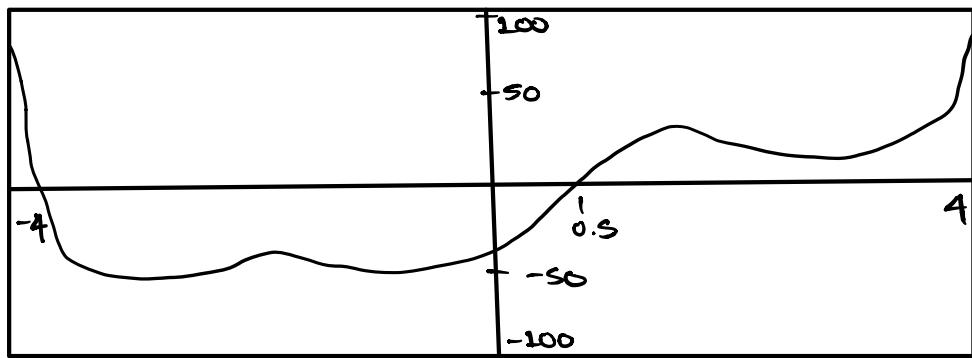

PROBLEM #1.

Given the function $f(x)$ find the derivative.

$$f(x) = \frac{x^6}{6} - 3x^4 - \frac{2x^3}{3} + \frac{27x^2}{2} + 18x - 30$$

$$\begin{aligned}f'(x) &= \frac{6x^5}{6} - 3(4)x^3 - 2\left(\frac{3}{3}\right)x^2 + \left(\frac{2}{2}\right)(27)x + 18 \\&= x^5 - 12x^3 - 2x^2 + 27x + 18\end{aligned}$$



PROBLEM #2.

Find the first estimate/iteration of the Newton-Raphson.

$$x_{i+1} = x_0 - \frac{f(x_0)}{f'(x_0)}, \quad x_0 = 1.$$

$$x_1 = 1 - \frac{\left[\frac{(1)^6}{6} - 3(1)^4 - \frac{2(1)^3}{3} + \frac{27(1)^2}{2} + 18(1) - 30 \right]}{(1^5 - 12(1)^3 - 2(1)^2 + 27 + 18)}$$

$$= 1 - \frac{\left[\frac{1}{6} - 3 - \frac{2}{3} + \frac{27}{2} + 18 - 30 \right]}{1 - 12 - 2 + 27 + 18}$$

$$= 1 - \frac{\left[\frac{1}{6} - \frac{2}{3} - \frac{3}{2} \right]}{32}$$

$$= 1 + \frac{1}{16}$$

PROBLEM #3

Perform Newton-Raphson to find the root around $x=-4$.

```

1 def f (x) :
2     return x**6/6 - 3*x**4 - 2*x**3/3 + 27*x**2/2 + 18*x - 30
3
4 def d_f (x) :
5     return x**5 - 12*x**3 - 2*x**2 + 27*x + 18 # Complete this line with
       the derivative you have calculated.
6
7 x = -4.0
8
9 d = {"x" : [x], "f(x)": [f(x)]}
10 for i in range(0, 20):
11     x = x - f(x) / d_f(x)
12     d["x"].append(x)
13     d["f(x)"].append(f(x))
14
15 pd.DataFrame(d, columns=['x', 'f(x)'])
16

```

Run Reset

	x	f(x)
0	-4.00000	7.133333e+01
1	-3.811287	1.223161e+01
2	-3.763093	6.515564e-01
3	-3.760224	2.198858e-03
4	-3.760214	2.531156e-08
5	-3.760214	1.421085e-13
6	-3.760214	4.263256e-14
7	-3.760214	4.263256e-14
8	-3.760214	4.263256e-14
9	-3.760214	4.263256e-14
10	-3.760214	4.263256e-14
11	-3.760214	4.263256e-14
12	-3.760214	4.263256e-14
13	-3.760214	4.263256e-14
14	-3.760214	4.263256e-14
15	-3.760214	4.263256e-14
16	-3.760214	4.263256e-14
17	-3.760214	4.263256e-14
18	-3.760214	4.263256e-14
19	-3.760214	4.263256e-14
20	-3.760214	4.263256e-14

PROBLEM #4.

What would happen if Newton-Raphson was computed for $f(x)$ around point $x_0=1.99$.

- method converges to root nearest $x=-4$.
- method does not converge, infinitely oscillates
- none of the other statements are true.
- method takes over 15 iterations to converge
- method diverges to infinity
- method converges to the root nearest $x=1$.

PROBLEM #5

There are points which oscillate and do not converge - like $\alpha = 3.1$.