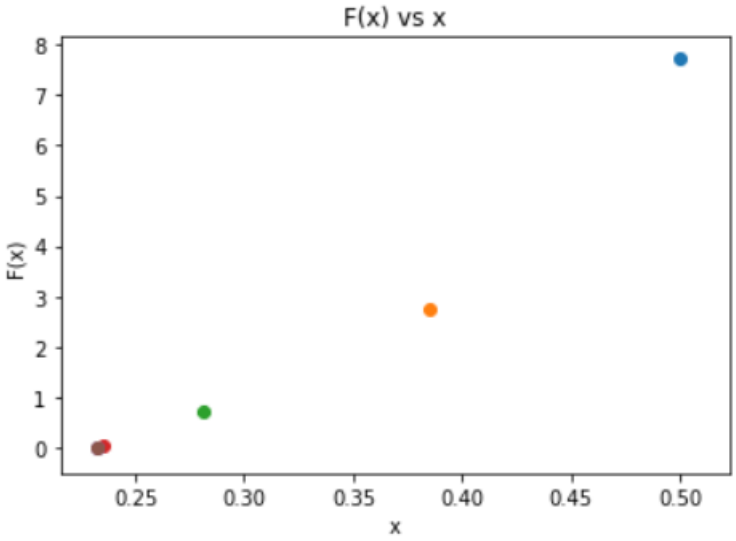
Numerical Method

Newton Raphson and Secant Method

Ques1: $F(x) = 600x^4 - 550x^3 + 200x^2 - 20x - 1 = 0$
Newton Raphson: $x_o = 0.5$
Secant: $x_{-1} = 0.1$ $x_o = 1.0$
Maximum Iteration: 20
Maximum Relative Approximate error (%): 0.05%

Ans 1: *By using Newton Raphson Method*

1. Plot F(x) vs x



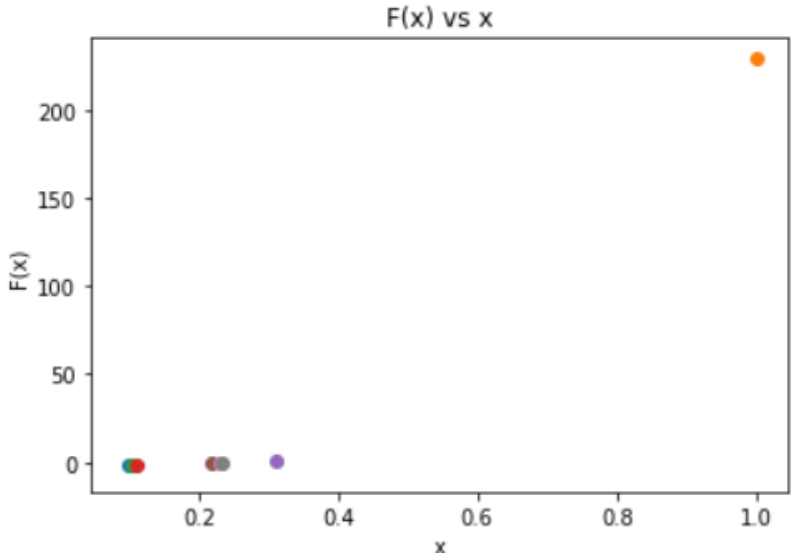
3. Roots of Equations

I.No	X	F(x)	F'(x)	Ea
1	0.500000	7.75000000000000	67.5000000000000	0.000000
2	0.385185	2.74563678752675	26.4251181222375	29.807692
3	0.281283	0.714025899619026	15.3773288418203	36.938836
4	0.234849	0.0349311327729267	14.0223102441345	19.771718
5	0.232358	6.84077488166679e-5	13.9674548474548	1.072101
6	0.232353	2.63235877540069e-10	13.9673473527337	0.002108

Therefore, Root = 0.232353

By using Secant Method

1. Plot F(x) vs x



3. Roots of Equations

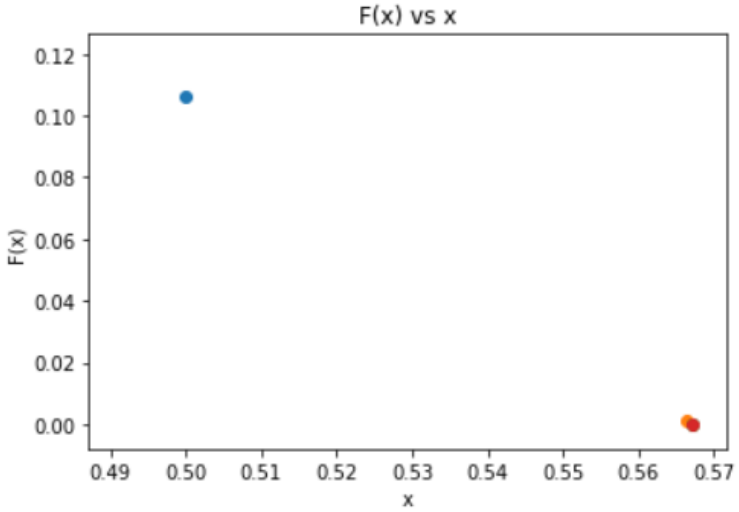
I. No	X0	X1	F(x0)	F(x1)	Ea
1	0.100000	1.000000	-1.49000000000000	229.000000000000	0.000000
2	1.000000	0.105818	229.000000000000	-1.45333060768536	845.018450
3	0.105818	0.111457	-1.45333060768536	-1.41353910294110	5.059406
4	0.111457	0.311777	-1.41353910294110	1.20628223822874	64.251055
5	0.311777	0.219541	1.20628223822874	-0.177147811297882	42.013265
6	0.219541	0.231352	-0.177147811297882	-0.0139722061494150	5.105141
7	0.231352	0.232363	-0.0139722061494150	0.000142319344494712	0.435234
8	0.232363	0.232353	0.000142319344494712	-1.11961218518530e-7	0.004389

Therefore, Root = 0.232353

Ques2: F(x) = exp(-x)-x
Newton-Raphson: $x_o = 0.5$
Secant: $x_{-1} = 0.1$ $x_o = 1.0$
Maximum Iteration: 20
Maximum Relative Approximate error (%): 0.05%

Ans 1: *By using Newton Raphson Method*

1. Plot F(x) vs x



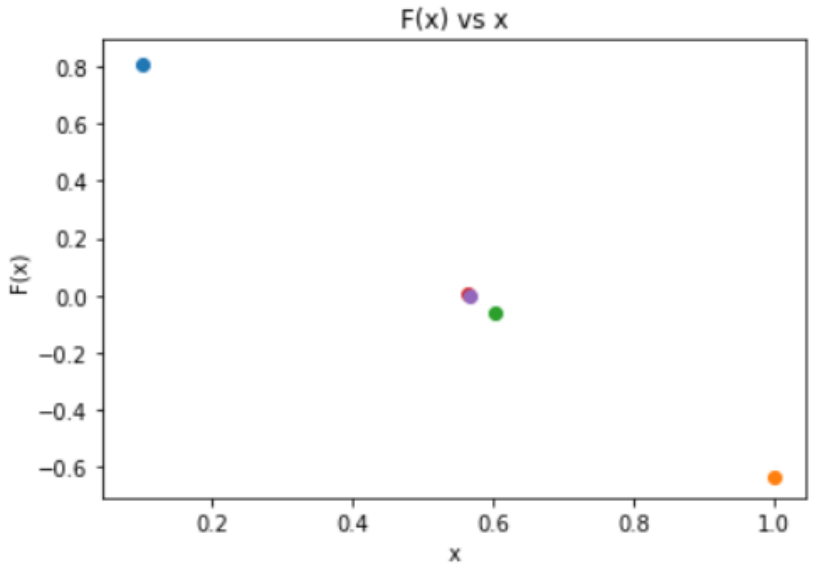
3. Roots of Equations

I.No	X	F(x)	F'(x)	Ea
1	0.500000	0.106530659712633	-1.60653065971263	0.000000
2	0.566311	0.0013045098060200 4	-1.56761551300324	11.709291
3	0.567143	1.96480471781335e-7	-1.56714336151533	0.146729
4	0.567143	4.44089209850063e-15	-1.56714329040979	0.000022

Therefore, Root = 0.567143

By using Secant Method

1. Plot F(x) vs x



3. Roots of Equations

I. No	X0	X1	F(x0)	F(x1)	Ea
1	0.100000	1.000000	0.804837418035960	-0.632120558828558	0.000000
2	1.000000	0.604088	-0.632120558828558	-0.0575157606946315	65.538719
3	0.604088	0.564459	-0.0575157606946315	0.00420868210793124	7.020751
4	0.564459	0.567161	0.00420868210793124	-2.79749148609509e-5	0.476429
5	0.567161	0.567143	-2.79749148609509e-5	-1.35933663214516e-8	0.003146

Therefore, Root = 0.567143

Comment: -

From above we can conclude that Secant Method requires a greater number of iterations as compared to Newton Raphson Method. Hence convergence rate for Newton Raphson Method (Quadratic convergence) is more as compared to Secant Method.