Guide to Midterm Exam 1

Review all your homework problems and quizzes. Then check the following topics and ask yourself if you understand them. If not sure, you can find related examples from your class note and/or homework problems and practice them.

1. Find and memorize typical examples of limit does not exists, not differentiable, etc. They will be very useful in resolving paradoxes about formal definition of limit.
2. Study Sandwich Theorem and applications. Practice on variants of $\lim_{\theta \to 0} \frac{\sin \theta}{\theta}$.
3. Review formal definition of limit in terms of ϵ and δ. Memorize the definition (the whole definition, beginning with "Given ..."). Generalize them to both $\lim_{x \to \infty}$ and/or $\lim_{\dots} = \infty$ cases. Then try to understand it and practice on related homework problems. Also try to define continuity in terms of ϵ and δ.
4. Study how to prove $\lim_{x \to c} f(x) = L$ using standard tricks such as the $\epsilon/2$ argument. Study how to disprove $\lim_{x \to c} f(x) = L$.
5. Study the Intermediate Value Theorem and application.
6. Study product rule and applications as in homework 03.
7. Review equations (10), (11) on page 184. Study the proof of Chain rule.
8. Practice on df/dx where the function $f(x)$ is a combination (multiplication, division, composition) of elementary functions.
9. Study how to find derivative of a function through implicit differentiation. Also study higher order derivatives.
10. Study how to find approximate value of functions using linear approximation such as $(1 + x)^k$ and $(1 + x)/(1 + y)$. Understand how to estimate the error of the linear approximation. Pay attention on assumptions that gives formula of the error. What if f is differentiable, but not twice differentiable?
11. Understand how to obtain formula of Newton's method and memorize the formula. Study how to use it to get, for example, numerical value of $\sqrt{2}$. Study on when does it work and not work. Study on how fast it converges.
12. Study extreme points, critical points, their differences and how to determine whether a critical point is a local maximum, a local minimum or neither? Pay attention to the examples involving $(x - c)^{\frac{1}{3}}$ as they are easily mistakable near $x = c$.