In [49]:

```
import numpy as np
import pandas as pd    ##importing the libraries
import matplotlib.pyplot as plt
```

In [50]:

```
data=pd.read_csv("D:\csvfiles\Advertising.csv") ###importing the datasets
```

In [51]:

```
data.head()
```

Out[51]:

	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 [52]:

```
data.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 [53]:

```
data=data.iloc[:,1:5] ##removing the unwanted columns
```

```
In [54]: data.head(5)
```

Out[54]:

	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	9.3
3	151.5	41.3	58.5	18.5
4	180.8	10.8	58.4	12.9

```
In [55]: data.info()  ##the data we containing is numerical data
```

```
<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
```

```
In [56]: data.describe()
```

Out[56]:

	TV	Radio	Newspaper	Sales
count	200.000000	200.000000	200.000000	200.000000
mean	147.042500	23.264000	30.554000	14.022500
std	85.854236	14.846809	21.778621	5.217457
min	0.700000	0.000000	0.300000	1.600000
25%	74.375000	9.975000	12.750000	10.375000
50%	149.750000	22.900000	25.750000	12.900000
75%	218.825000	36.525000	45.100000	17.400000
max	296.400000	49.600000	114.000000	27.000000

In [57]:
```
data.isnull().sum()
```

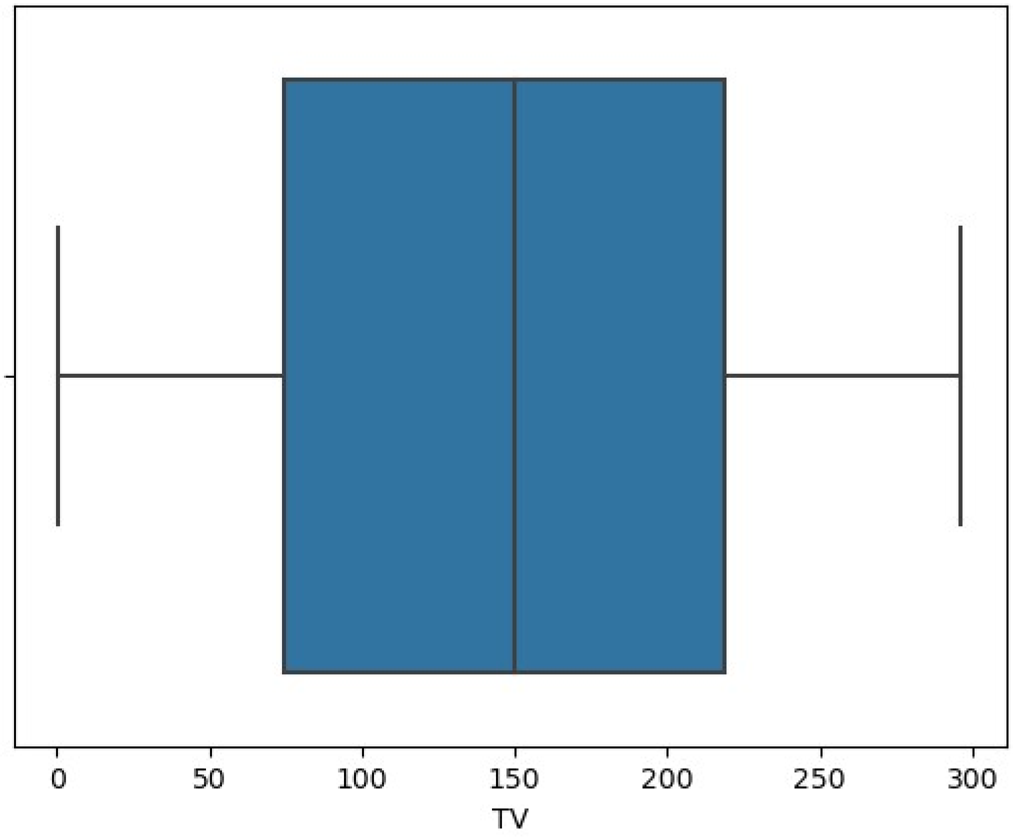
Out[57]:
```
TV           0
Radio        0
Newspaper    0
Sales        0
dtype: int64
```

In [58]:
```
###no null values
```

In [59]:
```
import seaborn as sns
sns.boxplot(data['TV'])  ##checking of outliers
```

```
C:\Users\ADMIN\anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWarning: Pass the following variable as a ke
yword arg: x. From version 0.12, the only valid positional argument will be `data`, and passing other arguments without
an explicit keyword will result in an error or misinterpretation.
  warnings.warn(
```

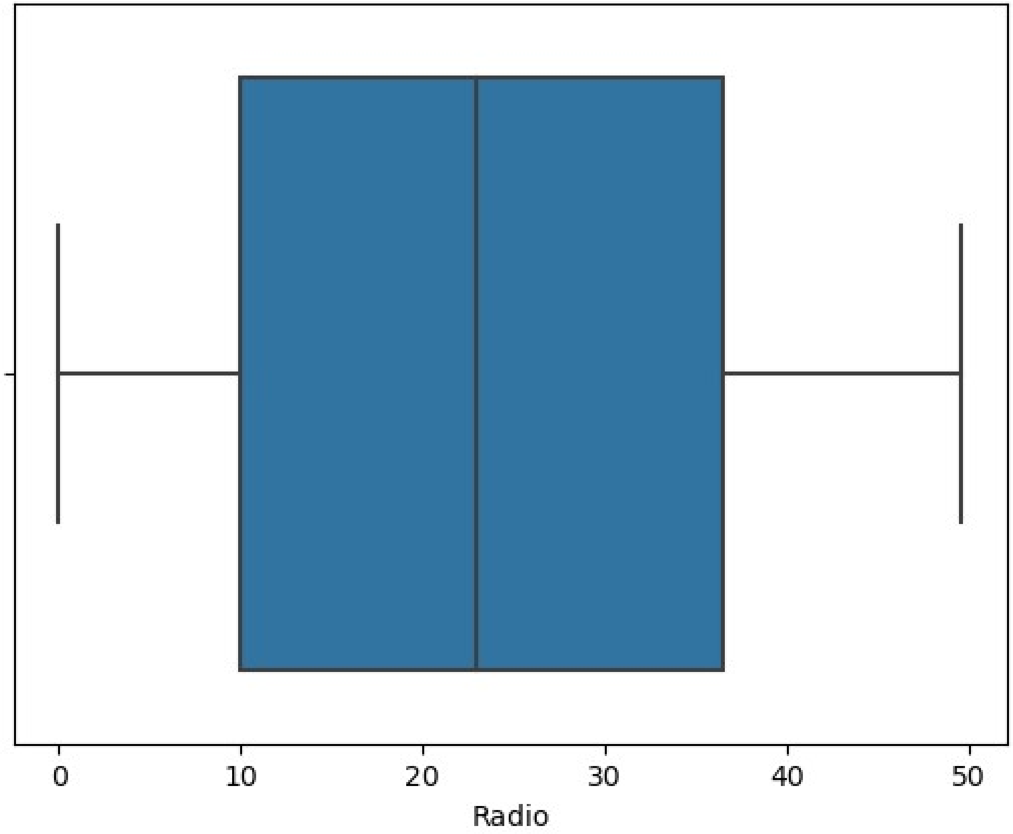
Out[59]:
```
<AxesSubplot:xlabel='TV'>
```



```
In [60]: sns.boxplot(data['Radio'])
```

```
C:\Users\ADMIN\anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWarning: Pass the following variable as a ke
yword arg: x. From version 0.12, the only valid positional argument will be `data`, and passing other arguments without
an explicit keyword will result in an error or misinterpretation.
  warnings.warn(
```

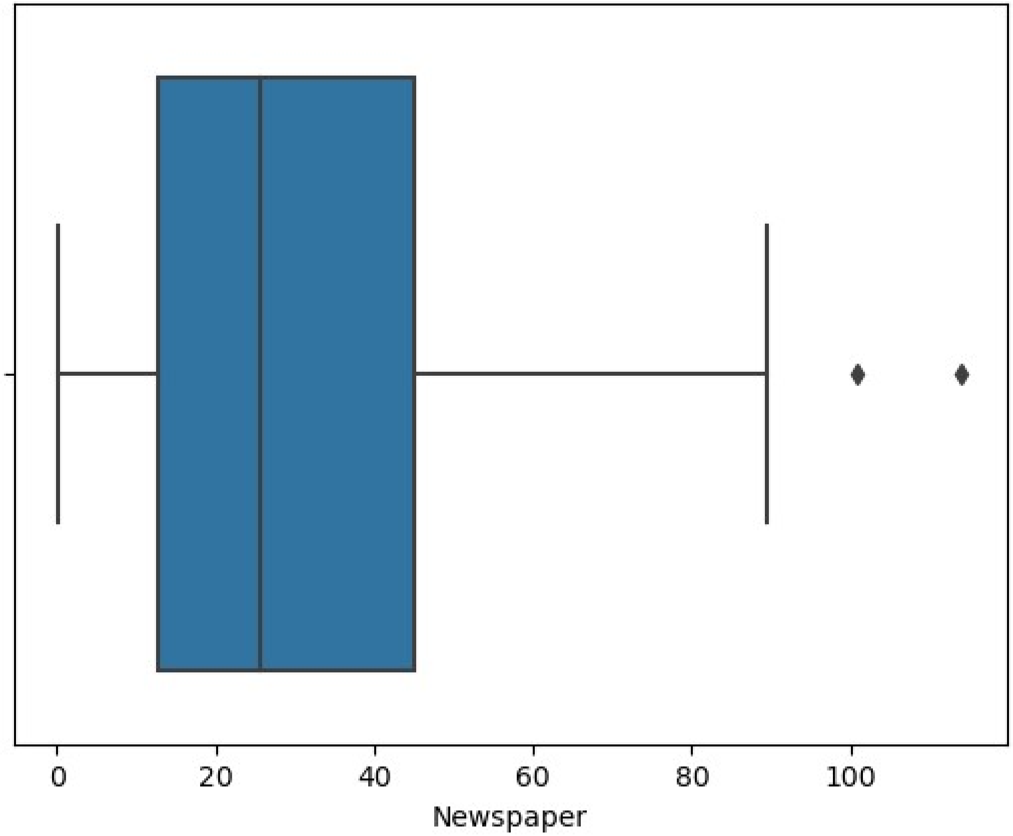
```
Out[60]: <AxesSubplot:xlabel='Radio'>
```



```
In [61]: sns.boxplot(data['Newspaper'])
```

```
C:\Users\ADMIN\anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWarning: Pass the following variable as a ke
yword arg: x. From version 0.12, the only valid positional argument will be `data`, and passing other arguments without
an explicit keyword will result in an error or misinterpretation.
  warnings.warn(
```

```
Out[61]: <AxesSubplot:xlabel='Newspaper'>
```



In [62]:

```
q1=data['Newspaper'].quantile(0.25)
q3=data['Newspaper'].quantile(0.75)
iqr=q3-q1
lower_bond=q1-1.5*iqr
upper_bond=1.5*iqr+q3
def Imputation(values):
    if values > upper_bond:
        return upper_bond
    elif values < lower_bond:
        return lower_bond
    else:
        return values
```

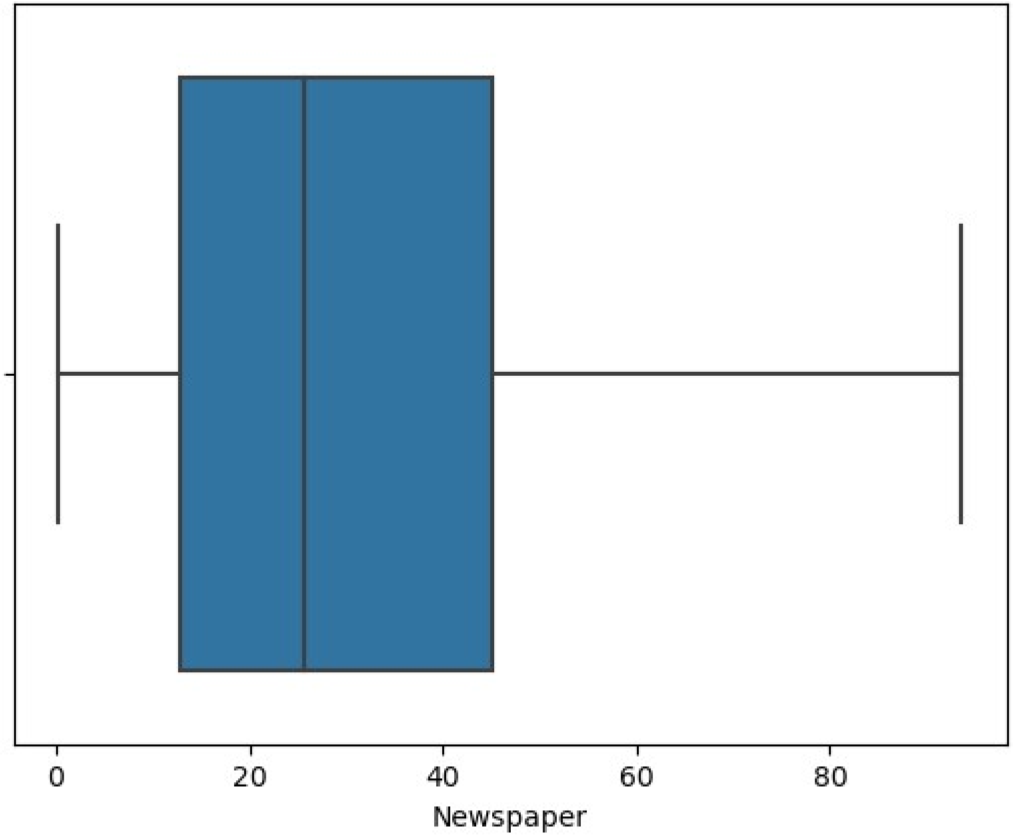
In [63]:

```
data['Newspaper']=data['Newspaper'].apply(Imputation)
```

In [64]:
```
sns.boxplot(data['Newspaper'])
```

```
C:\Users\ADMIN\anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWarning: Pass the following variable as a ke
yword arg: x. From version 0.12, the only valid positional argument will be `data`, and passing other arguments without
an explicit keyword will result in an error or misinterpretation.
  warnings.warn(
```

Out[64]:
```
<AxesSubplot:xlabel='Newspaper'>
```



In [65]:
```
##removed the outliers
```

In [66]:
```
## feature selection
```

In [67]:

```
data.corr()
```

Out[67]:

	TV	Radio	Newspaper	Sales
TV	1.000000	0.054809	0.059325	0.782224
Radio	0.054809	1.000000	0.355953	0.576223
Newspaper	0.059325	0.355953	1.000000	0.231432
Sales	0.782224	0.576223	0.231432	1.000000

here we can see that TV is contributing the maximum after that radio and than newspaper

since we didnt have more dimensions we are not performing any dimensionality reduction techniques

In [68]:

```
##here i am random forest to check the future sales prediction
```

In [69]:

```
from sklearn.ensemble import RandomForestRegressor
```

In [70]:

```
model=RandomForestRegressor(n_estimators=100,random_state=42)
```

In [71]:

```
x=data.iloc[:,0:3]
```

In [72]:
```
x
```

Out[72]:

	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 × 3 columns

In [73]:
```
y=data['Sales']
```

In [74]:
```
from sklearn.datasets import make_regression
```

In [75]:
```
x,y=make_regression(n_features=4, n_informative=2,random_state=0, shuffle=False)
```

In [76]:
```
cls=RandomForestRegressor(max_depth=2, random_state=0)   ##building the random forest model
```

In [77]:
```
cls.fit(x,y)
```

Out[77]:
```
RandomForestRegressor(max_depth=2, random_state=0)
```

In [78]:
```
y_pred=cls.predict(x)   ##prediction with test data
```

In [79]:
```
from sklearn.metrics import r2_score  ##finding r-square value
```

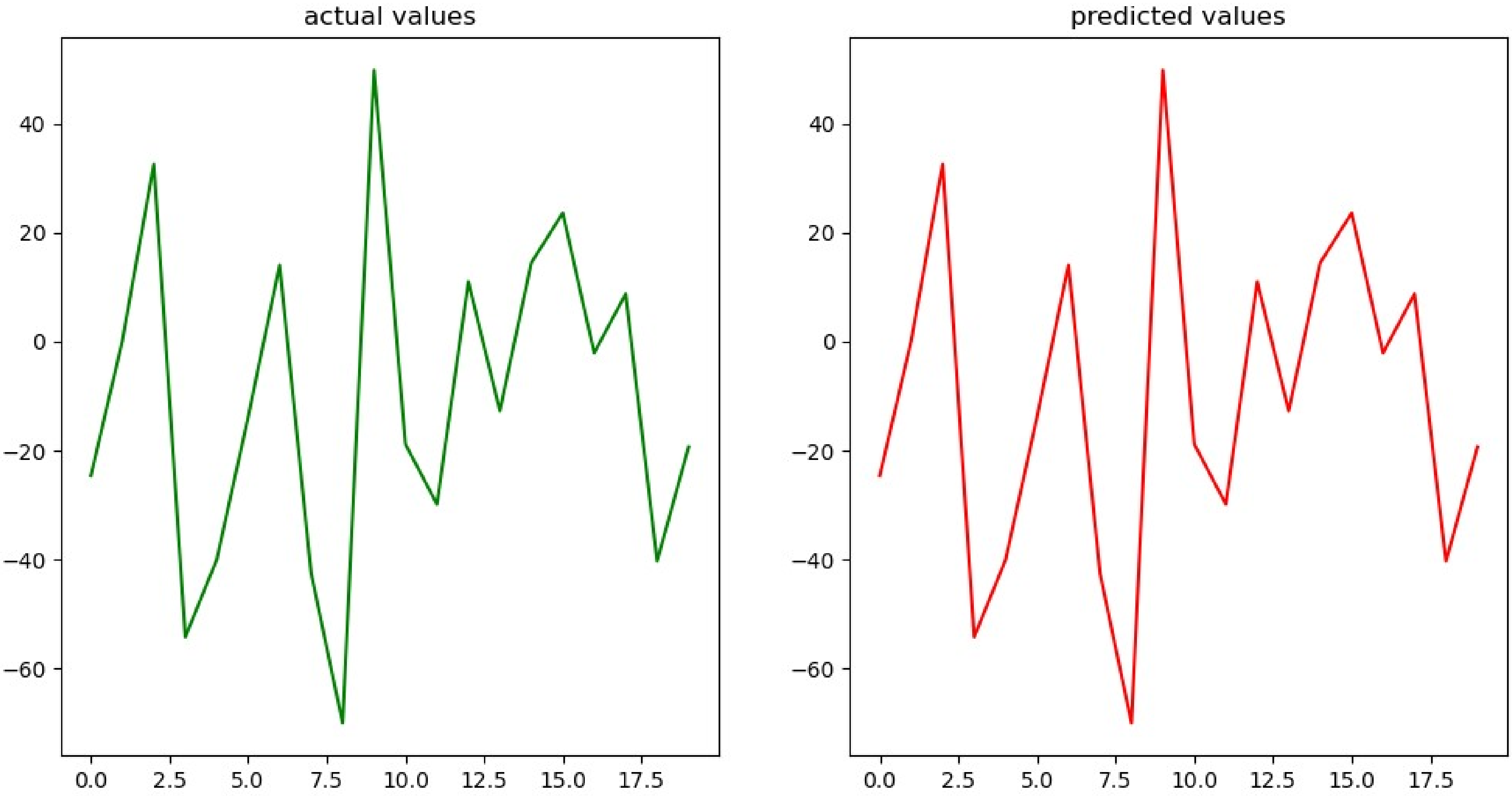
In [80]:
```
score=r2_score(y,y_pred)
```

In [81]:
```
score=round(score,2)*100
```

```
In [83]: print(score)  ##r-square value is 84%

         84.0

In [84]: ##multiple regression

In [85]: from sklearn.model_selection import train_test_split

In [86]: x_train,x_test,y_train,y_test=train_test_split(x,y,random_state=42,test_size=0.2) ##dividing the data into training and te

In [87]: from sklearn.linear_model import LinearRegression ##importing the linear regression

In [88]: model=LinearRegression()

In [89]: model.fit(x_train,y_train) ##fitting the training data

Out[89]: LinearRegression()

In [90]: y_pred=model.predict(x_test)  ##prediction using model

In [92]: score=r2_score(y_test,y_pred)

In [93]: score=score*100

In [96]: print(score)  ##score=100

         100.0

In [98]: print(y_pred,y_test)  ##printing the predicted values vs actual values

[-24.60719319   0.17626991  32.59386934 -54.23600024 -40.02555297
 -13.81361736  14.08815923 -42.5262156  -70.00907918  49.82290745
 -18.84474658 -29.85246699  10.99216958 -12.73102933  14.44189199
  23.60700003  -2.08694047   8.76446094 -40.341885   -19.3463247 ] [-24.60719319   0.17626991  32.59386934 -54.23600024
-40.02555297
 -13.81361736  14.08815923 -42.5262156  -70.00907918  49.82290745
 -18.84474658 -29.85246699  10.99216958 -12.73102933  14.44189199
  23.60700003  -2.08694047   8.76446094 -40.341885   -19.3463247 ]
```

```
In [113]: plt.figure(figsize=(12,6))
          plt.subplot(1,2,1)
          plt.plot(y_test,color="green")
          plt.title("actual values")                              ##plotting the values

          plt.subplot(1,2,2)
          plt.plot(y_test,color="red")
          plt.title("predicted values")
```

```
Out[113]: Text(0.5, 1.0, 'predicted values')
```


actual values
predicted values