Maxima and Minima

You should know what is meant by a local or global maximum, and a local or global minimum of a function. You should also know how to use the first derivative to find possible locations of maxima and minima, and how to use the second derivative to tell whether a critical point is a local maximum, a local minimum or neither. Don't forget about points where the first derivative doesn't exist (including endpoints).

Concavity and Inflection Points

You should be able to interpret the sign of the second derivative in terms of the concavity of the graph of a function. You should know what an inflection point is and how to use the second derivative to find these.

Roots

You should know what is meant by a root of a function and how to find them by factoring or using Newton's Method. You should understand how Newton's Method works and how it derives from the tangent line approximation of a function (i.e. the Microscope Approximation). You should also know about the kinds of problems Newton's Method can run into, and that the remedy for all of them is to try a different initial guess.

Behavior of a Function at Endpoints of an Open Interval

If your function is defined on a closed interval, you can check its values at the endpoints just by evaluating the function there. However, if the interval is open at one end (including if the "endpoint" is $-\infty$ or $+\infty$, you need to be able to determine what value the function approaches at its argument approaches the endpoint. This involves taking a limit. Thus, you need to know what is meant by $\lim_{x\to\infty} f(x)$ and $\lim_{x\to-\infty} f(x)$ and how to evaluate these limits. Graphically you need to know what a horizontal assymptote is. Whether your endpoint is at infinity or not, if your limit has the form $0/0$ or ∞/∞ you should know how to use L'Hospital's Rule to evaluate the limit. (This rule is, once again, based on the idea of local approximation of a function by its tangent line, i.e. the Microscope Approximation.)

Optimization Problems

There are many problems in mathematics and its applications which amount to finding a global maximum or minimum value of a function on a given domain. In the last week you have had lots of practice solving problems like these, where you often first have to determine what function you are optimizing. For the exam you should be prepared to solve simple problems of this type.

Qualitative Solution of Rate Equations: Equilibrium and Inflection Values

A rate equation of the form $y'(t) = F[y(t)]$ gives us information about the first derivative of a solution $y(t)$. By differentiating this equation with respect to t, you can get information about the second derivative of a solution. You should know what is meant by an equilibrium value and an inflection value for such a rate equation, how to find them, and how to use all this information to sketch approximate solutions to the rate equation passing through different initial values.

Suggested Problems

Chapter 5 Review: #3-6, 8, 11-13, 23, 24, 32