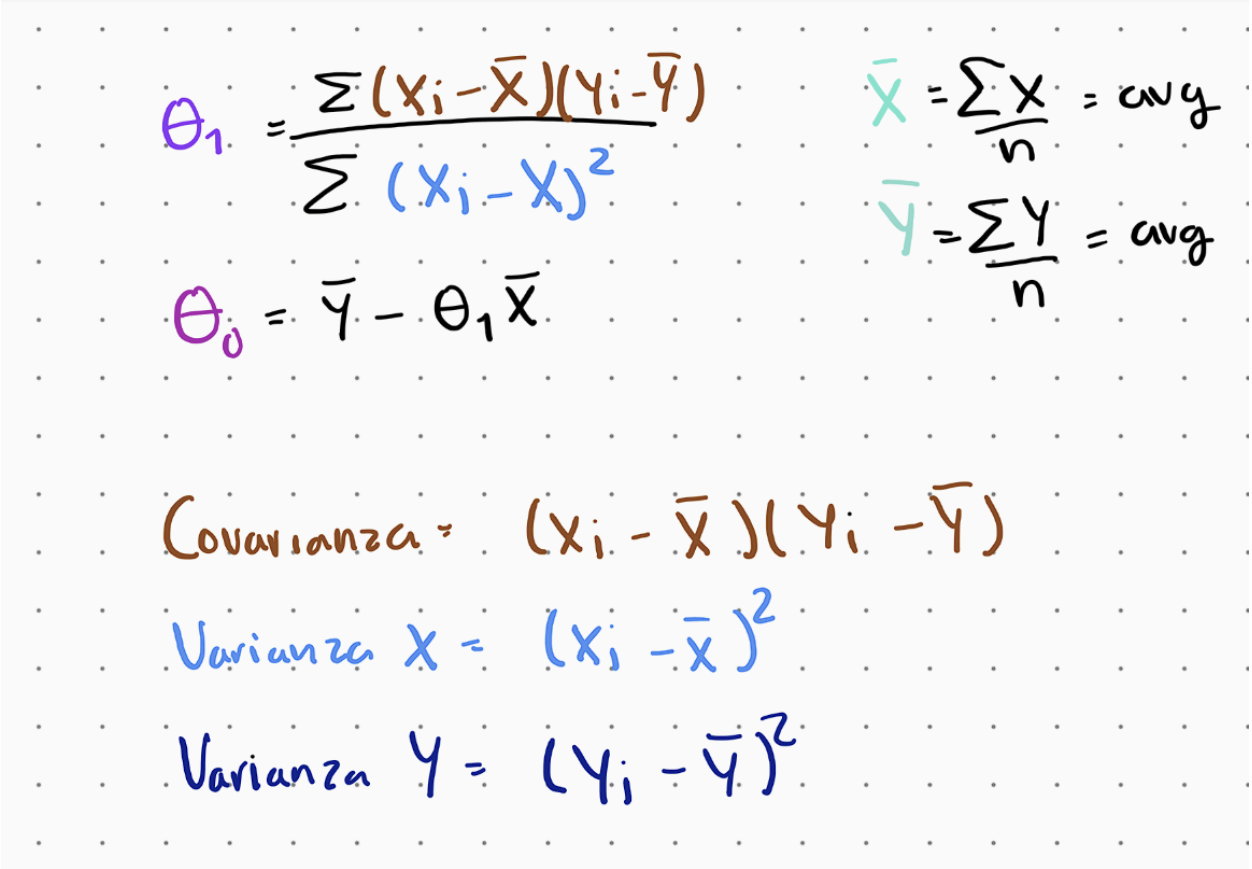
Actividad 5.3 Máxima Verosimilitud



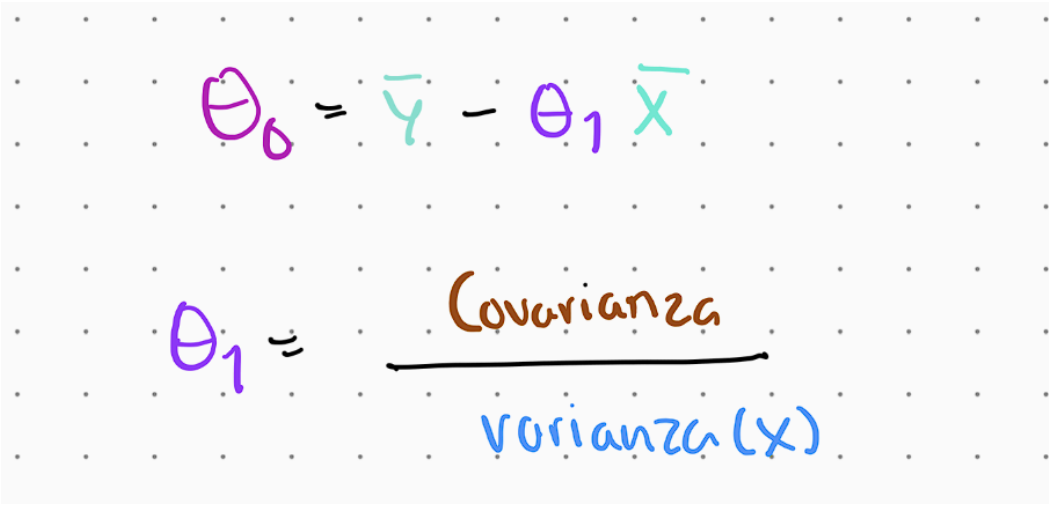
Calculamos los valores en python

```python
import numpy as np
from sklearn.linear_model import LinearRegression
import statsmodels.api as sm

X = np.array([1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20]).reshape(-1, 1)
Y = np.array([10.06, 6.6, 10.91, 17.96, 18.47, 9.09, 18.8, 16.39, 18.59, 22.64,
              23.58, 30.82, 30.04, 29.49, 32.78, 34.33, 40.98, 36.18,
              40.25, 37.58])
n = len(X)
mean_X = np.sum(X) / n
variance_X = np.sum((X - mean_X) ** 2) / (n - 1)

mean_Y = np.sum(Y) / n
variance_Y = np.sum((Y - mean_Y) ** 2) / (n - 1)

covariance_XY = np.sum((X.flatten() - mean_X) * (Y - mean_Y)) / (n - 1)
```




```
θ1 = covariance_XY / variance_X
θ0 = mean_Y - θ1 * mean_X

print(f"θ0: {θ0}  &  θ1: {θ1}")
print(f"Ecuación: {θ0} + {θ1} * X")
```

```
θ0: 5.790526315789471  &  θ1: 1.7606165413533834
Ecuación: 5.790526315789471 + 1.7606165413533834 * X
```

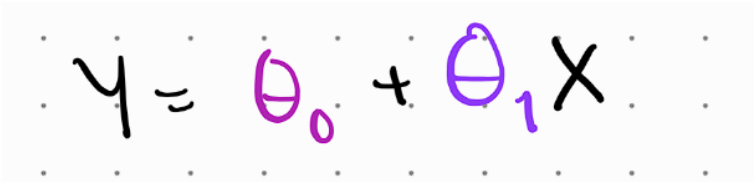
Ahora con Scikit Learn LinearRegression

```
# Regresión lineal usando scikit-learn
model = LinearRegression()
model.fit(X, Y)

slope = model.coef_[0]
intercept = model.intercept_

print(f"θ0 (intercept): {intercept}")
print(f"θ1 (slope): {slope}")
```

```
θ0 (intercept): 5.790526315789467
θ1 (slope): 1.7606165413533839
```



Confirmamos los resultados usando OLS de Statsmodels:

```python
# Análisis de regresión usando statsmodels
X_sm = sm.add_constant(X)
model_sm = sm.OLS(Y, X_sm)
results = model_sm.fit()

print("\nResumen de la regresión usando statsmodels:")
print(results.summary())
```

```
Resumen de la regresión usando statsmodels:
                            OLS Regression Results
==============================================================================
Dep. Variable:                      y   R-squared:                       0.914
Model:                            OLS   Adj. R-squared:                  0.910
Method:                 Least Squares   F-statistic:                     192.0
Date:                Fri, 01 Nov 2024   Prob (F-statistic):           4.82e-11
Time:                        18:20:33   Log-Likelihood:                -51.061
No. Observations:                  20   AIC:                             106.1
Df Residuals:                      18   BIC:                             108.1
Df Model:                           1
Covariance Type:            nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
const          5.7905      1.522      3.804      0.001       2.593       8.988
x1             1.7606      0.127     13.856      0.000       1.494       2.028
==============================================================================
Omnibus:                        0.249   Durbin-Watson:                   2.123
Prob(Omnibus):                  0.883   Jarque-Bera (JB):                0.142
Skew:                          -0.172   Prob(JB):                        0.931
Kurtosis:                       2.773   Cond. No.                         25.0
==============================================================================
```