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import components.simplereader.SimpleReader;
import components.simplereader.SimpleReader1L;
import components.simplewriter.SimpleWriter;
import components.simplewriter.SimpleWriter1L;

/**
 * Project #2: Compute Roots Using Newton's Iteration.
 *
 * @author Danny Kan (kan.74@osu.edu)
 * @version 01272022
 */
public final class Newton3 {

    /**
     * Private constructor so this utility class cannot be instantiated.
     */
    private Newton3() {
    }

    /**
     * Computes estimate of square root of x to within relative error 0.01%.
     *
     * @param x
     *     a non-negative number to compute the square root of.
     * @param error
     *     the relative error tolerance for computing the square root
     *     function.
     * @return the estimate of the square root if x is positive, zero if x is
     *         zero, and x if x is negative.
     */
    private static double sqrt(double x, double error) {
        double r = x; // estimate of the square root of x.

        if (x > 0) {
            while ((Math.abs(Math.pow(r, 2) - x)) / x >= Math.pow(error, 2)) {
                r = (r + (x / r)) / 2;
            }
        }

        return r;
    }

    /**
     * Main method.

```

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*
* @param args
*     the command line arguments
*/
public static void main(String[] args) {
    SimpleReader in = new SimpleReader1L();
    SimpleWriter out = new SimpleWriter1L();

    out.println("Project #2: Compute Roots Using Newton Iteration");

    // assume the user DOES NOT enter a negative value.
    out.print(
        "Enter a positive value of type double to calculate the square root: ");
    double userVal = Double.parseDouble(in.nextLine());

    // prompt the user to enter the relative error tolerance.
    out.print("Enter the relative error tolerance: ");
    double relError = Double.parseDouble(in.nextLine());

    // method call:
    out.print(sqrt(userVal, relError) + "\n");

    boolean valid = true;
    while (valid) {
        out.print(
            "Type \"Y\" or \"y\" if you wish to calculate another square root: ");
        String userInput = in.nextLine();
        if (userInput.equals("Y") || userInput.equals("y")) {
            out.print(
                "Enter a positive value of type double to calculate the square root: ");
            userVal = Double.parseDouble(in.nextLine());

            // method call:
            out.print(sqrt(userVal, relError) + "\n");
        } else {
            valid = false;
        }
    }

    // close input and output streams.
    in.close();
    out.close();
}
}

```

