

Newton-Raphson Iteration in Perl

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The classical Newton-Raphson method is a simple and efficient means of computing roots for many “well-behaved” equations.

The method consists of simply iterating

$$x_{i+1} = x_i - f(x)/f'(x)$$

until $|x_{i+1} - x_i| < \epsilon$ where ϵ is some suitably small number.

Thus for the computation of an arbitrary square root $x^2 = N$, the equation f would be $f(x) = x^2 - N$, and the iteration would be over:

$$x_{i+1} = x_i - \frac{x^2 - N}{2x}$$

A simple Perl program to compute this is found in listing 1 on page 2; you can see that this iteration quickly converges to 9.949874 when $N = 99$ by looking at figure 1 on page 3.

Listing 1: Perl code for Newton-Raphson \sqrt{N}

```

1  #!/usr/bin/perl -w
2
3  use strict;
4
5  # Use Newton-Raphson method (very unoptimized!)
6  # to compute a square root...
7
8  my $N = $ARGV[0];
9
10 my @x;
11 $x[0] = 1;
12 my $i = 0;
13
14 my $diff = 0;
15
16 while (1){
17     $x[$i+1] = $x[$i] -
18               ($x[$i]*$x[$i] - $N) / ($x[$i] * 2);
19     $diff = abs($x[$i+1] - $x[$i]);
20
21     my $j = $i+1;
22
23     if($diff < 0.0000001)
24     {
25         last;
26     }
27
28     $i++;
29 }
30
31 print "Answer \sqrt{$N} = $x[-1]\n";

```

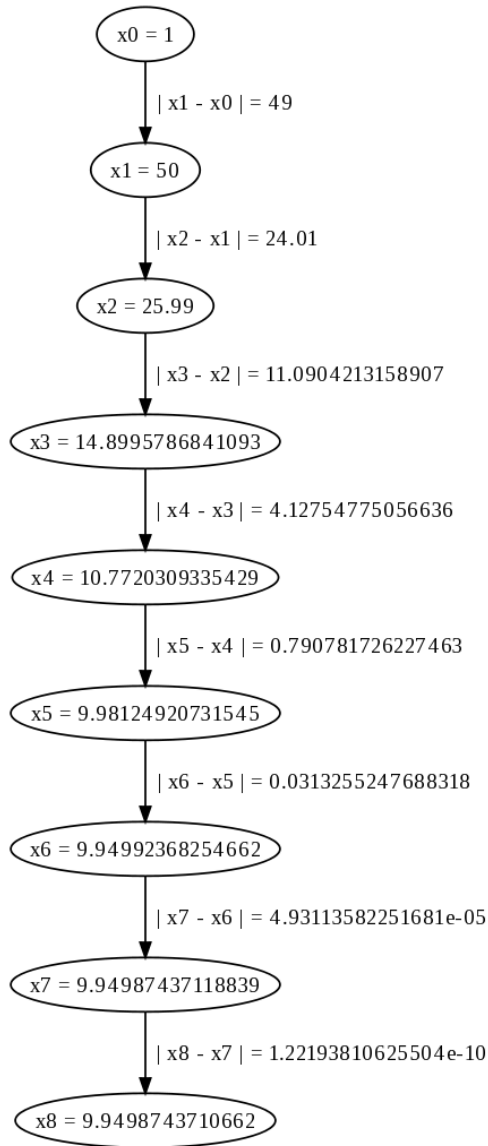


Figure 1: Convergence when computing $\sqrt{99}$ with Newton-Raphson method