

Untitled

June 5, 2024

```
[1]: !pip install sounddevice
```

```
Requirement already satisfied: sounddevice in
c:\users\fabio\appdata\local\programs\python\python311\lib\site-packages (0.4.7)
Requirement already satisfied: CFFI>=1.0 in
c:\users\fabio\appdata\local\programs\python\python311\lib\site-packages (from
sounddevice) (1.16.0)
Requirement already satisfied: pycparser in
c:\users\fabio\appdata\local\programs\python\python311\lib\site-packages (from
CFFI>=1.0->sounddevice) (2.22)
```

```
[2]: pip install --upgrade pip
```

```
Requirement already satisfied: pip in
c:\users\fabio\appdata\local\programs\python\python311\lib\site-packages (24.0)
Note: you may need to restart the kernel to use updated packages.
```

```
[3]: import math
import random
import numpy as np
import pandas as pd
import sounddevice as sd
import matplotlib.pyplot as plt
```

```
[4]: import random
import numpy as np
def y_predict(a, b, c, d, x):
    return a * np.cos(b * x + c) + d

def gradientesDecendiente(x, y, epoch):
    n = len(x)
    rsl = []
    lr = 0.05
    batch = 100
    a = random.random()
    b = random.random()
    c = random.random()
    d = 0
```

```

for i in range(epoch):
    a_gradiente = 0
    b_gradiente = 0
    c_gradiente = 0
    d_gradiente = 0
    e = 0

    for _ in range(batch):
        ix = int(random.uniform(0, n))
        y_pred = y_predict(a, b, c, d, x[ix])
        error = y[ix] - y_pred

        e += error**2
        a_gradiente += 2 * error * -1.0*np.cos(b * x[ix] + c)
        b_gradiente += 2 * error * -1.0*a * np.sin(b * x[ix] + c) * x[ix]
        c_gradiente += 2 * error * -1.0*a * np.sin(b * x[ix] + c)
        d_gradiente += 2 * error

    a -= lr * a_gradiente / batch
    b -= lr * b_gradiente / batch
    c -= lr * c_gradiente / batch

    e /= batch
    rsl.append([a, b, c, e])
    print(f"Amplitude: {a}, Period: {b}, Constant: {c}, Error: {e}")

return rsl, a, b, c

```

```
[5]: data = pd.read_csv('train.csv')
```

```
[6]: data
```

```
[6]:
```

	example_id	x	TARGET
0	0	0.000	0.800000
1	1	0.001	0.800000
2	2	0.002	0.800000
3	3	0.003	0.799999
4	4	0.004	0.799998
...
12562	12562	12.562	0.799998
12563	12563	12.563	0.799999
12564	12564	12.564	0.799999
12565	12565	12.565	0.800000
12566	12566	12.566	0.800000

```
[12567 rows x 3 columns]
```

```
[7]: x = data['x'].values
     y = data['TARGET'].values
```

```
[8]: epoch = [1000, 2000]
```

```
[9]: ##Aplicamos la funcion gradiente decendiente con 10 epoch
```

```
[10]: resultados, a, b, c = gradientesDecendiente(x, y, epoch =10)
```

```
Amplitude: 0.41714399921178835, Period: 0.601753052258218, Constant:
0.13028724293114963, Error: 0.10115754474505982
Amplitude: 0.4262230416502226, Period: 0.6733703931938657, Constant:
0.14020724707293405, Error: 0.1486091482874677
Amplitude: 0.4187716609434276, Period: 0.7582678099650344, Constant:
0.15193685124909637, Error: 0.2572998730020695
Amplitude: 0.3887880559002548, Period: 0.8023397940583884, Constant:
0.16115458456466333, Error: 0.4523186375212152
Amplitude: 0.35183690481737817, Period: 0.8206678198194952, Constant:
0.1675939640361989, Error: 0.49874082749469545
Amplitude: 0.32299403723923087, Period: 0.8487758857113338, Constant:
0.17508254798987324, Error: 0.43867025005339677
Amplitude: 0.29003255238827313, Period: 0.8736688811675488, Constant:
0.1818222983424018, Error: 0.49269376485799976
Amplitude: 0.2625387507191217, Period: 0.846499363857851, Constant:
0.18276486056782518, Error: 0.46355659760393114
Amplitude: 0.24110845892051241, Period: 0.8312059394289825, Constant:
0.18512071383258538, Error: 0.3825230306248475
Amplitude: 0.21373557412482824, Period: 0.8315335144401844, Constant:
0.18826958885702338, Error: 0.39945774552100516
```

```
[11]: ##Se crea una tabla con los datos
```

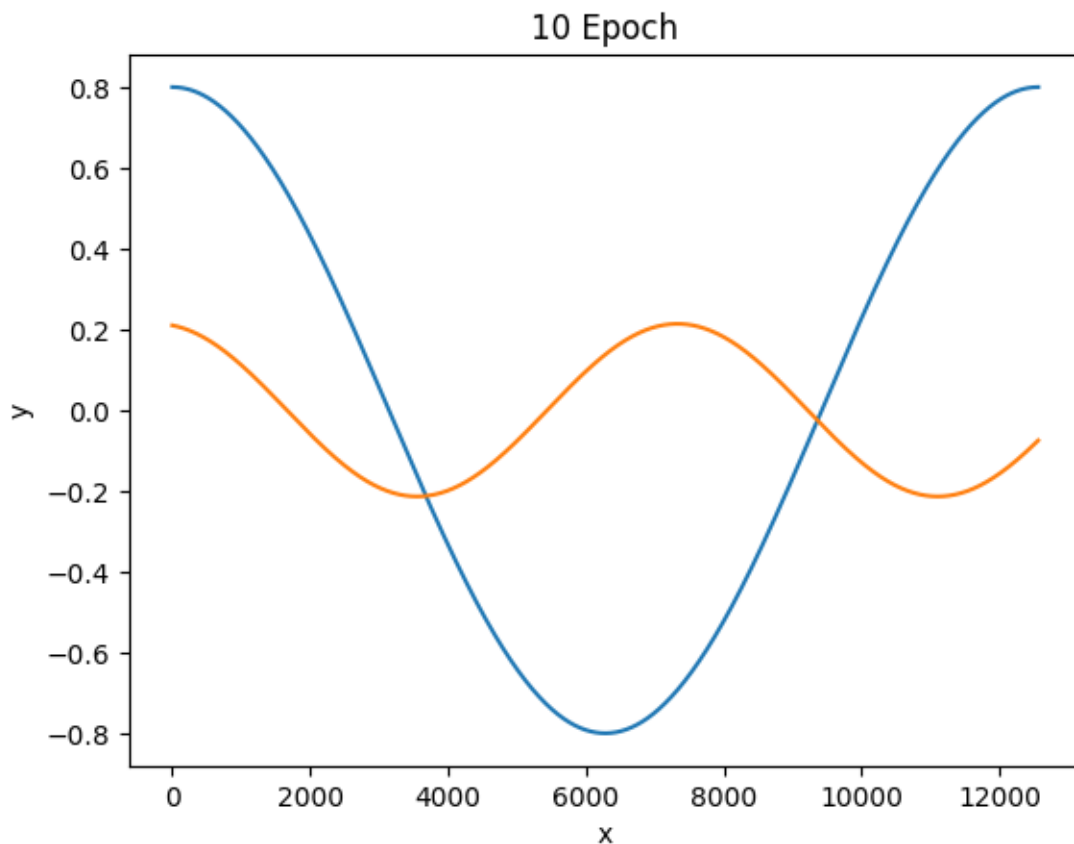
```
[12]: tablaResultados = pd.DataFrame(resultados, columns=['error', 'period', 'amplitude', 'constant'])
     print(tablaResultados)
```

	error	period	amplitude	constant
0	0.417144	0.601753	0.130287	0.101158
1	0.426223	0.673370	0.140207	0.148609
2	0.418772	0.758268	0.151937	0.257300
3	0.388788	0.802340	0.161155	0.452319
4	0.351837	0.820668	0.167594	0.498741
5	0.322994	0.848776	0.175083	0.438670
6	0.290033	0.873669	0.181822	0.492694
7	0.262539	0.846499	0.182765	0.463557
8	0.241108	0.831206	0.185121	0.382523
9	0.213736	0.831534	0.188270	0.399458

```
[13]: #Generacion de señal
```

```
[14]: import matplotlib.pyplot as plt
plt.title("10 Epoch")
plt.xlabel('x')
plt.ylabel("y")
plt.plot(y)
ix = -1
plt.plot([y_predict(a,b,c,0,xi)for xi in x[:ix]])
```

```
[14]: [<matplotlib.lines.Line2D at 0x179ff075f10>]
```



```
[15]: #Se aplica la funcion gradiente decendiente con 400 epoch
```

```
[16]: resultados, a, b, c = gradientesDecendiente(x, y, epoch=400)
```

Amplitude: 0.21274567446789452, Period: 0.7466494772731522, Constant:
0.9271511922070679, Error: 0.5224723739945272
Amplitude: 0.1756908469324952, Period: 0.7558306126818187, Constant:
0.9314383712077614, Error: 0.4617595338815847

Amplitude: 0.1467511974098144, Period: 0.7653020520543216, Constant:
 0.9356528088994156, Error: 0.40022444000060686
 Amplitude: 0.11280882523784452, Period: 0.7691468852071642, Constant:
 0.9386879714086341, Error: 0.43491655491807146
 Amplitude: 0.08821670911084531, Period: 0.7718248789960842, Constant:
 0.9411347186258161, Error: 0.3669505501074066
 Amplitude: 0.05894502766480876, Period: 0.7654825604241915, Constant:
 0.9418619556642963, Error: 0.37992206937746575
 Amplitude: 0.0261751524382667, Period: 0.7659058324216007, Constant:
 0.9427449784226242, Error: 0.37233436207875026
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 0.9431143833450109, Error: 0.30629717264622475
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 0.9431614707339788, Error: 0.33838526038318617
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 0.9428083370871813, Error: 0.31043602493992883
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```
[17]: tablaResultados = pd.DataFrame(resultados, columns=['Amplitude', 'Period', 'Constant', 'Error'])
print(tablaResultados)
```

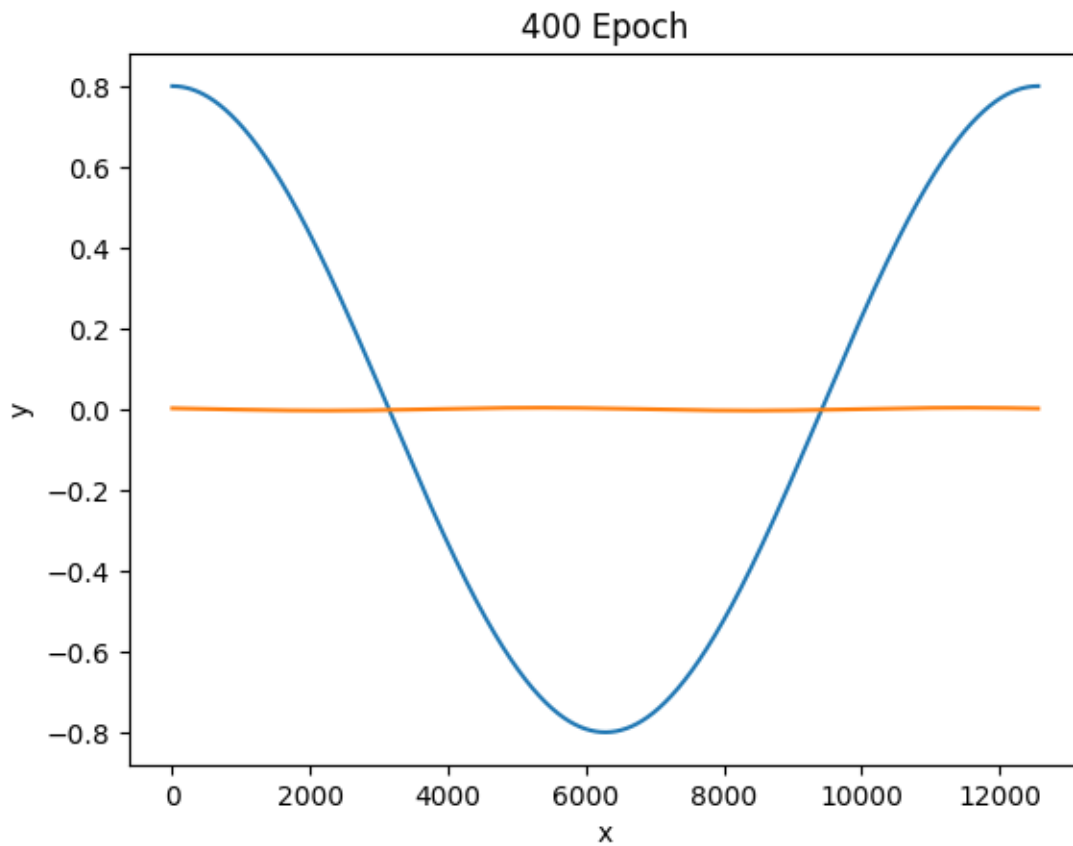
	Amplitude	Period	Constant	Error
0	0.212746	0.746649	0.927151	0.522472
1	0.175691	0.755831	0.931438	0.461760
2	0.146751	0.765302	0.935653	0.400224
3	0.112809	0.769147	0.938688	0.434917
4	0.088217	0.771825	0.941135	0.366951
..
395	0.003683	1.015633	0.896784	0.336936
396	-0.003257	1.015488	0.896800	0.317586
397	-0.001433	1.015601	0.896793	0.267632
398	0.003372	1.015695	0.896791	0.289928
399	0.003486	1.015589	0.896814	0.310874

[400 rows x 4 columns]

```
[18]: #Se dibuja la señal 400
```

```
[19]: plt.title("400 Epoch")
plt.xlabel('x')
plt.ylabel("y")
plt.plot(y)
ix = -1
plt.plot([y_predict(a,b,c,0,xi) for xi in x[:ix]])
```

```
[19]: [<matplotlib.lines.Line2D at 0x1798104c190>]
```



```
[20]: ##Por último utiliza los parámetros aprendidos, y crea la señal por un periodo
      ↪ más
      #largo de tiempo long_s = [ y_predict(a,b,c,d,xi) for xi in np.arange(x_min ,
      ↪ 20*math.pi, 0.001).astype(np.float32)] ,
      ##dibuja la señal, y escuchala utilizando la libreria (import sounddevice as sd
      ↪ y el método sd.play(long_s))
```

```
[21]: #Para 10 Epoch
```

```
[22]: resultados, a, b, c = gradientesDecendiente(x, y, epoch=10)
```

```
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Amplitude: 0.2534089034257516, Period: -0.14899176247284465, Constant:
0.7277696006829997, Error: 0.4141314153226853
Amplitude: 0.22835908683619305, Period: -0.15615749601685103, Constant:
0.7288406087066549, Error: 0.4195533854119804
Amplitude: 0.20037099092047478, Period: -0.15223214834307316, Constant:
0.7307686512890998, Error: 0.3814723941917203
```

```
[23]: tablaResultados = pd.DataFrame(resultados, columns=['Amplitude', 'Period', 'Constant', 'Error'])
print(tablaResultados)
```

	Amplitude	Period	Constant	Error
0	0.499480	-0.072054	0.729197	0.437549
1	0.451829	-0.116230	0.722220	0.590271
2	0.415653	-0.128143	0.722503	0.520916
3	0.372405	-0.118430	0.724769	0.504809
4	0.332127	-0.125868	0.725088	0.536861
5	0.302906	-0.136951	0.725383	0.434004
6	0.280903	-0.143002	0.726696	0.384598
7	0.253409	-0.148992	0.727770	0.414131
8	0.228359	-0.156157	0.728841	0.419553
9	0.200371	-0.152232	0.730769	0.381472

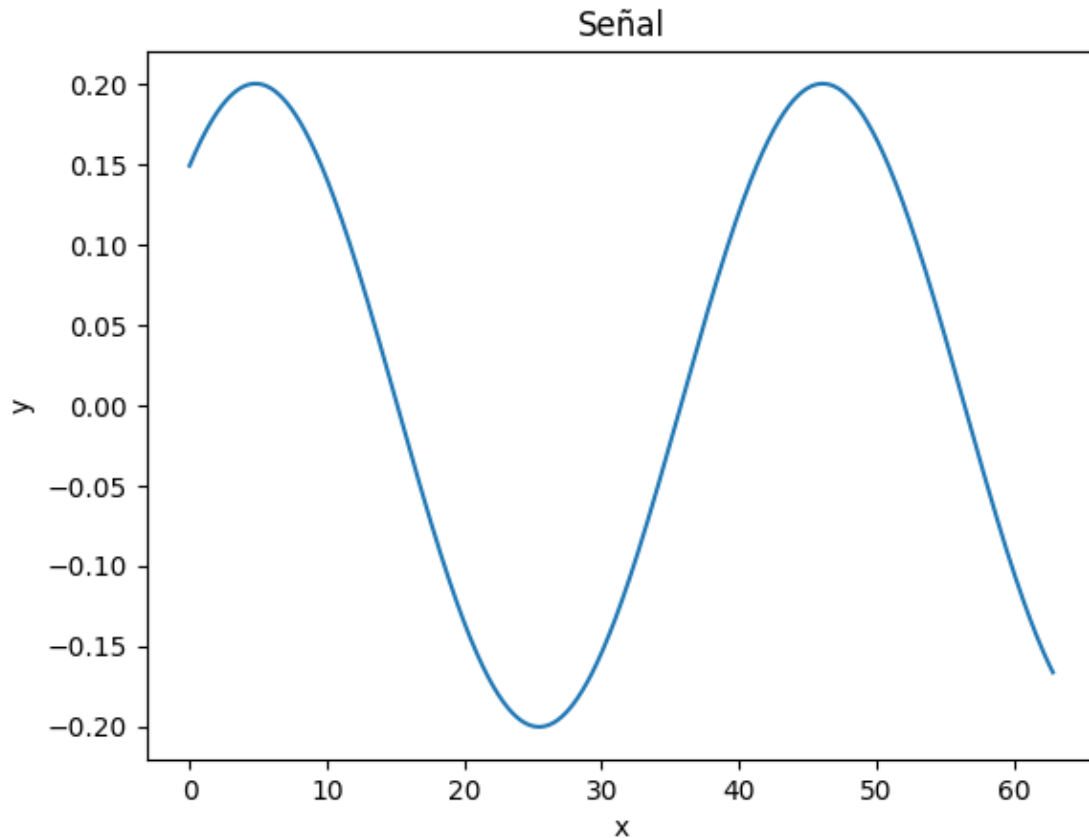
```
[24]: import math

xMinima = np.min(x)
longitudSeñal = [y_predict(a, b, c, 0, xi) for xi in np.arange(xMinima, 20 * math.pi, 0.001).astype(np.float32)]
```

```
[25]: #señal
```

```
[26]: plt.plot(np.arange(xMinima, 20 * math.pi, 0.001), longitudSeñal)
plt.xlabel('x')
plt.ylabel('y')
plt.title('Señal')
```

```
[26]: Text(0.5, 1.0, 'Señal')
```



```
[27]: #Para 400 Epoch
```

```
[28]: resultados, a, b, c = gradientesDecendiente(x, y, epoch=400)
```

```
Amplitude: 0.3393106011847691, Period: 0.7917059305933761, Constant:
1.00157721259307, Error: 0.5217251012270107
Amplitude: 0.3040529999204906, Period: 0.7459454296715392, Constant:
1.0012402184351394, Error: 0.4926207107446771
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1.0061956677597055, Error: 0.5416324917559527
Amplitude: 0.22069508109365055, Period: 0.7606681751828779, Constant:
1.0108460198650295, Error: 0.46382426770133894
Amplitude: 0.1863459473120032, Period: 0.7587743718823875, Constant:
```


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 1.0156278024288716, Error: 0.47640785339403974
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 1.0179247900396686, Error: 0.4098064299126882
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```
[29]: tablaResultados = pd.DataFrame(resultados, columns=['Amplitude', 'Period', 'Constant', 'Error'])
      print(tablaResultados)
```

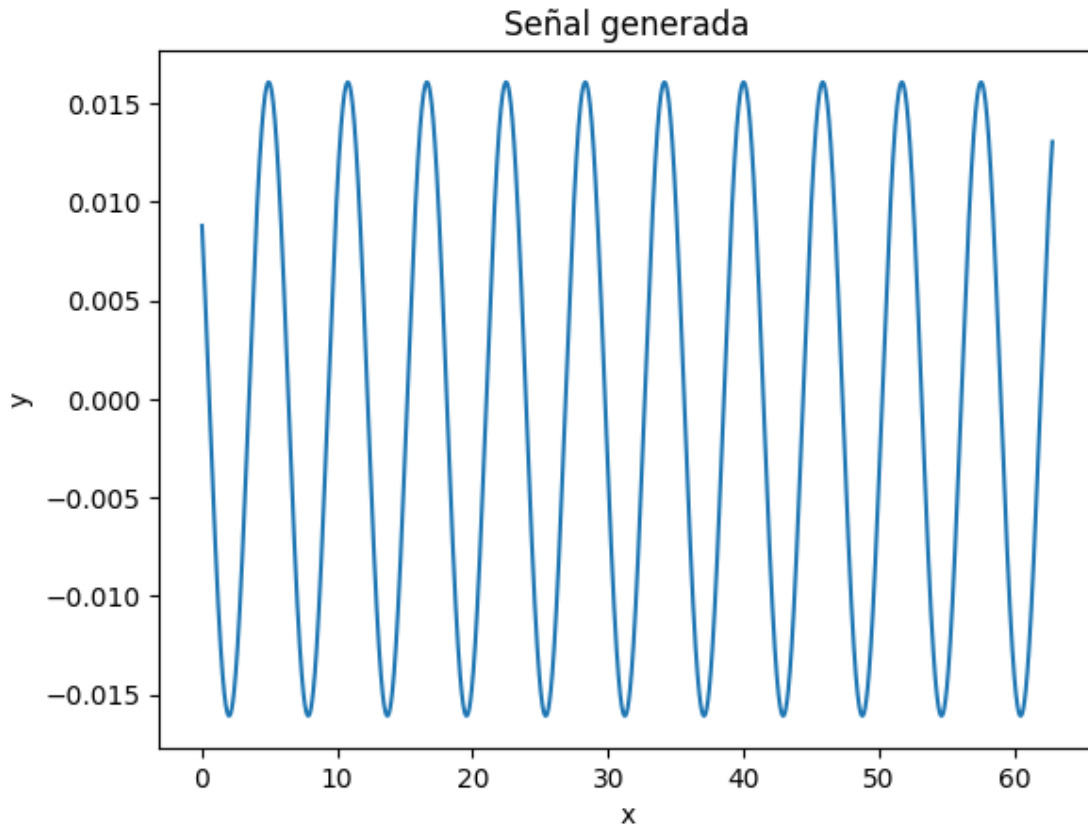
	Amplitude	Period	Constant	Error
0	0.339311	0.791706	1.001577	0.521725
1	0.304053	0.745945	1.001240	0.492621
2	0.258274	0.752558	1.006196	0.541632
3	0.220695	0.760668	1.010846	0.463824
4	0.186346	0.758774	1.013523	0.440219
..
395	0.026394	1.071596	0.991282	0.305941
396	0.021886	1.072560	0.991424	0.342276
397	0.018277	1.073107	0.991645	0.332552
398	0.021281	1.073487	0.991746	0.309590
399	0.016082	1.074309	0.991854	0.282828

[400 rows x 4 columns]

```
[30]: xMinima = np.min(x)
      longitud = [y_predict(a, b, c, 0, xi) for xi in np.arange(xMinima, 20 * math.
      pi, 0.001).astype(np.float32)]
```

```
[31]: plt.plot(np.arange(xMinima, 20 * math.pi, 0.001), longitud)
plt.xlabel('x')
plt.ylabel('y')
plt.title('Señal generada')
```

```
[31]: Text(0.5, 1.0, 'Señal generada')
```



```
[32]: sd.play(longitud)
```

```
[35]: df_test = pd.read_csv("test.csv")
```

```
[36]: df_test.head()
```

```
[36]:
```

	example_id	x
0	13000	12.566371
1	13001	12.567371
2	13002	12.568371
3	13003	12.569371
4	13004	12.570371

```
[42]: y_pred = y_predict(a, b, c, 0, df_test.x)
      df_result = pd.DataFrame({"example_id":df_test["example_id"], "TARGET": y_pred})

[45]: df_result.to_csv("submission.csv", index=False)

[ ]:
```