

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

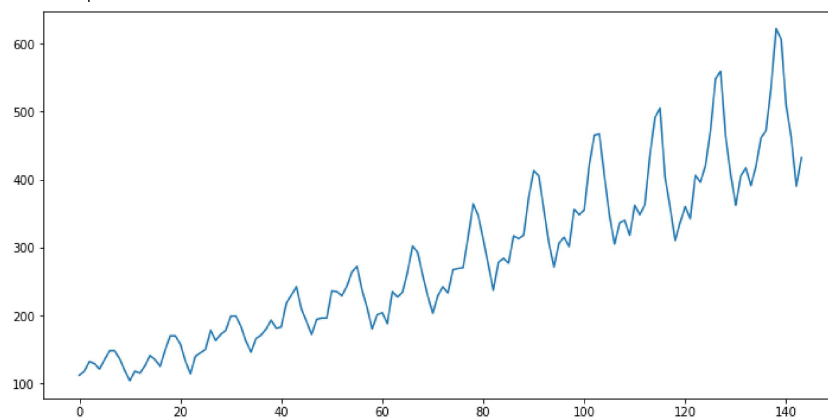
```
df = pd.read_csv("AirPassengers.csv")
```

```
df.head()
```

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

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

<AxesSubplot:>



▼ Method 1 : Differencing and seasonal differencing

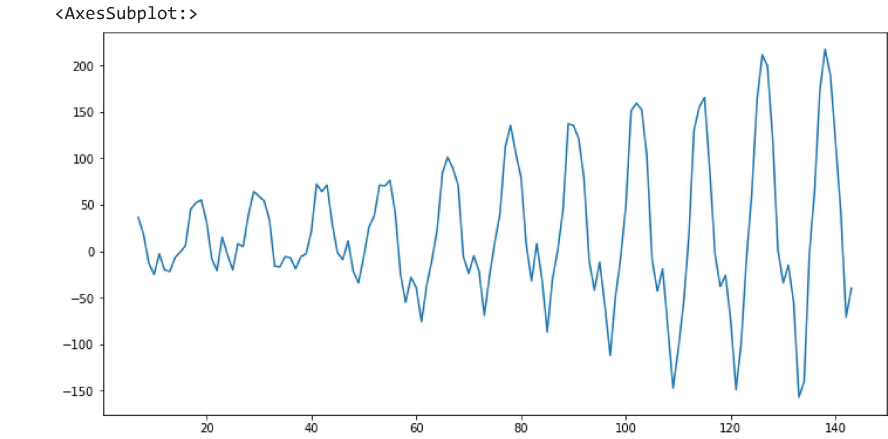
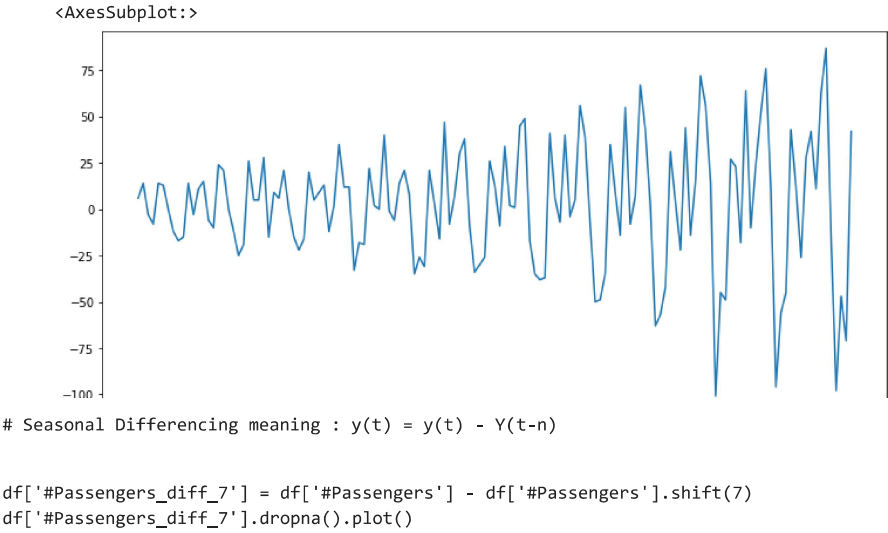
```
#Differencing meaning  $y(t) = y(t) - y(t-1)$ 
```

```
df['#Passengers_diff'] = df['#Passengers'] - df['#Passengers'].shift(1)
```

```
df.head()
```

	Month	#Passengers	#Passengers_diff	
0	1949-01	112	NaN	
1	1949-02	118	6.0	
2	1949-03	132	14.0	
3	1949-04	129	-3.0	
4	1949-05	121	-8.0	

```
df['#Passengers_diff'].dropna().plot()
```



df.head(10)

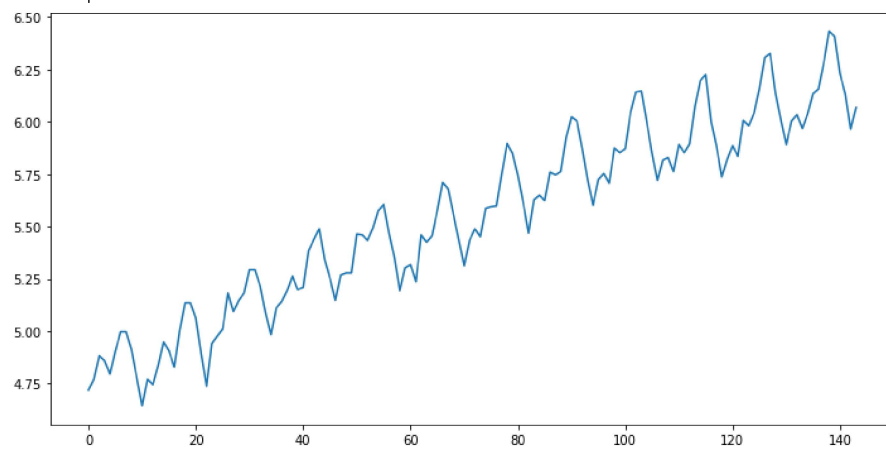
	Month	#Passengers	#Passengers_diff	#Passengers_diff_7	
0	1949-01	112	NaN	NaN	
1	1949-02	118	6.0	NaN	
2	1949-03	132	14.0	NaN	
3	1949-04	129	-3.0	NaN	
4	1949-05	121	-8.0	NaN	
5	1949-06	135	14.0	NaN	
6	1949-07	148	13.0	NaN	
7	1949-08	148	0.0	36.0	
8	1949-09	136	-12.0	18.0	
9	1949-10	119	-17.0	-13.0	

▼ Method 2: Transformation

```
df['adj_log'] = np.log(df['#Passengers'])
df['adj_sqrt'] = np.sqrt(df['#Passengers'])
df['adj_cbrt'] = np.cbrt(df['#Passengers'])

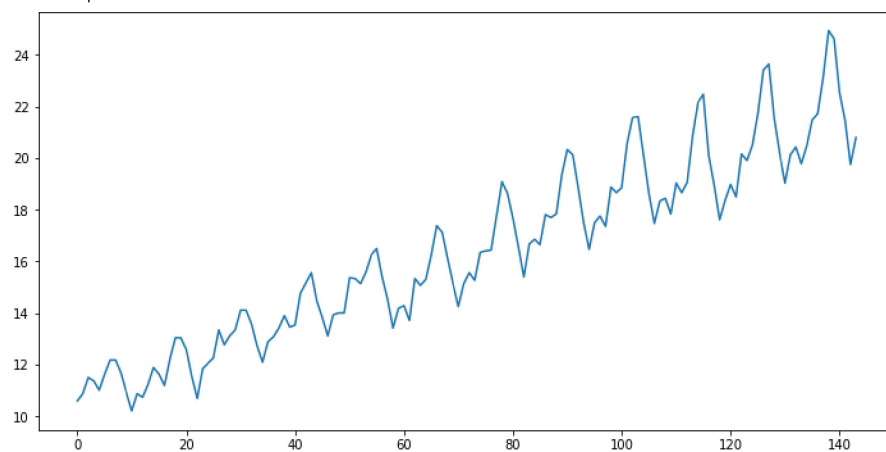
df['adj_log'].dropna().plot()
```

<AxesSubplot:>



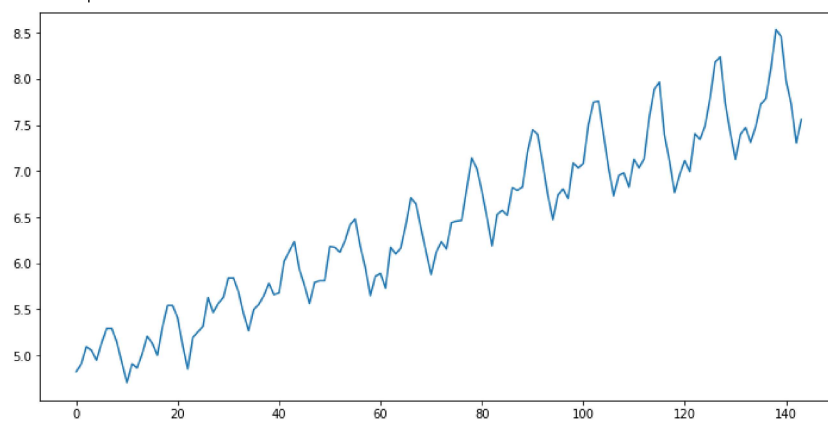
```
df['adj_sqrt'].dropna().plot()
```

<AxesSubplot:>



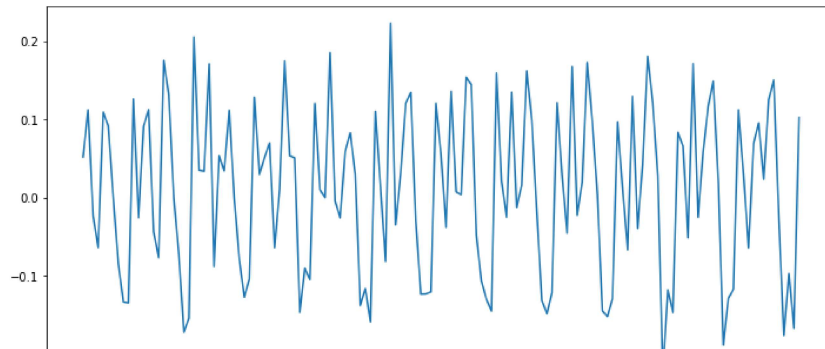
```
df['adj_cbrt'].dropna().plot()
```

<AxesSubplot:>



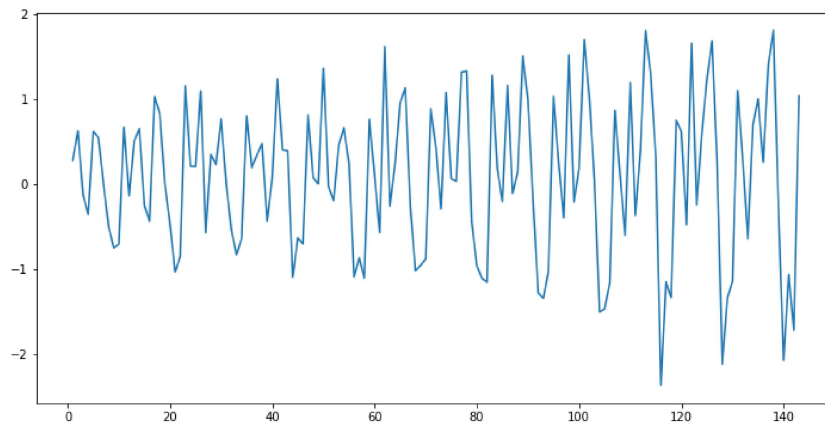
```
df['#Passengers_log_diff'] = df['adj_log'] - df['adj_log'].shift(1)
df['#Passengers_log_diff'].dropna().plot()
```

<AxesSubplot:>



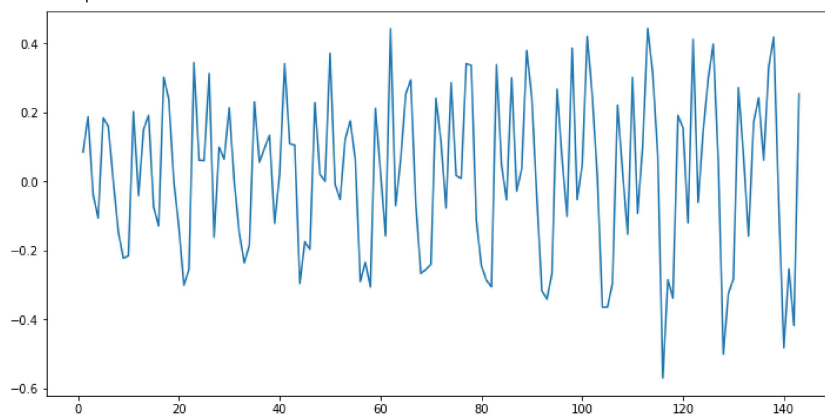
```
df['#Passengers_sqrt_diff'] = df['adj_sqrt'] - df['adj_sqrt'].shift(1)
df['#Passengers_sqrt_diff'].dropna().plot()
```

<AxesSubplot:>



```
df['#Passengers_cbrt_diff'] = df['adj_cbrt'] - df['adj_cbrt'].shift(1)
df['#Passengers_cbrt_diff'].dropna().plot()
```

<AxesSubplot:>



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