Maximum Likelihood Estimation

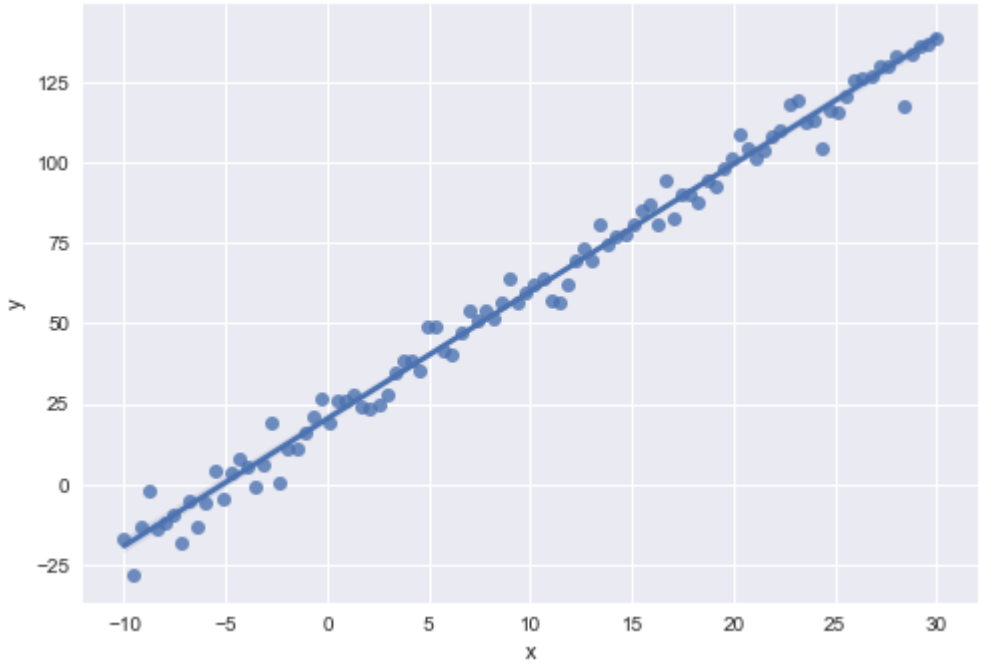
In [24]:
```
import numpy as np
import pandas as pd
from matplotlib import pyplot as plt
import seaborn as sns
from statsmodels import api
from scipy import stats
from scipy.optimize import minimize
```

In [25]:
```
# generate an independent variable
x = np.linspace(-10, 30, 100)
# generate a normally distributed residual
e = np.random.normal(10, 5, 100)
# generate ground truth
y = 10 + 4*x + e
df = pd.DataFrame({'x':x, 'y':y})
df.head()
```

Out[25]:

	x	y
0	-10.000000	-16.789727
1	-9.595960	-28.273278
2	-9.191919	-13.206354
3	-8.787879	-2.159996
4	-8.383838	-13.658483

In [26]:
```
sns.regplot(x='x', y='y', data = df)
plt.show()
```



In [28]:
```
def MLE_Norm(parameters):
   # extract parameters
   const, beta, std_dev = parameters
   # predict the output
   pred = const + beta*x
   # Calculate the log-likelihood for normal distribution
   LL = np.sum(stats.norm.logpdf(y, pred, std_dev))
   # Calculate the negative log-likelihood
   neg_LL = -1*LL
   return neg_LL
```

In [29]:
```
mle_model = minimize(MLE_Norm, np.array([2,2,2]), method='L-BFGS-B')
mle_model
```

Out[29]:
```
      fun: 299.16131301125677
 hess_inv: <3x3 LbfgsInvHessProduct with dtype=float64>
      jac: array([ 1.13686828e-05,  8.52651288e-05, -2.27373677e-05])
  message: 'CONVERGENCE: REL_REDUCTION_OF_F_<=_FACTR*EPSMCH'
     nfev: 136
      nit: 28
     njev: 34
   status: 0
  success: True
        x: array([20.36984056,  3.95324845,  4.81951892])
```

In [ ]: