```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
```

```
data=pd.read_csv("/content/advertising.csv")
data.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

```
data.shape
```

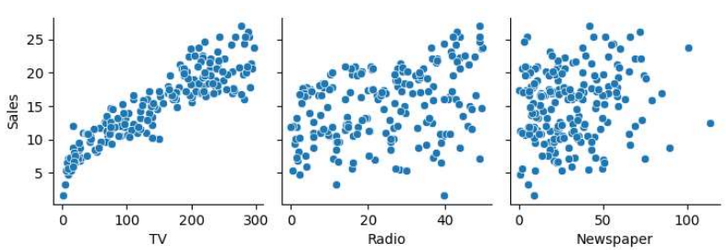
```
(200, 4)
```

```
data.describe()
```

	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

observations: avg expenses spend is highest on tv , avg expenses spend lowest on radio, max sale is 27 and min is 1.6

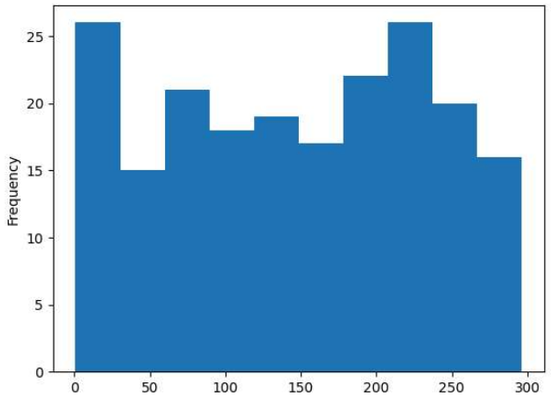
```
sns.pairplot(data,x_vars=['TV','Radio','Newspaper'],y_vars='Sales',kind='scatter')
plt.show()
```



observations: when advertising cost increases in tv ads the sale will also increases as well. while newspaper and radio is unpredictable

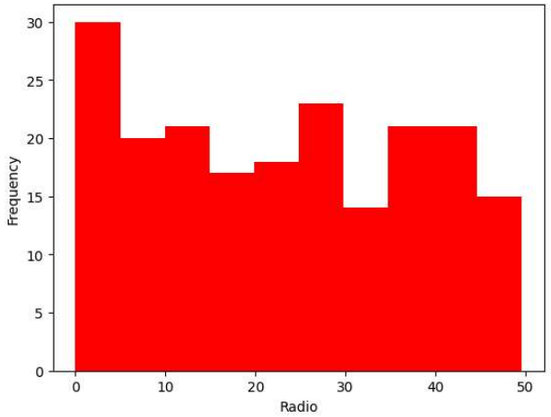
```
data['TV'].plot.hist(bins=10)
```

```
<Axes: ylabel='Frequency'>
```



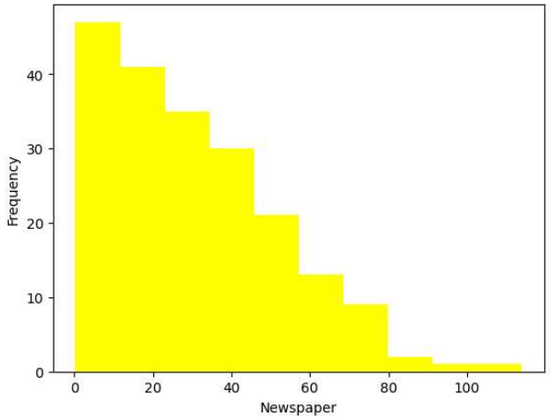

```
data['Radio'].plot.hist(bins=10,color='red',xlabel="Radio")
```

```
<Axes: xlabel='Radio', ylabel='Frequency'>
```



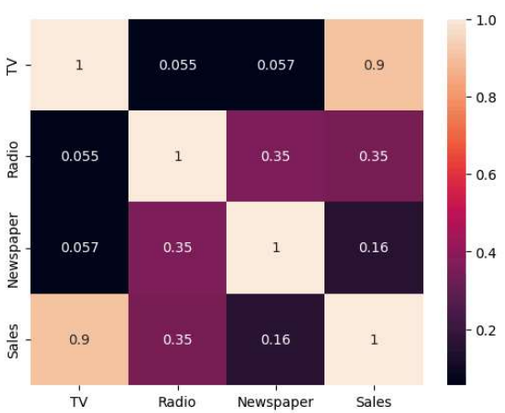

```
data['Newspaper'].plot.hist(bins=10,color='yellow',xlabel='Newspaper')
```

```
<Axes: xlabel='Newspaper', ylabel='Frequency'>
```



observations: majority sales is the result of low advertising cost in newspaper

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



sales is highly correlated with the tv

training model with one variables separately

```
from sklearn.model_selection import train_test_split
x_train,x_test,y_train,y_test = train_test_split(data[['TV']],data[['Sales']],test_size=0.3,random_state=0)
```

```
print(x_train)
```

```
        TV
131  265.2
96   197.6
181  218.5
19   147.3
153  171.3
```

```
..     ...
67   139.3
192   17.2
117   76.4
47   239.9
172   19.6

[140 rows x 1 columns]
```

```
print(y_train)
```

```
     Sales
131   17.7
96    16.7
181   17.2
19    14.6
153   16.0
..     ...
67    13.4
192    5.9
117    9.4
47    23.2
172    7.6

[140 rows x 1 columns]
```

```
print(x_test)
```

```
        TV
18    69.2
170   50.0
107   90.4
98   289.7
177  170.2
182   56.2
5      8.7
146  240.1
12    23.8
152  197.6
61   261.3
125   87.2
180  156.6
154  187.8
80    76.4
7    120.2
33   265.6
130    0.7
37    74.7
74   213.4
183  287.6
145  140.3
45   175.1
159  131.7
60    53.5
123  123.1
179  165.6
185  205.0
122  224.0
44    25.1
16    67.8
55   198.9
150  280.7
111  241.7
22    13.2
189   18.7
129   59.6
4    180.8
83    68.4
106   25.0
134   36.9
66    31.5
26   142.9
113  209.6
168  215.4
63   102.7
8      8.6
75    16.9
```

```
118  125.7
143  104.6
71   109.8
124  229.5
184  253.8
97   184.9
149   44.7
24    62.3
30   292.9
```

```
print(y_test)
```

```
     Sales
18    11.3
170    8.4
107   12.0
98    25.4
177   16.7
182    8.7
5      7.2
146   18.2
12     9.2
152   16.6
61    24.2
125   10.6
180   15.5
154   20.6
80    11.8
7     13.2
33    17.4
130    1.6
37    14.7
74    17.0
183   26.2
145   10.3
45    16.1
159   12.9
60     8.1
123   15.2
179   17.6
185   22.6
122   16.6
44     8.5
16    12.5
55    23.7
150   16.1
111   21.8
22     5.6
189    6.7
129    9.7
4     17.9
83    13.6
106    7.2
134   10.8
66    11.0
26    15.0
113   20.9
168   17.1
63    14.0
8      4.8
75     8.7
118   15.9
143   10.4
71    12.4
124   19.7
184   17.6
97    20.5
149   10.1
24     9.7
30    21.4
```

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

```
LinearRegression()
```

```
res = model.predict(x_test)
print(res)
```

```
[12.09159447]
[22.99968079]
[16.45920756]
[10.21976029]
[ 7.6199906 ]
[20.28497391]
[ 8.4464437 ]
[17.95886418]
[21.44529217]
[11.91645209]
[15.71485245]
[17.42249065]
[11.32534656]
[13.72260788]
[21.68063975]
[ 7.18213465]
[11.23230217]
[18.82362968]
[22.88474361]
[14.82272095]
[16.72739433]
[14.35202581]
[10.07198391]
[13.88133066]
[16.20744039]
[18.36388094]
[19.40378881]
[ 8.51759529]
[10.85465142]
[18.03001578]
[22.50709285]
[20.3725451 ]
[ 7.86628457]
[ 8.16731053]
[10.40584907]
[17.03936669]
[10.88749061]
[ 8.51212209]
[ 9.16343282]
[ 8.86788005]
[14.96502414]
[18.61564811]
[18.93309367]
[12.76479799]
[ 7.6145174 ]
[ 8.06879294]
[14.02363385]
[12.86878878]
[13.15339515]
[19.70481478]
[21.03480222]
[17.26376787]
[ 9.59034237]
[10.55362545]
[23.17482317]
[16.58509115]
[18.22705095]
[ 7.54336581]]
```

```
model.coef_
```

```
array([[0.05473199]])
```

```
model.intercept_
```

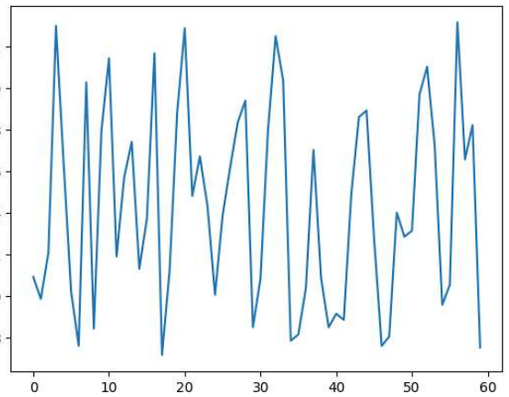
```
array([7.14382225])
```

```
0.05473199*69.2 + 7.14382225
```

```
10.931275958
```

```
plt.plot(res)
```

```
[<matplotlib.lines.Line2D at 0x7a242600b730>]
```




```
plt.scatter(x_test,y_test)
plt.plot(x_test,7.14382225+0.05473199*x_test,'r')
plt.show()
```