```
In [4]:  import numpy as np
         import pandas as pd
         import matplotlib.pyplot as plt
         %matplotlib inline
```

```
In [5]:  df = pd.read_csv("AirPassengers.csv")
```
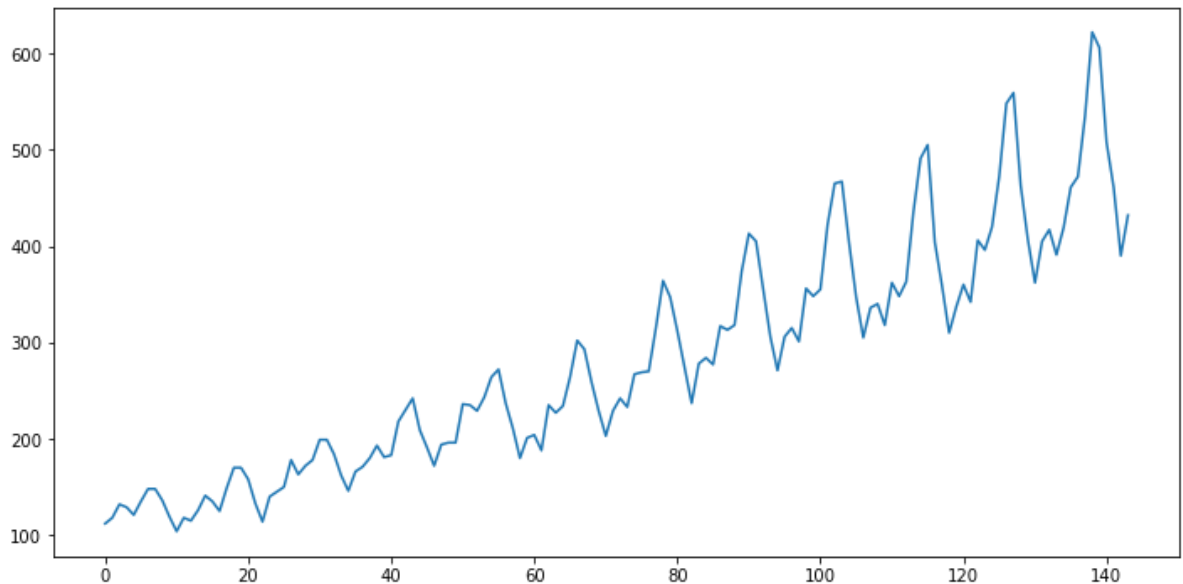
```
In [11]:  df.head()
```

Out[11]:

	Month	#Passengers	SMA_30
0	1949-01	112	NaN
1	1949-02	118	NaN
2	1949-03	132	NaN
3	1949-04	129	NaN
4	1949-05	121	NaN

```
In [7]:  plt.rcParams.update({'figure.figsize': (12,6)})
         df["#Passengers"].plot()
```

Out[7]: <AxesSubplot:>

Moving Averages:Types

1. Simple Moving Averages(SMA)
2. Cumulative Moving Averages(CMA)
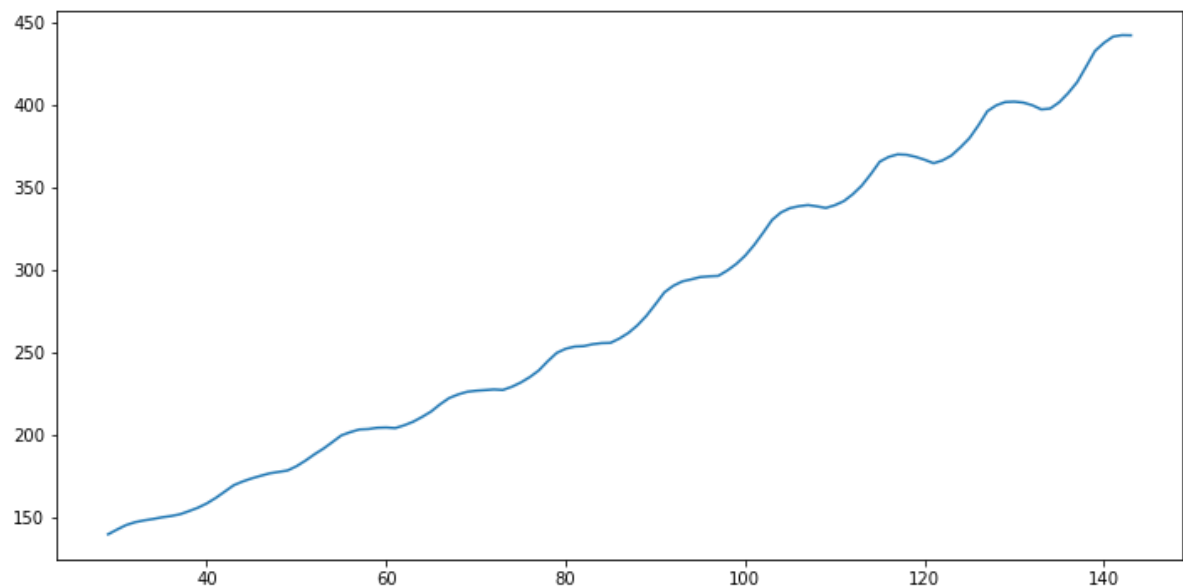3. Exponential Moving Averages(EMA/EMWMA)

In [ ]:

SMA / Rolling Mean

$$SMA_t = \frac{x_t + x_{t-1} + x_{t-2} + \ldots x_{t-n}}{n}$$

In [10]:
```python
df["SMA_30"] = df["#Passengers"].rolling(window=30).mean()
```
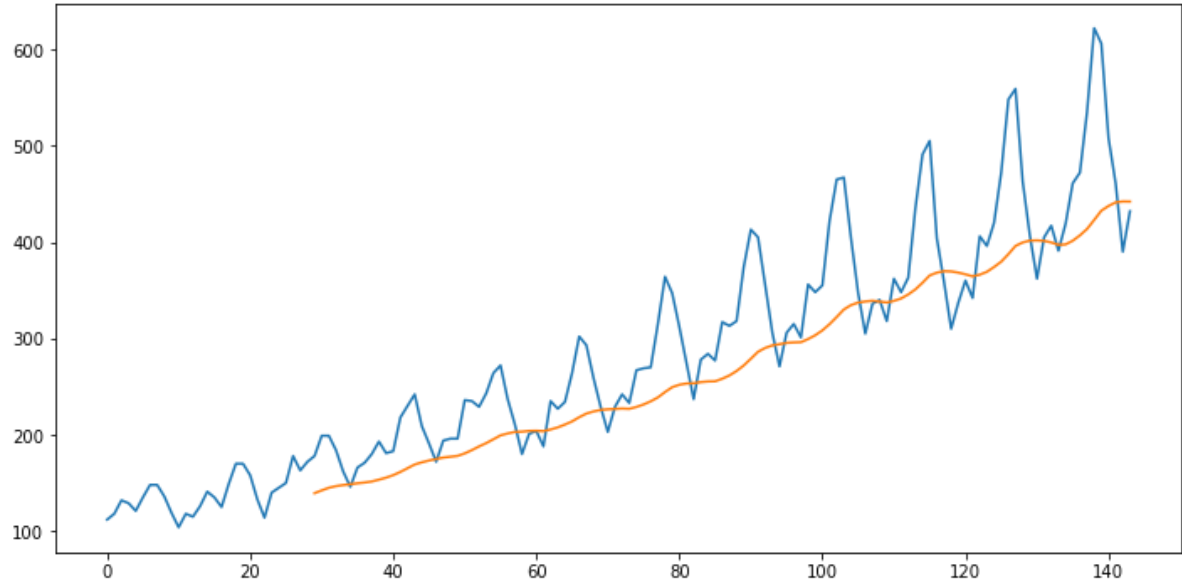
In [14]:
```python
df['SMA_30'].dropna().plot()
```

Out[14]: `<AxesSubplot:>`

In [15]:
```
df["#Passengers"].plot()
df['SMA_30'].dropna().plot()
```

Out[15]: `<AxesSubplot:>`

Conclusion:

#Passengers Columns has Uptrend/ Increasing Trend(Pattern)

CMA

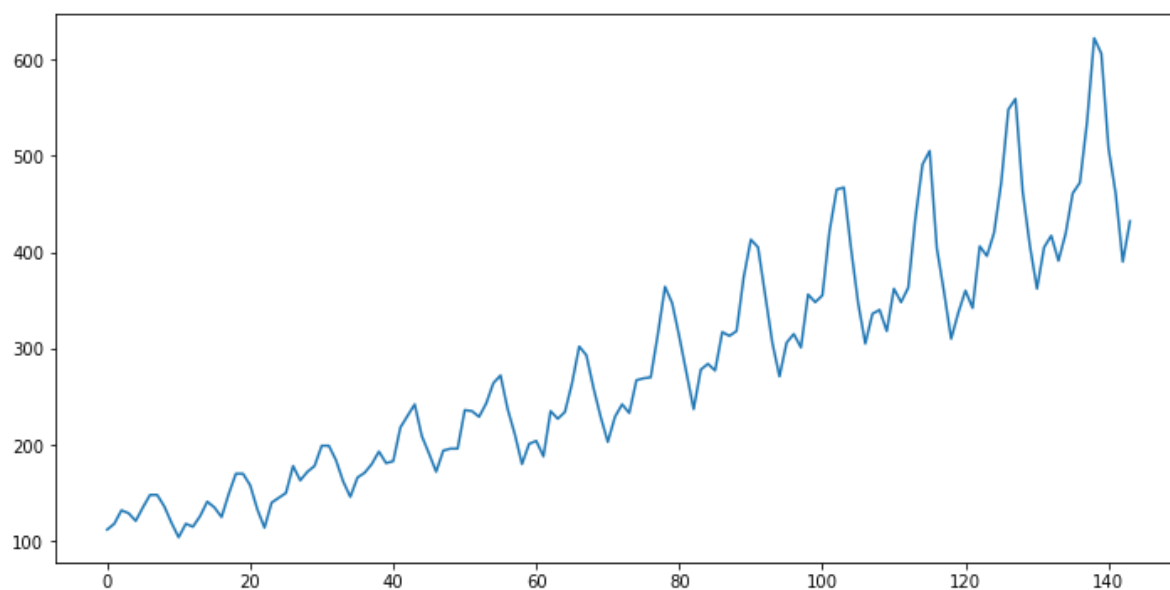$$CMA_t = \frac{x_1 + x_2 + \ldots x_n}{n}$$

In [16]:
```
df['CMA'] = df["#Passengers"].expanding().mean()
```

In [17]:
```
df['CMA']
```

Out[17]:
```
0      112.000000
1      115.000000
2      120.666667
3      122.750000
4      122.400000
          ...
139    275.514286
140    277.163121
141    278.457746
142    279.237762
143    280.298611
Name: CMA, Length: 144, dtype: float64
```
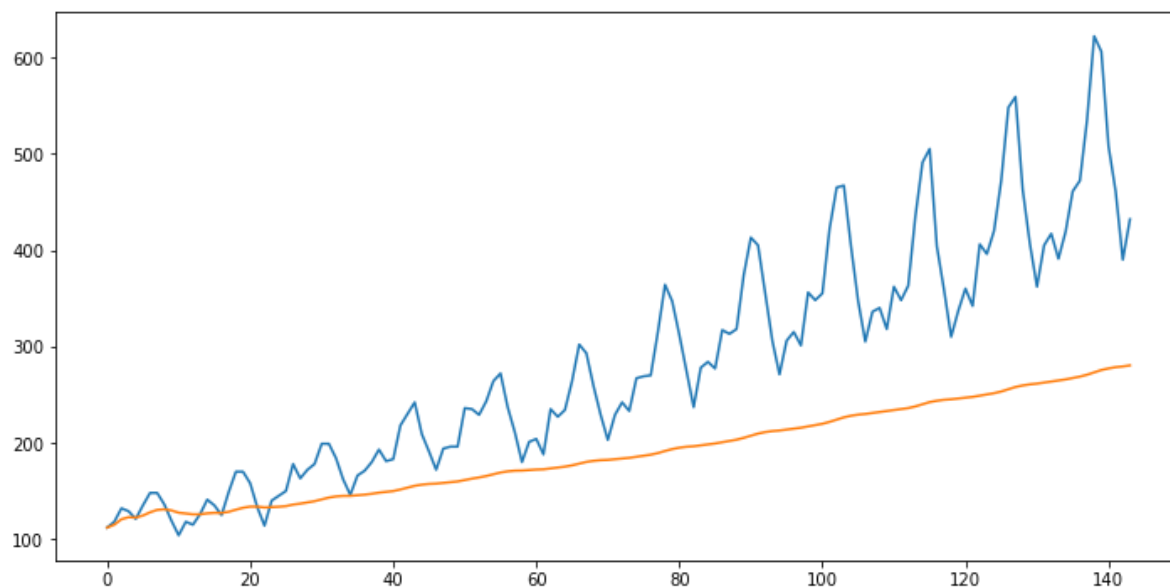
In [18]:
```python
df["#Passengers"].plot()
```

Out[18]: <AxesSubplot:>

In [19]:
```python
df["#Passengers"].plot()
df['CMA'].plot()
```

Out[19]: <AxesSubplot:>

In [ ]:

EMA/EWMA

$$EMA_t = \alpha * x_t + (1 - \alpha * EMA_{t-1}$$

Alpha is smoothing factor

Range of alpha is between 0 to 1
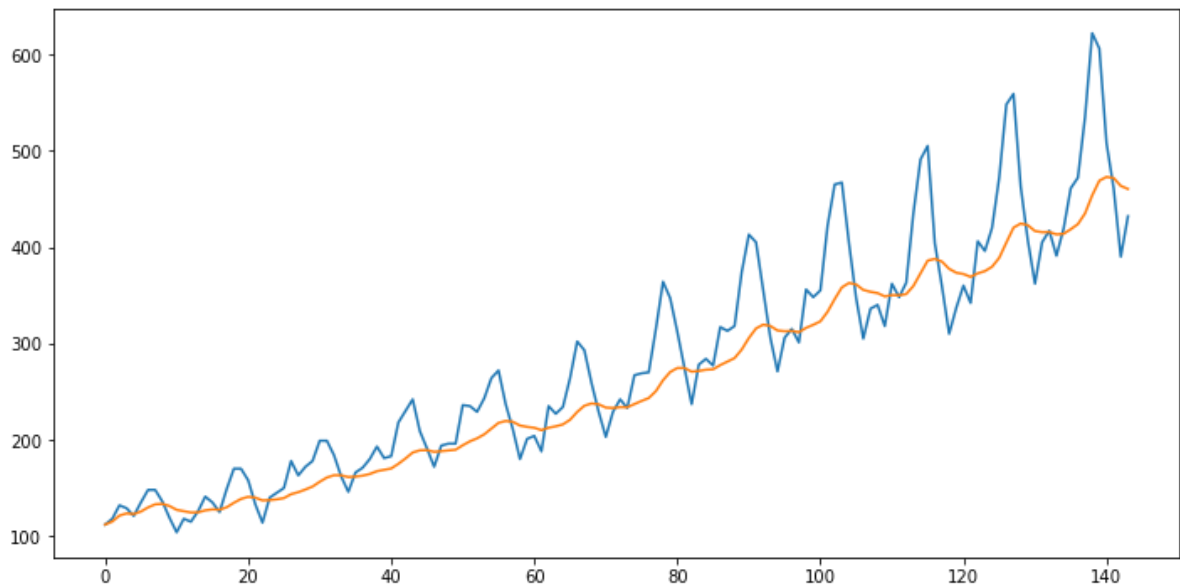
```
In [21]: df["EMA_0.1"] = df["#Passengers"].ewm(alpha=0.1).mean()
```

```
In [22]: df["EMA_0.1"]
```

```
Out[22]: 0       112.000000
         1       115.157895
         2       121.372694
         3       123.590579
         4       122.957974
                    ...
         139     468.874660
         140     472.787195
         141     471.608475
         142     463.447626
         143     460.302862
         Name: EMA_0.1, Length: 144, dtype: float64
```

```
In [24]: df["#Passengers"].plot()
         df["EMA_0.1"].plot()
```
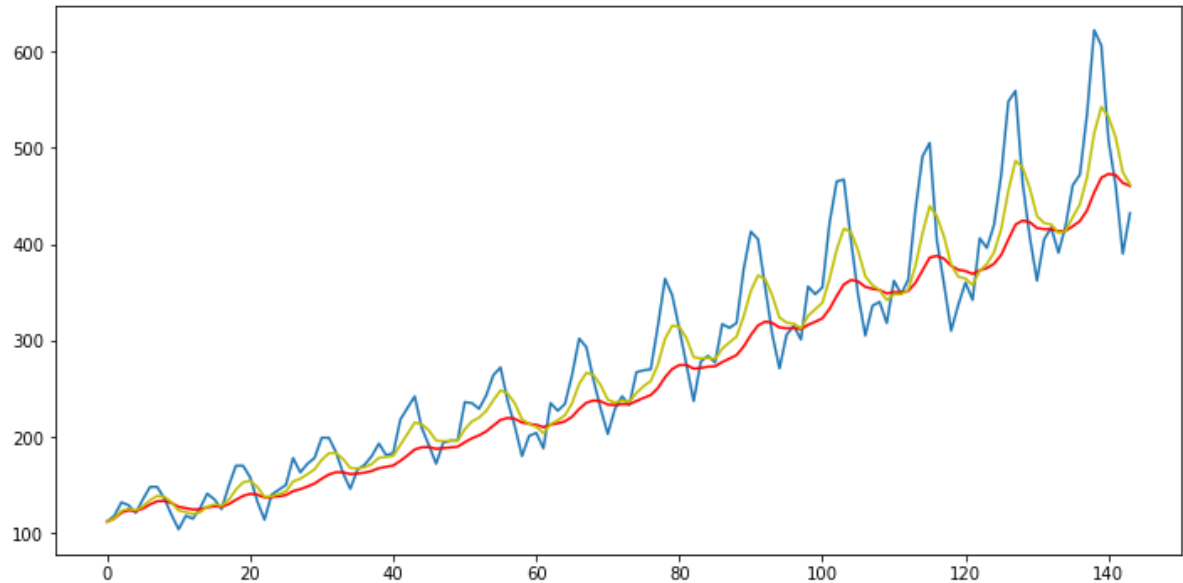
```
Out[24]: <AxesSubplot:>
```



```
In [25]: df["EMA_0.3"] = df["#Passengers"].ewm(alpha=0.3).mean()
```

In [28]:
```python
df["#Passengers"].plot()
df["EMA_0.1"].plot(color = "r")
df["EMA_0.3"].plot(color = "y")
```

Out[28]: `<AxesSubplot:>`

Conclusion:

If we increase the value of alpha then the noise will also increse in the trend ¶

In [ ]: