In [3]:
```
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn import metrics
from sklearn import preprocessing,svm
```

In [4]:
```
df=pd.read_csv(r"C:\Users\DELL E5490\Downloads\Advertising (1).csv")
df
```

Out[4]:

	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
...	...	...	...	...
195	38.2	3.7	13.8	7.6
196	94.2	4.9	8.1	14.0
197	177.0	9.3	6.4	14.8
198	283.6	42.0	66.2	25.5
199	232.1	8.6	8.7	18.4

200 rows × 4 columns

In [5]:
```
df.head()
```

Out[5]:

	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

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

Out[6]:

	TV	Radio	Newspaper	Sales
195	38.2	3.7	13.8	7.6
196	94.2	4.9	8.1	14.0
197	177.0	9.3	6.4	14.8
198	283.6	42.0	66.2	25.5
199	232.1	8.6	8.7	18.4

In [7]:
```
df.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
```

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

Out[8]:

	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

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

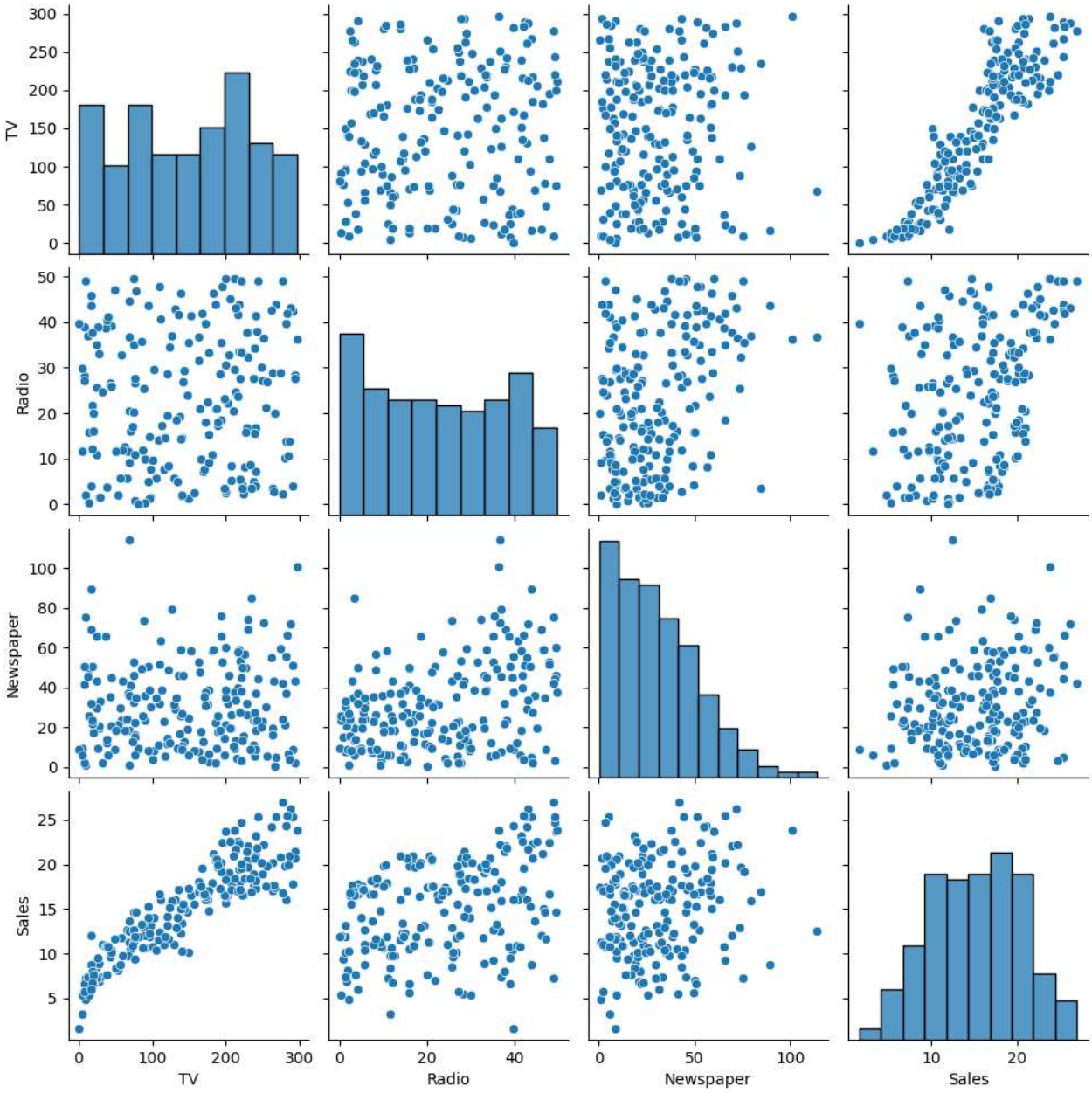
Out[9]:
```
(200, 4)
```

In [10]:
```
df.columns
Index(['TV', 'Radio', 'Newspaper', 'Sales', dtype='object'])
```

```
  Cell In[10], line 2
    Index(['TV', 'Radio', 'Newspaper', 'Sales', dtype='object'])
                                                ^
SyntaxError: invalid syntax. Maybe you meant '==' or ':=' instead of '='?
```

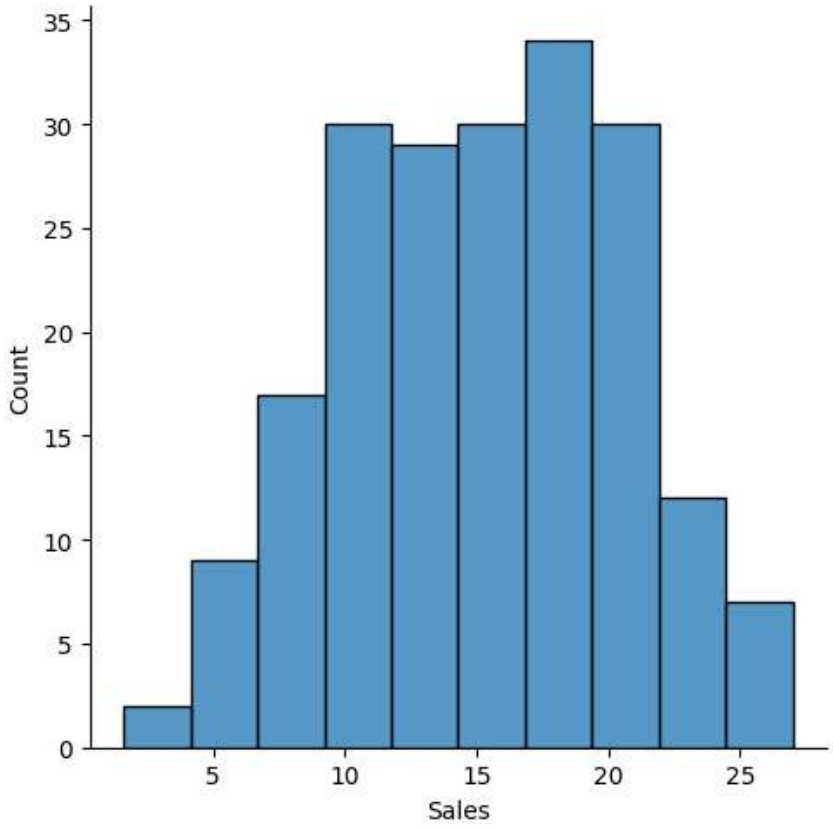
In [11]:
```
sns.pairplot(df)
```

Out[11]:
```
<seaborn.axisgrid.PairGrid at 0x1e0b523fbb0>
```



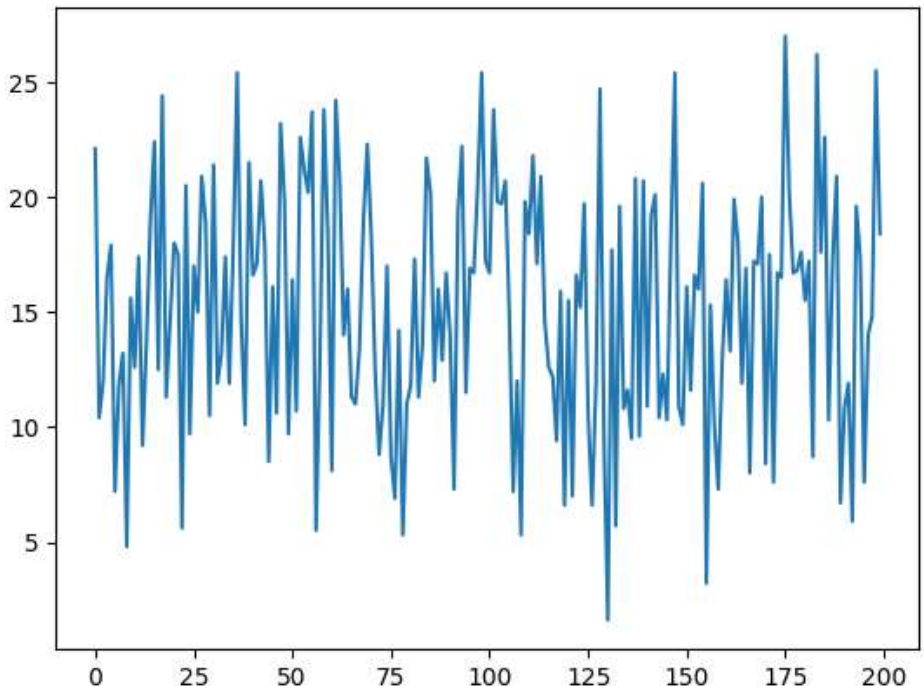
In [12]:
```
sns.displot(df['Sales'])
```

Out[12]:
```
<seaborn.axisgrid.FacetGrid at 0x1e094a029b0>
```



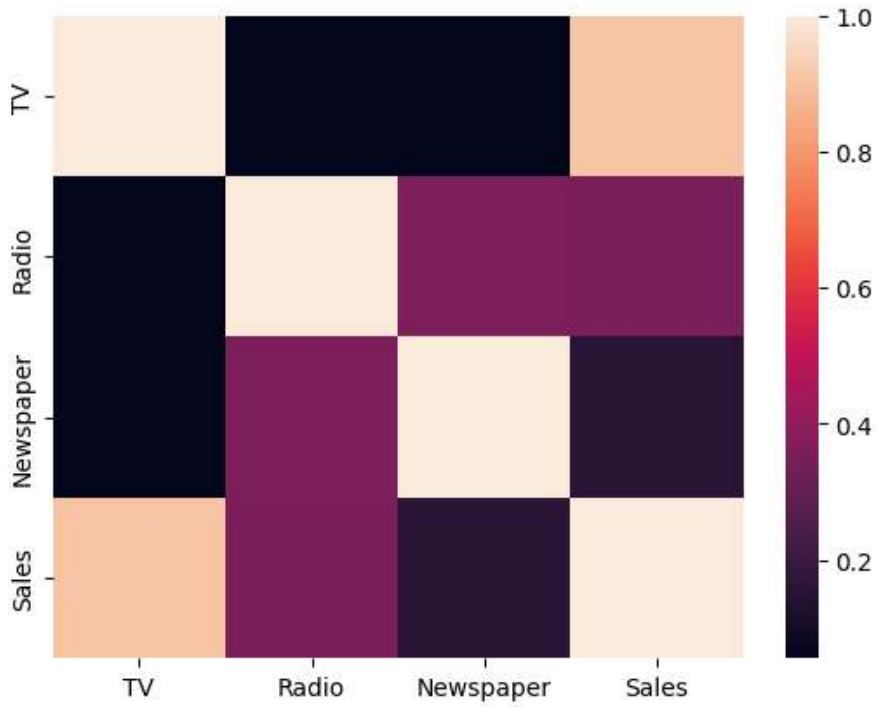
In [13]:
```
plt.plot(df['Sales'])
```

Out[13]:
```
[<matplotlib.lines.Line2D at 0x1e0b970eda0>]
```



In [14]:
```
addf=df[['TV','Radio','Newspaper','Sales']]
sns.heatmap(addf.corr())
```

Out[14]: <Axes: >



In [15]:
```
x=df[['TV','Radio','Newspaper']]
y=df['Sales']
```

In [16]:
```
from sklearn.model_selection import train_test_split
x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.3,random_state=101)
from sklearn.linear_model import LinearRegression
lm=LinearRegression()
lm.fit(x_train,y_train)
print(lm.intercept_)
```

```
4.681232151484295
```

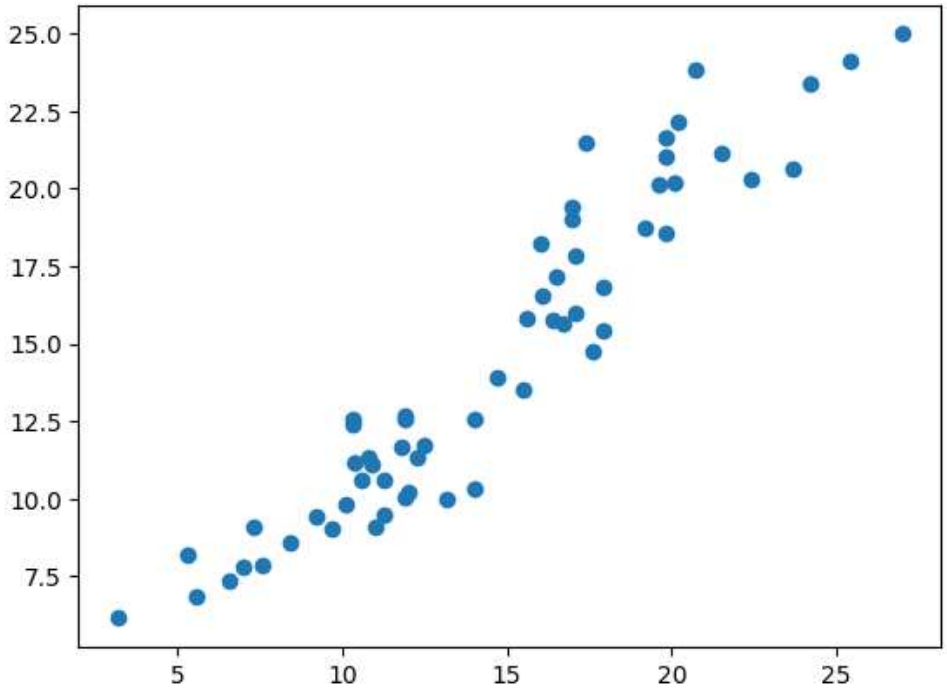
In [17]:
```
coeff_df=pd.DataFrame(lm.coef_,x.columns,columns=['coefficient'])
coeff_df
```

Out[17]:

	coefficient
TV	0.054930
Radio	0.109558
Newspaper	-0.006194

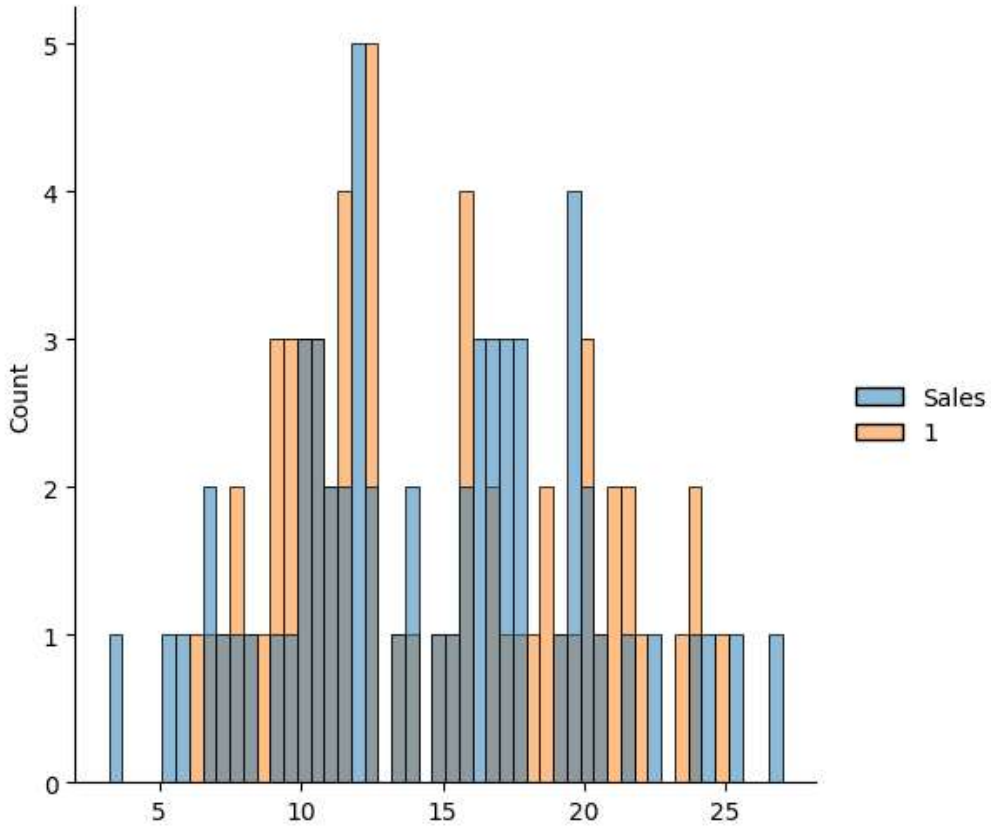
In [18]:
```
predictions=lm.predict(x_test)
plt.scatter(y_test,predictions)
```

Out[18]: <matplotlib.collections.PathCollection at 0x1e0b9866a10>



In [19]:
```
sns.displot((y_test,predictions),bins=50)#without semicolon
```

Out[19]: <seaborn.axisgrid.FacetGrid at 0x1e0b9820310>

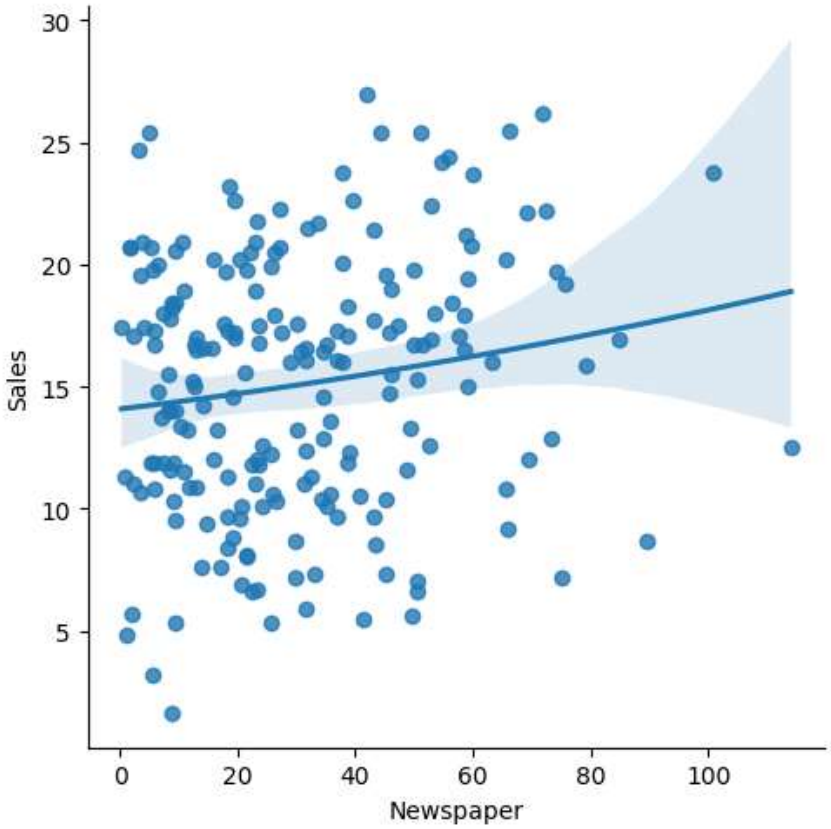


In [20]:
```
from sklearn import metrics
print('MAE:',metrics.mean_absolute_error(y_test,predictions))
print('MSE:',metrics.mean_squared_error(y_test,predictions))
print('RMSE:',np.sqrt(metrics.mean_squared_error(y_test,predictions)))
```

```
MAE: 1.3731200698367851
MSE: 2.868570633896497
RMSE: 1.6936855180040058
```

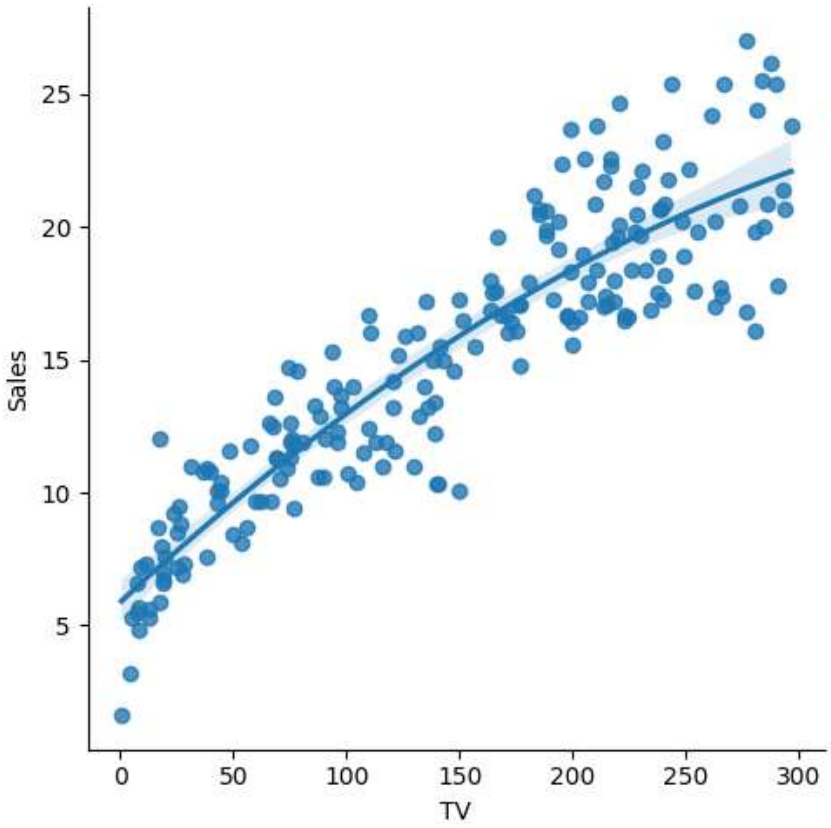
In [21]:
```
sns.lmplot(x="Newspaper",y="Sales",data=df,order=2)
```

Out[21]:
```
<seaborn.axisgrid.FacetGrid at 0x1e0b9867400>
```



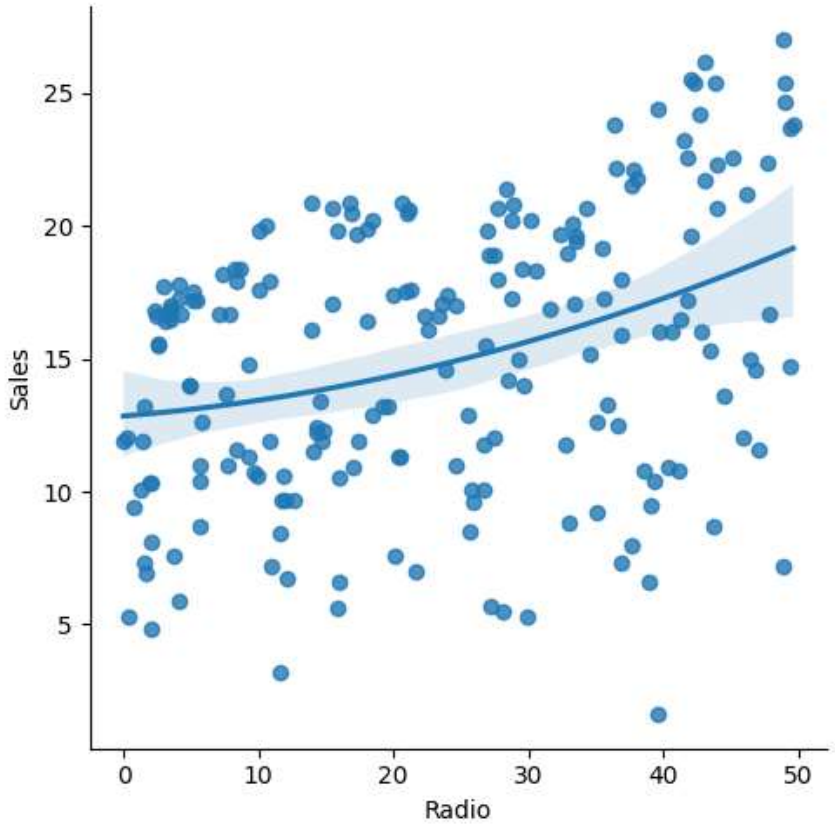
In [22]:
```
sns.lmplot(x="TV",y="Sales",data=df,order=2)
```

Out[22]:
```
<seaborn.axisgrid.FacetGrid at 0x1e0b6a11330>
```



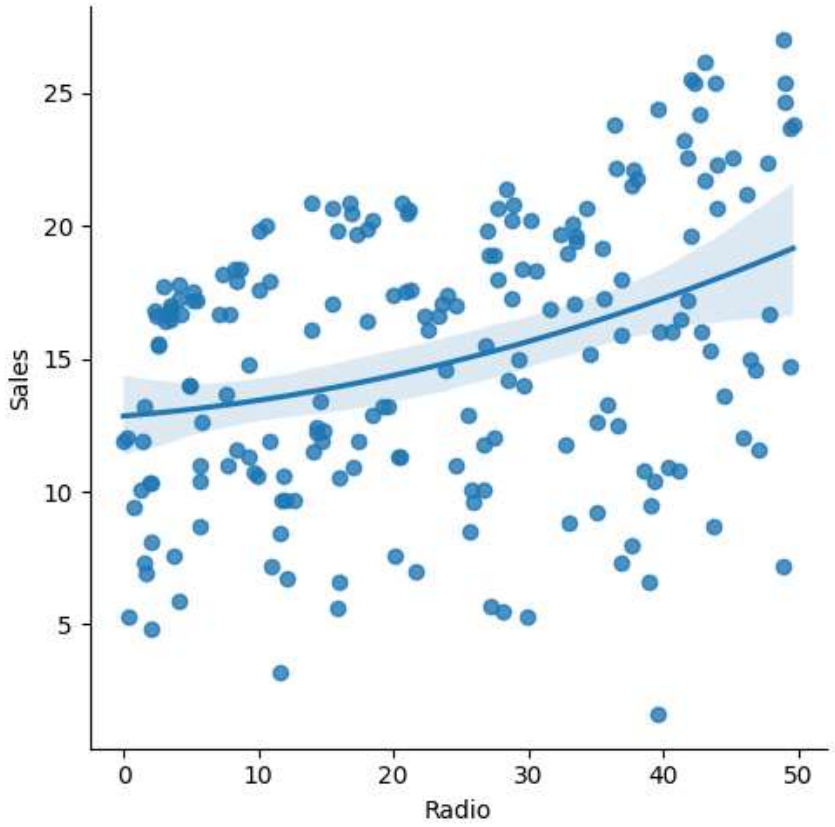
In [23]:
```
sns.lmplot(x="Radio",y="Sales",data=df,order=2)
```

Out[23]:
```
<seaborn.axisgrid.FacetGrid at 0x1e0b92d24d0>
```



In [24]:
```
sns.lmplot(x="Radio",y="Sales",data=df,order=2)
```

Out[24]:
```
<seaborn.axisgrid.FacetGrid at 0x1e0b90ff520>
```

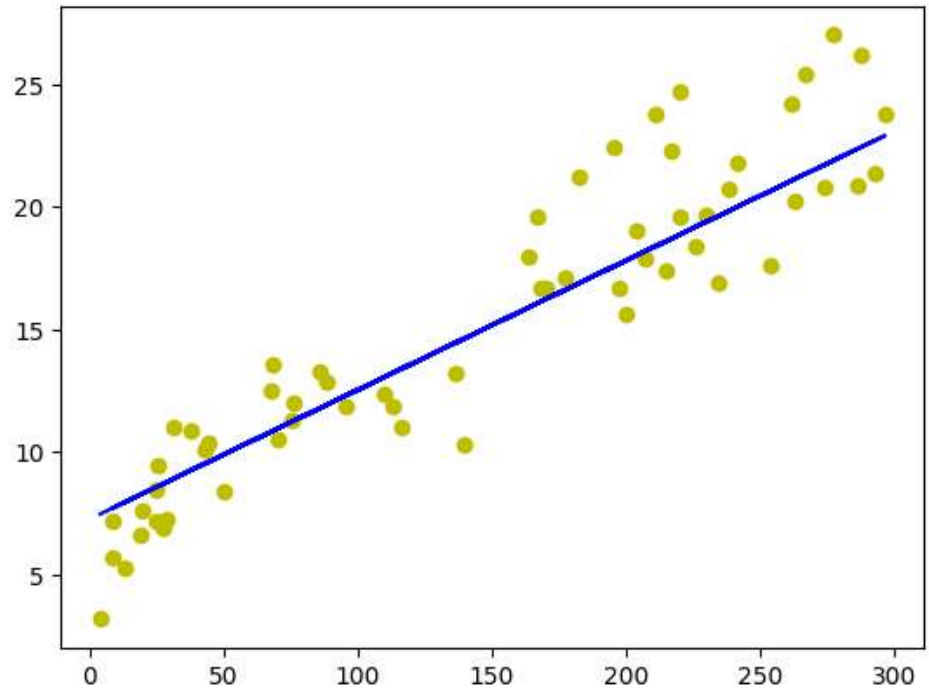


In [25]:
```
regr=LinearRegression()
x=np.array(df['TV']).reshape(-1,1)
y=np.array(df['Sales']).reshape(-1,1)
df.dropna(inplace=True)
```

In [26]:
```
x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.3)
regr.fit(x_train,y_train)
regr.fit(x_train,y_train)
```

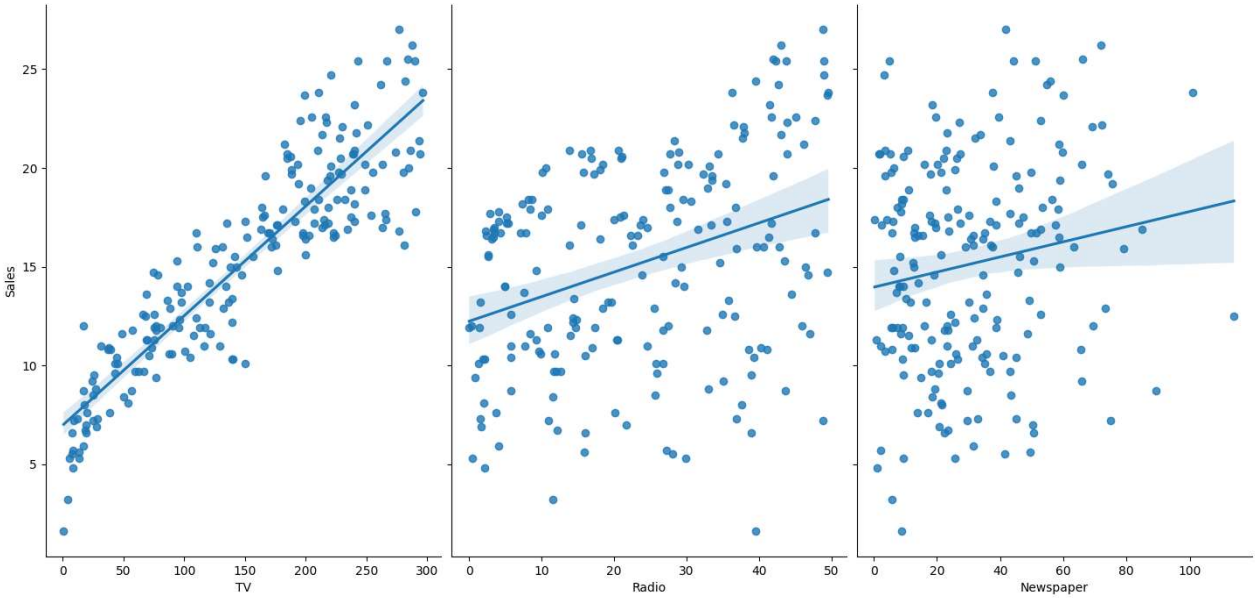
Out[26]:
```
LinearRegression
LinearRegression()
```

In [27]:
```
y_pred=regr.predict(x_test)
plt.scatter(x_test,y_test,color='y')
plt.plot(x_test,y_pred,color='b')
plt.show()
```



In [28]:
```
sns.pairplot(df,x_vars=['TV','Radio','Newspaper'],y_vars='Sales',height=7,aspect=0.7,kind='reg'
```

Out[28]: <seaborn.axisgrid.PairGrid at 0x1e0bcd2e6e0>



In [29]:
```
regr=LinearRegression()
regr.fit(x_train,y_train)
regr.fit(x_train,y_train)
print(regr.score(x_test,y_test))
```

```
0.8500118840620675
```

In [30]:
```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.linear_model import Ridge, RidgeCV, Lasso
from sklearn.preprocessing import StandardScaler
```

In [32]:
```
data=pd.read_csv(r"C:\Users\DELL E5490\Downloads\Advertising (1).csv")
df
```

Out[32]:

	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
...	...	...	...	...
195	38.2	3.7	13.8	7.6
196	94.2	4.9	8.1	14.0
197	177.0	9.3	6.4	14.8
198	283.6	42.0	66.2	25.5
199	232.1	8.6	8.7	18.4

200 rows × 4 columns

In [33]:
```
data.head()
```

Out[33]:

	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

In [34]:
```
data.tail()
```

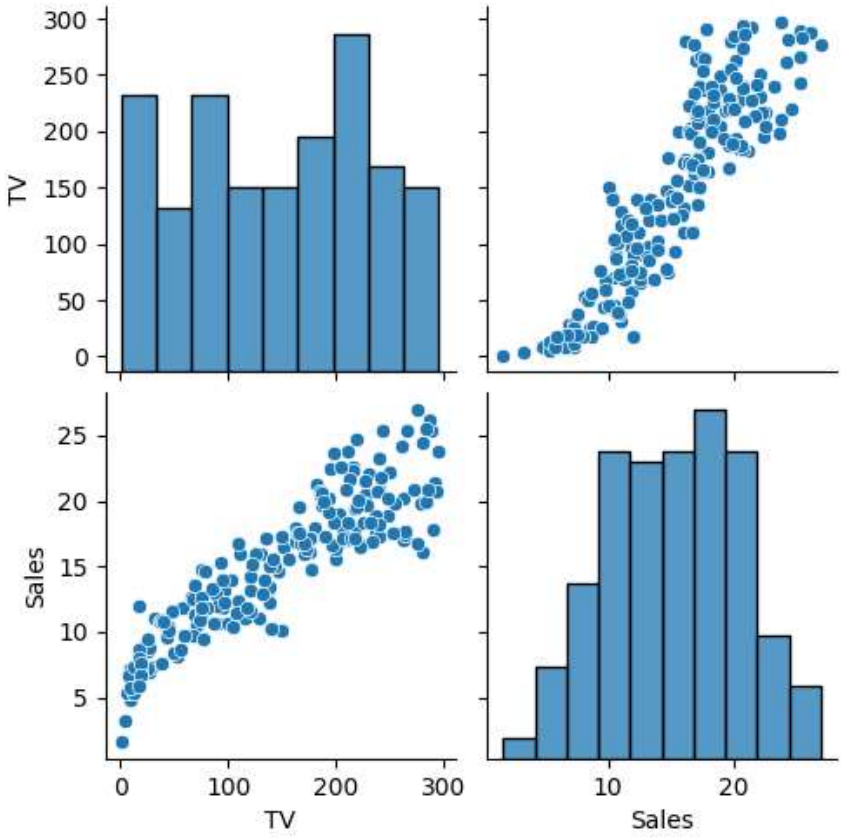
Out[34]:

	TV	Radio	Newspaper	Sales
195	38.2	3.7	13.8	7.6
196	94.2	4.9	8.1	14.0
197	177.0	9.3	6.4	14.8
198	283.6	42.0	66.2	25.5
199	232.1	8.6	8.7	18.4

In [35]:
```
plt.figure(figsize = (10, 10))
sns.heatmap(data.corr(), annot = True)
```

Out[35]: <Axes: >

In [36]:
```
data.drop(columns = ["Radio", "Newspaper"], inplace = True)
#pairplot
sns.pairplot(data)
data.Sales = np.log(data.Sales)
```



In [37]:
```
features = data.columns[0:2]
target = data.columns[-1]
#X and y values
X = data[features].values
y = data[target].values
#splot
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.3, random_state=17)
print("The dimension of X_train is {}".format(X_train.shape))
print("The dimension of X_test is {}".format(X_test.shape))
#Scale features
scaler = StandardScaler()
X_train = scaler.fit_transform(X_train)
X_test = scaler.transform(X_test)
```

```
The dimension of X_train is (140, 2)
The dimension of X_test is (60, 2)
```

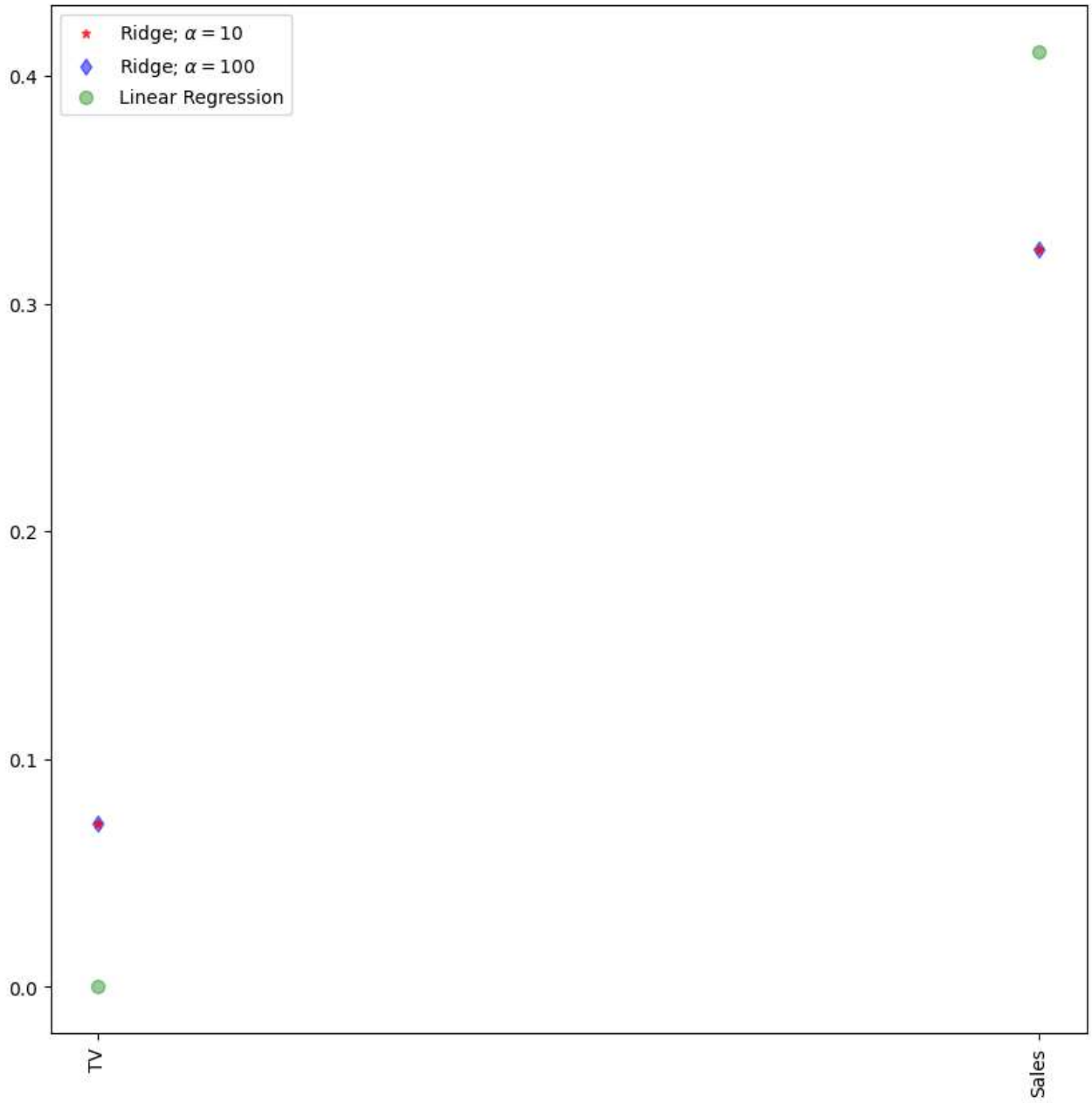
In [38]:
```
#Model
lr = LinearRegression()
#Fit model
lr.fit(X_train, y_train)
#predict
#prediction = lr.predict(X_test)
#actual
actual = y_test
train_score_lr = lr.score(X_train, y_train)
test_score_lr = lr.score(X_test, y_test)
print("\nLinear Regression Model:\n")
print("The train score for lr model is {}".format(train_score_lr))
print("The test score for lr model is {}".format(test_score_lr))
```

```
Linear Regression Model:

The train score for lr model is 1.0
The test score for lr model is 1.0
```

In [39]:
```
#Ridge Regression Model
ridgeReg = Ridge(alpha=10)
ridgeReg.fit(X_train,y_train)
#train and test scorefor ridge regression
train_score_ridge = ridgeReg.score(X_train, y_train)
test_score_ridge = ridgeReg.score(X_test, y_test)
print("\nRidge Model:\n")
print("The train score for ridge model is {}".format(train_score_ridge))
print("The test score for ridge model is {}".format(test_score_ridge))
```

```
Ridge Model:

The train score for ridge model is 0.990287139194161
The test score for ridge model is 0.9844266285141221
```

In [40]:
```
plt.figure(figsize = (10, 10))
plt.plot(features,ridgeReg.coef_,alpha=0.7,linestyle='none',marker='*',markersize=5,color='red'
plt.plot(ridgeReg.coef_,alpha=0.5,linestyle='none',marker='d',markersize=6,color='blue',label=r
plt.plot(features,lr.coef_,alpha=0.4,linestyle='none',marker='o',markersize=7,color='green',lab
plt.xticks(rotation = 90)
plt.legend()
plt.show()
```

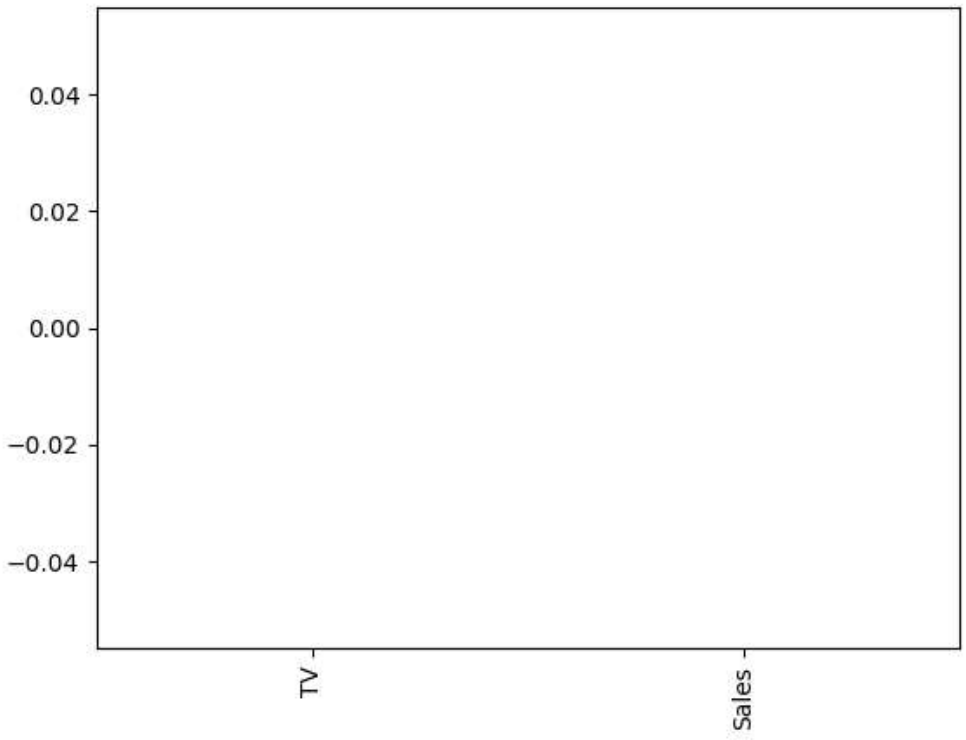


In [41]:
```
#Lasso regression model
print("\nLasso Model: \n")
lasso = Lasso(alpha = 10)
lasso.fit(X_train,y_train)
train_score_ls =lasso.score(X_train,y_train)
test_score_ls =lasso.score(X_test,y_test)
print("The train score for ls model is {}".format(train_score_ls))
print("The test score for ls model is {}".format(test_score_ls))
```

```
Lasso Model:

The train score for ls model is 0.0
The test score for ls model is -0.0042092253233847465
```

In [42]:
```
pd.Series(lasso.coef_, features).sort_values(ascending = True).plot(kind = "bar")
```

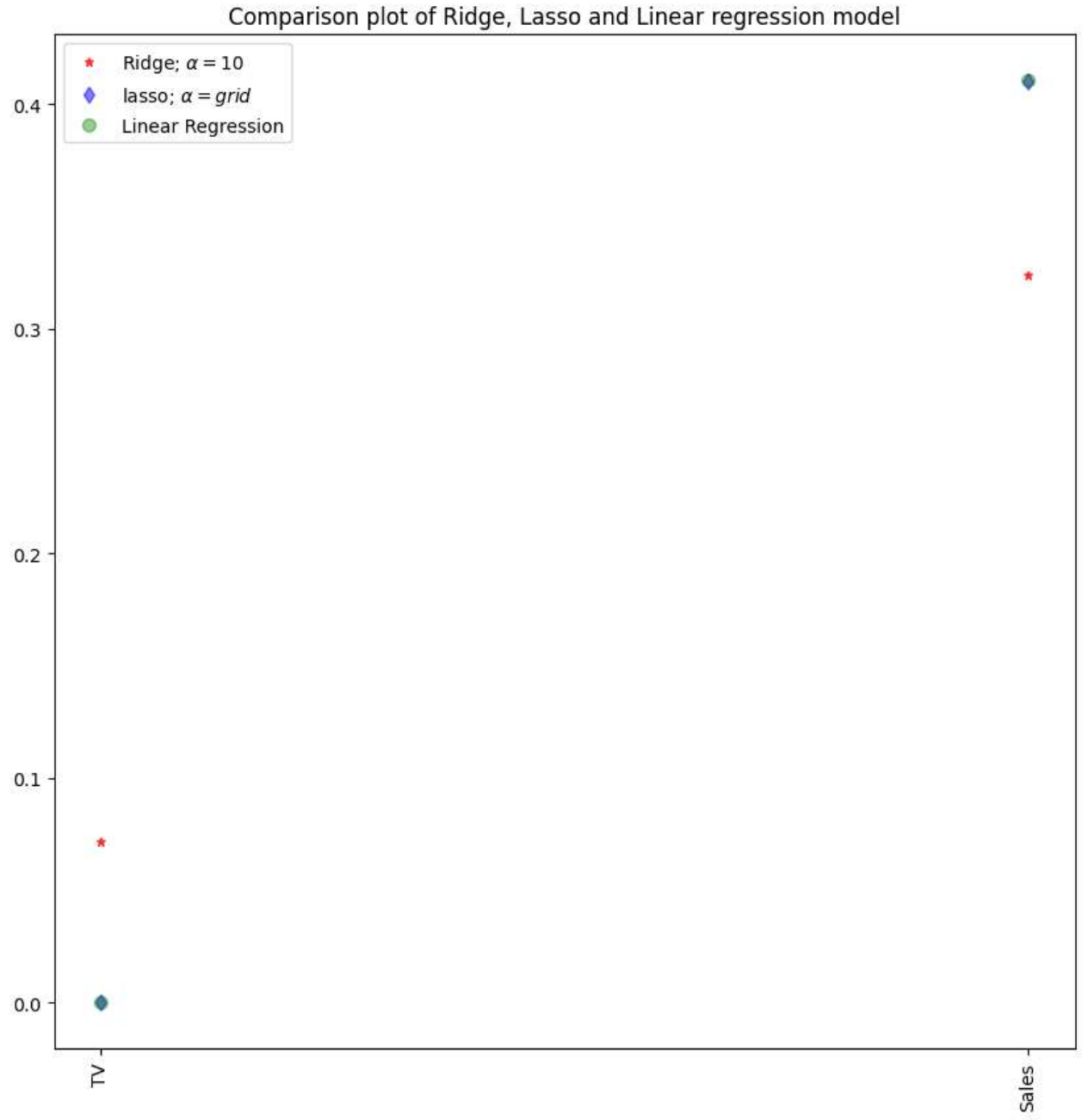
Out[42]: <Axes: >



In [43]:
```
#Using the Linear CV model
from sklearn.linear_model import LassoCV
#Lasso Cross validation
lasso_cv = LassoCV(alphas = [0.0001, 0.001,0.01, 0.1, 1, 10], random_state=0).fit(X_train, y_tr
#score
print(lasso_cv.score(X_train, y_train))
print(lasso_cv.score(X_test, y_test))
```

```
0.9999999343798134
0.9999999152638072
```

In [44]:
```
#plot size
plt.figure(figsize = (10, 10))
#add plot for ridge regression
plt.plot(features,ridgeReg.coef_,alpha=0.7,linestyle='none',marker='*',markersize=5,color='red'
#add plot for lasso regression
plt.plot(lasso_cv.coef_,alpha=0.5,linestyle='none',marker='d',markersize=6,color='blue',label=r
#add plot for linear model
plt.plot(features,lr.coef_,alpha=0.4,linestyle='none',marker='o',markersize=7,color='green',lab
#rotate axis
plt.xticks(rotation = 90)
plt.legend()
plt.title("Comparison plot of Ridge, Lasso and Linear regression model")
plt.show()
```



In [46]:
```
#Using the linear CV model
from sklearn.linear_model import RidgeCV
#Ridge Cross validation
ridge_cv = RidgeCV(alphas = [0.0001, 0.001,0.01, 0.1, 1, 10]).fit(X_train, y_train)
#score
print("The train score for ridge model is {}".format(ridge_cv.score(X_train, y_train)))
print("The train score for ridge model is {}".format(ridge_cv.score(X_test, y_test)))
```

```
The train score for ridge model is 0.999999999997627
The train score for ridge model is 0.9999999999962467
```

In [ ]:

In [ ]:

In [ ]:

In [ ]:

In [ ]:

In [ ]:

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In [ ]:

In [ ]: