Math 201 - Test 1
February 22, 2011

Name key

Score _____

Show all work. Supply explanations when necessary.

1. (3 points) For small x, the sine of x can be closely approximated by x itself:

$$\sin x \approx x \quad \text{for small } x.$$

Using your calculator's value as the exact value, find the relative error made in using this idea to approximate $\sin 0.13$. $\sin(0.13) \approx 0.13$

$$\left|\frac{\sin(0.13) - 0.13}{\sin(0.13)}\right| = \left|\frac{0.12963414... - 0.13}{0.12963414...}\right| = 0.002822...$$

$$\approx 0.28\%$$

2. (3 points) Suppose $f(x) = 3 - \sqrt{x^2+9}$ is to be evaluated numerically for values of x that are close to zero. How should the expression be rewritten to avoid subtractive cancellation?

RATIONALIZE...

$$\frac{3-\sqrt{x^2+9}}{1} \cdot \frac{3+\sqrt{x^2+9}}{3+\sqrt{x^2+9}} = \frac{9-(x^2+9)}{3+\sqrt{x^2+9}} = \frac{-x^2}{3+\sqrt{x^2+9}}$$

3. (3 points) Rewrite $P(x)$ in nested form and count the operations required in using the nested form to evaluate $P(2)$.

$$P(x) = 6x^4 + 4x^3 - 5x^2 + 2x + 1$$

$$P(x) = \Big(\big((6x+4)x - 5\big)x + 2\Big)x + 1$$

$$P(2) = \Big(\big((6\cdot 2+4)2 - 5\big)2 + 2\Big)2 + 1$$

$$= 113 \text{ IN } 8 \text{ OPERATIONS}$$

4. (2 points) Give an example of a header line for a function that is sent an integer data type and returns an long double data type.

LONG DOUBLE g(INT K)

5. (2 points) If a, b, and c have all been assigned the value 3, what will their values be after the statement `a = b * ++c` is executed.

c = 4, b = 3 (UNCHANGED),

a = 3·4 = 12

⇒ a = 12, b = 3, c = 4

6. (4 points) Determine the value of each expression (true or false) assuming the following values have been set: `a = 5, b = 2, c = 4, d = 6` and `e = 3`.

(a) `a != b`

5 != 2 YES ⇒ TRUE

(b) `d / c == d / a`

d/c = 6/4 = 1
d/a = 6/5 = 1
} ASSUMING INTEGER DIVISION THESE ARE EQUAL

TRUE

(c) `!(a * b) && (d > e)`

!(10) AND (6 > 3)

FALSE AND TRUE = FALSE

(d) `(c / b * a) || (a % c * b)`

10 OR 2

TRUE OR TRUE = TRUE

7. (3 points) Determine the exact output of the following program.

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

int main()
{
   for ( int i = 20; i >= 0; i -= 4 )
      cout << i << " ";

return( 0 );
}
```

20␣16␣12␣8␣4␣0␣ WHERE ␣ DENOTES A SPACE.

8. (3 points) Carefully explain why the following program will not compile. (Hint: The problem involves an idea that rhymes with rope.)

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

int main()
{
   int sum = 0;

   for ( int i = 1; i <= 1000; i += 10 ) {
      sum += i;
      cout << i << "    " << sum << "\n";
   }

   cout << "\nThe last number is " << i;

   return( 0 );
}
```

THE VARIABLE i IS ONLY DEFINED IN THE SCOPE OF THE FOR LOOP.

i WILL NOT BE RECOGNIZED

9. (2 points) Rewrite each statement using a shortcut assignment operator.

(a) `count = count + 5;`

count += 5;

(b) `iquotient = iquotient / 2;`

iquotient /= 2;

10. (5 points) Find five compile-time errors in the following source code.

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

int main( )
{
   const PI = 3.1415926535;
   long double myNum1, myNum2;
   double myNum3;

   1.57L = myNum2;

   cout << "Enter a number." << endl;
   cin >> mynum3;
   cout << "\n";

   myNum1 = myNum2 + long double( myNum3 );
   cout << sine( myNum1 );

   return( 0 )
}
```

PI HAS NO TYPE

CAN'T ASSIGN A VALUE TO A NUMBER

NOT DECLARED! C++ IS CASE-SENSITIVE

NEEDS PARENTHESES

NO SUCH FUNCTION. SHOULD BE SIN

NEED A SEMI-COLON.

11. (3 points) What would be the exact output of the following program?

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

int main()
{
    float x = 1.5;

    cout << sin(x);
    cout << cos(x);

    return( 0 );
}
```

NO LINE BREAK.

0.997495 0.0707372

SIN 1.5 w/ 6 SIG DIGITS

COS 1.5 w/ 6 SIG DIGITS

12. (3 points) Give the output of each statement. Assume all variables have been appropriately declared.

(a) `cout << int( sqrt( 2.0 * 14.5 ) + 13.52 );`

INT (18.9052) = 18

(b) `cout << "8 > 7 = " << (8 > 7);`

TRUE

OUTPUT IS 8>7 = 1

(c) `cout << float( long( 18.7 ) + 18.7 );`

FLOAT (18 + 18.7) = 36.7

13. (2 points) Give an example of an expression that makes use of the operators >=, &&, and ==, and has a value of zero.

(5 >= 7) && (13 == 9)

FALSE AND FALSE IS FALSE = 0

14. (2 points) Give an example of an expression that makes use of the operators <, ||, and !, and has a value of one.

(6 < 10) || (5 != 5)

TRUE OR FALSE IS TRUE = 1

15. (2 points) Write a `for` statement for the following case:

Use a counter named `icnt` that has an initial value of 26, a final value of 4, and an increment of -2.

FOR (INT ICNT = 26; ICNT >= 4; ICNT -= 2)

16. (3 points) When the following source code was printed, one line was unreadable. Give a single statement that is appropriate in its place.

```
#include <iostream>
#include <cmath>
```

← Needs to have using namespace std;

```
int main( )
{
   float radius, area;

   cout << "Enter the radius of the circle." << endl;
   cin >> radius;

   if ( radius >= 0 )
   {
      ****************************************
      cout << "\nThe area of the circle is " << area << endl;
   }
   else
      cout << "A circle cannot have a negative radius." << endl;

   return( 0 );
}
```

area = MPI * radius * radius ;

17. (5 points) Write a complete C++ program that prompts for and accepts an integer as user input and returns a value of -1, 0, or 1 depending on whether the integer is negative, zero, or positive, respectively.

```
#include <iostream>
using namespace std;
int main ( )
{
   int mynum;
   cout << " Enter an integer. " ;
   cin >> mynum ;
   if (mynum > 0)
      cout << 1 ;
   else if (mynum < 0)
      cout << -1 ;
   else
      cout << 0 ;
   cout << "\n\n";
   system ( "pause");
   return (0);
}
```