Math 1, Fall 2003
Goals for Week 9: November 17-21, 2003

Rational Functions and Their Domains: You should know what a rational function is. You should be able to find the domain of a rational function and its derivative.

Limits of Rational Functions and L'Hôpital's Rule: Given a rational function $h(x)$ and a point a at which the denominator is 0 but the numerator is not, you should know that the function will have vertical asymptotes at a. If the numerator is also 0 at a, you should be able to numerically estimate the limit, if its exists. You should know the statement of L'Hôpital's Rule. If both the numerator and the denominator have derivatives at a, you should be able to apply L'Hôpital's Rule to possibly find the limit. You should know examples of when L'Hôpital's Rule fails to give us the limit, and you should know examples of when we must apply L'Hôpital's Rule more than once to find the limit.

The Difference Quotient and the Derivative: Given a function $f(x)$ and a value a of x at which $f(x)$ is defined, you should be able to given the difference quotient of $f(x)$ at $x = a$. You should know how to geometrically represent the difference quotient as the slope of a certain line. You should know how the derivative of $f(x)$ at $x = a$ is related geometrically to the difference quotient of $f(x)$ at $x = a$. You should know the limit definition of the derivative. You should know what it means for a function to be differentiable, to be differentiable at a point, and to have a point of non-differentiability. You should be able to apply the limit definition of the derivative to very simple functions to compute the formula for their derivatives. You should be able to estimate the derivative of a function at a point using a numerical table and the difference quotient. You should know why we cannot use L'Hôpital's Rule to prove the value of the derivative of a function at a point.

Points of Non-Differentiability: You should know that a function must be defined and be continuous at a point in order to have a derivative at that point, and you should have some idea as to why this is true. You should know that even if a function is defined and is continuous at a point, that point could still be a point of non-differentiability. You should have an example in mind of a function and a point for which this is the case. You should know that if we restrict a function to a closed interval, then the endpoints of that interval are automatically points of non-differentiability for that restricted function, and you should know why this is true. You should be aware that if a function is restricted to a closed interval, then it automatically has a maximum value and a minimum value on that closed interval. You should know that for any function, if a function has a local maximum or a local minimum at a point, then that point is either a critical point or a point of non-differentiability.

Logarithmic Functions and Their Properties: You should know what a logarithmic function is and what the natural logarithmic function is. You should know the bounds on the base a of a logarithmic function. You should know the shape of the graph of a logarithmic function. You should the domain of all logarithmic functions. You should know the horizontal intercept of all logarithmic functions. You should know the vertical asymptotes of logarithmic functions and how they vary based on a. You should be aware that logarithmic function either go to positive infinity or negative infinity as x gets more and more positive, but that they grow slowly compared to other functions we have studied.

Differentiating Logarithmic Functions: You should know the formula for the derivative of all logarithmic functions and, in particular, the natural logarithmic function. You should know the domain of the formula for the derivative of logarithmic functions. Given a function which is the composition of a logarithmic function with another function, you should be able to give its domain and its derivative, as well as the domain of the derivative.

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Lecture Notes for Week 9: Lecture 20, Lecture 21 and Lecture 22

Homework for Week 9: Homework 17 and Homework 18