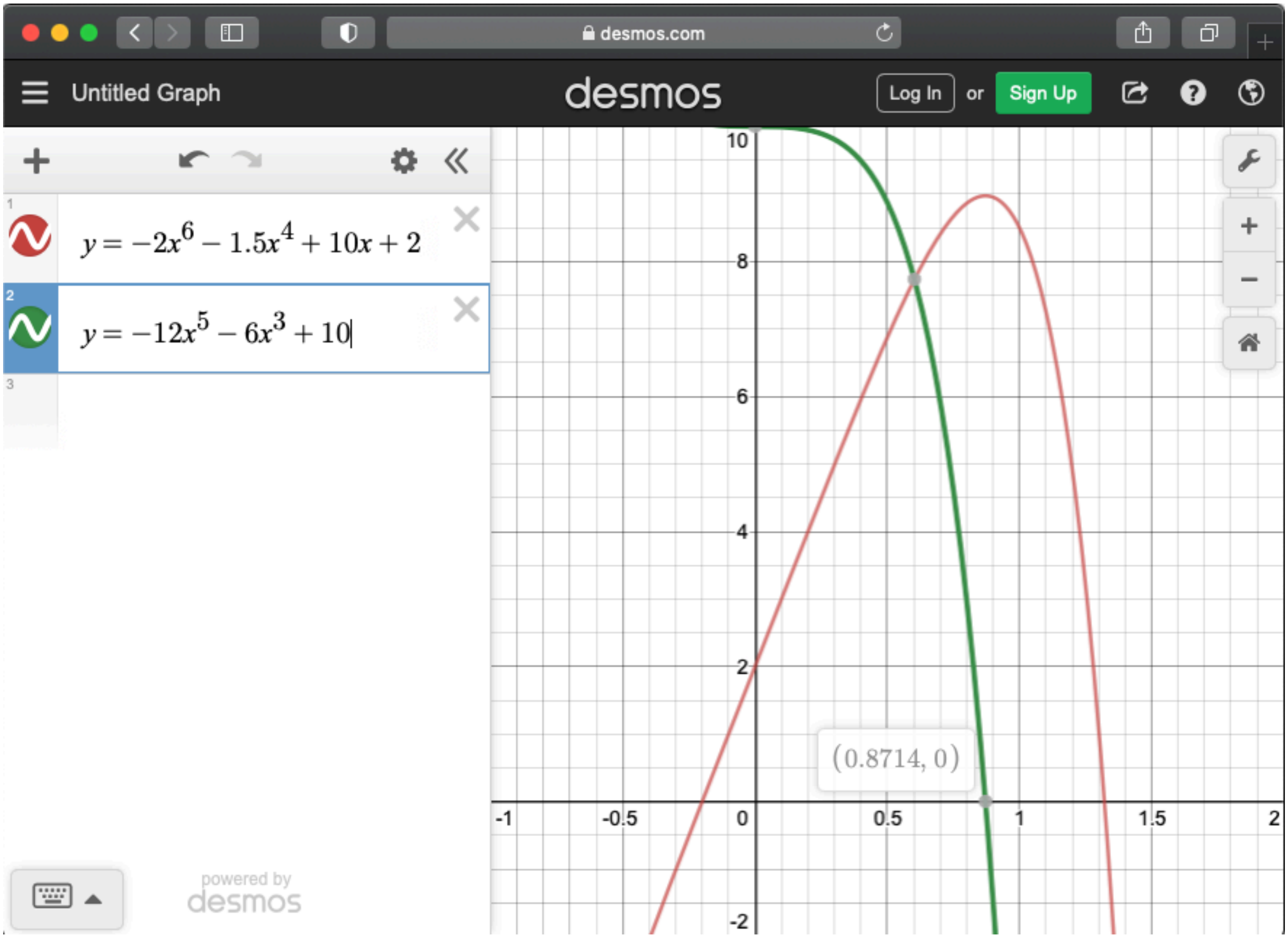
Problems 5.12

For $F(x)=-2x^6-1.5x^4+10x+2$, approximate maximum for F(x) in the interval x 0<x<1 with an Ea<5%

First, I would visualize f(x) between the area of interest.



One approach to find the F'(x) for it represents the slope of the curve. At Maximin F(x) the slope will be 0.

Using the bisection method on F'(x)=-12x^5-6x^3+10 to approximate F'(x) =0

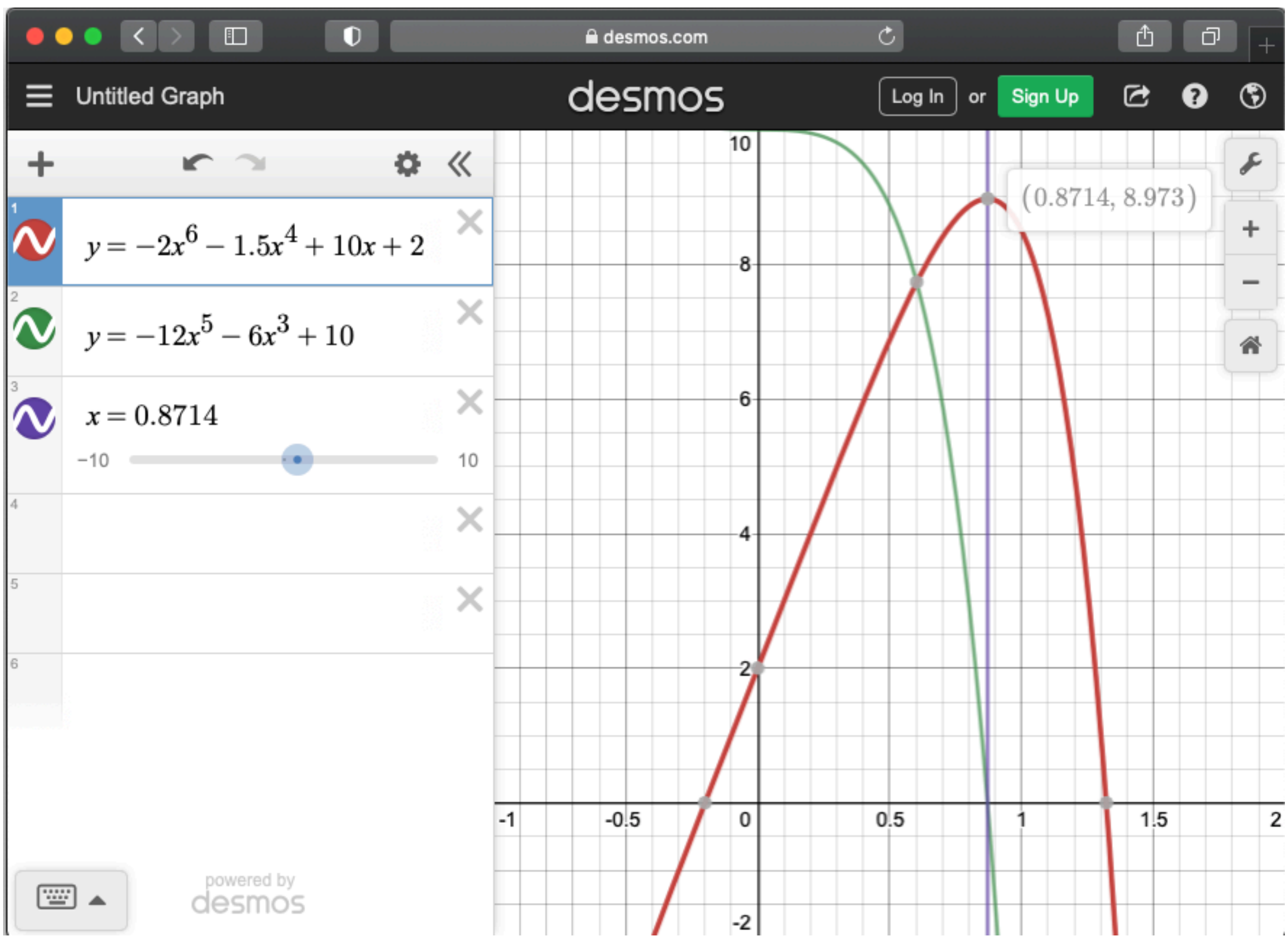
Iteration	Xi	Xu	F'(Xi)	F'(Xu)	F'(Xi) x F'(Xu)	Xr	Ea
1	0	1	10	-8	-80	0.5	
2	0.5	1	8.875	-8	-71	0.75	100
3	0.75	1	4.62109375	-8	-36.96875	0.875	33.33333333
4	0.875	1	-0.174438477	-8	1.395507813	0.8125	14.28571429
5	0.75	0.875	4.62109375	-0.174438477	-0.806096554	0.8125	14.28571429
6	0.8125	0.875	2.532627106	-0.174438477	-0.441787614	0.84375	7.692307692
7	0.84375	0.875	1.264366031	-0.174438477	-0.220554084	0.859375	3.703703704

Maximum of the F(x) is about X=0.875 at (0.875, 8.973)

Another approach is to work with the F(x) directly

Using the bisection method on F(x)=-2x^6-1.5x^4+10x+2 to approximate F(x) maximum in the interval

Iteration	Xi	Xu	F(Xi)	F(Xu)	F(Xu) > F(Xi)	Xr	Ea
1	0	1	2	8.5	TRUE	0.5	
2	0.5	1	6.875	8.5	TRUE	0.75	100
3	0.75	1	8.669433594	8.5	FALSE	0.875	33.33333333
4	0.75	0.875	8.669433594	8.973136902	TRUE	0.8125	14.28571429
5	0.8125	0.875	8.895890117	8.973136902	TRUE	0.84375	7.692307692
6	0.84375	0.875	8.955640657	8.973136902	TRUE	0.859375	3.703703704
7	0.859375	0.875	8.970007699	8.973136902	TRUE	0.8671875	1.818181818

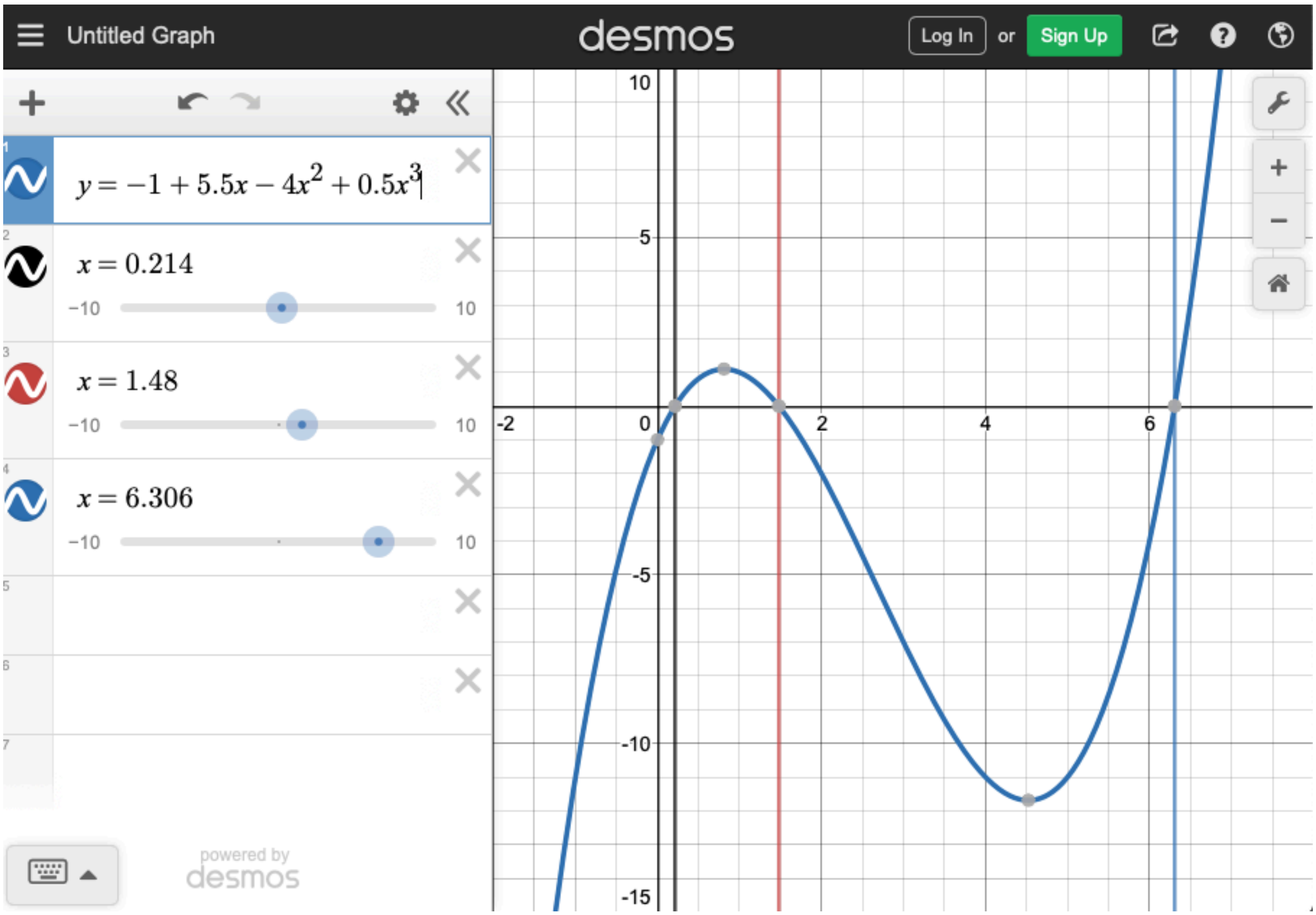


Problem 6.4

Determine the real roots for $F(x)=-1+5.5x-4x^2+0.5x^3$

a) Graphically.

   a. I plotted the curve using the Desmos graphing calculator online: https://www.desmos.com/calculator
   b. I searched for the roots and found 3.
   c. I placed the pointer at the X interceptions points and found (0.214,0), (1.48,0) and (6.306,0) and then I plotted some verticals lines to indicated the interception points.



b) Using the Newton-Raphson method to withing Es=0.01%
   a. For $F(x)=-1+5.5x-4x^2+0.5x^3$, For $F'(x)=5.5-8x+1.5x^2$
   b. Then, calculate x(i+1)=xi-F(x)/F'(x) till Er= 100 x abs((i+1)-xi/ x(i+1)) < 0.01

Iteraton	Xi	Et
1st Root		
1	0.000	
2	0.182	100.000
3	0.213	14.789
4	0.214	0.447
5	0.214	0.0004
2nd Root		
1	1.000	
2	2.000	50.000
3	1.556	28.571
4	1.483	4.912
5	1.480	0.199
6	1.480	0.0003
3rd Root		
1	5.000	
2	8.667	42.308
3	7.198	20.398
4	6.503	10.689
5	6.319	2.916
6	6.306	0.205
7	6.306	0.001