Midterm 1 Study Guide

1. Intuitive concept of the limit. Being able to estimate a limit by computing values at points nearby the limit point.
2. Estimating instantaneous velocity given a position function $s(t)$.
3. Limit laws: Both stating them and using them to compute limits step-by-step.
4. One-sided limits. Examples of functions that have two different one-sided limits at a point.
5. Definition of continuity. Left-continuity, right-continuity.
6. Graphical understanding of continuity.
7. Evaluating indeterminate limits (e.g. "0 over 0" or "infinity minus infinity" situations) via algebraic manipulations.
8. Definition of the squeeze theorem.
9. Be able to show using the squeeze theorem that $\lim_{x\to 0} \sin x = 0$ and $\lim_{x\to 0} \cos x = 1$.
10. Be able to show, using the limits $\lim_{x\to 0} \sin x = 0$ and $\lim_{x\to 0} \cos x = 1$ and other rules, that $\lim_{x\to a} \sin x = \sin a$.
11. Compute limits that involve the trigonometric limits $\lim_{x\to 0} \dfrac{\sin x}{x} = 1$ and $\lim_{x\to 0} \dfrac{1-\cos x}{x} = 0$.
12. Compute limits at infinity ($x \to \infty$) by expressing in terms of $\frac{1}{x}$s and/or by doing a $y = \frac{1}{x}$ substitution.
13. Precisely state the intermediate value theorem. Show how it can be used to show that $\sqrt{2}$ and other square roots exist.
14. Use the bisection method to obtain the first couple of decimal places of a solution to an equation. Apply to the case of $\sqrt{2}$.
15. Limit definition of a derivative (2 forms). Be able to compute the derivative of various functions.
16. Equation for tangent line.