In [1]:
```
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 [2]:
```
df=pd.read_csv(r"C:\Users\venka\OneDrive\Documents\Advertising.csv")
df
```

Out[2]:

	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 [3]:
```
df.head()
```

Out[3]:

	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 [4]:
```
df.tail()
```

Out[4]:

	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 [6]:
```
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 [7]:
```
df.describe()
```

Out[7]:

	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
```

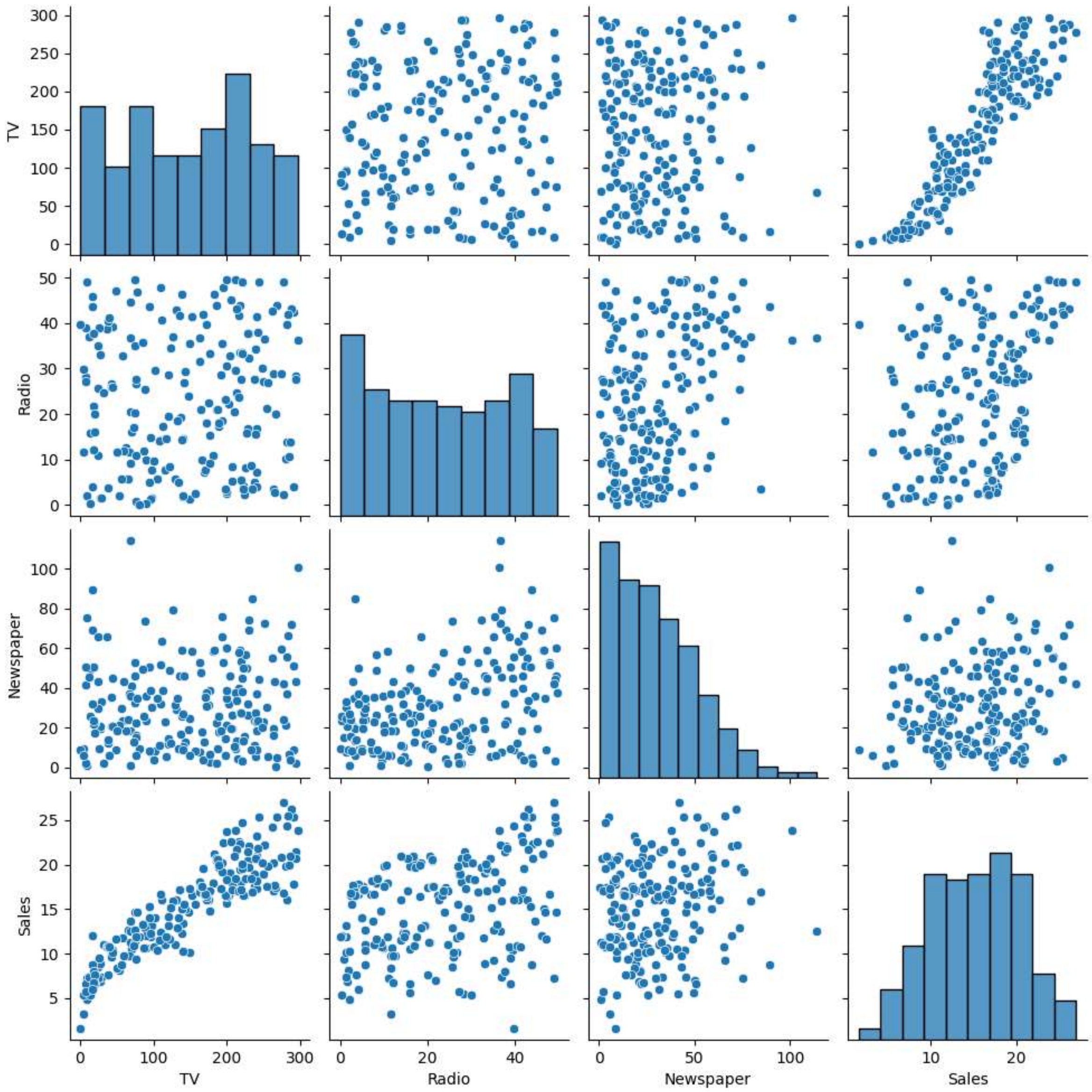
Out[9]:
```
(200, 4)
```

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

Out[10]:
```
Index(['TV', 'Radio', 'Newspaper', 'Sales'], dtype='object')
```

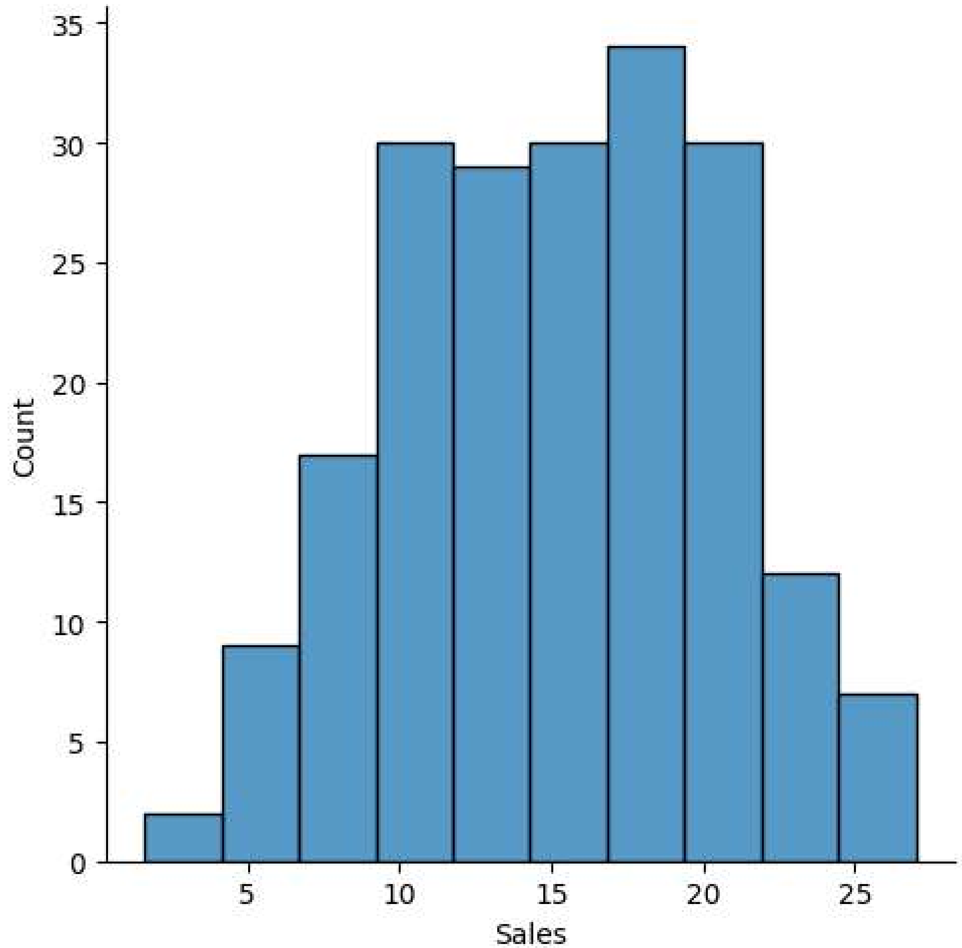
In [11]:
```
sns.pairplot(df)
```

Out[11]: <seaborn.axisgrid.PairGrid at 0x1e2e3533510>



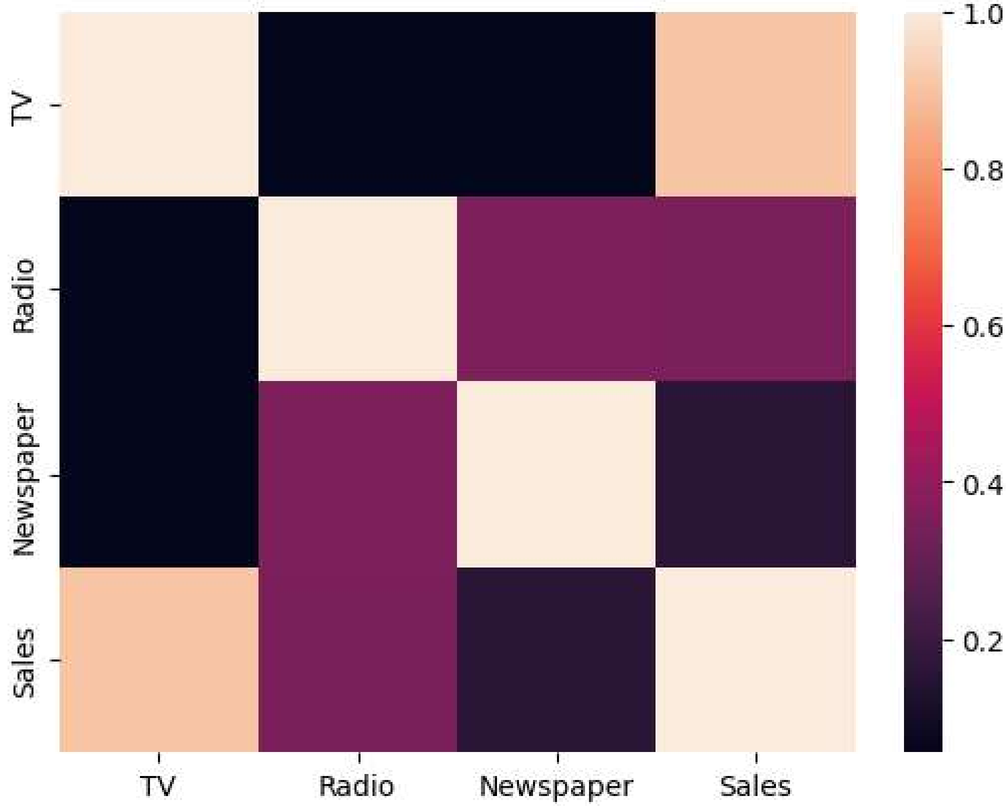
In [12]:
```
sns.displot(df['Sales'])
```

Out[12]: <seaborn.axisgrid.FacetGrid at 0x1e2e711a090>



In [13]:
```
addf=df[['TV', 'Radio', 'Newspaper', 'Sales']]
sns.heatmap(addf.corr())
```

Out[13]: <Axes: >



In [14]:
```
X=addf[['TV', 'Radio', 'Newspaper']]
y=df['Sales']
```

In [15]:
```
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
from sklearn.linear_model import LinearRegression
lm=LinearRegression()
lm.fit(X_train,y_train)
print(lm.intercept_)
```

4.681232151484295

In [16]:
```
coeff_df=pd.DataFrame(lm.coef_,X.columns,columns=['coefficient'])
coeff_df
```

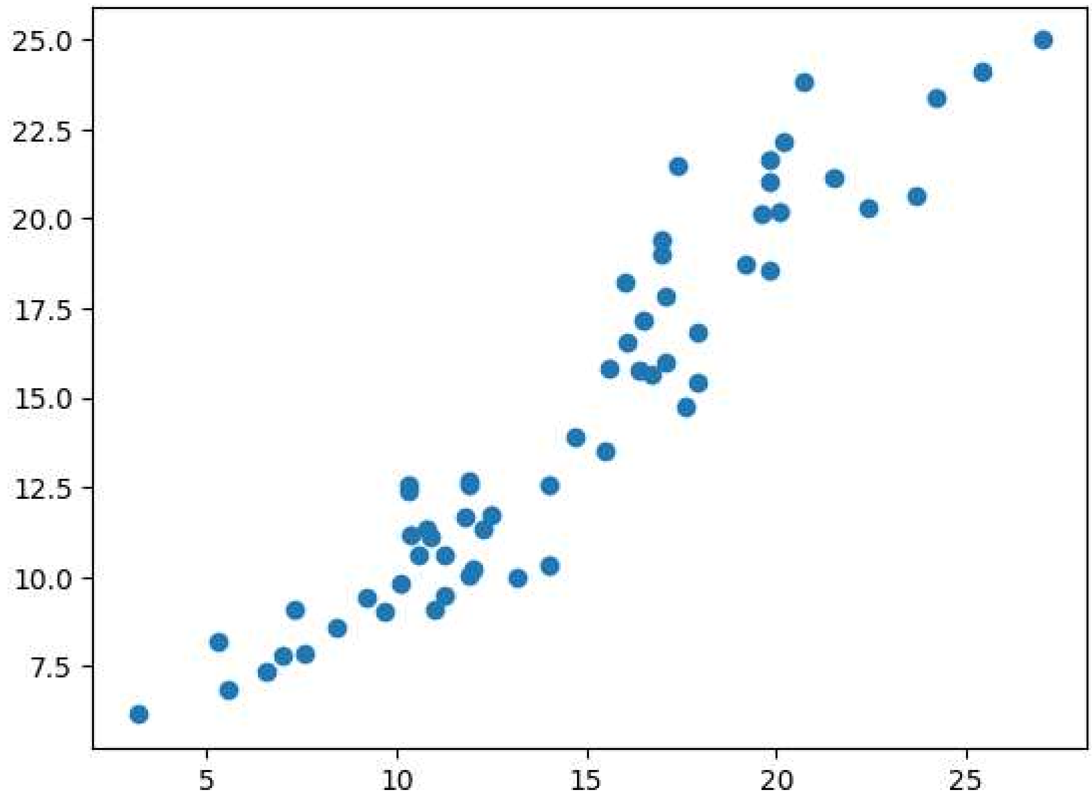
Out[16]:

	coefficient
TV	0.054930
Radio	0.109558
Newspaper	-0.006194

In [20]:
```
predictions=lm.predict(X_test)
```

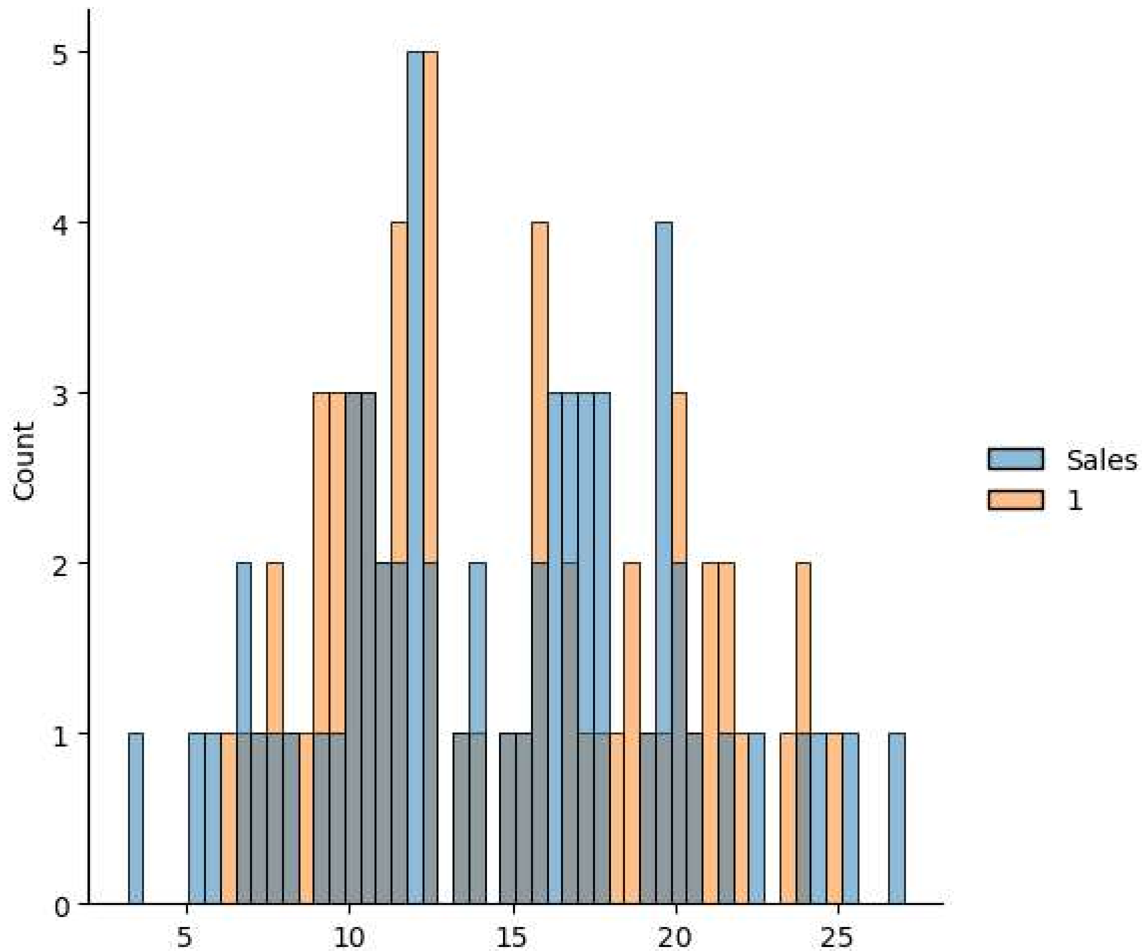
In [18]:
```
plt.scatter(y_test,predictions)
```

Out[18]:
```
<matplotlib.collections.PathCollection at 0x1e2e45e1010>
```



In [21]:
```
sns.displot((y_test,predictions),bins=50)#without semicolon
```

Out[21]: <seaborn.axisgrid.FacetGrid at 0x1e2e70e0b90>

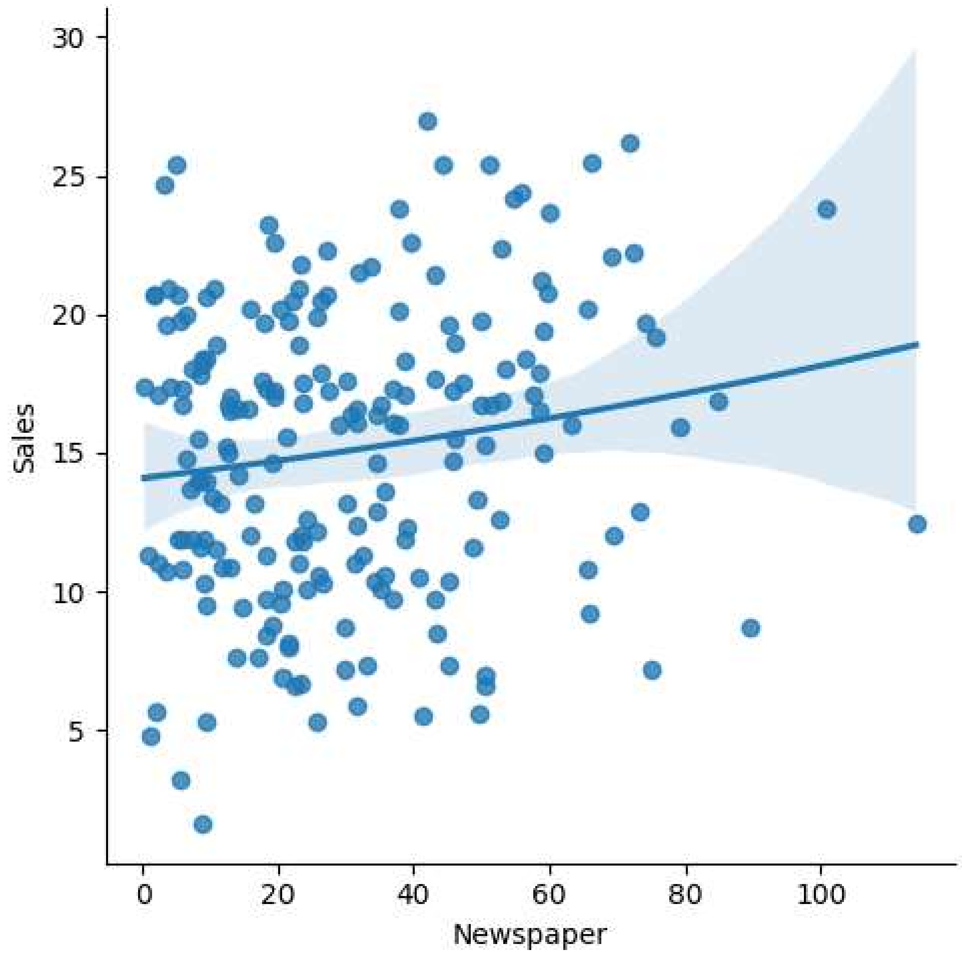


In [24]:
```
from sklearn import metrics
print('MAE:',metrics.mean_absolute_error(y_test,predictions))
print('MSE:',metrics.mean_squared_error(y_test,predictions))
print('MAE:',np.sqrt(metrics.mean_squared_error(y_test,predictions)))
```

```
MAE: 1.3731200698367851
MSE: 2.8685706338964962
MAE: 1.6936855180040054
```

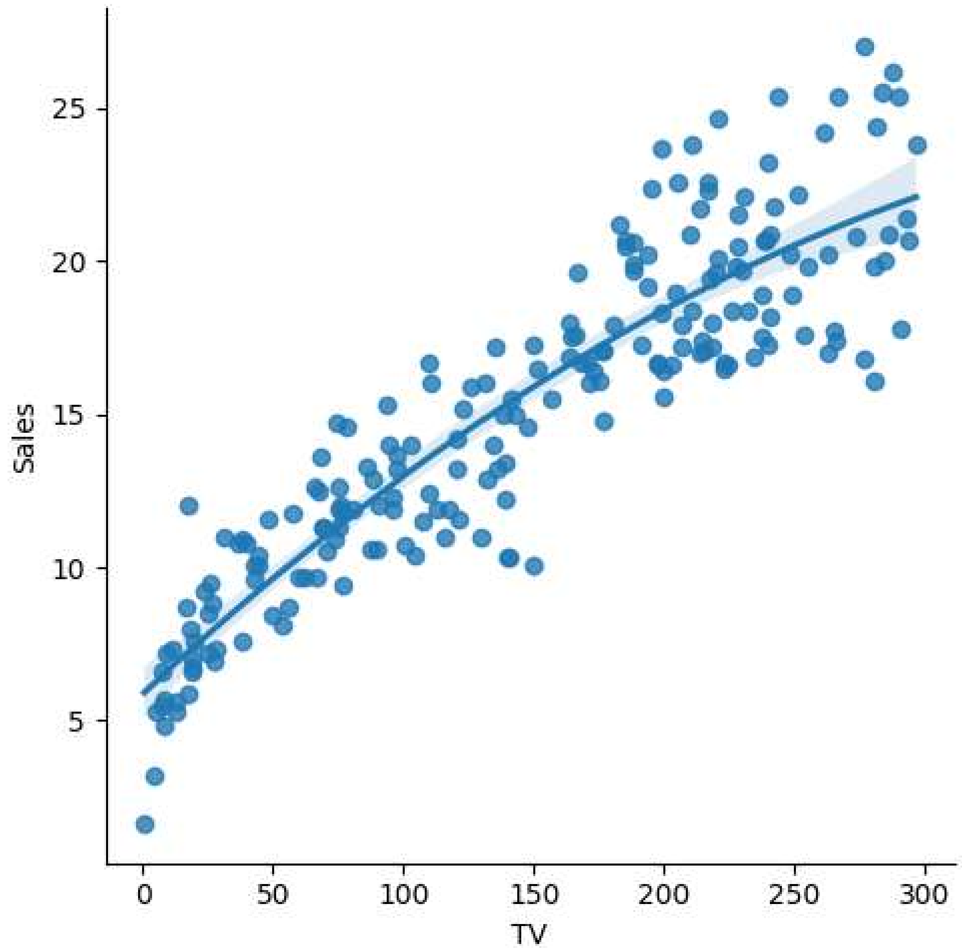
In [25]:
```
sns.lmplot(x="Newspaper",y="Sales",data=df,order=2)
```

Out[25]: <seaborn.axisgrid.FacetGrid at 0x1e2ea719d90>



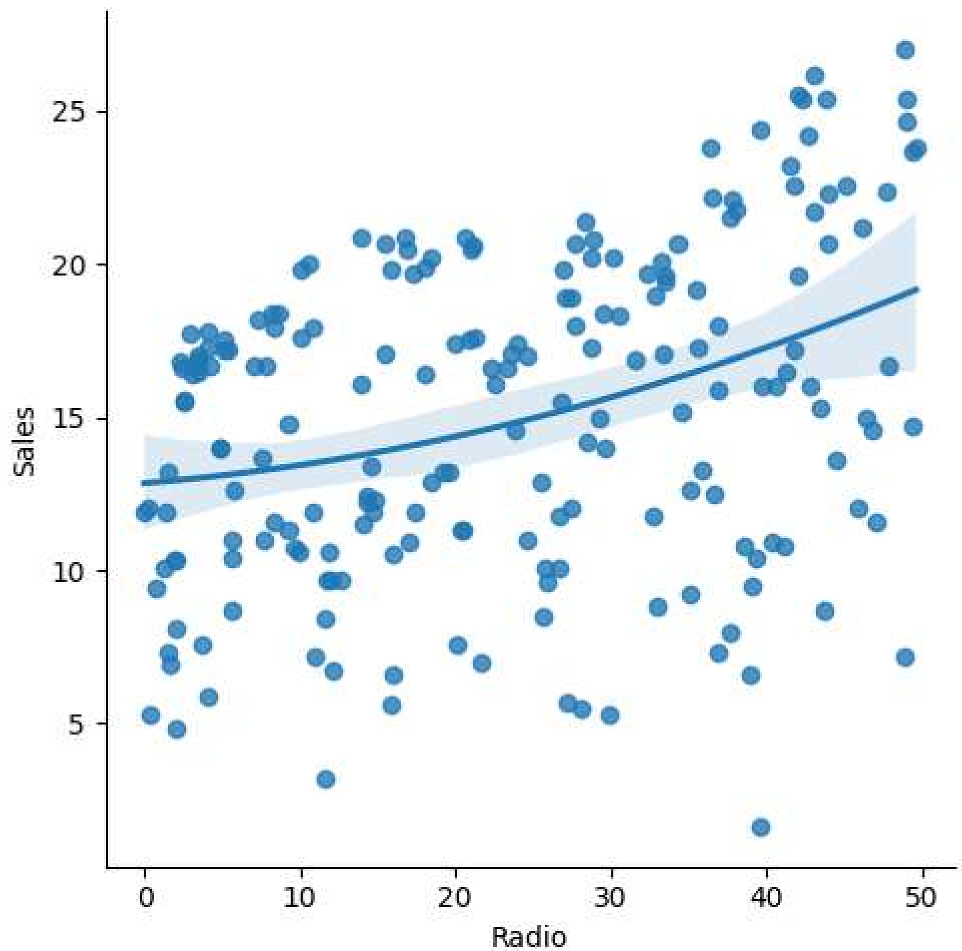
In [26]:
```
sns.lmplot(x="TV",y="Sales",data=df,order=2)
```

Out[26]:
```
<seaborn.axisgrid.FacetGrid at 0x1e2ea7fa1d0>
```



In [27]:
```
sns.lmplot(x="Radio",y="Sales",data=df,order=2)
```

Out[27]: <seaborn.axisgrid.FacetGrid at 0x1e2e75a7b50>



In [29]:
```
df.fillna(method='ffill',inplace=True)
```

In [30]:
```
regr=LinearRegression()
```

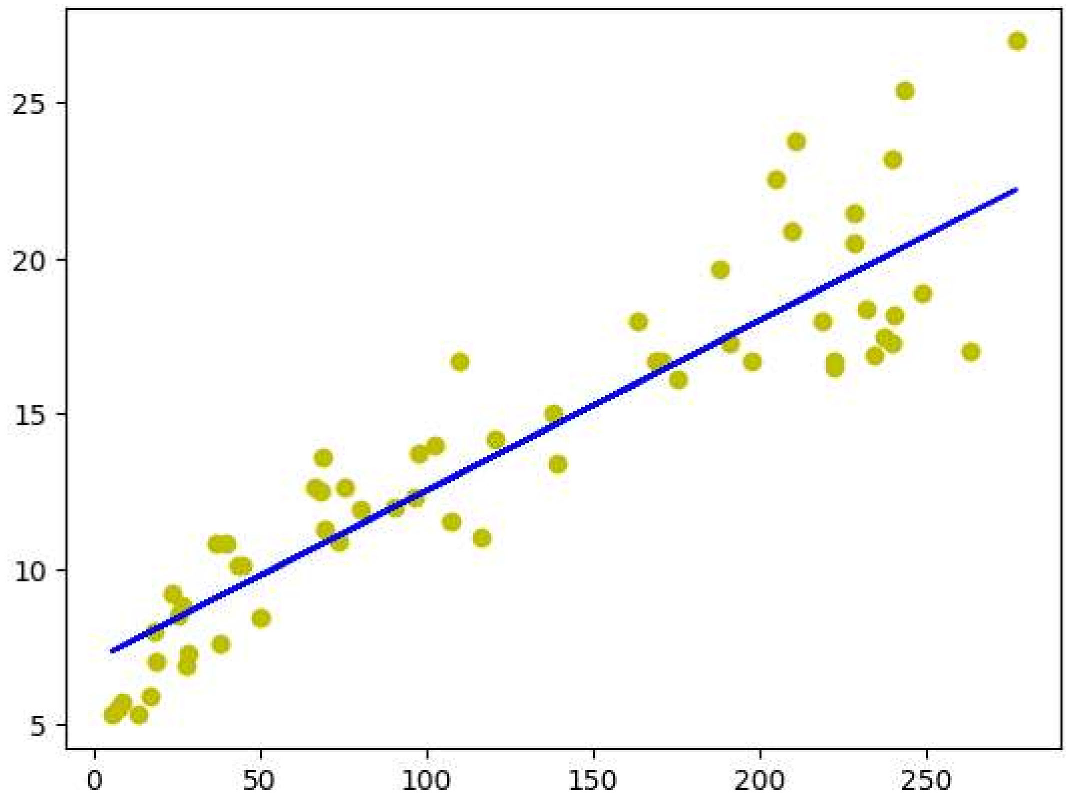
In [32]:
```
x=np.array(df['TV']).reshape(-1,1)
y=np.array(df['Sales']).reshape(-1,1)
df.dropna(inplace=True)
```

In [33]:
```
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[33]:
```
LinearRegression()
```

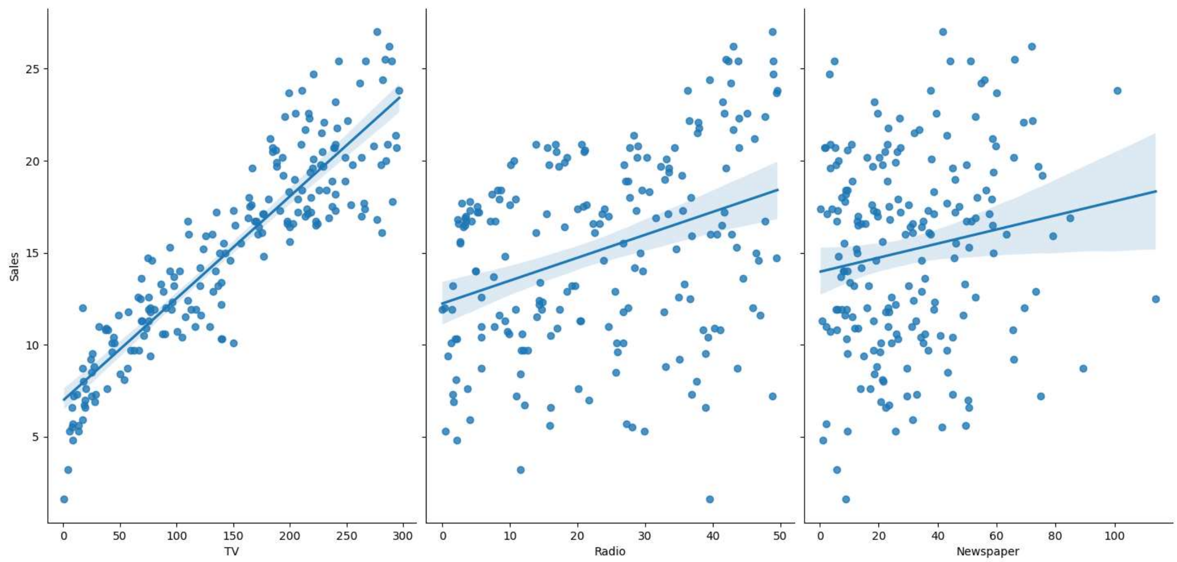
In a Jupyter environment, please rerun this cell to show the HTML representation or trust the notebook.
On GitHub, the HTML representation is unable to render, please try loading this page with nbviewer.org.

In [34]:
```
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 [37]:
```
sns.pairplot(df,x_vars=['TV', 'Radio', 'Newspaper'],y_vars='Sales',height=7,a
```

Out[37]: <seaborn.axisgrid.PairGrid at 0x1e2ea71b510>



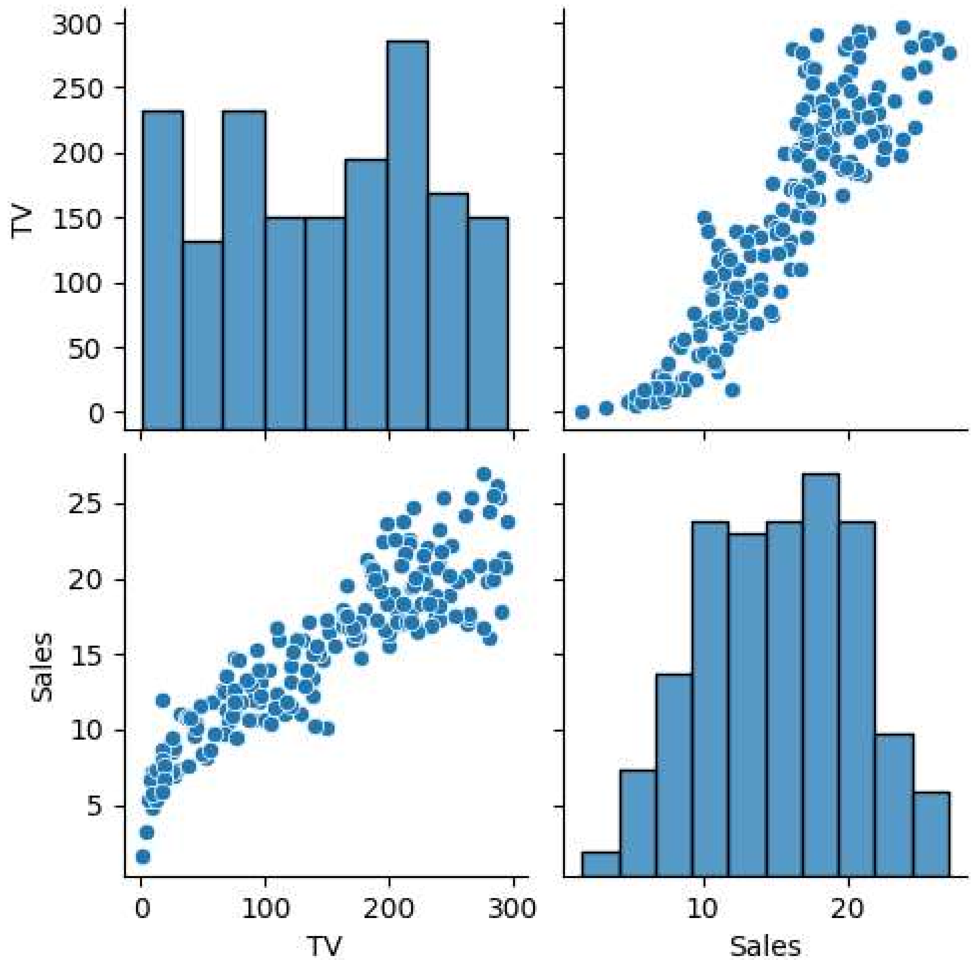
In [38]:
```
#accuracy
regr=LinearRegression()
regr.fit(X_train,y_train)
regr.fit(X_train,y_train)
print(regr.score(X_test,y_test))
```

0.8399051466016911

In [39]:
```
from sklearn.linear_model import Lasso,Ridge
from sklearn.preprocessing import StandardScaler
```

In [40]:
```
ddf=df[['TV', 'Radio', 'Newspaper', 'Sales']]
```

In [42]:
```
df.drop(columns = ["Radio", "Newspaper"], inplace = True)
sns.pairplot(df)
df.Sales=np.log(df.Sales)
```



In [43]:
```
features=df.columns[0:2]
target=df.columns[-1]
X=df[features].values
y=df[target].values
X_train,X_test,y_train,y_test=train_test_split(X,y,test_size=0.3,random_state
print("The dimension of X_train is {}".format(X_train.shape))
print("The dimension of X_test is {}".format(X_test.shape))
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 [44]:
```
#Linear regression model
regr=LinearRegression()
regr.fit(X_train,y_train)
actual=y_test #actual value
train_score_regr=regr.score(X_train,y_train)
test_score_regr=regr.score(X_test,y_test)
print("\nLinear model:\n")
print("The train score for Linear model is {}".format(train_score_regr))
print("The test score for Linear model is {}".format(test_score_regr))
```

```
Linear model:

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

In [45]:
```
#ridge regression model
ridgeReg=Ridge(alpha=10)
ridgeReg.fit(X_train,y_train)
#train and test score for 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
```

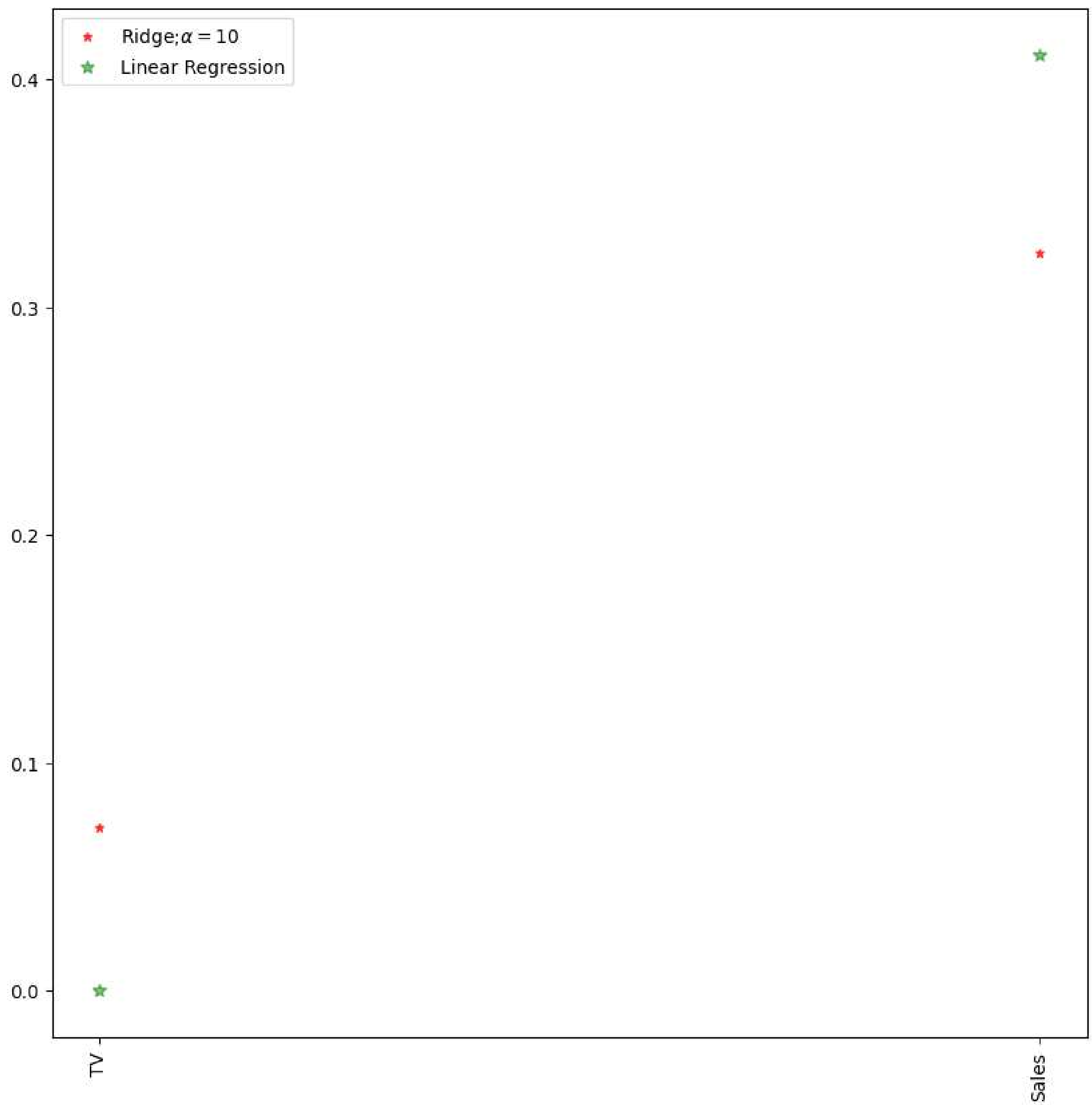
In [46]:
```
#using the linear cv model for ridge regression
from sklearn.linear_model import RidgeCV
#ridge cross validation
ridge_cv=RidgeCV(alphas=[0.0001,0.001,0.01,0.1,1,10]).fit(X_train,y_train)
#score
print(ridge_cv.score(X_train,y_train))
print(ridge_cv.score(X_test,y_test))
```

```
0.9999999999976281
0.9999999999962489
```

In [54]:
```
#using the linear cv model for lasso regression
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_tr
#score
print(lasso_cv.score(X_train,y_train))
print(lasso_cv.score(X_test,y_test))
```

```
0.9999999343798134
0.9999999152638072
```

In [58]:
```
plt.figure(figsize=(10,10))
plt.plot(features,ridgeReg.coef_,alpha=0.7,linestyle='none',marker='*',marker
plt.plot(features,regr.coef_,alpha=0.5,linestyle='none',marker='*',markersize
plt.xticks(rotation=90)
plt.legend()
plt.show()
```



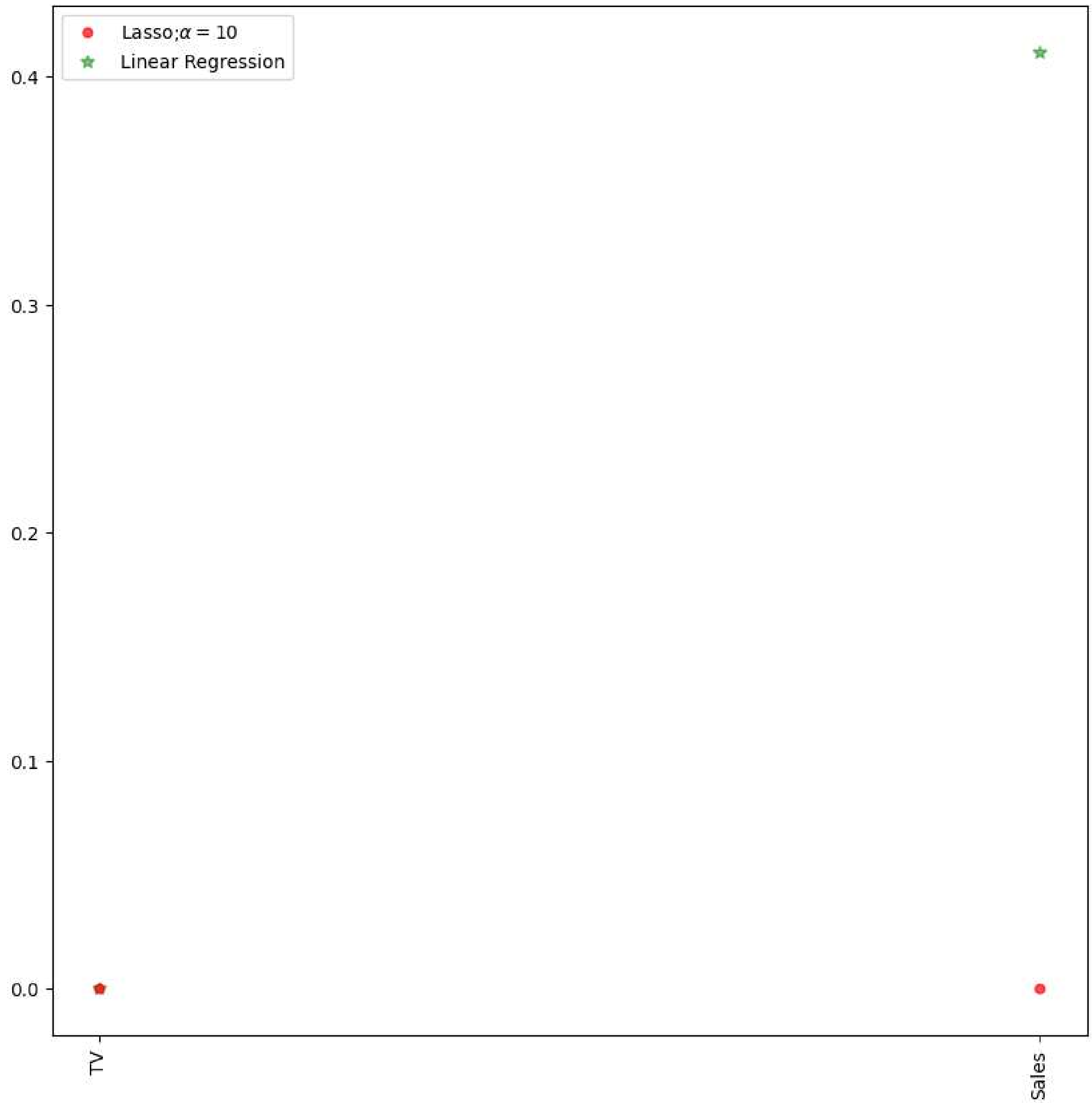
In [49]:
```
#ridge regression
plt.figure(figsize=(10,10))
sns.heatmap(ddf.corr(),annot=True)
```

Out[49]: <Axes: >

In [64]:
```
#ridge regression
plt.figure(figsize=(10,10))
sns.heatmap(ddf.corr(),annot=True)
```

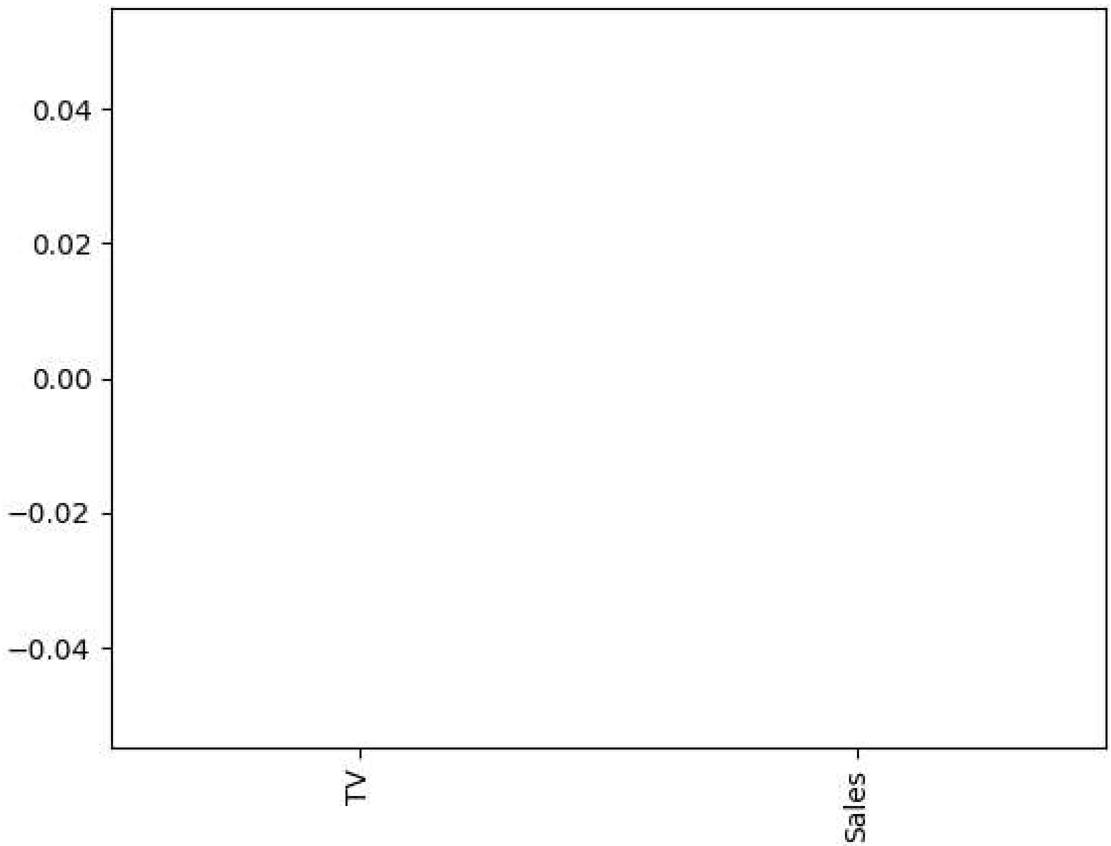
Out[64]: <Axes: >

In [57]:
```
plt.figure(figsize=(10,10))
plt.plot(features,lassoReg.coef_,alpha=0.7,linestyle='none',marker='o',marker
plt.plot(features,regr.coef_,alpha=0.5,linestyle='none',marker='*',markersize
plt.xticks(rotation=90)
plt.legend()
plt.show()
```

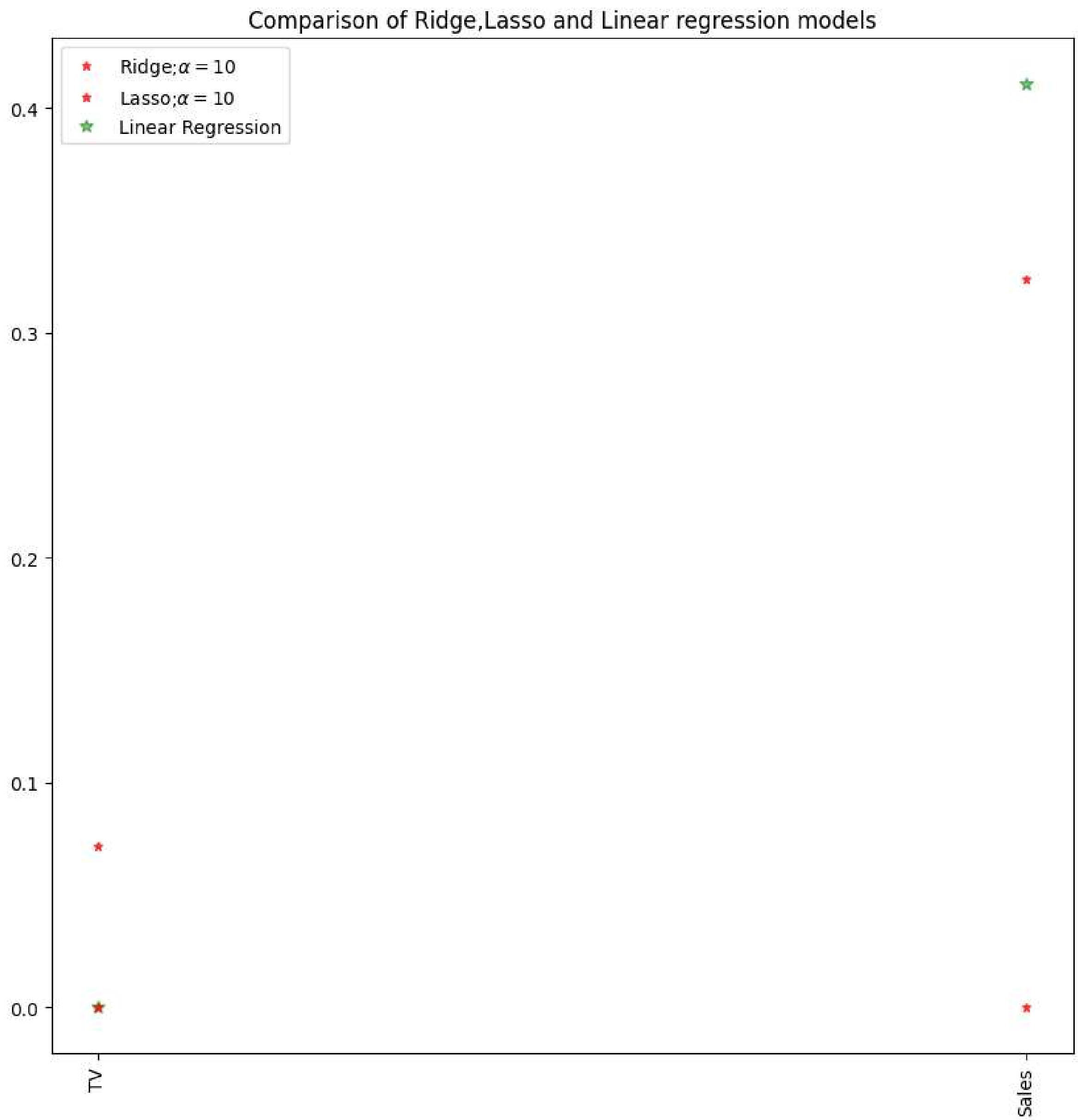


In [52]:
```
pd.Series(lassoReg.coef_,features).sort_values(ascending=True).plot(kind="bar
```

Out[52]: <Axes: >



In [63]:
```
#plot size
plt.figure(figsize=(10,10))
#add plot for ridge regression
plt.plot(features,ridgeReg.coef_,alpha=0.7,linestyle='none',marker='*',marker
#add plot for lasso regression
plt.plot(features,lassoReg.coef_,alpha=0.7,linestyle='none',marker='*',marker
#add plot for linear model
plt.plot(features,regr.coef_,alpha=0.5,linestyle='none',marker='*',markersize
#rotate axis
plt.xticks(rotation=90)
plt.legend()
plt.title("Comparison of Ridge,Lasso and Linear regression models")
plt.show()
```



In [ ]:

```

```

In [ ]:

```

```