

```
In [81]: import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
%matplotlib inline
```

```
In [82]: from numpy.random import randn, randint, uniform, sample
```

```
In [85]: df = pd.DataFrame(randn(1000), index = pd.date_range('2019-06-07', periods = 1000), columns=['value'])
ts = pd.Series(randn(1000), index = pd.date_range('2019-06-07', periods = 1000))
df.head()
```

Out[85]:

	value
2019-06-07	1.232051
2019-06-08	-0.261482
2019-06-09	1.242395
2019-06-10	0.895954
2019-06-11	0.736072

```
In [87]: df['value'] = df['value'].cumsum()
df.head()
```

Out[87]:

	value
2019-06-07	1.232051
2019-06-08	2.202620
2019-06-09	4.415583
2019-06-10	7.524501
2019-06-11	11.369490

```
In [88]: ts = ts.cumsum()  
ts.head()
```

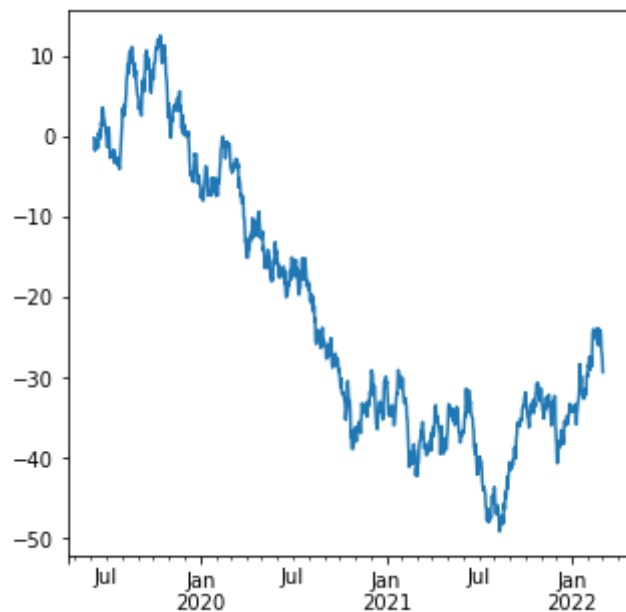
```
Out[88]: 2019-06-07    -0.173462  
2019-06-08    -1.410669  
2019-06-09    -1.760961  
2019-06-10    -1.244528  
2019-06-11    -0.363838  
Freq: D, dtype: float64
```

```
In [89]: type(df), type(ts)
```

```
Out[89]: (pandas.core.frame.DataFrame, pandas.core.series.Series)
```

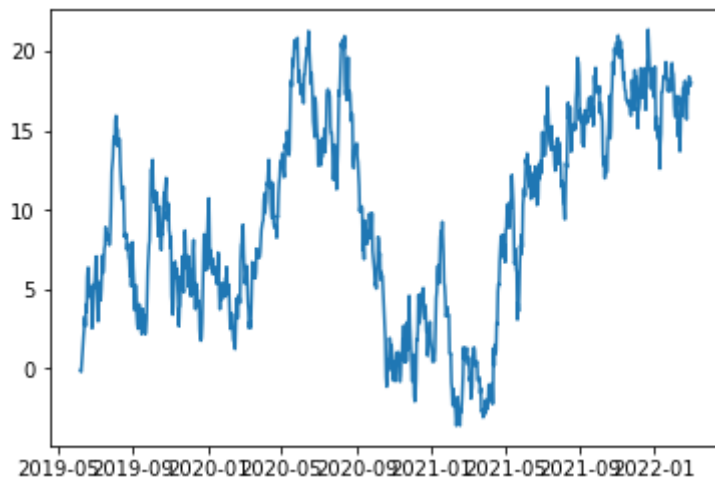
```
In [92]: ts.plot(figsize=(5,5))
```

```
Out[92]: <matplotlib.axes._subplots.AxesSubplot at 0x1a2ac85a20>
```



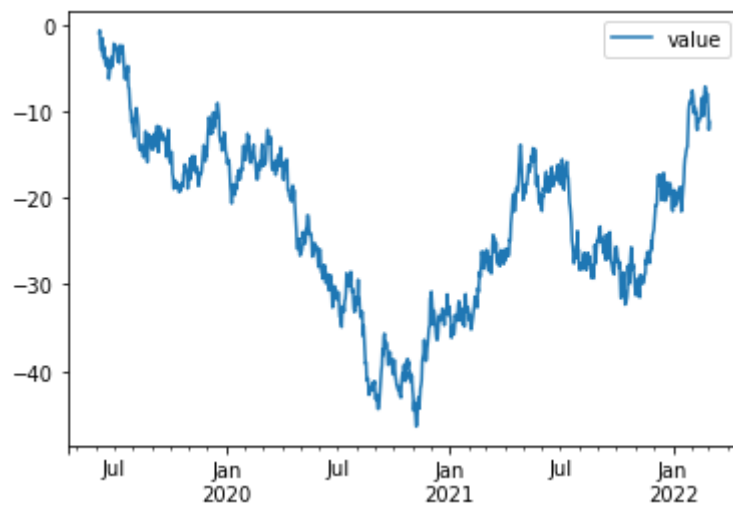
```
In [8]: plt.plot(ts)
```

```
Out[8]: [<matplotlib.lines.Line2D at 0x1a1ac73668>]
```



```
In [9]: df.plot()
```

```
Out[9]: <matplotlib.axes._subplots.AxesSubplot at 0x1a1aa34160>
```



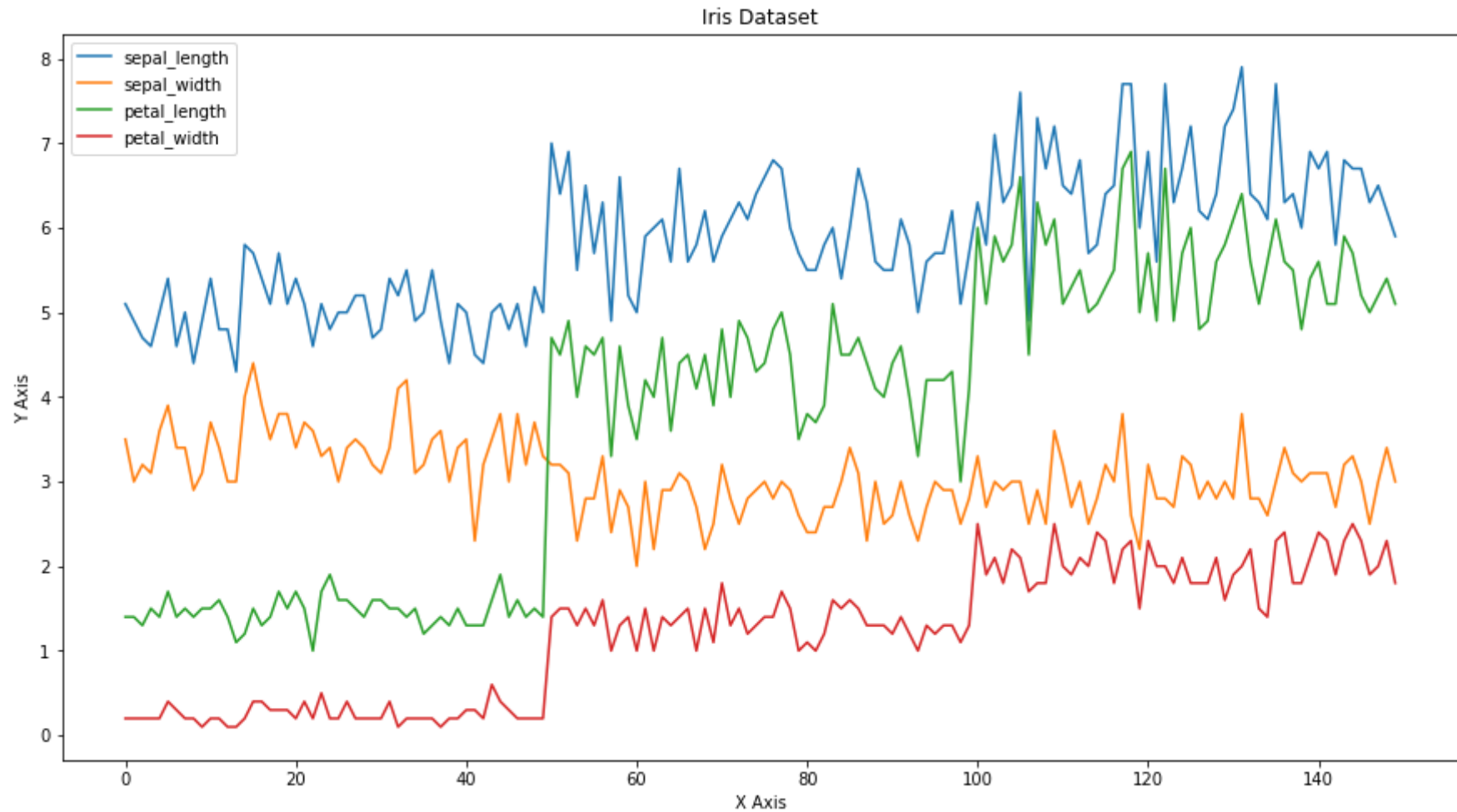
```
In [10]: iris = sns.load_dataset('iris')  
iris.head()
```

Out[10]:

	sepal_length	sepal_width	petal_length	petal_width	species
0	5.1	3.5	1.4	0.2	setosa
1	4.9	3.0	1.4	0.2	setosa
2	4.7	3.2	1.3	0.2	setosa
3	4.6	3.1	1.5	0.2	setosa
4	5.0	3.6	1.4	0.2	setosa

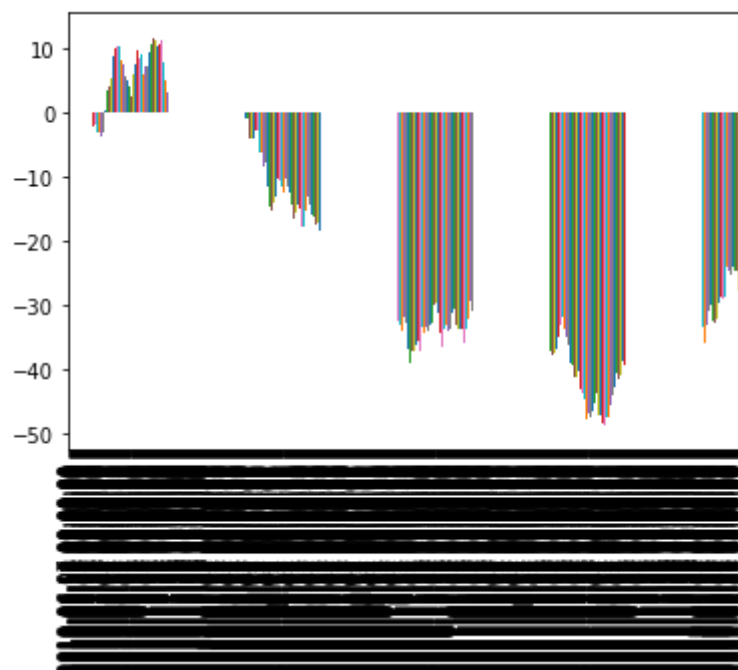
```
In [11]: ax = iris.plot(figsize=(15,8), title='Iris Dataset')  
ax.set_xlabel('X Axis')  
ax.set_ylabel('Y Axis')
```

```
Out[11]: Text(0, 0.5, 'Y Axis')
```



```
In [94]: ts.plot(kind = 'bar')
```

```
Out[94]: <matplotlib.axes._subplots.AxesSubplot at 0x1a2ae7d080>
```



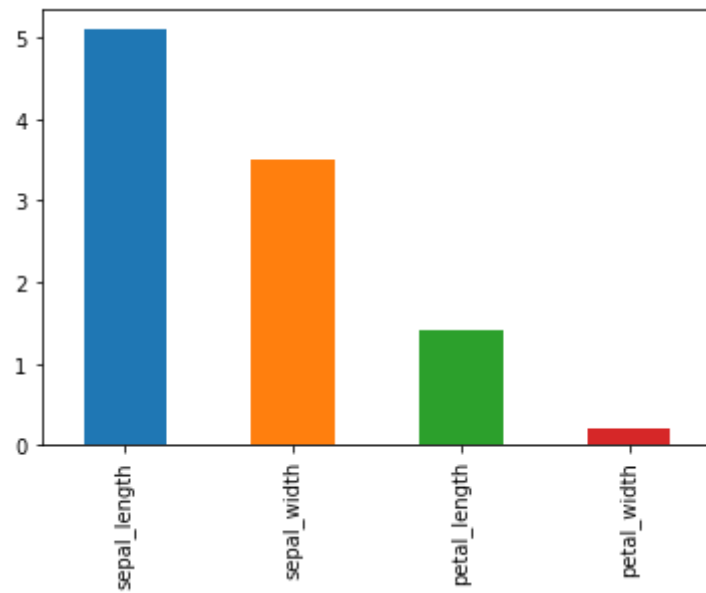
```
In [95]: df = iris.drop(['species'], axis = 1)
```

```
In [97]: df.iloc[0]
```

```
Out[97]: sepal_length    5.1  
sepal_width      3.5  
petal_length     1.4  
petal_width      0.2  
Name: 0, dtype: float64
```

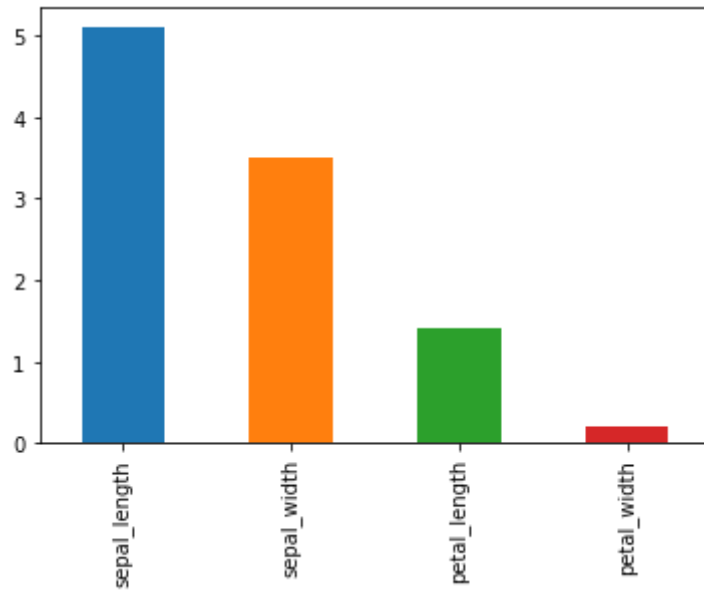
```
In [15]: df.iloc[0].plot(kind='bar')
```

```
Out[15]: <matplotlib.axes._subplots.AxesSubplot at 0x1a1bbc4dd8>
```



```
In [16]: df.iloc[0].plot.bar()
```

```
Out[16]: <matplotlib.axes._subplots.AxesSubplot at 0x1a1c99e940>
```



```
In [98]: titanic = sns.load_dataset('titanic')
```

```
In [99]: titanic.head()
```

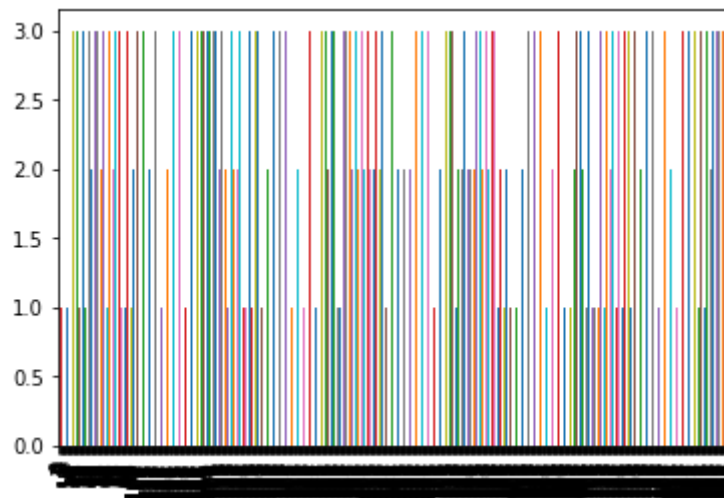
```
Out[99]:
```

	survived	pclass	sex	age	sibsp	parch	fare	embarked	class	who	adult_male	deck	embark_town	alive	alone
0	0	3	male	22.0	1	0	7.2500	S	Third	man	True	NaN	Southampton	no	False
1	1	1	female	38.0	1	0	71.2833	C	First	woman	False	C	Cherbourg	yes	False
2	1	3	female	26.0	0	0	7.9250	S	Third	woman	False	NaN	Southampton	yes	True
3	1	1	female	35.0	1	0	53.1000	S	First	woman	False	C	Southampton	yes	False
4	0	3	male	35.0	0	0	8.0500	S	Third	man	True	NaN	Southampton	no	True



```
In [100]: titanic['pclass'].plot(kind = 'bar')
```

```
Out[100]: <matplotlib.axes._subplots.AxesSubplot at 0x1a22dee6d8>
```



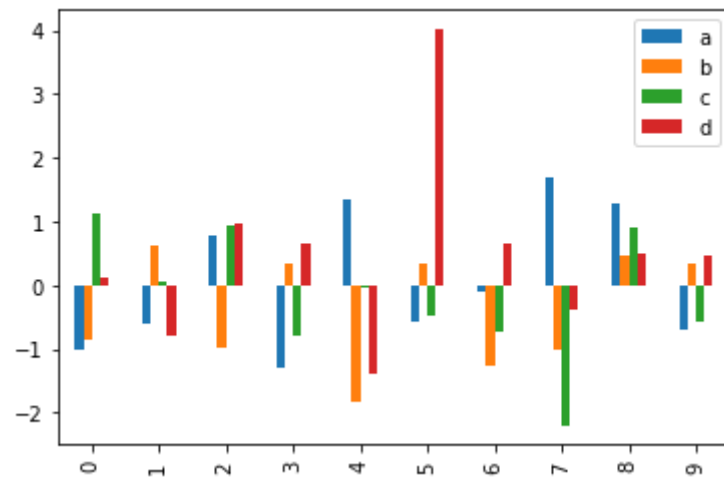
```
In [101]: df = pd.DataFrame(randn(10, 4), columns=['a', 'b', 'c', 'd'])
df.head(10)
```

```
Out[101]:
```

	a	b	c	d
0	0.326203	2.331026	-0.454617	0.107559
1	0.468923	1.185780	0.008878	0.723547
2	2.054247	1.828960	1.536323	-1.792616
3	0.170623	0.640836	1.402193	0.045841
4	0.009997	-0.727844	0.079510	-1.533088
5	-0.197923	0.135551	1.871942	1.361573
6	0.798528	-0.079833	1.438415	0.397582
7	0.995109	-1.384738	-0.012644	-1.937791
8	1.436894	-0.254240	-0.760523	-0.523546
9	-0.210206	-0.766180	-1.179217	-1.280725

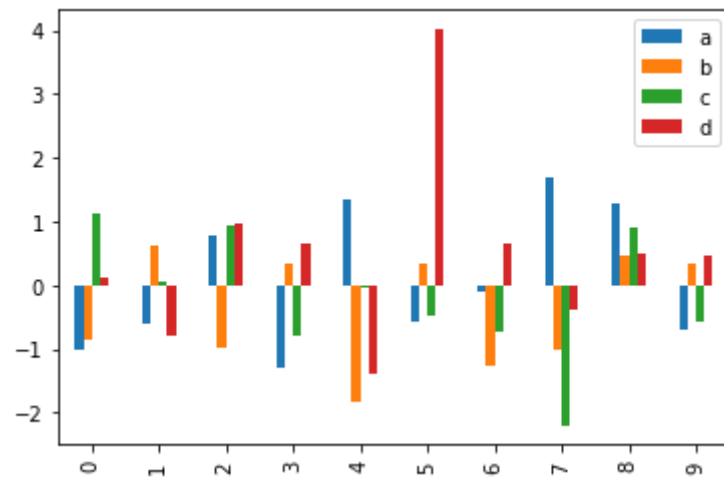
```
In [21]: df.plot.bar()
```

```
Out[21]: <matplotlib.axes._subplots.AxesSubplot at 0x1a1c994860>
```



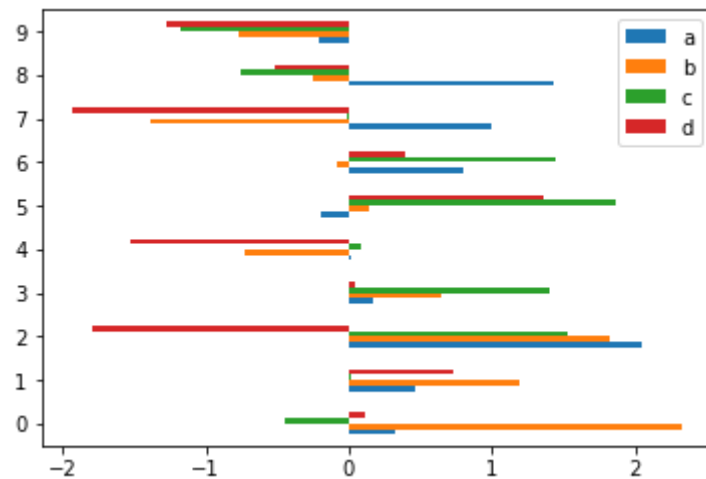
```
In [22]: df.plot(kind = 'bar')
```

```
Out[22]: <matplotlib.axes._subplots.AxesSubplot at 0x1a1c9dc9e8>
```



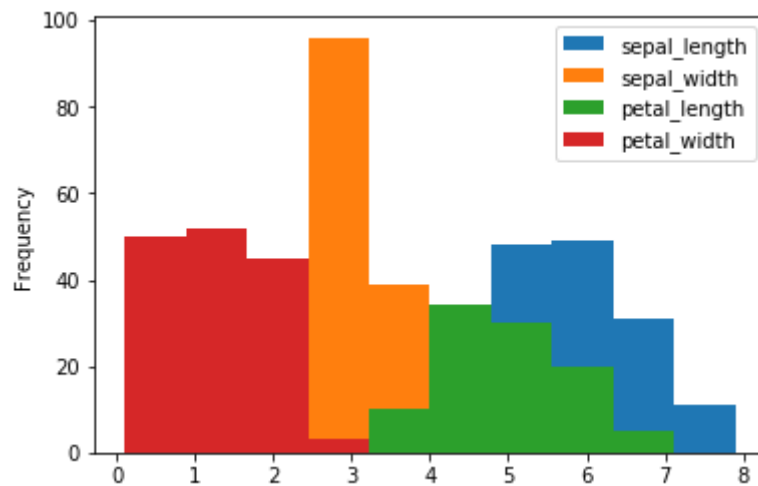
```
In [102]: df.plot.barh()
```

```
Out[102]: <matplotlib.axes._subplots.AxesSubplot at 0x1a2b6de208>
```



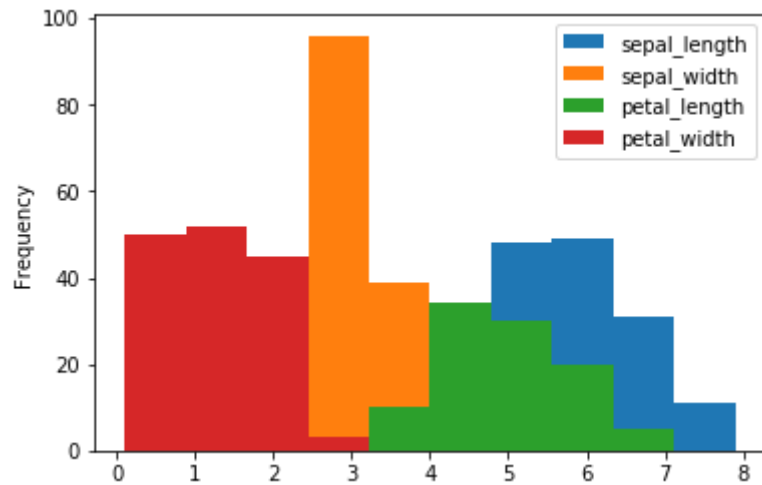
```
In [103]: iris.plot.hist()
```

```
Out[103]: <matplotlib.axes._subplots.AxesSubplot at 0x1a2c1e9c18>
```



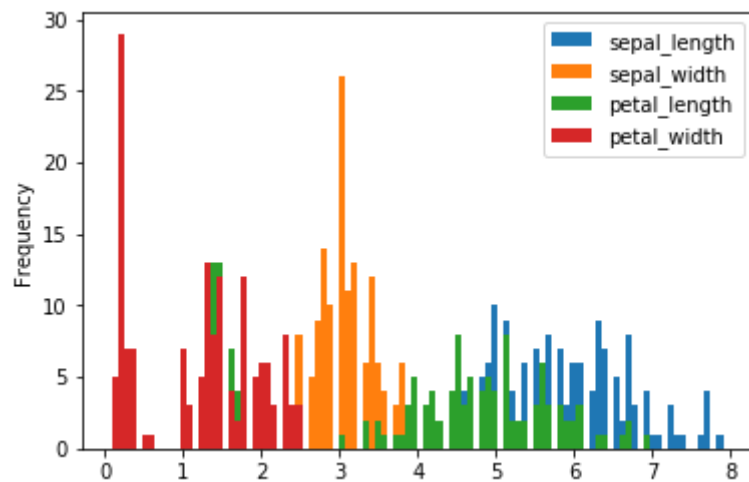
```
In [25]: iris.plot(kind = 'hist')
```

```
Out[25]: <matplotlib.axes._subplots.AxesSubplot at 0x1a1d22ec50>
```



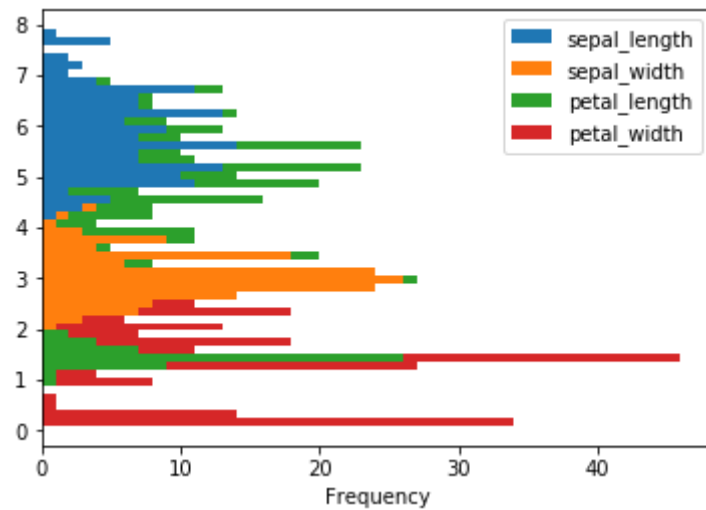
```
In [110]: iris.plot(kind = 'hist', stacked = False, bins = 100)
```

```
Out[110]: <matplotlib.axes._subplots.AxesSubplot at 0x1a2d5a3b70>
```



```
In [111]: iris.plot(kind = 'hist', stacked = True, bins = 50, orientation = 'horizontal')
```

```
Out[111]: <matplotlib.axes._subplots.AxesSubplot at 0x1a2da82320>
```



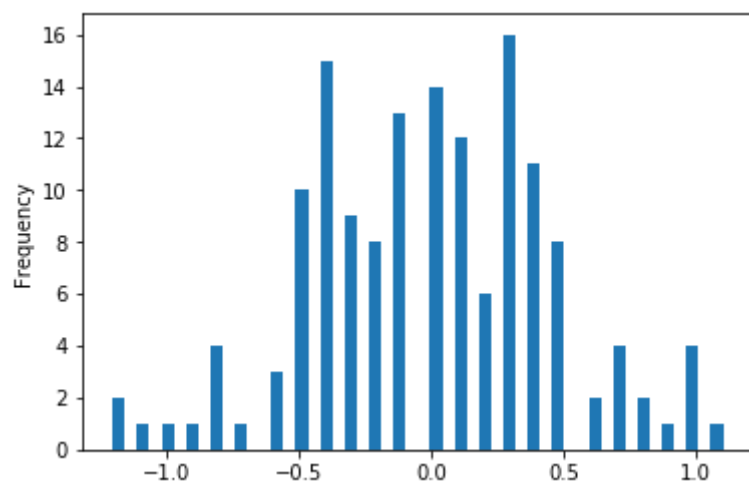
```
In [112]: iris['sepal_width'].diff()
```

```
Out[112]: 0      NaN
          1    -0.5
          2     0.2
          3    -0.1
          4     0.5
          5     0.3
          6    -0.5
          7     0.0
          8    -0.5
          9     0.2
         10     0.6
         11    -0.3
         12    -0.4
         13     0.0
         14     1.0
         15     0.4
         16    -0.5
         17    -0.4
         18     0.3
         19     0.0
         20    -0.4
         21     0.3
         22    -0.1
         23    -0.3
         24     0.1
         25    -0.4
         26     0.4
         27     0.1
         28    -0.1
         29    -0.2
          ...
        120     1.0
        121    -0.4
        122     0.0
        123    -0.1
        124     0.6
        125    -0.1
        126    -0.4
        127     0.2
        128    -0.2
        129     0.2
```

```
130  -0.2
131   1.0
132  -1.0
133   0.0
134  -0.2
135   0.4
136   0.4
137  -0.3
138  -0.1
139   0.1
140   0.0
141   0.0
142  -0.4
143   0.5
144   0.1
145  -0.3
146  -0.5
147   0.5
148   0.4
149  -0.4
Name: sepal_width, Length: 150, dtype: float64
```

```
In [113]: iris['sepal_width'].diff().plot(kind = 'hist', stacked = True, bins = 50)
```

```
Out[113]: <matplotlib.axes._subplots.AxesSubplot at 0x1a2dc198>
```





In [ ]:

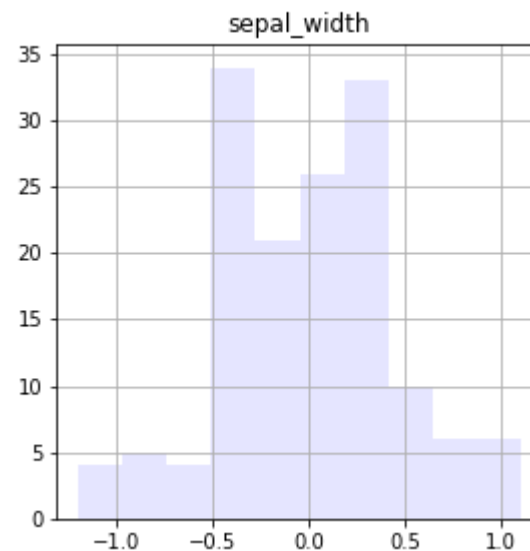
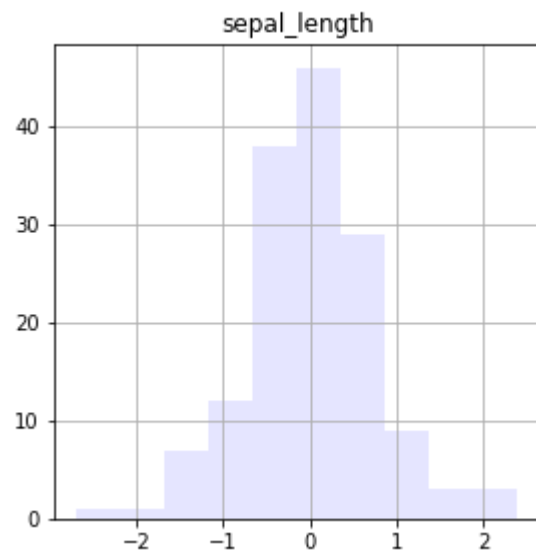
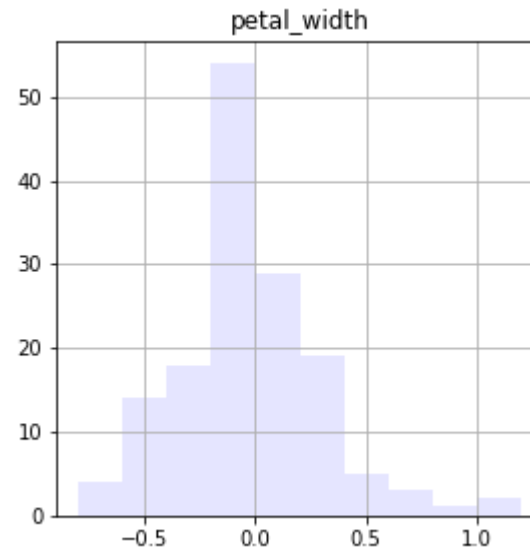
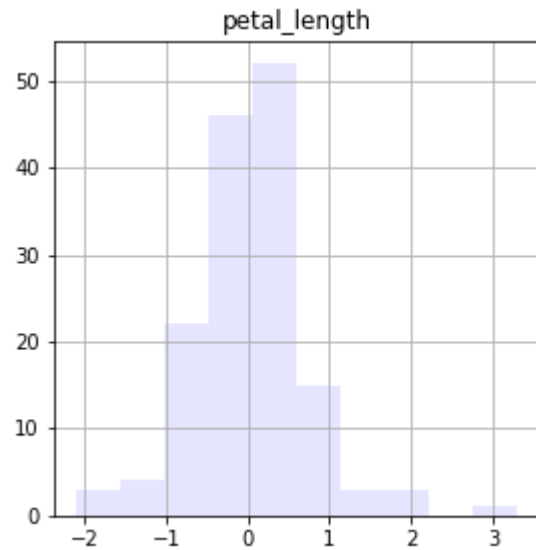
```
In [118]: df = iris.drop(['species'], axis = 1)
df.diff().head()
```

Out[118]:

	sepal_length	sepal_width	petal_length	petal_width
0	NaN	NaN	NaN	NaN
1	-0.2	-0.5	0.0	0.0
2	-0.2	0.2	-0.1	0.0
3	-0.1	-0.1	0.2	0.0
4	0.4	0.5	-0.1	0.0

```
In [121]: df.diff().hist(color = 'b', alpha = 0.1, figsize=(10,10))
```

```
Out[121]: array([[<matplotlib.axes._subplots.AxesSubplot object at 0x1a2dcbceb8>,  
                <matplotlib.axes._subplots.AxesSubplot object at 0x1a2eace7b8>],  
                [<matplotlib.axes._subplots.AxesSubplot object at 0x1a2eaf3d30>,  
                <matplotlib.axes._subplots.AxesSubplot object at 0x1a2eb242e8>]],  
            dtype=object)
```



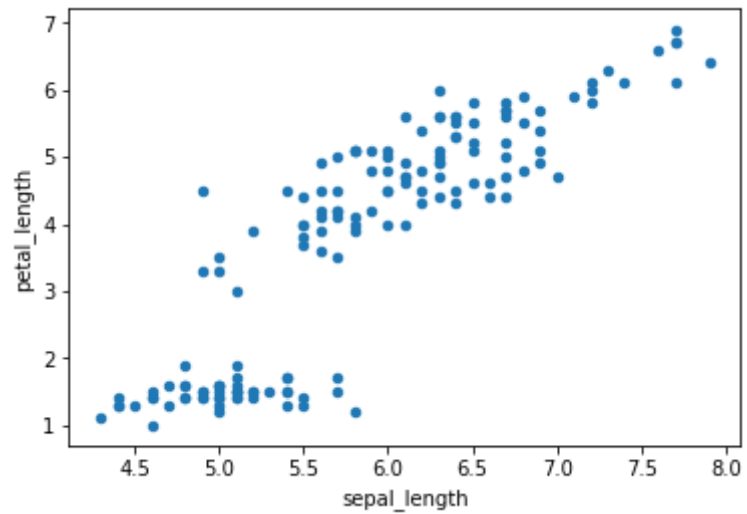
```
In [122]: color = {'boxes': 'DarkGreen', 'whiskers': 'b'}  
color
```

```
Out[122]: {'boxes': 'DarkGreen', 'whiskers': 'b'}
```

```
In [ ]:
```

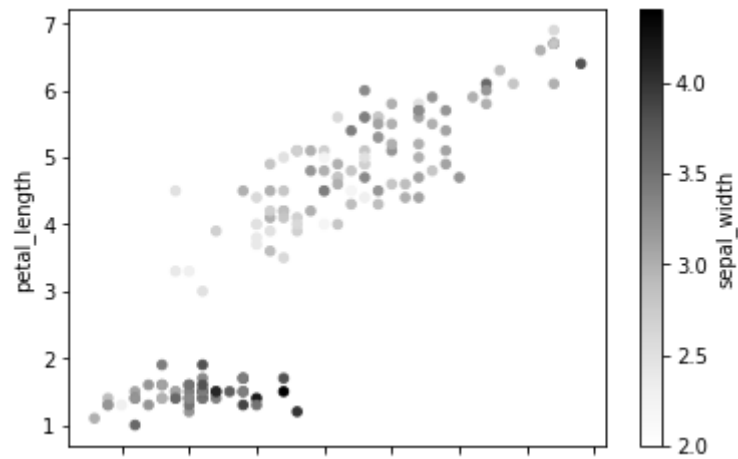
```
In [123]: df.plot.scatter(x = 'sepal_length', y = 'petal_length')
```

```
Out[123]: <matplotlib.axes._subplots.AxesSubplot at 0x1a2ebce518>
```



```
In [125]: df.plot.scatter(x = 'sepal_length', y = 'petal_length', c = 'sepal_width')
```

```
Out[125]: <matplotlib.axes._subplots.AxesSubplot at 0x1a2ef4ec18>
```

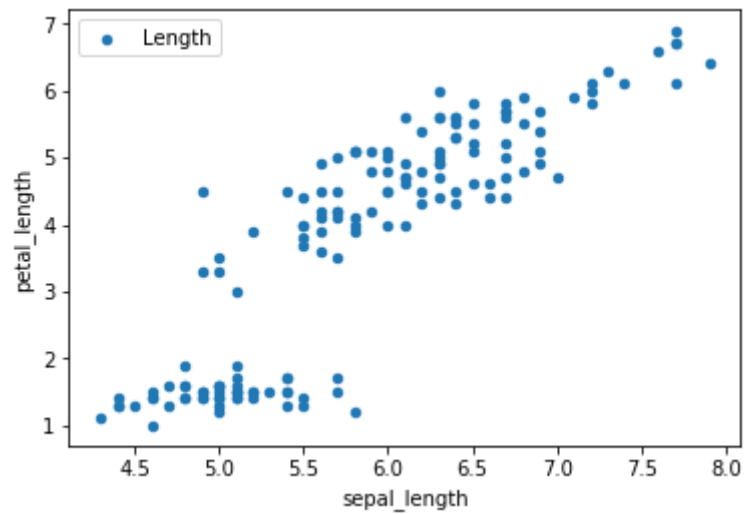


```
In [126]: df.head()
```

```
Out[126]:
```

	sepal_length	sepal_width	petal_length	petal_width
0	5.1	3.5	1.4	0.2
1	4.9	3.0	1.4	0.2
2	4.7	3.2	1.3	0.2
3	4.6	3.1	1.5	0.2
4	5.0	3.6	1.4	0.2

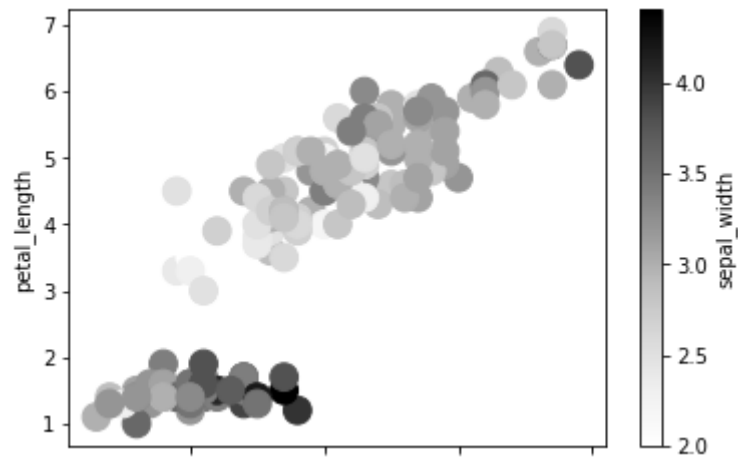
```
In [131]: df.plot.scatter(x = 'sepal_length', y = 'petal_length', label = 'Length');  
#df.plot.scatter(x = 'sepal_width', y = 'petal_width', label = 'Width', ax = ax, color = 'r')  
#df.plot.scatter(x = 'sepal_width', y = 'petal_length', label = 'Width', ax = ax, color = 'g')
```



```
In [ ]:
```

```
In [133]: df.plot.scatter(x = 'sepal_length', y = 'petal_length', c = 'sepal_width', s = 190)
```

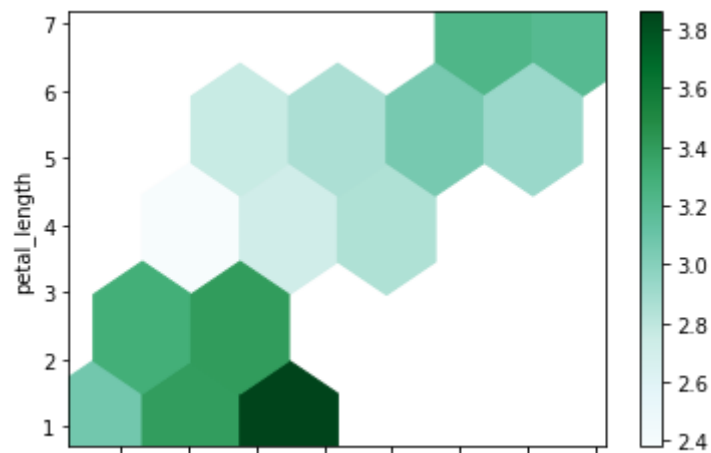
```
Out[133]: <matplotlib.axes._subplots.AxesSubplot at 0x1a2f5fde80>
```



```
In [ ]:
```

```
In [135]: df.plot.hexbin(x = 'sepal_length', y = 'petal_length', gridsize = 5, C = 'sepal_width')
```

```
Out[135]: <matplotlib.axes._subplots.AxesSubplot at 0x1a2f883b00>
```



In [ ]:

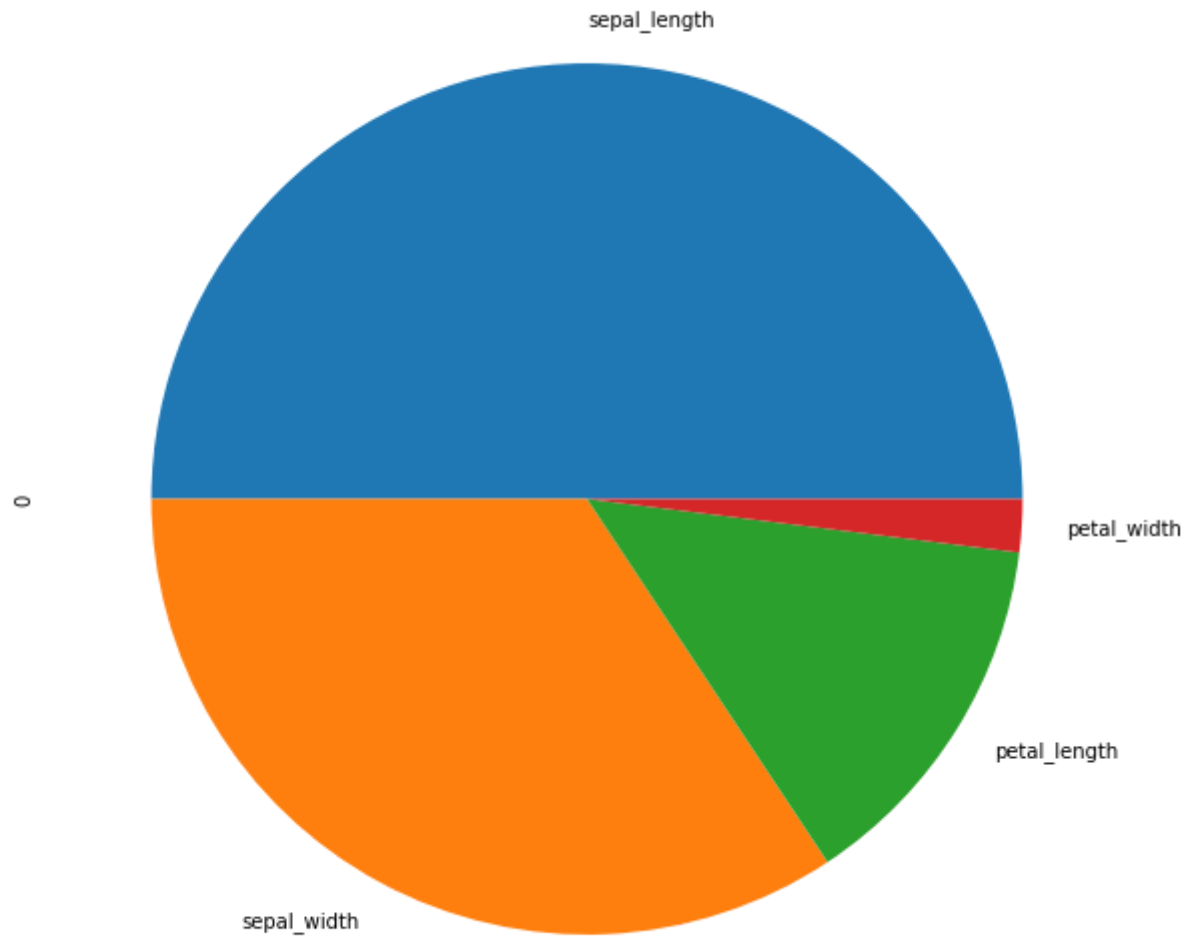
In [136]: `d = df.iloc[0]`  
`d`

Out[136]: `sepal_length 5.1`  
`sepal_width 3.5`  
`petal_length 1.4`  
`petal_width 0.2`  
`Name: 0, dtype: float64`



```
In [39]: d.plot.pie(figsize = (10,10))
```

```
Out[39]: <matplotlib.axes._subplots.AxesSubplot at 0x1a1e0fea58>
```



```
In [137]: d = df.head(3).T
```

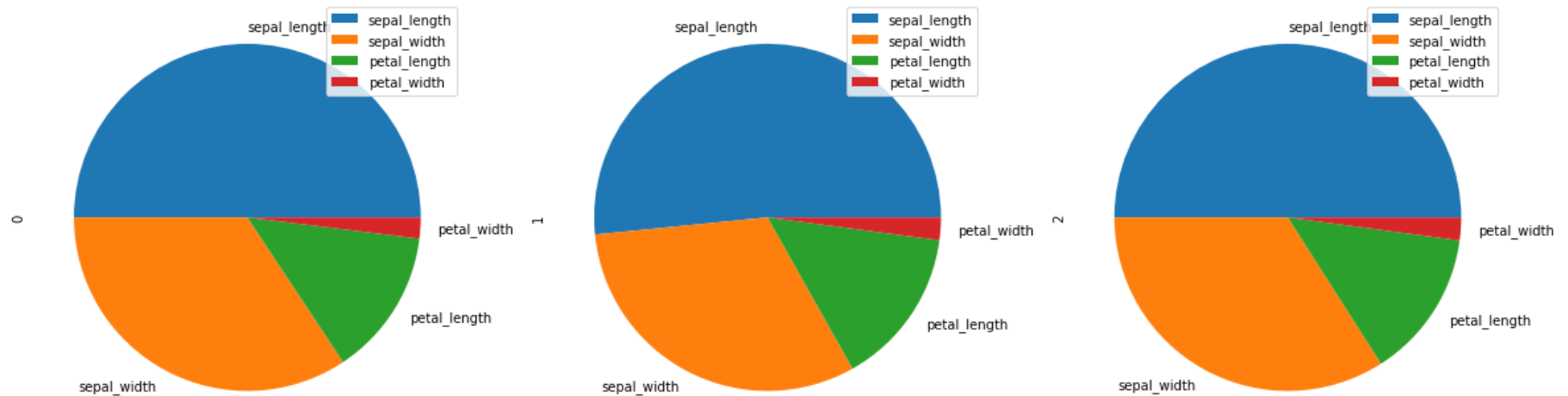
In [138]: d

Out[138]:

	0	1	2
sepal_length	5.1	4.9	4.7
sepal_width	3.5	3.0	3.2
petal_length	1.4	1.4	1.3
petal_width	0.2	0.2	0.2

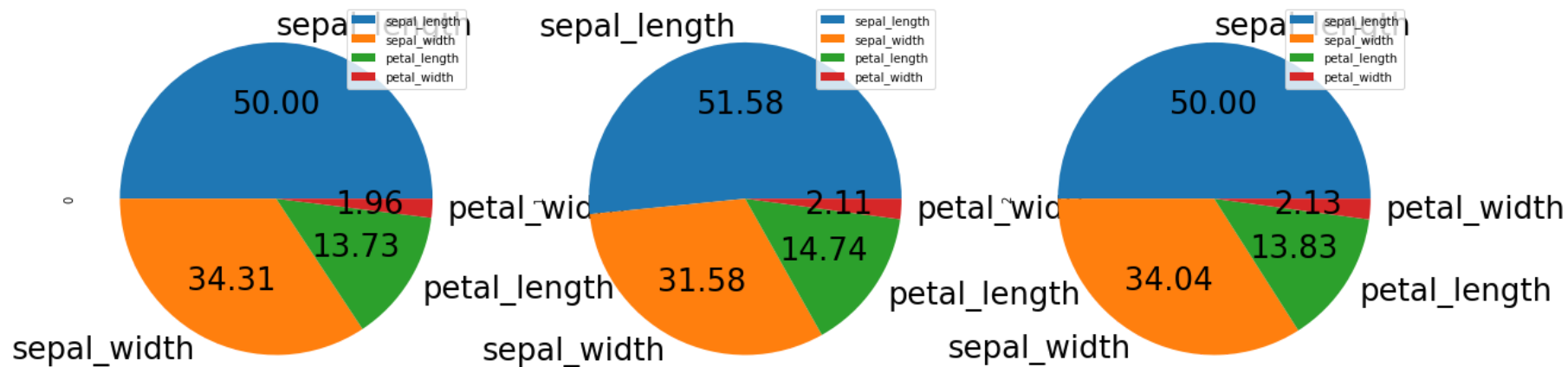
In [140]: d.plot.pie(subplots = True, figsize = (20, 20))

Out[140]: array([<matplotlib.axes.\_subplots.AxesSubplot object at 0x1a2f7d3f28>,  
<matplotlib.axes.\_subplots.AxesSubplot object at 0x1a2fa52e80>,  
<matplotlib.axes.\_subplots.AxesSubplot object at 0x1a2fa81320>],  
dtype=object)



```
In [142]: d.plot.pie(subplots = True, figsize = (20, 20), fontsize = 26, autopct = '%.2f')
```

```
Out[142]: array([<matplotlib.axes._subplots.AxesSubplot object at 0x1a303d2630>,
  <matplotlib.axes._subplots.AxesSubplot object at 0x1a3040fcf8>,
  <matplotlib.axes._subplots.AxesSubplot object at 0x1a30662198>],
  dtype=object)
```

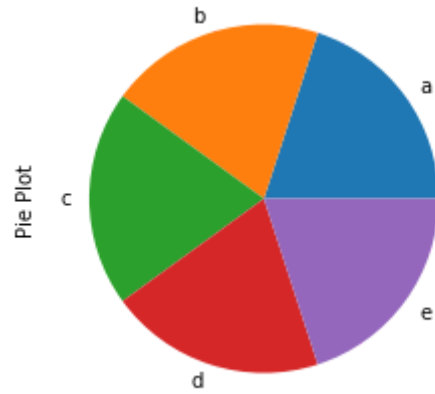


```
In [44]: [0.1]*4
```

```
Out[44]: [0.1, 0.1, 0.1, 0.1]
```

```
In [144]: series = pd.Series([0.2]*5, index = ['a','b','c', 'd','e'], name = 'Pie Plot')  
          series.plot.pie()
```

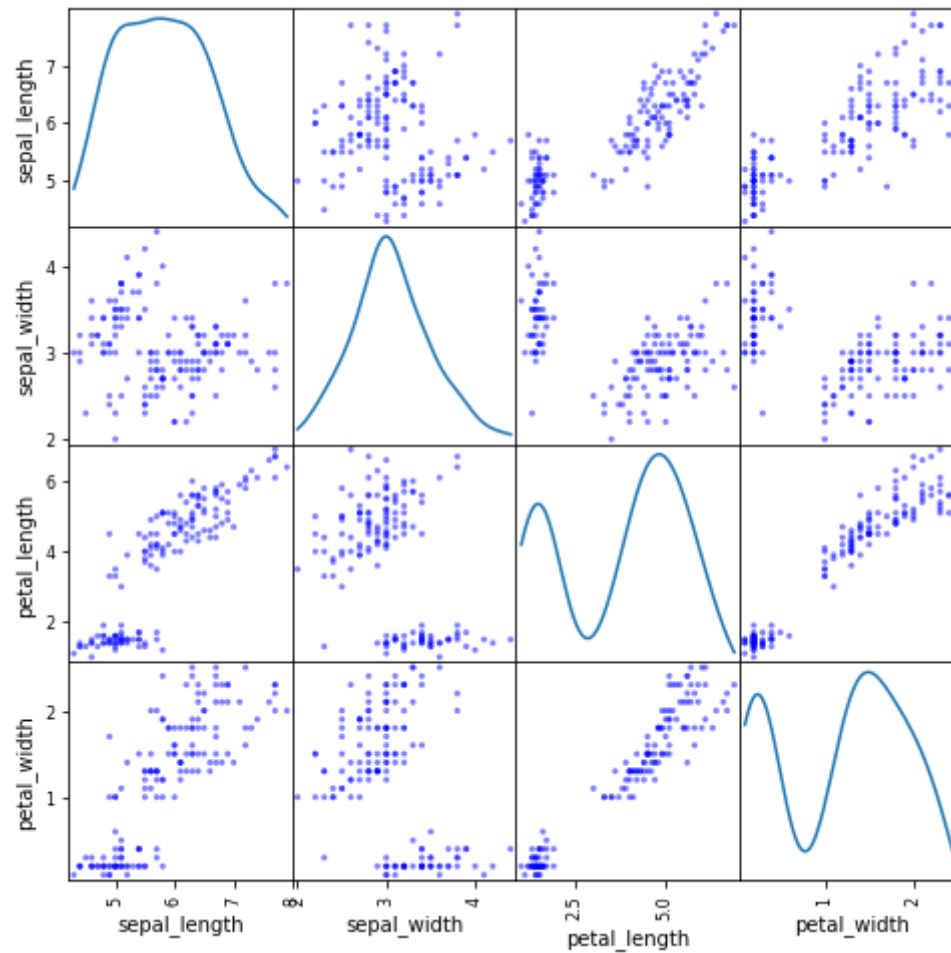
```
Out[144]: <matplotlib.axes._subplots.AxesSubplot at 0x1a306f4ba8>
```



```
In [ ]:
```

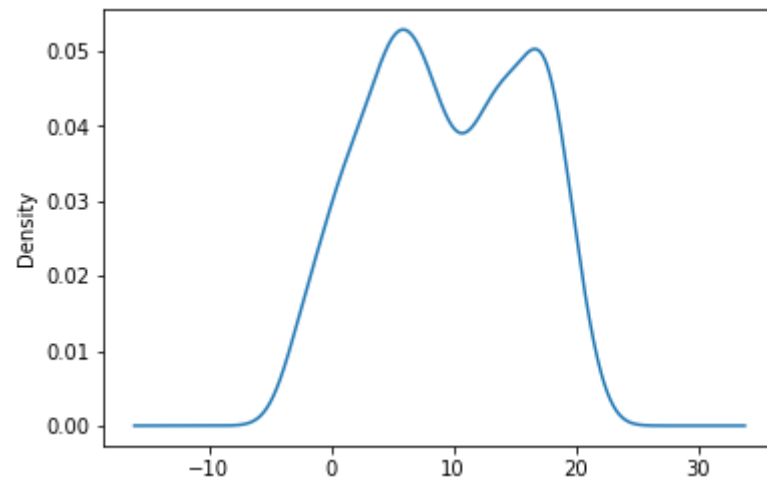
```
In [46]: from pandas.plotting import scatter_matrix
```

```
In [47]: scatter_matrix(df, figsize= (8,8), diagonal='kde', color = 'b')  
plt.show()
```



```
In [48]: ts.plot.kde()
```

```
Out[48]: <matplotlib.axes._subplots.AxesSubplot at 0x1a1f41df98>
```

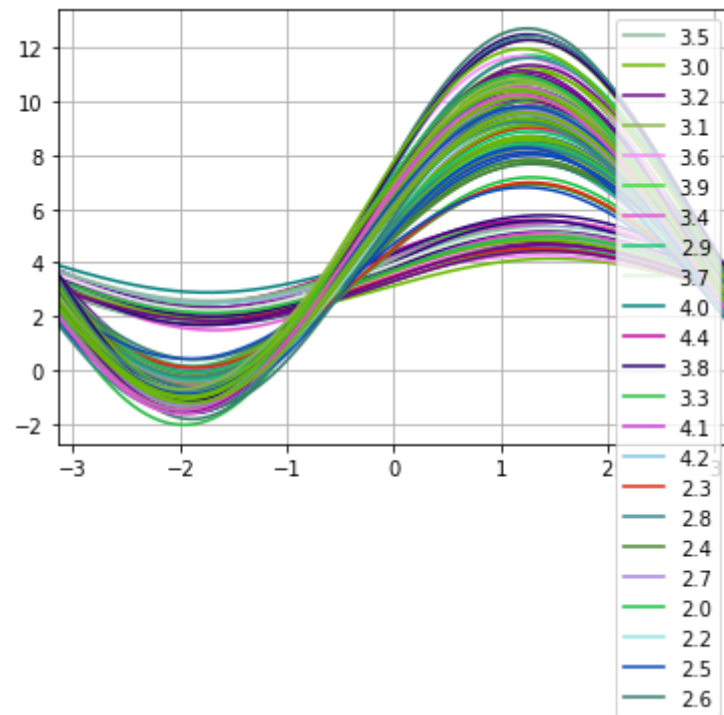


```
In [ ]:
```

```
In [49]: from pandas.plotting import andrews_curves
```

```
In [50]: andrews_curves(df, 'sepal_width')
```

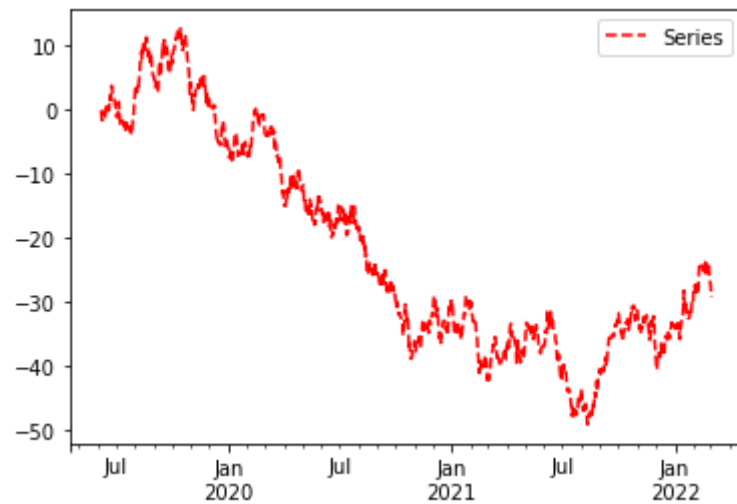
```
Out[50]: <matplotlib.axes._subplots.AxesSubplot at 0x1a1eda8dd8>
```



```
In [ ]:
```

```
In [145]: ts.plot(style = 'r--', label = 'Series', legend = True)
```

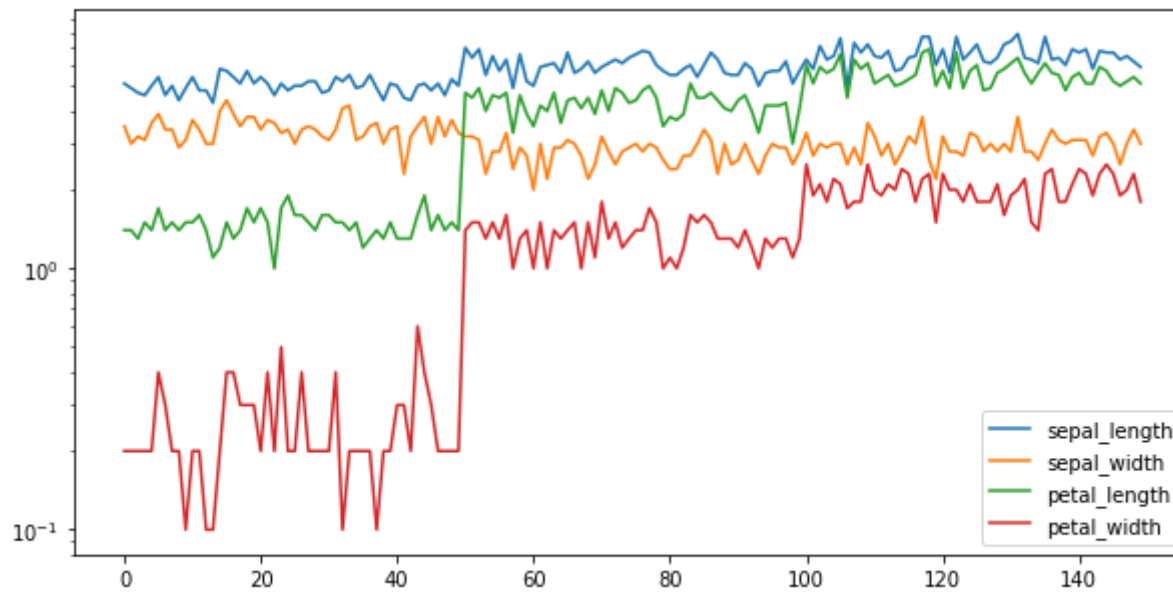
```
Out[145]: <matplotlib.axes._subplots.AxesSubplot at 0x1a30949f28>
```





```
In [146]: df.plot(legend = True, figsize = (10, 5), logy = True)
```

```
Out[146]: <matplotlib.axes._subplots.AxesSubplot at 0x1a30a13ac8>
```



```
In [53]: df.head(0)
```

```
Out[53]:
```

<u>sepal_length</u>	<u>sepal_width</u>	<u>petal_length</u>	<u>petal_width</u>
---------------------	--------------------	---------------------	--------------------

```
In [ ]:
```

```
In [54]: x = df.drop(['sepal_width', 'petal_width'], axis = 1)
x.head()
```

Out[54]:

	sepal_length	petal_length
0	5.1	1.4
1	4.9	1.4
2	4.7	1.3
3	4.6	1.5
4	5.0	1.4

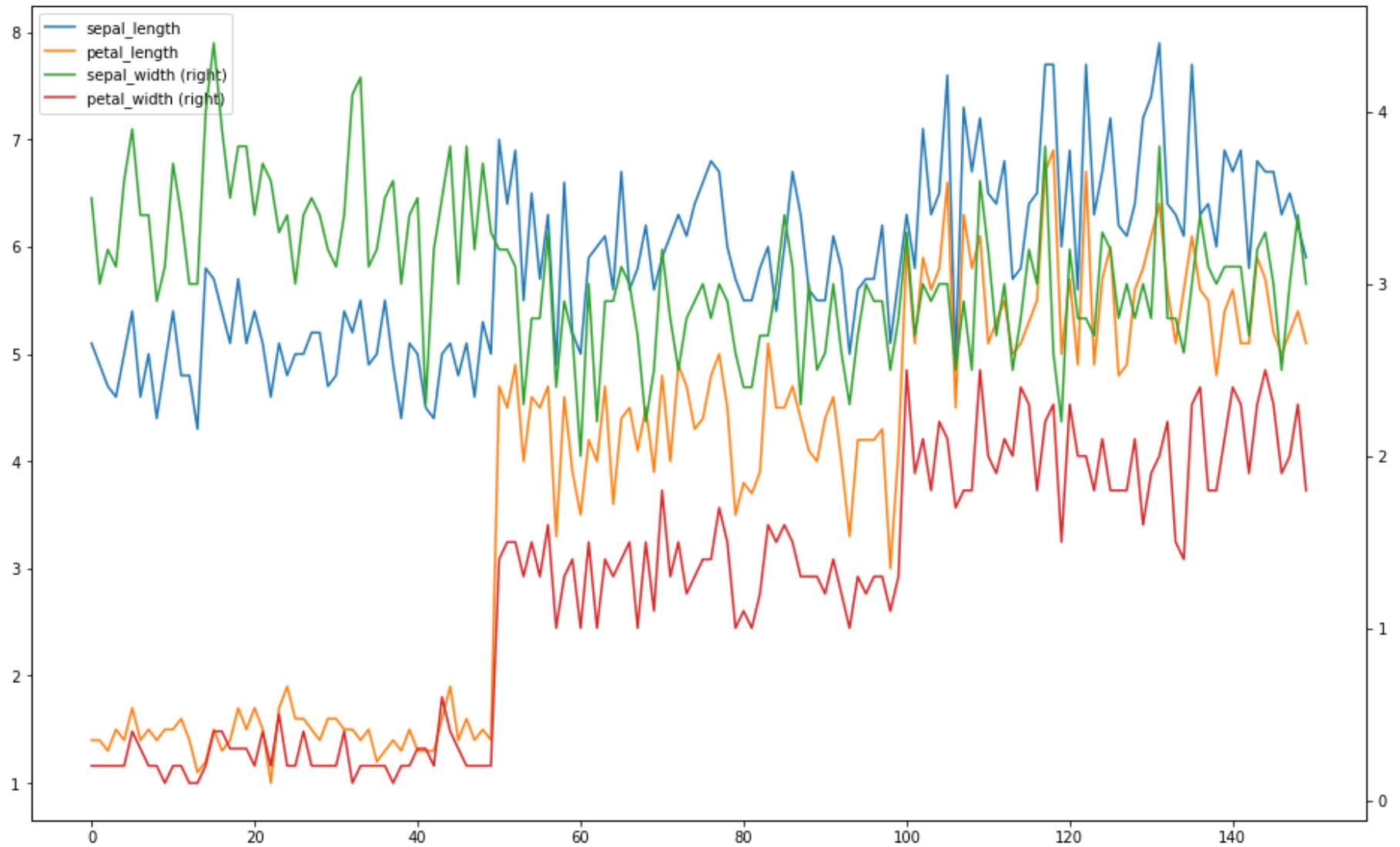
```
In [55]: y = df.drop(['sepal_length', 'petal_length'], axis = 1)
y.head()
```

Out[55]:

	sepal_width	petal_width
0	3.5	0.2
1	3.0	0.2
2	3.2	0.2
3	3.1	0.2
4	3.6	0.2

```
In [56]: ax = x.plot()  
y.plot(figsize = (16,10), secondary_y=True, ax = ax)
```

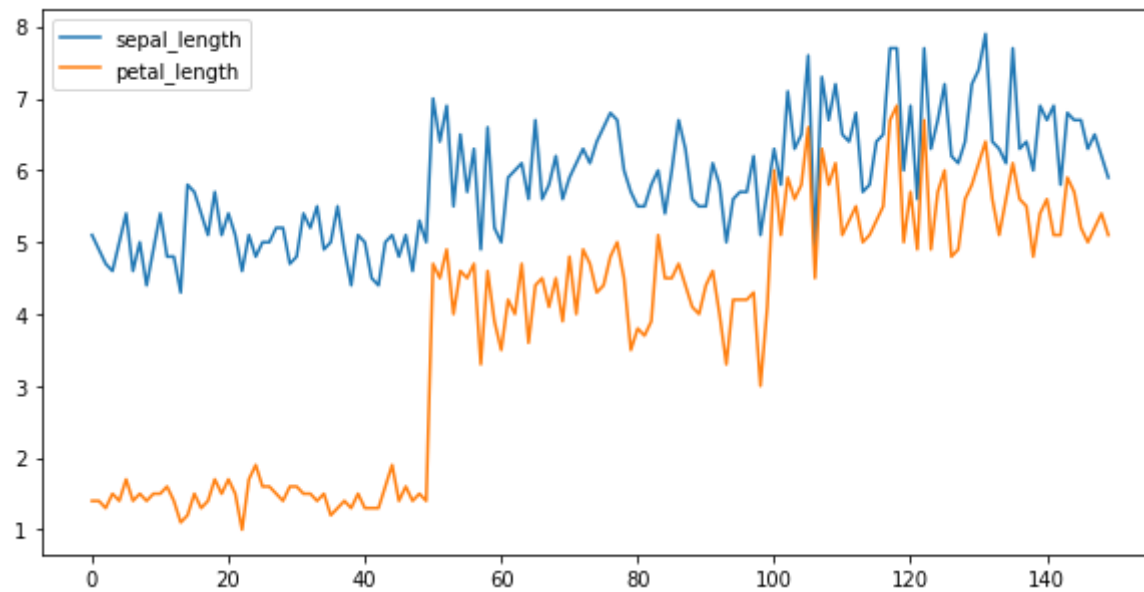
```
Out[56]: <matplotlib.axes._subplots.AxesSubplot at 0x1a1e6d7e80>
```



```
In [ ]:
```

```
In [57]: x.plot(figsize=(10,5), x_compat = True)
```

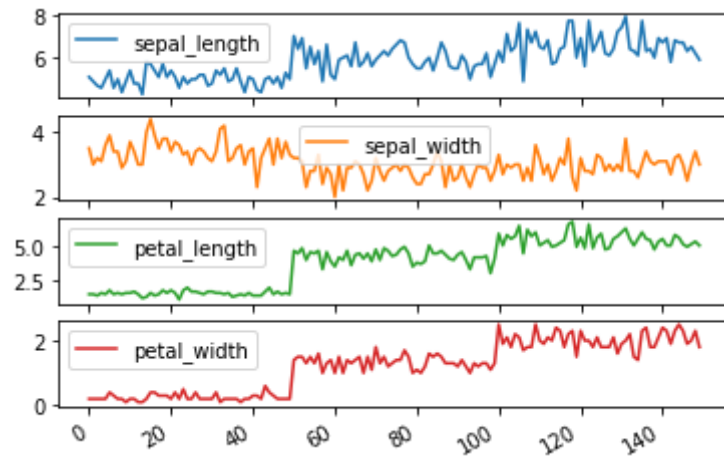
```
Out[57]: <matplotlib.axes._subplots.AxesSubplot at 0x1a1e6c3a58>
```



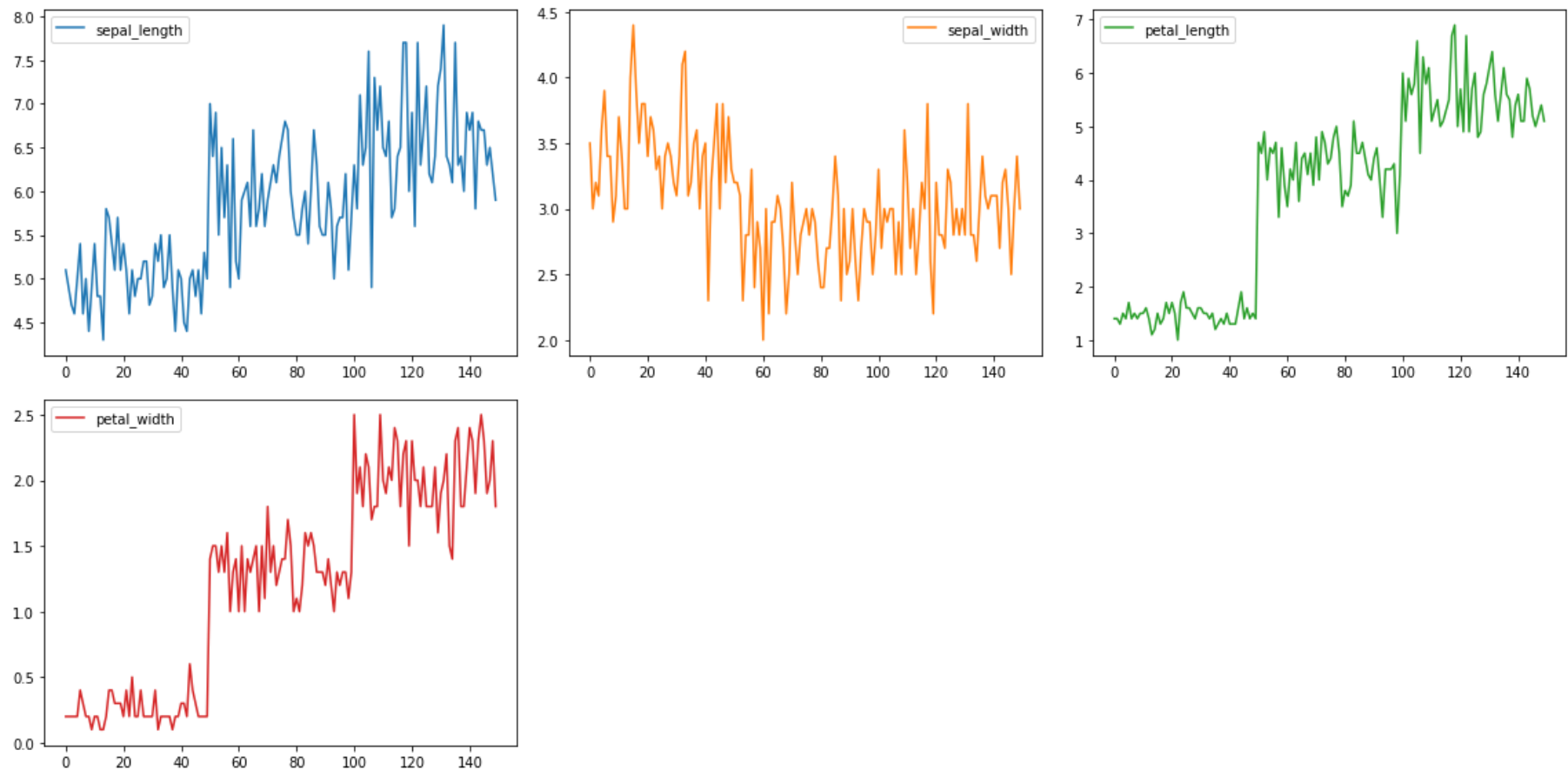
```
In [ ]:
```

```
In [58]: df.plot(subplots = True)
```

```
Out[58]: array([<matplotlib.axes._subplots.AxesSubplot object at 0x1a1ec1ea58>,  
                <matplotlib.axes._subplots.AxesSubplot object at 0x1a1ecbcef0>,  
                <matplotlib.axes._subplots.AxesSubplot object at 0x1a1faab240>,  
                <matplotlib.axes._subplots.AxesSubplot object at 0x1a1fad26a0>],  
              dtype=object)
```



```
In [59]: df.plot(subplots = True, sharex = False, layout = (2,3), figsize = (16,8))  
plt.tight_layout()
```



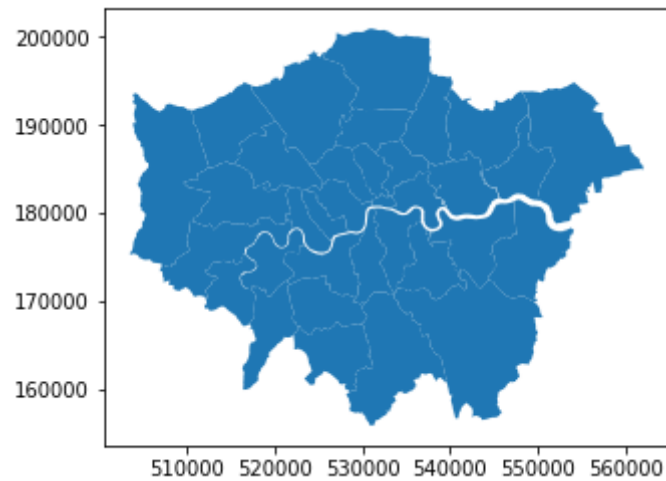
```
In [ ]:
```

```
In [78]: from descartes import PolygonPatch
```

```
In [ ]:
```

```
In [79]: map_df = gpd.read_file("London_Borough_Excluding_MHW.shp")  
# check data type so we can see that this is not a normal dataframe, but a GEOdataframe  
map_df.head()  
map_df.plot()
```

Out[79]: <matplotlib.axes.\_subplots.AxesSubplot at 0x1a1e9f9630>



```
In [71]: import geopandas as gpd
```

```
In [80]: map_df
```



Out[80]:

	NAME	GSS_CODE	HECTARES	NONLD_AREA	ONS_INNER	SUB_2009	SUB_2006	geometry
0	Kingston upon Thames	E09000021	3726.117	0.000	F	None	None	POLYGON ((516401.6 160201.8, 516407.3 160210.5...
1	Croydon	E09000008	8649.441	0.000	F	None	None	POLYGON ((535009.2 159504.7, 535005.5 159502, ...
2	Bromley	E09000006	15013.487	0.000	F	None	None	POLYGON ((540373.6 157530.4, 540361.2 157551.9...
3	Hounslow	E09000018	5658.541	60.755	F	None	None	POLYGON ((521975.8 178100, 521967.7 178096.8, ...
4	Ealing	E09000009	5554.428	0.000	F	None	None	POLYGON ((510253.5 182881.6, 510249.9 182886, ...
5	Havering	E09000016	11445.735	210.763	F	None	None	POLYGON ((549893.9 181459.8, 549894.6 181465.7...
6	Hillingdon	E09000017	11570.063	0.000	F	None	None	POLYGON ((510599.8 191689.5, 510615.2 191591.3...
7	Harrow	E09000015	5046.330	0.000	F	None	None	POLYGON ((510599.8 191689.5, 510660 191690.9, ...
8	Brent	E09000005	4323.270	0.000	F	None	None	POLYGON ((525201 182512.6, 525181.5 182521.1, ...
9	Barnet	E09000003	8674.837	0.000	F	None	None	POLYGON ((524579.9 198355.2, 524594.3 198321.4...
10	Lambeth	E09000022	2724.940	43.927	T	None	None	POLYGON ((530046.8 177893.4, 530048.4 177894.6...
11	Southwark	E09000028	2991.340	105.139	T	None	None	POLYGON ((531335.6 180529.5, 531337.7 180530.5...
12	Lewisham	E09000023	3531.706	16.795	T	None	None	POLYGON ((536691 178958.6, 536691.9 178955.3, ...
13	Greenwich	E09000011	5044.190	310.785	F	None	None	(POLYGON ((537238.7 178137.7, 537242.6 178136....
14	Bexley	E09000004	6428.649	370.619	F	None	None	POLYGON ((547226.2 181299.3, 547320.9 181342.4...
15	Enfield	E09000010	8220.025	0.000	F	None	None	POLYGON ((531023.5 200933.6, 531039.9 200933.9...

	NAME	GSS_CODE	HECTARES	NONLD_AREA	ONS_INNER	SUB_2009	SUB_2006	geometry
16	Waltham Forest	E09000031	3880.793	0.000	F	None	None	POLYGON ((539923.1 191863.1, 539928.1 191846.6...
17	Redbridge	E09000026	5644.225	2.300	F	None	None	POLYGON ((543595.5 184832.8, 543577.1 184837.7...
18	Sutton	E09000029	4384.698	0.000	F	None	None	POLYGON ((528552.3 159658.1, 528399.7 159928.8...
19	Richmond upon Thames	E09000027	5876.111	135.443	F	None	None	POLYGON ((516677.5 175383.8, 516678.6 175378.9...
20	Merton	E09000024	3762.466	0.000	F	None	None	POLYGON ((529906.2 167417.3, 529902.2 167411.8...
21	Wandsworth	E09000032	3522.022	95.600	T	None	None	POLYGON ((523489.6 176224.8, 523500.6 176218.4...
22	Hammersmith and Fulham	E09000013	1715.409	75.648	T	None	None	POLYGON ((521975.8 178100, 521973 178109.8, 52...
23	Kensington and Chelsea	E09000020	1238.379	25.994	T	None	None	POLYGON ((526219.7 176948, 526208.8 176960.4, ...
24	Westminster	E09000033	2203.005	54.308	T	None	None	POLYGON ((528549.5 177903.8, 528542.6 177949.4...
25	Camden	E09000007	2178.932	0.000	T	None	None	POLYGON ((528840.2 187217.8, 528834.6 187205.8...
26	Tower Hamlets	E09000030	2157.501	179.707	T	None	None	POLYGON ((533387.6 180516.4, 533389.8 180523.6...
27	Islington	E09000019	1485.664	0.000	T	None	None	POLYGON ((529153.6 185861.4, 529144.8 185877.8...
28	Hackney	E09000012	1904.902	0.000	T	None	None	POLYGON ((531928.4 187801.5, 531935.7 187804.4...
29	Haringey	E09000014	2959.837	0.000	T	None	None	POLYGON ((531928.4 187801.5, 531919.2 187797.3...
30	Newham	E09000025	3857.806	237.637	T	None	None	(POLYGON ((544065 183254.1, 544062.9 183259, 5...
31	Barking and Dagenham	E09000002	3779.934	169.150	F	None	None	(POLYGON ((543905.4 183199.1, 543905 183198.9,...
32	City of London	E09000001	314.942	24.546	T	None	None	POLYGON ((531145.1 180782.1, 531143.8 180799.3...

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