2a) Four Error Types

True Error: This is the difference between the calculated answer and the true answer. While technically the most accurate error measurement, it can't be calculated unless the true answer is already known. This means that it is largely useless in realistic problem-solving settings.

Tolerance In: Tolerance in is the maximum difference between f(x) from the calculated solution to the true solution. In a root-finding scenario the tolerance in would simply be the absolute value of the function at the calculated solution.

Tolerance in the Solution: Tolerance in the solution is, in essence, a desired precision of the solution. A tolerance sets the maximum distance from the edge of the bracket to the true solution.

Relative Error: Rather than showing the exact error, shows the error's magnitude in comparison to the answer. Since part of the calculation involves the true error, it can't really be calculated easily. A solution for this is the estimated relative error. The estimated relative error assumes that each iteration is successively closer to the correct answer, and uses the last iterations answer as the calculated solution, treating the current iterations result as the "true" solution.

The estimated relative error makes certain assumptions, so it can fail. It fails, firstly, when the current iteration's answer is still far off from the true solution. It also fails when the two iterations' results are very far apart, as to get a realistic error estimate the difference between them must be small compared to the size of the solution.

2b) Bisection Method

Results

Tolerance	1.00E-03	1.00E-06	1.00E-12
f1x Root	3.603515625	0.360421180725097	0.36042170295968
Iterations (f1x)	10	20	40
f2x Root	0	0	0
Iterations (f2x)	1	1	1
f3x Root	0.307617188	0.308310508728027	0.30830988618345
Iterations (f3x)	10	20	40
f4x Root	DNE	DNE	DNE
Iterations (f4x)	-1	-1	-1