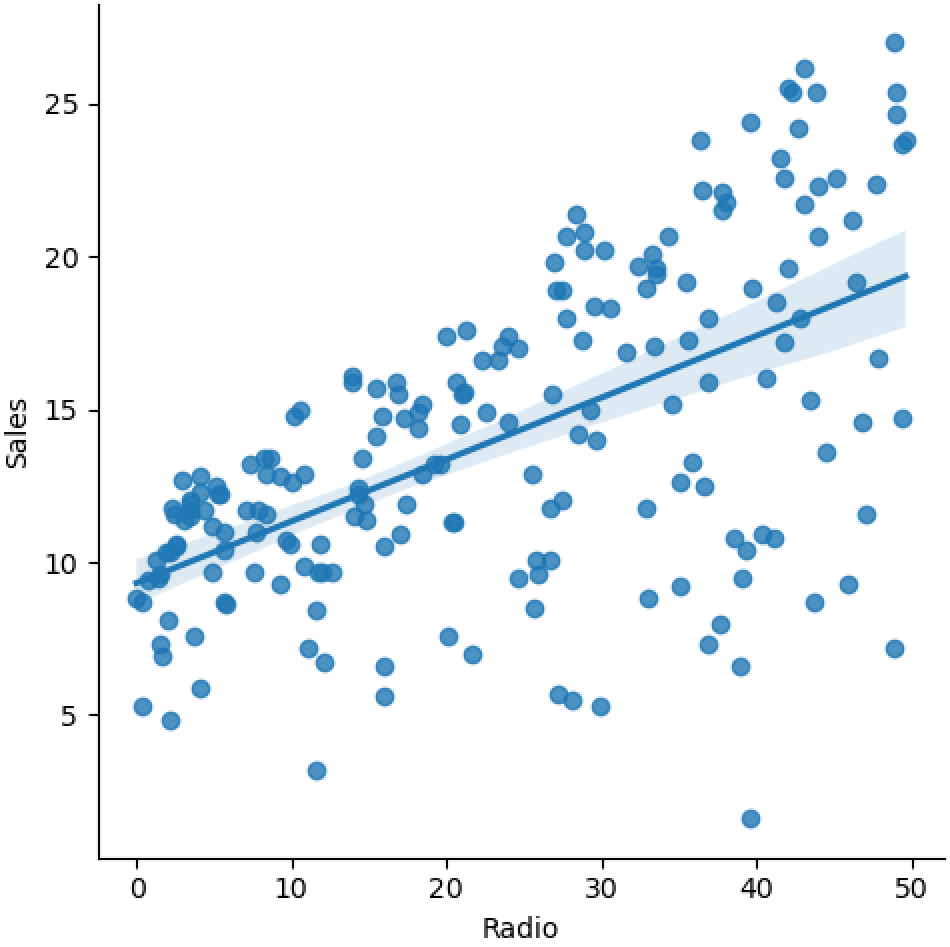
```
sns.heatmap(df.corr(),annot=True)
plt.show()
```



|  | Unnamed: 0 | TV | Radio | Newspaper | Sales |
|---|---|---|---|---|---|
| Unnamed: 0 | 1 | 0.018 | -0.11 | -0.15 | -0.052 |
| TV | 0.018 | 1 | 0.055 | 0.057 | 0.78 |
| Radio | -0.11 | 0.055 | 1 | 0.35 | 0.58 |
| Newspaper | -0.15 | 0.057 | 0.35 | 1 | 0.23 |
| Sales | -0.052 | 0.78 | 0.58 | 0.23 | 1 |

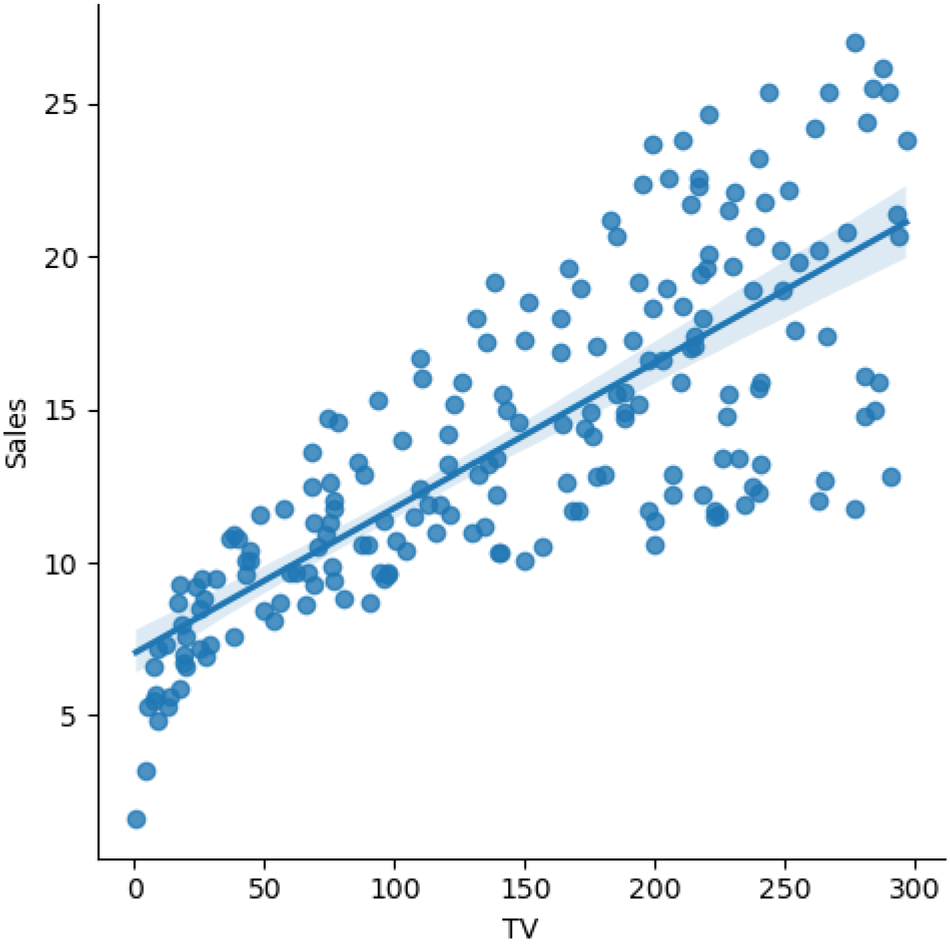
In [23]:

```
sns.lmplot(data=df,x='Radio',y="Sales")
plt.show()
```



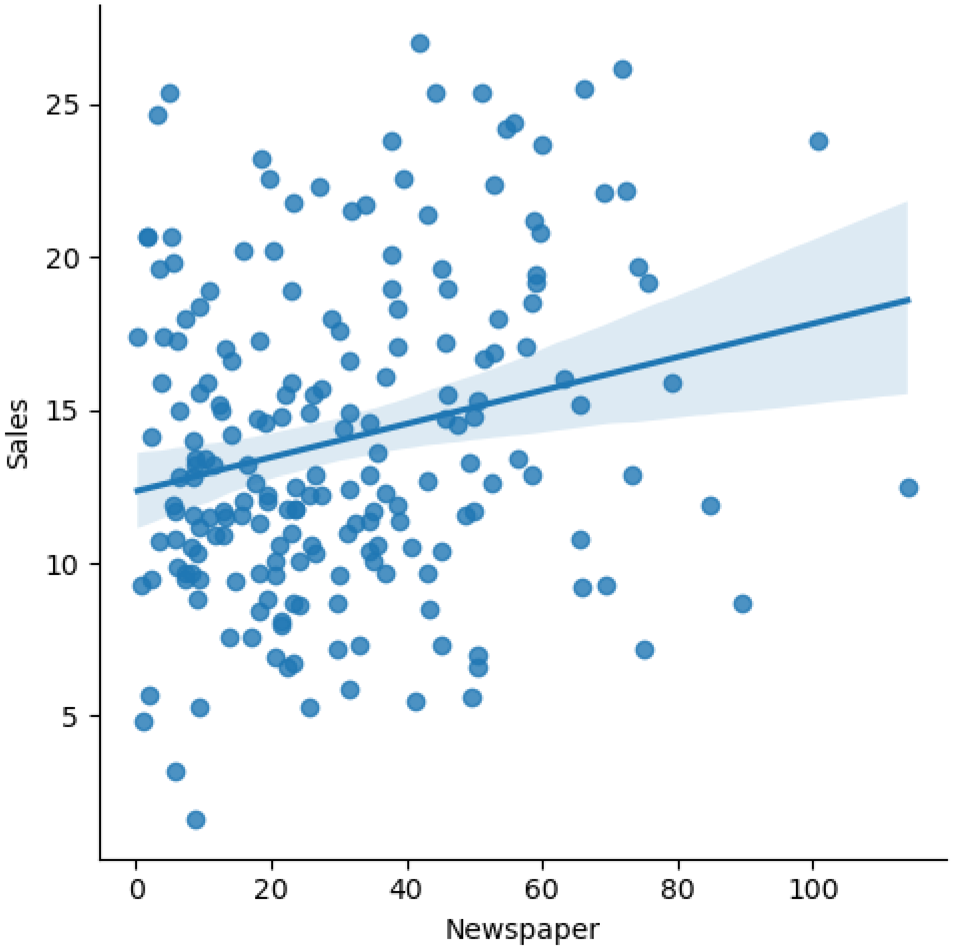
In [24]:

```
sns.lmplot(data=df,x='TV',y="Sales")
plt.show()
```



In [25]:

```
sns.lmplot(data=df,x='Newspaper',y="Sales")
plt.show()
```



In [29]:

```
## Splitting the data ##

x=df[['TV','Radio','Newspaper']]
y=df['Sales']
print(len(x), len(y))
print(x)
print(y)
print(x.shape)
print(y.shape)
```

```
200 200
        TV  Radio  Newspaper
0    230.1   37.8       69.2
1     44.5   39.3       45.1
2     17.2   45.9       69.3
3    151.5   41.3       58.5
4    180.8   10.8       58.4
..     ...    ...        ...
195   38.2    3.7       13.8
196   94.2    4.9        8.1
197  177.0    9.3        6.4
198  283.6   42.0       66.2
199  232.1    8.6        8.7

[200 rows x 3 columns]
0      22.1
1      10.4
2       9.3
3      18.5
4      12.9
       ...
195     7.6
196     9.7
197    12.8
198    25.5
199    13.4
Name: Sales, Length: 200, dtype: float64
(200, 3)
(200,)
```

In [30]:

```
## Training and Test Data ##
from sklearn.model_selection import train_test_split
x_train, x_test, y_train, y_test=train_test_split(x,y,test_size=1/10,rand
```

In [31]:

```
## Linear Regression ##

from sklearn.linear_model import LinearRegression
model = LinearRegression()
model.fit(x_train,y_train)
model.score(x_test,y_test)
```

Out[31]:

```
0.7556846087219637
```

In [32]:

```
from sklearn.linear_model import LinearRegression
regressor = LinearRegression()
regressor.fit(x_train, y_train)
```

Out[32]:

```
LinearRegression()
```

In [33]:

```
t_data_predic = regressor.predict(x_train)
```

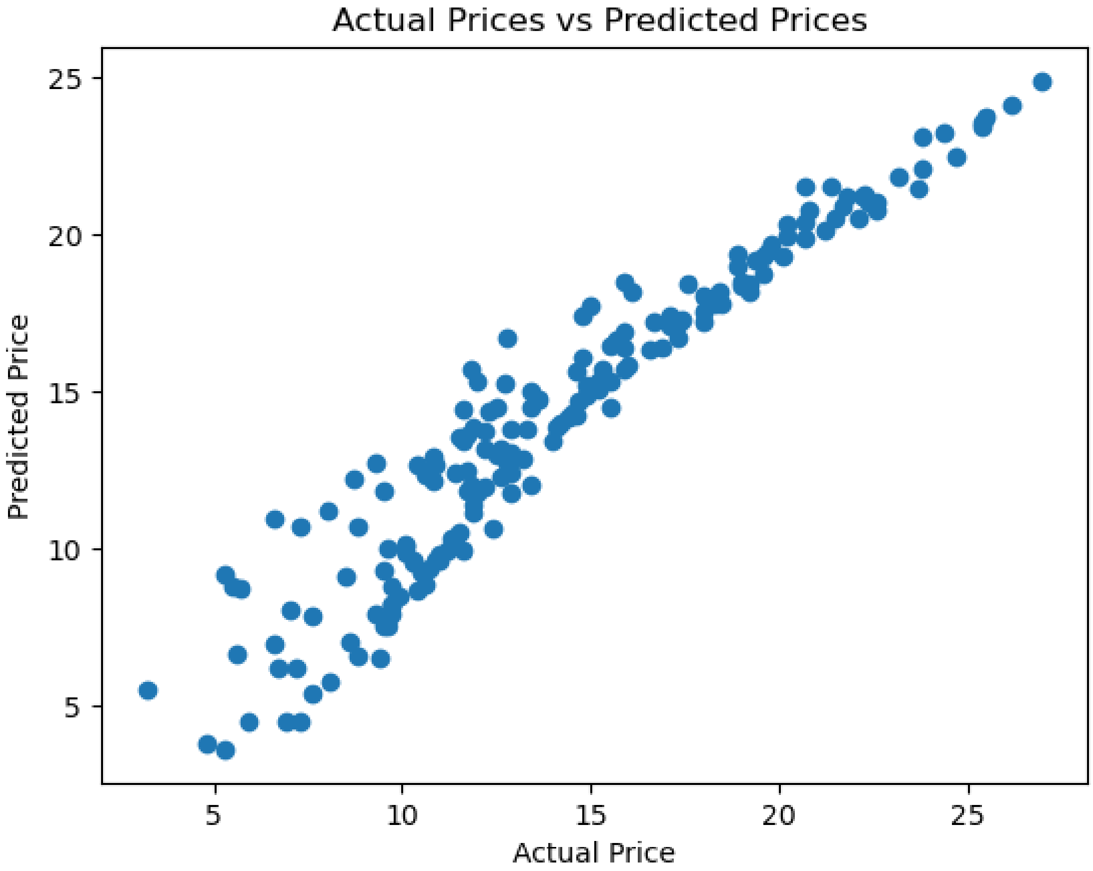
In [34]:

```
## Error Calculation ##

from sklearn import metrics
error_score = metrics.r2_score(y_train, t_data_predic)
print("R squared Error : ", error_score)
```

```
R squared Error :  0.9126527610435033
```

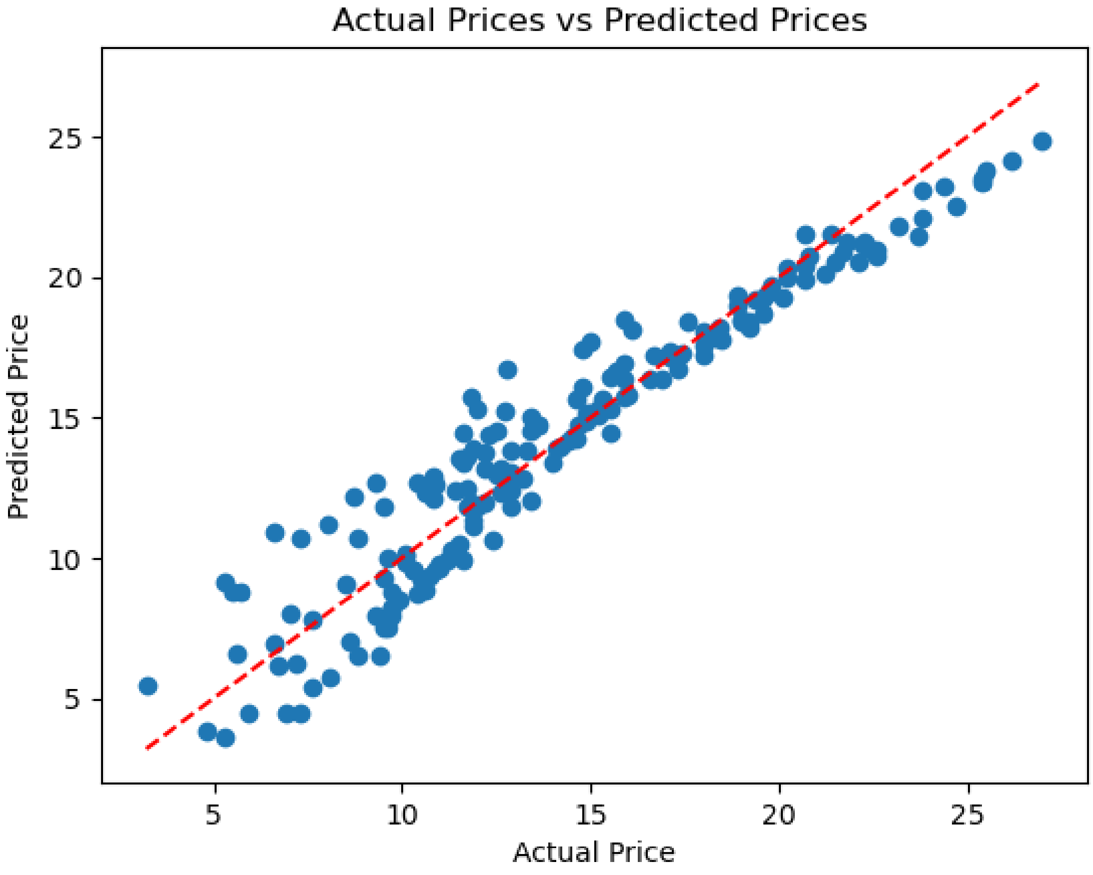
In [40]:

```
## Plotting THE data ##

plt.scatter(y_train, t_data_predic)
plt.xlabel("Actual Price")
plt.ylabel("Predicted Price")
plt.title(" Actual Prices vs Predicted Prices")
plt.show()
```



In [43]:

```
## Adding the linear line ##

plt.scatter(y_train, t_data_predic)
plt.xlabel("Actual Price")
plt.ylabel("Predicted Price")
plt.title(" Actual Prices vs Predicted Prices")
plt.plot([min(y_train), max(y_train)], [min(y_train), max(y_train)], 'r--
plt.show()
```



In [44]:

```
b = regressor.coef_
print("Coefficient :",b)
```

```
Coefficient : [ 0.04445735  0.19820881 -0.00245565]
```

In [45]:

```
a = regressor.intercept_
print("Intercept :",a)
```

```
Intercept : 3.0013503531930663
```