Math 201 - Quiz 2

January 28, 2015

Name key

Score _____

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

1. (4 points) Let $f(x) = x^2$, $a = 3.253$, and $h = 0.0020$.

   (a) Use four-digit arithmetic with rounding to compute $\dfrac{f(a+h) - f(a)}{h}$.

$$\frac{(3.253 + 0.0020)^2 - (3.253)^2}{0.0020} = \frac{10.60 - 10.58}{0.0020}$$

$$= \frac{0.02}{0.002} = \boxed{10}$$

   (b) The exact value of the expression is 6.508. Find the relative error in your computed value.

$$\text{Rel error} = \left| \frac{6.508 - 10}{6.508} \right| \approx 54\%$$

   (c) Explain why your computed result in part (a) is inaccurate.

Loss of significant digits occurred when the nearly equal quantities $f(a+h)$ and $f(a)$ were subtracted.

   (d) Find a way to obtain an accurate result while still using four-digit arithmetic. What is the relative error in your new result?

$$\frac{(a+h)^2 - a^2}{h} = \frac{a^2 + 2ah + h^2 - a^2}{h} = \frac{2ah + h^2}{h} = 2a + h$$

$$2a + h \rightarrow 2(3.253) + 0.002 = 6.508$$

Rel error is 0.

2. (1 point) Find the three compile-time errors in the program below.

```
#include <iostream>
using namespace std;

int main()
{
    cout << "Here is the letter x: " << x << '\n';
    cout << "Here is the number 2: " << 2 << '\n'
    cout << Here is the number 0.5: << 0.5 << '\n';

    return( 0 );
}
```

① x IS AN UNDECLARED IDENTIFIER, NEED QUOTES TO MAKE IT A CHARACTER

② ; STATEMENT TERMINATOR REQUIRED

③ DOUBLE QUOTES NEEDED AROUND STRING.

3. (1 point extra credit) Use a TI-83/84 (or other scientific calculator) to convince yourself that $x = 85/23$ satisfies the equation $23x + e^{-8x} = 85$. Recalling that the exponential function always has positive values, explain how it can be that the equations

$$23x + e^{-8x} = 85$$

and

$$23x = 85$$

can have the same solution.

IT CAN'T BE! THE SOLUTIONS FOR THE EQUATIONS ARE NOT THE SAME, BUT BECAUSE e^{-8x} IS VERY SMALL NEAR THE SOLUTION OF $23x + e^{-8x} = 85$, THE SOLUTIONS OF THE EQUATIONS AGREE TO MANY DECIMAL PLACES.