Math 201 - HW #1
February 4, 2015

Name key

Score _____

Show all work to receive full credit. Supply explanations when necessary.

1. (3 points) Consider the quadratic equation $x^2 + 0.4002x + 0.0008 = 0$.

   (a) Use four-digit arithmetic with truncating and the standard quadratic formula to compute the solutions.

$$X = \frac{-0.4002 \pm \sqrt{0.1601 - 0.0032}}{2} = \frac{-0.4002 \pm 0.3961}{2}$$

$$X_1 = \frac{-0.4002 + 0.3961}{2} = \boxed{-0.002050}$$

$$X_2 = \frac{-0.4002 - 0.3961}{2} = \boxed{-0.3981}$$

   (b) Use four-digit arithmetic with truncating and the modified quadratic formula to compute the solutions.

$$q = -0.5\left[0.4002 + \sqrt{0.1601 - 0.0032}\right] = -0.5\left[0.4002 + 0.3961\right]$$

$$= -0.3981$$

$$X_1 = \frac{0.0008}{-0.3981} = \boxed{-0.002019}$$

$$X_2 = \frac{-0.3981}{1} = \boxed{-0.3981}$$

   (c) Do the two approaches give significantly different results? Explain.

THE VALUES OF X_1 ARE SIGNIFICANTLY DIFFERENT.

A QUICK COMPARISON AGAINST THE EXACT VALUE FOR X_1 SHOWS THAT, IN PART (a), THE RELATIVE ERROR IN X_1 IS ABOUT 2%, WHILE IN PART (b), THE RELATIVE ERROR IN X_1 IS ABOUT 0.5%. SIGNIFICANT DIGITS WERE LOST IN THE SUBTRACTION OF NEARLY EQUAL QUANTITIES.

2. (2 points) Suppose you are working with a computer that cannot process numbers greater than 100. How could you use your computer to compute $\sqrt{50^2 + 70^2}$?

REWRITE...

$$\sqrt{50^2 + 70^2} = \sqrt{(5 \times 10)^2 + (7 \times 10)^2}$$

$$= \sqrt{(5^2 + 7^2) \times 10^2}$$

$$= 10\sqrt{5^2 + 7^2}$$

3. (1 point extra credit) Write a very short C++ program that implements your strategy from above and outputs the value of $\sqrt{50^2 + 70^2}$. (You will need to `#include<cmath>`.)

SEE ATTACHED.

```
 1: #include <iostream>
 2: #include <cmath>
 3: using namespace std;
 4:
 5: int main()
 6: {
 7:     cout << "Without the trick... " << sqrt( 50.F * 50.F + 70.F * 70.F ) << endl;
 8:     cout << "With the trick... " << 10.F * sqrt( 5.F * 5.F + 7.F * 7.F ) << endl;
 9:
10:     return( 0 );
11: }
12:
```