Example: NEWTON'S METHOD for f = cos(x)-x using derivative f' = -sin(x)-1with initial guess p_0 = 0.5 and tolerance = 1e-015

In 5 iterations we have convergence to: 7.390851332151607e-001

approximations	Absolute error	abs(fix(log10(abs(error))))	
5.000000000000000e-001	2.390851332151607e-001	0	
7.552224171056364e-001	-1.613728389047575e-002	1.000000000000000e+000	**# of accurate**
7.391416661498792e-001	-5.653293471852283e-005	4.000000000000000e+000	**decimal places**
7.390851339208068e-001	-7.056460971099909e-010	9.000000000000000e+000	
7.390851332151607e-001	0	Inf	
7.390851332151607e-001	0	Inf	**implies 15 accurate places**

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Example: NEWTON'S METHOD for f = (cos(x)-x)^2 using derivative f' = 2*(cos(x)-x)*(-sin(x)-1) with initial guess x0 = 0.5 and tolerance = 1e-015

In 48 iterations we have convergence to: 7.390851332151599e-001

approximations	error	abs(fix(log10(abs(error))))
5.000000000000000e-001	2.390851332151602e-001	0
6.276112085528183e-001	1.114739246623420e-001	0
6.848881310197823e-001	5.419700219537793e-002	1.000000000000000e+000
7.123297687588075e-001	2.675536445635274e-002	1.000000000000000e+000
7.257887251583034e-001	1.329640805685683e-002	1.000000000000000e+000
7.324567215164742e-001	6.628411698685999e-003	2.000000000000000e+000
7.357758118245156e-001	3.309321390644660e-003	2.000000000000000e+000
7.374316858106148e-001	1.653447404545427e-003	2.000000000000000e+000
7.382587118654977e-001	8.264213496624873e-004	3.000000000000000e+000
7.386719980077101e-001	4.131352074501216e-004	3.000000000000000e+000
7.388785844632145e-001	2.065487519457010e-004	3.000000000000000e+000
7.389818635502510e-001	1.032696649092557e-004	3.000000000000000e+000
7.390334995602366e-001	5.163365492366623e-005	4.000000000000000e+000
↓	↓	↓
7.390851332149683e-001	1.919575609576896e-013	1.200000000000000e+001
7.390851332150644e-001	9.581224702515101e-014	1.300000000000000e+001
7.390851332151125e-001	4.773959005888173e-014	1.300000000000000e+001
7.390851332151366e-001	2.364775042451583e-014	1.300000000000000e+001
7.390851332151486e-001	1.165734175856414e-014	1.300000000000000e+001
7.390851332151546e-001	5.662137425588298e-015	1.400000000000000e+001
7.390851332151576e-001	2.664535259100376e-015	1.400000000000000e+001
7.390851332151591e-001	1.110223024625157e-015	1.400000000000000e+001
7.390851332151599e-001	3.330669073875470e-016	1.500000000000000e+001
7.390851332151602e-001	0	Inf

Behavior recognition:
Linear convergence: Once you get one decimal place of accuracy, then every "few" iterations you gain another place of accuracy.
Quadratic convergence: Once you get one decimal place of accuracy, then at each succeeding iteration you almost double the number of accurate decimal places.

Information: Newton's method can also find complex roots of real functions starting with a complex initial guess.