Math 111 (Extra Long) Practice Exam #3 Fall 2014

1. Compute $\int_1^5 5 - 2x - x^2 \, dx$ using two different methods:

(a) Fundamental Theorem of Calculus and (b) Limit Definition of the Definite Integral.

2. Compute each of the following derivatives.

(a) $g'(x)$ where $g(x) = \int_x^4 \frac{\sin t}{e^t} \, dt$

(b) $f''(x)$, where $f(x) = \frac{x^4}{e^x}$. Simplify here.

(c) $g'(x)$, where $g(x) = \frac{1}{\sin\sqrt{e^x + e^7}} + \frac{1}{e^{\sqrt{x^2+7\sin x}}} + \frac{1}{\sqrt{e^{x^2} + 7\sin x}}$. Do not simplify here.

(d) $\frac{dy}{dx}$, if $\sin y + e^x = \sec x + \cos(e^9) - e^{xy}$.

3. Evaluate each of the following integrals. Simplify.

(a) $\int_{-\frac{\pi}{3}}^{\frac{\pi}{2}} \sin\left(\frac{x}{2}\right) \, dx$

(b) $\int \frac{\sqrt{2}\ \sec^2(3x+4)}{\tan^2(3x+4)} \, dx$

(c) $\int_{\frac{\pi^2}{4}}^{\pi^2} \frac{\cos\sqrt{x}}{\sqrt{x}\ (1+\sin\sqrt{x}\ )^3} \, dx$

(d) $\int \frac{\cos x + \sin x}{\sqrt{\cos x - \sin x}} \, dx$

(e) $\int \frac{x^{\frac{7}{4}} + x^{-\frac{1}{3}}}{\sqrt{x}} \, dx$

(f) $\int \frac{5}{x^2\left(5 + \frac{3}{x}\right)^{\frac{5}{3}}} \, dx$

(g) $\int_{-2}^{-1} \left(x - \frac{5}{x^3}\right)^2 \, dx$

(h) $\displaystyle\int_{-3}^{-2} x\ (x+2)^7\ dx$

(i) $\displaystyle\int \frac{\sec\left(e^{-x}\right)\tan\left(e^{-x}\right)}{e^x}\ dx$

(j) $\displaystyle\int_1^4 \frac{1}{\sqrt{x}\ e^{1+\sqrt{x}}}\ dx$

(k) $\displaystyle\int \frac{1}{e^{3x}\left(1+e^{-3x}\right)^{\frac{2}{9}}}\ dx$

(l) $\displaystyle\int e^x + \frac{1}{e^x} + x^e + \frac{1}{x^e} + \frac{x}{e} + \frac{e}{x^2} + ex + \frac{1}{e^3x^3}\ dx$

(m) $\displaystyle\int \frac{e^x}{(1+e^x)^2}\ dx$

(n) $\displaystyle\int \frac{(1+e^x)^2}{e^x}\ dx$

4. Consider an object travelling with velocity $v(t) = 3t - 9$ meters per second.

(a) Compute the **displacement** for the object from time $t = 1$ to $t = 4$.

(b) Compute the **total distance** travelled by the object from time $t = 1$ to $t = 4$.

5. Let R be the region bounded between $y = 9 - x^2$ and the x-axis. Find the area of the largest rectangle that can be inscribed in the region R. Two vertices of the rectangle lie on the x-axis. Its other two vertices above the x-axis lie on the parabola $y = 9 - x^2$.

6. Compute the area bounded between $y = e^x$, $y = x$, $x = 0$ and $x = 1$.

7. A ball is thrown upwards from the top edge of a building with initial velocity 128 feet per second. The velocity of the ball at impact with the ground is -160 feet per second. How tall is the building?