Math 141 Fall 2016 Review Items for Exam 2

The second midterm is Monday 10/24/2016. It will cover all of Chapter 3 except sections 3.7 and 3.11. Also material in Section 1.5 is relevant.

Here are some differentiation formulas to know. In the formulas below you should assume \( u = u(x) \) is a function of \( x \).

\[
\begin{array}{c|c}
F(x) & F'(x) \\
\hline
\text{c} & \text{0} \\
u^n & nu^{n-1} \frac{du}{dx} \\
sin(u) & \cos(u) \frac{du}{dx} \\
cos(u) & - \sin(u) \frac{du}{dx} \\
tan(u) & \sec^2(u) \frac{du}{dx} \\
sec(u) & \sec(u) \tan(u) \frac{du}{dx} \\
csc(u) & - \csc(u) \cot(u) \frac{du}{dx} \\
cot(u) & - \csc^2(u) \frac{du}{dx} \\
a^u & a^u \ln(a) \frac{du}{dx} \\
\log_a(u) & \frac{1}{u \ln(a)} \frac{du}{dx} \\
\sin^{-1}(u) & \frac{1}{\sqrt{1-u^2}} \frac{du}{dx} \\
\cos^{-1}(u) & \frac{-1}{\sqrt{1-u^2}} \frac{du}{dx} \\
\tan^{-1}(u) & \frac{1}{1+u^2} \frac{du}{dx} \\
\end{array}
\]

**Product Rule:** \((f(x)g(x))' = f'(x)g(x) + f(x)g'(x)\)

**Quotient Rule:** \((f(x)/g(x))' = \frac{g(x)f'(x) - f(x)g'(x)}{g(x)^2}\)

**Chain Rule:** \((f(g(x)))' = f'(g(x))g'(x)\).
Other skills to have:

(1) Be familiar with rules for logs and exponentials. Know the domains of these functions and how to sketch basic examples.

(2) Given an equation $F(x, y) = 0$ find $y' = dy/dx$ by implicit differentiation. Also use this to find tangent lines, horizontal tangent lines. Find $y''$ by implicit differentiation.

(3) Given two data points for a quantity with exponential growth or decay, find an equation $y = y(0)e^{kt}$. Be able to work problems with half-lives.

(4) Solve related rate problems.

(5) Given a function $f(x)$, compute its linear approximation $L(x)$ as on page 252. Use the linear approximation to estimate the values of the function, for example Example 1 on page 252 or 23 – 28 in Section 3.10.

(6) Given $y = f(x)$ calculate the differential $dy$. 