Secant and False Position Method
Numerical Computation
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Project #3

The Secant Method was used to find a root of an equation by finding a point and determined it if had a root by proximity to the x-axis. The secant method requires two points, which we used from our given interval, [-7,-5] and [-5,-3]. The secant method was used to find a root of f(x)=0. The false position method also uses two points. The false position differs from the secant in this case with the amount of intervals.

Results: For intervals [-7,-5], using the secant method, the maximum amount of iterations were 5, while the least were 4 using the Absolute relative error. The root came out to be -5.78 as shown in Figure1. With interval [-5,-3], the maximum amount of iterations before finding the root was using the Absolute error, taking 7 iterations, while the shortest was 6, both the absolute relative and true error. The root for the second interval using the secant method was -3.66, as seen in figure 1. For the False Position method there was a slight convergence issues where the repeated error did not stop, until I adjusted the code, if the error calculation kept repeating to break. The iterations are shown in following figures but as seen for intervals [-7,-5], it took 16 iterations for both the absolute error and relative while only 7 for the absolute true error. Also converging to root= -5.759. For interval [-5,-3], there were less iterations but again the absolute error and absolute relative error where the maximum with 9 iterations while the true error gave us the least of 5 iterations, all converges to -3.668. Overall both methods are faster than the bisection method but I had the most complications with the false proposition method.

```
Case 0: Absolute Error
1             -5.737312       0.170092
2             -5.760588       0.023276
3             -5.759122       0.001466
4             -5.759131       0.000009
5             -5.759131       0.000000
Root:  -5.759131
----------------------------
Case 1: Absolute Relative
1             -5.737312       0.029647
2             -5.760588       0.004041
3             -5.759122       0.000254
4             -5.759131       0.000002
5             -5.759131       0.000000
Root:  -5.759131
----------------------------
Case 2: Absolute True Error
1             -5.737312       0.037524
2             -5.760588       0.002522
3             -5.759122       0.000016
4             -5.759131       0.000000
Root:  -5.759131
----------------------------
Case 0: Absolute Error
1             -1.310773       2.860438
2             -3.623605       2.312832
3             -3.686597       0.062992
4             -3.669105       0.017491
5             -3.668876       0.000230
6             -3.668877       0.000001
7             -3.668877       0.000000
Root:  -3.668877
----------------------------
Case 1: Absolute Relative
1             -1.310773       2.182252
2             -3.623605       0.638268
3             -3.686597       0.017087
4             -3.669105       0.004767
5             -3.668876       0.000063
6             -3.668877       0.000000
Root:  -3.668877
----------------------------
Case 2: Absolute True Error
1             -1.310773       3.000171
2             -3.623605       0.079545
3             -3.686597       0.030579
4             -3.669105       0.000397
5             -3.668876       0.000002
6             -3.668877       0.000000
Root:  -3.668877
----------------------------
```

The Following is the same function, Testing with The False Proposition Method, [-7,-5] &[-5,-3]

```
Case 0: Absolute Error
1             -5.162685      1.837315
2             -5.634320      1.365680
3             -5.746782      1.253218
4             -5.758210      1.241790
5             -5.759065      1.240935
6             -5.759126      1.240874
7             -5.759131      1.240869
8             -5.759131      1.240869
9             -5.759131      1.240869
10             -5.759131      1.240869
11             -5.759131      1.240869
12             -5.759131      1.240869
13             -5.759131      1.240869
14             -5.759131      1.240869
15             -5.759131      1.240869
16             -5.759131      1.240869
Root:  -5.759131
----------------------------
Case 1: Absolute Relative
1             -5.162685      0.355884
2             -5.634320      0.242386
3             -5.746782      0.218073
4             -5.758210      0.215656
5             -5.759065      0.215475
6             -5.759126      0.215462
7             -5.759131      0.215461
8             -5.759131      0.215461
9             -5.759131      0.215461
10             -5.759131      0.215461
11             -5.759131      0.215461
12             -5.759131      0.215461
13             -5.759131      0.215461
14             -5.759131      0.215461
15             -5.759131      0.215461
16             -5.759131      0.215461
Root:  -5.759131
----------------------------
Case 2: Absolute True Error
1             -5.162685      0.799205
2             -5.634320      0.207672
3             -5.746782      0.021298
4             -5.758210      0.001594
5             -5.759065      0.000115
6             -5.759126      0.000008
7             -5.759131      0.000001
Root:  -5.759131
----------------------------
Case 0: Absolute Error
1             -4.253147      2.424359
2             -3.744706      1.915917
3             -3.665346      0.079359
4             -3.668960      0.003613
5             -3.668877      0.003530
6             -3.668877      0.003530
```

```
Case 0: Absolute Error
1             -4.253147      2.424359
2             -3.744706      1.915917
3             -3.665346      0.079359
4             -3.668960      0.003613
5             -3.668877      0.003530
6             -3.668877      0.003530
7             -3.668877      0.003530
8             -3.668877      0.003530
9             -3.668877      0.000000
Root:  -3.668877
----------------------------
Case 1: Absolute Relative
1             -4.253147      1.325664
2             -3.744706      1.047643
3             -3.665346      0.021651
4             -3.668960      0.000986
5             -3.668877      0.000963
6             -3.668877      0.000963
7             -3.668877      0.000963
8             -3.668877      0.000963
9             -3.668877      0.000000
Root:  -3.668877
----------------------------
Case 2: Absolute True Error
1             -4.253147      0.789223
2             -3.744706      0.128507
3             -3.665346      0.006130
4             -3.668960      0.000144
5             -3.668877      0.000000
Root:  -3.668877
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```