Midterm Review Questions

1. What is a derivative? (at least two answers)
2. How can you approximate the derivative at a point from a graph?
3. Given a formula for a function f, how can you approximate the derivative at a point if you don't know the formula for the derivative function?
4. How can you approximate the derivative at a point from a table of function values?
5. Given a graph of a function $f(x)$, how can you sketch a graph of the derivative function $f'(x)$?
6. Given the graph of a derivative $f'(x)$, how can you sketch a graph of the original function $f(x)$?
7. What is the difference between "average velocity" and "instantaneous velocity"? How do you compute each, given position s as a function of time t?
8. Suppose a function f is measured in flugels and it is a function of x, measured in xiapets. What are the units of $\frac{df}{dx}$?
9. Describe the meaning of "$g'(4) = 9$" in terms of inputs and outputs.
10. What is a difference quotient? How can you use one to approximate the derivative of a function at a point?
11. What is the limit definition of derivative? How is it related to an average rate of change? Why does it involve a limit?
12. How do you use the limit definition to find a formula for the derivative function (for simple functions like power functions or polynomials)?
13. Explain why the following two statements are NOT saying the same thing: (1) "f is increasing" vs. (2) "the slope of f is increasing". What do each of these statements mean?
14. Given a graph of a function f and a point on the graph x, what do the following quantities represent: $f(x)$? $f(x+h)$? $f(x+h) - f(x)$? h? What do these all have to do with derivatives?
15. If a function $f(x)$ is increasing, what does that say about $f'(x)$? Does it say anything about $f''(x)$?
16. Suppose we know that $f'(x)$ (the derivative of a function f) is positive and decreasing. What does that say about the graph of $f(x)$?
17. Suppose we know that $f'(x)$ (the derivative of a function f) is positive and decreasing. What does that say about the graph of $f'(x)$? What about $f''(x)$?
18. What does the second derivative, $f''(x)$ tell you about the graph of $f(x)$?
19. What does the second derivative, $f''(x)$ tell you about the graph of $f'(x)$?
20. Explain why acceleration is the second derivative of the position function.
21. If the derivative of $f(x)$ is positive over an interval, what does that tell you about f itself?
22. If $f''(x)$ is positive over an interval, what does that tell you about f itself?
23. Give an example of the graph of a function $f(x)$ for each of the following scenarios:
    - $f'(x) > 0$ and $f''(x) > 0$
    - $f'(x) > 0$ and $f''(x) < 0$
    - $f'(x) < 0$ and $f''(x) > 0$
    - $f'(x) < 0$ and $f''(x) < 0$
24. Suppose you know that $f(500) = 10$ and $f'(500) = .2$. What can you say about the graph of $f(x)$? What can you say about $f(503)$? What about $f(499)$?
25. Given a formula for a function $f(x)$, how do you find the equation for the line tangent to f at $x = 3$?

26. For which kinds of functions do we have formulas for the derivative?

27. How can you tell the difference between a power function and an exponential function? What are the derivative formulas in each case?

28. What are the product and quotient rules? How do you know if you need to use them?

29. How do you know when to use each of the rules (formulas) for differentiation? Compare: power rule vs. exponential functions, product rule vs. quotient rule, derivative of a constant vs. derivative of a constant multiple.

30. Try to write each of the differentiation formulas in terms of the function $g(t)$ instead of $f(x)$.

31. What are the steps you use to find the formula for the line tangent to a curve at a point?

32. If the derivative of $f(x)$ is positive over an interval, what does that tell you about f itself?

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Besides thinking about the questions above, here are some other ways to study for the test:

- Skim through each section of the book and write down a few words about what the BIG IDEA in that section.
- Practice using the formula for derivatives (Ch.3) by generating a random quiz in Mathematica (see my webpage).
- Re-read your worksheets, and remind yourself what was the point of each new idea.
- Take the Spring 2006 exam (see my webpage) as though it was a real test.
- Review your quizzes on this material.
- Review your homework on this material.
- Read through the examples in the book, and after going through each try to summarize the procedure or idea in a few sentences.
- Memorize formulas that you will need.
- Read through the review problems in the book and decide how you would approach each one.