Mathematics 131 – Calculus for Physical and Life Sciences 1
Exam 2 – Things to Know
October 19, 2004

General Information

- The second exam of the semester will be given on Wednesday evening, October 27 at 6:00pm, in Haberlin 103 (the large lecture hall on 1st floor Haberlin). You will have until 7:30pm to work on the exam if you need that much time.
- Alternate time for those who have conflicts: Wednesday evening, October 27, 7:30pm - 9:00pm. If neither time works for you, contact me as soon as possible to arrange for another time to take the exam.
- This exam will cover the material we have studied since the first exam – Chapter 2 and sections 1 - 5 of Chapter 3 in the text. (See below for a more detailed breakdown of the topics to know.)
- A basic scientific (non-graphing) calculator will be provided for your use on the exam.
- You will not be allowed to use cell-phones, computers, or any other electronic devices during the exam. Please do not bring them with you; they will be subject to confiscation for the period of the exam if you use them.

We will review for the exam in class on Tuesday, October 26.

Material To Know

You should know the following topics:

A) Section 2.1 – Average velocity ($v_{ave} = \frac{x(t+\Delta t)-x(t)}{\Delta t}$) and instantaneous velocity ($v_{inst} = \lim_{\Delta t \to 0} \frac{x(t+\Delta t)-x(t)}{\Delta t}$).

B) Section 2.2 – Limits

1) Know the precise definition of the statement $\lim_{x \to c} f(x) = L$ (see page 64 in text or class notes) and what it means
2) Know the Limit Theorems (Theorem 2.1 in text) and how to use them to evaluate limits.
3) Know how to tell when $\lim_{x \to c} f(x)$ does not exist because one-sided limits are different or because $f(x)$ has an infinite discontinuity at c.

C) Section 2.3 – The Derivative at a point

1) Know the precise definition $f'(x) = \lim_{h \to 0} \frac{f(x+h)-f(x)}{h}$ (limit of the difference quotient for f) and how to apply it to compute some simple derivatives (like ones from problem sets and class notes)
2) Also know how to estimate $f'(x)$ numerically by approximating the limit of the difference quotient.

2) Know the interpretation of $f'(x)$ as the slope of the tangent line to $y = f(x)$ at x, and how to find the equation of the tangent line at a given point.

D) Section 2.4 – The Derivative function

1) Know how to sketch a qualitative graph of $y = f'(x)$, given the graph $y = f(x)$ without y-axis scale
2) Also know how to estimate $f'(x)$, given the graph $y = f(x)$ with coordinate grid.
3) f' positive on an interval implies f is increasing on that interval; f' negative on an interval implies f is decreasing on that interval

E) Section 2.5 – Interpretations of the derivative

1) Know how to interpret the derivative as the instantaneous rate of change of the function, and how to determine units for the derivative

F) Section 2.6 – The second derivative

1) f'' positive on an interval implies f' is increasing on that interval and graph of f is concave up; f'' negative on an interval implies f' is decreasing on that interval and graph of f is concave down
2) second derivative of position with respect to time is acceleration

G) Section 2.7 – Continuity and differentiability

1) Precise definition of continuity: f is continuous at $x = c$ if $\lim_{x \to c} f(x) = f(c)$.
2) Know that sharp corners, cusps, or vertical tangents give points where a function is not differentiable
3) If f is differentiable at x, then f is continuous at x.

H) Sections 3.1 and 3.2 – Derivative rules for sums, constant multiples, powers, polynomials, exponentials (Know how to apply all of these on functions like ones seen on problem sets, etc.)

I) Section 3.3 – Product and Quotient Rules – know the statements and how to apply them

J) Section 3.4 – Chain Rule – know the statement and how to apply it

K) Section 3.5 – Derivatives of trigonometric functions

Some Good Review Problems

From the Review problems at the end of Chapter 2: 1-8, 13-15, 22, 25, 28, 29, 31, 36

From the Review problems at the end of Chapter 3: All the problems 1-52 except ones involving arcsin, arctan are good practice – you don't need to do them all, but pick a "representative sample", 60, 69, 70, 72

The "Check Your Understanding Problems" at the end of Chapter 2 and Chapter 3 are also very good for studying.