Topics and information for the Math 2141 final exam

The final exam will cover the material since the 2nd exam as well as on the most important ideas from the entire semester. The material since the 2nd exam includes the definitions and properties of \( \ln x \) and \( e^x \), and techniques of integration including \( u \)-substitutions, integration by parts, integrals of trigonometric functions, integrals by trig substitutions and integrals by partial fractions. I can pretty much guarantee that there be half a dozen or so integrals on the final. I will give you any trig identities (other than \( \sin^2 x + \cos^2 x = 1 \) and \( \sec^2 x = \tan^2 x + 1 \)) that you need.

You should review the following topics from the material covered on the two midterm exams. In particular, you should be able to precisely state the definitions and theorems below.

- Proofs by induction.
- Definition of the integral in terms of step functions.
- The \( \varepsilon - \delta \) definition of \( \lim_{x \to p} f(x) = L \).
- Proofs involving limits such as \( \lim_{x \to 3} 4x - 1 = 11 \), \( \lim_{x \to p} 2x + 5 = 2p + 5 \) and if \( \lim_{x \to p} f(x) = L \), then \( \lim_{x \to p} cf(x) = cL \).
- Definition for \( f(x) \) is continuous at \( p \).
- Limit definition for \( f'(x) \) and \( f'(a) \).
- Bolzano’s Theorem and the Intermediate Value Theorem.
- Rolle’s Theorem and the Mean Value Theorem (for Derivatives).

For the final exam, you will *not* need to calculate sups and infs, explicitly use the Archimedean property or the Least Upper Bound property, or do work problems or related rates problems.