

## Assignment 1

due January 26

The quadratic formula

$$\frac{-(b/2) \pm \sqrt{(b/2)^2 - ac}}{a} \quad (1)$$

gives (in theory) the roots of the quadratic equation  $ax^2 + bx + c = 0$ .

1. Show that the alternative formula

$$\frac{c}{-(b/2) \mp \sqrt{(b/2)^2 - ac}} \quad (2)$$

is equivalent to (1) in theory. That is, in the absence of roundoff errors, (1) and (2) yield the same results.

2. In class we showed that if we solve the equation

$$.0256x^2 - 78x + .0142 = 0$$

in (IEEE floating point) single-precision arithmetic, formula (1) computes the smaller root inaccurately. Show that if double precision is used, both (1) and (2) compute both roots fairly accurately. (Use MATLAB or Octave, which give you double precision by default.) How many correct digits do you get in each case? (Use `format long` to examine your results.)

3. The result of the previous exercise does not imply that we can solve all of our problems by going to double precision. Concoct an example of a quadratic equation for which (1) computes the small root inaccurately and (2) computes the large root inaccurately, even if double precision is used.