ADF

Use the data provided for earlier problems to test the non-stationarity in the time series with Augmented Dickey-Fuller test. Take the level of significance equal to 5%.

In [1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
plt.rcParams['figure.figsize'] = (20, 9)
```

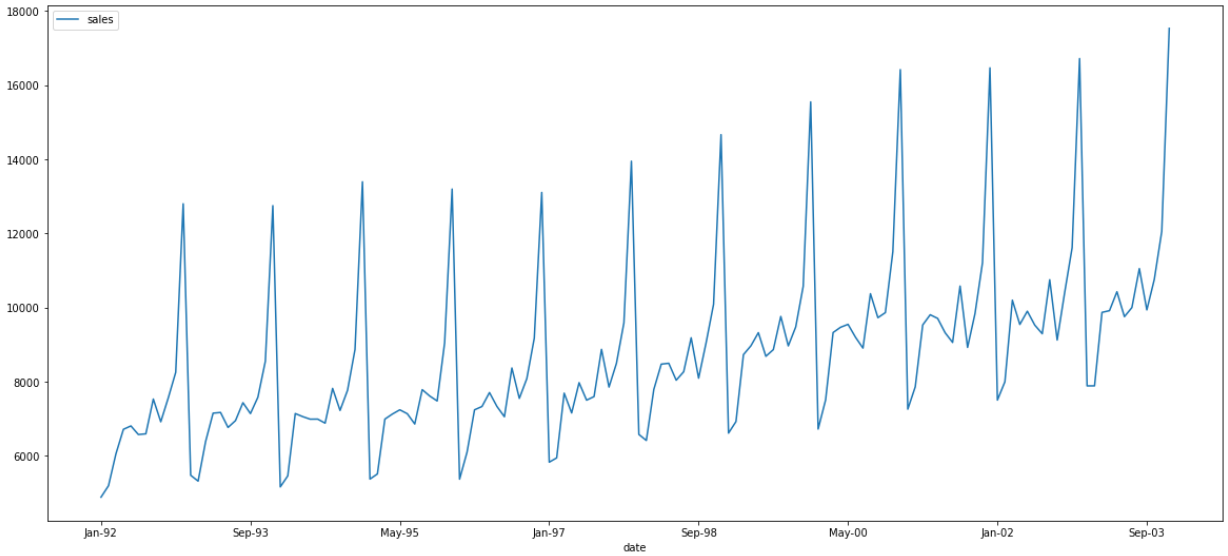
In [2]:
```
cloth=pd.read_csv("C:\\Users\\Lenovo\\OneDrive\\Desktop\\cloth_sales.csv",index_col=
cloth
```

Out[2]:

date	sales
Jan-92	4889
Feb-92	5198
Mar-92	6061
Apr-92	6720
May-92	6811
...	...
Aug-03	11055
Sep-03	9941
Oct-03	10763
Nov-03	12058
Dec-03	17535

144 rows × 1 columns

In [3]:
```
# Plot ant show the time series on axis ax
fig, ax = plt.subplots();
cloth.plot(ax=ax);
```



In [4]:
```
from statsmodels.tsa.stattools import adfuller
```

In [5]:
```
test_result=adfuller(cloth['sales'])
test_result
```

Out[5]:
```
(0.6384826676448164,
 0.9885267347007707,
 14,
 129,
 {'1%': -3.482087964046026,
  '5%': -2.8842185101614626,
  '10%': -2.578864381347275},
 1856.6652424701979)
```

In [6]:
```
def adfuller_test(sales):
    result=adfuller(sales)
    labels = ['ADF Test Statistic','p-value','#Lags Used','Number of Observations']
    for value,label in zip(result,labels):
        print(label+' : '+str(value) )

    if result[1] <= 0.05:
        print("strong evidence against the null hypothesis(Ho), reject the null hypot
    else:
        print("weak evidence against null hypothesis,indicating it is non-stationary

adfuller_test(cloth['sales'])
```

```
ADF Test Statistic : 0.6384826676448164
p-value : 0.9885267347007707
#Lags Used : 14
Number of Observations : 129
weak evidence against null hypothesis,indicating it is non-stationary
```

In [7]:
```
cloth['Sales First Difference'] = cloth['sales'] - cloth['sales'].shift(1)
cloth['Seasonal First Difference']=cloth['sales']-cloth['sales'].shift(12)
cloth
```

Out[7]:

date	sales	Sales First Difference	Seasonal First Difference
Jan-92	4889	NaN	NaN
Feb-92	5198	309.0	NaN
Mar-92	6061	863.0	NaN
Apr-92	6720	659.0	NaN
May-92	6811	91.0	NaN
...	...	...	...
Aug-03	11055	1052.0	300.0
Sep-03	9941	-1114.0	813.0
Oct-03	10763	822.0	355.0
Nov-03	12058	1295.0	440.0
Dec-03	17535	5477.0	814.0

144 rows × 3 columns

In [10]:
```
# Again testing if data is stationary
adfuller_test(cloth['Sales First Difference'].dropna())
```

```
ADF Test Statistic : -3.2611246781041316
p-value : 0.01670818921919844
#Lags Used : 13
Number of Observations : 129
strong evidence against the null hypothesis(Ho), reject the null hypothesis. Data is
stationary
```

In [11]:
```
# Plot ant show the time series on axis ax
fig, ax = plt.subplots();
cloth.plot(ax=ax);
```

In [ ]: