Calculus I **EXAM 2**
MATH 105 **March 20, 2015**

Name: _____

SHOW ALL WORK, CLEARLY AND LEGIBLY, TO RECEIVE FULL CREDIT. CORRECT SPELLING, ORGANIZATION OF YOUR SOLUTION, AND PROPER USE OF MATHEMATICAL NOTATION ALL COUNT. YOU MAY USE A STAND-ALONE GRAPHING CALCULATOR, BUT NOT ANY INTERNET-BASED CALCULATORS. NO NOTES, BOOKS, OR OTHER ADDITIONAL RESOURCES ARE PERMITTED. GOOD LUCK!

1.) (10 pts.) Use the given table to compute and evaluate the derivatives of the functions below.

x	1	4	6
$f(x)$	4	0	6
$f'(x)$	5	7	4
$g(x)$	4	1	6
$g'(x)$	5	1/2	3

a.) Compute the derivative of $y = f(g(x))$ when $x = 6$.

b.) Compute the derivative of $y = g(f(x))$ when $x = 1$.

2.) (15 pts.) Differentiate implicitly and solve for $\frac{dy}{dx}$:

$$x^2 + \sin y = xy^2 + 1.$$

3.) (15 pts.)

a.) (5 pts.) Use a reference triangle to simplify $\tan(\cos^{-1} x)$ to a quantity containing no trigonometric or inverse trigonometric functions.

b.) (5 pts.) Compute y' if $y = \sin^{-1}(\sqrt{x})$. Show each part of your derivative. You do not need to simplify.

c.) (5 pts.) Find an antiderivative of $f(x) = \dfrac{3x^2}{1+x^6}$. Be sure to confirm it is a valid antiderivative.

4.) (15 pts.)

a.) (5 pts.) Compute y' if $y = \dfrac{3^{\cos x}}{\ln x + 4x^2}$. Show each part of your derivative. You do not need to simplify.

b.) (5 pts.) Determine whether $G(x) = x \ln x - x$ is an antiderivative of $g(x) = \ln x$. Justify your response.

c.) (5 pts.) Find an antiderivative of $h(x) = \dfrac{3x^2 + \cos x}{x^3 + \sin x}$. Be sure to confirm it is a valid antiderivative.

5.) (15 pts.) Compute the following limits. You may use any algebra- or calculus-based method to do so. You may check your answer with a graph, but a graph alone is insufficient justification for a response and will earn no credit.

a.) (5 pts.) $\lim_{x \to 0} \dfrac{7x^2 + 4x + 1}{9 + 3x^2}$

b.) (5 pts.) $\lim_{x \to \infty} \dfrac{7x^2 + 4x + 1}{9 + 3x^2}$

c.) (5 pts.) $\lim_{x \to 1} \dfrac{e^x - e}{\ln x}$

6.) (15 pts.) *Optimization:* Find the point on the line $y = x$ closest to the point $(1, 0)$. Use calculus to solve this and use the First or Second Derivative Test to confirm your result.

7.) (15 pts.) Consider the function $y = 4 - 2x^2 + \frac{1}{6}x^4$.

a.) (5 pts.) Use calculus to compute all stationary points of y.

b.) (5 pts.) Use the First or Second Derivative Test to determine whether each stationary point is a local maximum, local minimum, or neither.

c.) (5 pts.) Use calculus to compute all points of inflection of y.

BONUS (5 pts.): Submit a math joke, math poem, or original creative mathematically-themed drawing. It is permissible to look up other people's math jokes or poems, but if you do so, cite your source. You may use the back of this page.