```
from pandas import read_csv
series = read_csv('/content/daily-minimum-temperatures.csv', header=0, index_col=0)
print(series.describe())
```

```
              Temp
count  3650.000000
mean     11.177753
std       4.071837
min       0.000000
25%       8.300000
50%      11.000000
75%      14.000000
max      26.300000
```

```
series.isnull().sum()
```

```
Temp    0
dtype: int64
```

```
series=series.dropna()
```

```
series.isnull().sum()
```

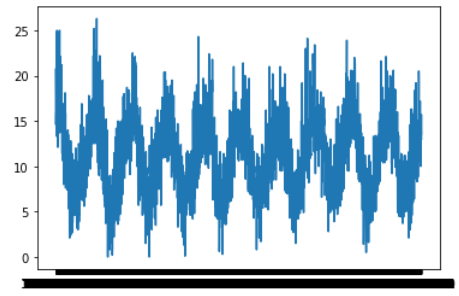
```
Temp    0
dtype: int64
```

```
series.isnull().values.any()
```

```
False
```

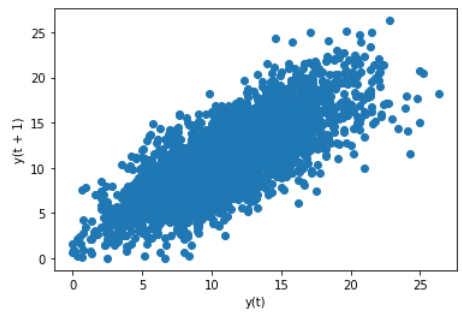
```
from pandas import read_csv
from matplotlib import pyplot
series = read_csv('/content/daily-minimum-temperatures.csv', header=0, index_col=0)
```

```
pyplot.plot(series)
pyplot.show()
```




```
from pandas.plotting import lag_plot
lag_plot(series)
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fcb06120eb8>
```



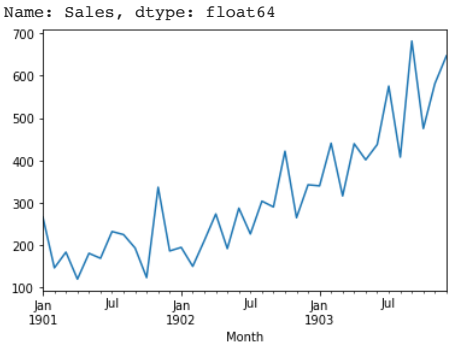

```
from pandas import read_csv
from pandas import datetime
from matplotlib import pyplot

def parser(x):
  return datetime.strptime('190'+x, '%Y-%m')

series = read_csv('/content/shampoo-sales.csv', header=0, parse_dates=[0], index_col=0, squeeze=True, date_parser=parser)
print(series.head())
series.plot()
pyplot.show()
```

```
/usr/local/lib/python3.6/dist-packages/ipykernel_launcher.py:6: FutureWarning: The pandas.datetime class is deprecated and will be removed from pandas in a future version. Import from datetime instead
```

```
Month
1901-01-01    266.0
1901-02-01    145.9
1901-03-01    183.1
1901-04-01    119.3
1901-05-01    180.3
Name: Sales, dtype: float64
```

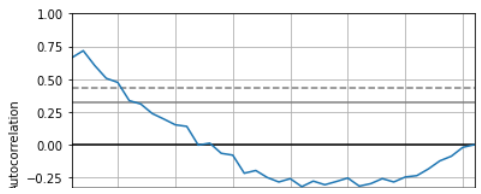



```
# Plot the autocorrelation graph
from pandas import read_csv
from pandas import datetime
from matplotlib import pyplot
from pandas.plotting import autocorrelation_plot

def parser(x):
  return datetime.strptime('190'+x, '%Y-%m')

series = read_csv('shampoo-sales.csv', header=0, parse_dates=[0], index_col=0, squeeze=True, date_parser=parser)
autocorrelation_plot(series)
pyplot.show()
```

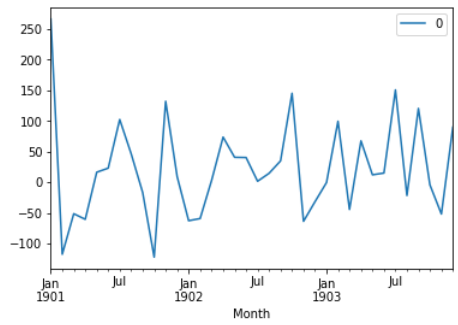
```
/usr/local/lib/python3.6/dist-packages/ipykernel_launcher.py:8: FutureWarning: The pandas.datetime class is deprecated and will be removed from pandas in a future version. Import from datetime instead
```

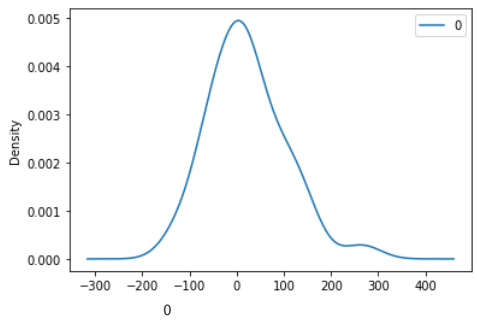



```
!pip install --upgrade statsmodels
# fit an ARIMA model and plot residual errors
from pandas import datetime
from pandas import read_csv
from pandas import DataFrame
from statsmodels.tsa.arima.model import ARIMA
from matplotlib import pyplot
# load dataset
def parser(x):
  return datetime.strptime('190'+x, '%Y-%m')
series = read_csv('shampoo-sales.csv', header=0, index_col=0, parse_dates=True, squeeze=True, date_parser=parser)
series.index = series.index.to_period('M')
# fit model
model = ARIMA(series, order=(5,1,0))
model_fit = model.fit()
# summary of fit model
print(model_fit.summary())
# line plot of residuals
residuals = DataFrame(model_fit.resid)
residuals.plot()
pyplot.show()
# density plot of residuals
residuals.plot(kind='kde')
pyplot.show()
# summary stats of residuals
print(residuals.describe())
```

```
Covariance Type:                 opg
==============================================================================
                 coef    std err          z      P>|z|      [0.025      0.975]
------------------------------------------------------------------------------
ar.L1         -0.9014      0.247     -3.647      0.000      -1.386      -0.417
ar.L2         -0.2284      0.268     -0.851      0.395      -0.754       0.298
ar.L3          0.0747      0.291      0.256      0.798      -0.497       0.646
ar.L4          0.2519      0.340      0.742      0.458      -0.414       0.918
ar.L5          0.3344      0.210      1.593      0.111      -0.077       0.746
sigma2      4728.9608   1316.021      3.593      0.000    2149.607    7308.314
===================================================================================
Ljung-Box (L1) (Q):                   0.61   Jarque-Bera (JB):                 0.96
Prob(Q):                              0.44   Prob(JB):                         0.62
Heteroskedasticity (H):               1.07   Skew:                             0.28
Prob(H) (two-sided):                  0.90   Kurtosis:                         2.41
===================================================================================

Warnings:
[1] Covariance matrix calculated using the outer product of gradients (complex-step).
```






```
                0
count   36.000000
mean    21.936144
std     80.774430
min   -122.292030
25%    -35.040859
50%     13.147219
75%     68.848286
max    266.000000
```

```
from pandas import read_csv
from pandas import datetime
from matplotlib import pyplot
from statsmodels.tsa.arima.model import ARIMA
from sklearn.metrics import mean_squared_error
from math import sqrt
# load dataset
def parser(x):
  return datetime.strptime('190'+x, '%Y-%m')
series = read_csv('shampoo-sales.csv', header=0, index_col=0, parse_dates=True, squeeze=True, date_parser=parser)
series.index = series.index.to_period('M')
# split into train and test sets
X = series.values
```

```
size = int(len(X) * 0.66)
train, test = X[0:size], X[size:len(X)]
history = [x for x in train]
predictions = list()
# walk-forward validation
for t in range(len(test)):
  model = ARIMA(history, order=(5,1,0))
  model_fit = model.fit()
  output = model_fit.forecast()
  yhat = output[0]
  predictions.append(yhat)
  obs = test[t]
  history.append(obs)
  print('predicted=%f, expected=%f' % (yhat, obs))
# evaluate forecasts
rmse = sqrt(mean_squared_error(test, predictions))
print('Test RMSE: %.3f' % rmse)
# plot forecasts against actual outcomes
pyplot.plot(test)
pyplot.plot(predictions, color='red')
pyplot.show()
```

```
/usr/local/lib/python3.6/dist-packages/ipykernel_launcher.py:9: FutureWarning: The pandas.datetime class is deprecated and will be removed from pandas in a future version. Import from datetime instead
  if __name__ == '__main__':
predicted=343.272180, expected=342.300000
predicted=293.329674, expected=339.700000
predicted=368.668956, expected=440.400000
predicted=335.044741, expected=315.900000
predicted=363.220221, expected=439.300000
predicted=357.645324, expected=401.300000
predicted=443.047835, expected=437.400000
predicted=378.365674, expected=575.500000
predicted=459.415021, expected=407.600000
predicted=526.890876, expected=682.000000
predicted=457.231274, expected=475.300000
predicted=672.914943, expected=581.300000
predicted=531.541449, expected=646.900000
Test RMSE: 89.021
```