
A List of Topics for the Second Midterm

Here's what you should be able to do for the midterm next week.

Old stuff.

1. Limit rules

- (a) Calculate limits using basic properties: if you know the limits of two expressions, can you find the limits of their sum, product, etc.?
- (b) Compute more difficult limits using cancellation, multiplication by the conjugate, and other algebraic tricks.
- (c) Recognize when limits tend to infinity or do not exist.
- (d) Do all of the above when x tends to ∞ or $-\infty$ rather than some real number a .

2. Basic derivatives

- (a) Understand the relationship between derivatives and limits, and compute basic derivatives by evaluating limits.
- (b) Compute limits of monomials (via the power rule), e^x , and trigonometric functions.
- (c) Use the product rule and quotient rule to find derivatives of functions that are products and quotients of other functions.
- (d) Find the equation for a tangent line to a function at a certain point.

New stuff.

3. Advanced derivatives

- (a) Find derivatives of exponential, inverse trigonometric, and logarithmic functions.
- (b) Use the chain rule to find the derivatives of compositions of functions.
- (c) Use logarithmic differentiation to differentiate functions of the form $f(x) = g(x)^{h(x)}$.

4. Calculus with parametric equations

- (a) Find the equation for a tangent line to a parametric curve at a given point in time, or at a given point on the curve.
- (b) Determine when a particle is moving horizontally, or vertically, or not moving at all, by examining the derivatives of its parametric equations.
- (c) Calculate the speed of an object based on its parametric equations.

5. Implicit differentiation

- (a) Compute y' , y'' , y''' , etc. when x and y are related by an implicit equation.
- (b) Find the equation for the tangent line to a given point on a curve.
- (c) Find all points on a curve whose tangent line is horizontal or vertical.
- (d) Find the equation for a tangent line to a given curve that passes through a given point **not** on that curve.

6. Related rates

- (a) Solve related rates problems.

7. Linear approximation

- (a) Find the linear approximation to a function around a certain point.
- (b) Use linear approximation to estimate values of functions that would otherwise be difficult without the aid of technology.
- (c) Use linear approximation and implicit differentiation to estimate solutions to an implicit equation that would otherwise be difficult or impossible to solve algebraically.

8. Absolute extrema

- (a) Find the critical numbers for a function.
- (b) Compute the absolute maximum and minimum values of a continuous function over a closed interval.