

```
1 import components.simplereader.SimpleReader;
2
3
4
5
6 /**
7  * Put a short phrase describing the program here.
8  *
9  * @author Isaac Frank
10 *
11 */
12 public final class Newton3 {
13
14     /**
15      * Private constructor so this utility class cannot be
16      instantiated.
17      */
18     private Newton3() {}
19
20     /**
21      * Returns the approximate square root of x.
22      *
23      * @param x
24      *         the input to calculate the square root of
25      *
26      * @param relError
27      *         the input for the relative error allowed
28      *
29      * @return r, the approximate square root of x.
30      */
31     private static double sqrt(double x, double relError) {
32         // Allows method to work for user input 0.0
33         if (x == 0.0) {
34             return 0.0;
35         }
36         double r = x;
37         double error = Math.abs(r * r - x) / x;
38         // r becomes the average of r and r/x until the error is
39         within range
40         while (error >= (relError * relError)) {
41             r = (r + x / r) / 2;
42             error = Math.abs(r * r - x) / x;
43         }
44         return r;
45     }
46 }
```

```
46     /**
47      * Main method.
48      *
49      * @param args
50      *         the command line arguments
51      */
52     public static void main(String[] args) {
53         // Opening input and output
54         SimpleWriter out = new SimpleWriter1L();
55         SimpleReader in = new SimpleReader1L();
56
57         out.print("Input relative error: ");
58         double relError = in.nextDouble();
59
60         String ans = "y";
61
62         // Loop to allow user to repeatedly calculate roots
63         while (ans.equals("y")) {
64             out.print(
65                 "Do you wish to calculate another square root?
66                 (enter 'y'): ");
67             ans = in.nextLine();
68             // Checking user input if 'y', then calling method with
69             // input x
70             if (ans.equals("y")) {
71                 out.print("Enter a double: ");
72                 double x = in.nextDouble();
73                 out.println("Approximate sqrt " + sqrt(x,
74                     relError));
75             }
76         }
77
78         // Closing input and output streams
79         in.close();
80         out.close();
81     }
```