Ej 2

Problem 1: Consider the equation $x^3 - 5x + 1 = 0$.

(a) Prove that this equation has at least one real root.

(b) Use the bisection method to calculate a solution of this equation, accurate to at least 2 significant digits.

(c) How many iterations are needed to obtain a solution with 12 accurate digits?

a) $f(x) = x^3 - 5x + 1 = 0$

$f'(x) = 3x^2 - 5$

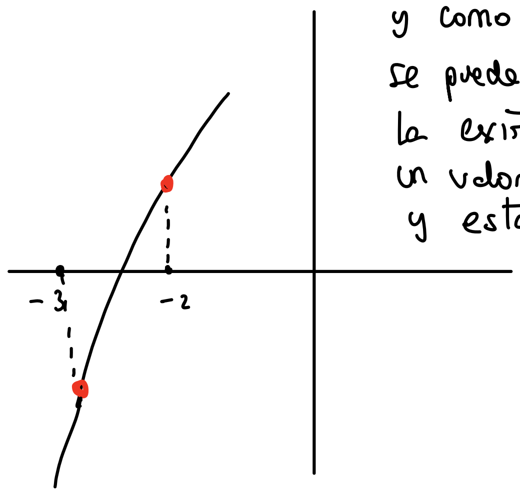
$f''(x) = 6x \rightarrow$ $x>0$, maximo relativo; $x<0$, minimo relativo

Ahora:

para $f(-3) = -11$; $f'(-3) > 0$

$f(-2) = 3$; $f'(-2) > 0$

Entonces se puede asegurar que



y como $f(-3)\,f(-2) < 0$ se puede garantizar la existencia de un valor $c \in [-3;-2]$ y este seria una raiz.

b) Para el metodo de bisección se usara:

```
import numpy as np
from numpy import log as ln
f=lambda x: x**3-5*x+1
a = -3
b = -2
print(f"f0={f(a)} f1={f(b)}")
eps = 1e-2
maxIter = 100
fa = f(a)
fb = f(b)
i = 0
while i < maxIter and b-a>=eps :
    c = (a+b)/2
    fc=f(c)
    i+=1
    if fc==0:
        a=b=c
    elif fa*fc<0:
        b=c ; fb = fc
    else :
        a=c ; fa=fc
        print(f'[a,b]=[{a:5.4f},{b:5.4f}]')
if b-a>=eps:
    print (f'Metodo no converge')
else:
    print(f'Solucion c={c}')
    print(f'Numero de iteraciones = {i}')
```

```
f0=-11 f1=3
[a,b]=[-2.5000,-2.0000]
[a,b]=[-2.3750,-2.2500]
[a,b]=[-2.3438,-2.3125]
[a,b]=[-2.3359,-2.3281]
Solucion c=-2.3359375
Numero de iteraciones = 7

Process finished with exit code 0
```

c) $\varepsilon = 10^{-12}$

$$n = \left[\!\left[\log_2\left(\frac{-2+3}{10^{-12}}\right) \right]\!\right] = 39$$ //