Topic #21(Math 31)

1. Goals (Section 5.1)
    a. Definite Integral
    b. Reiman Sums
2. Integration Intro:
    a. Basic application: Want to find area under a curve
    b. Why?
        i. Can find the area and volume of curved shapes
        ii. Provides an operation which is the reverse of differentiation
3. Problems: Find the area under the curve between x = .. and x = ..
    a. Do lines: horizontal and sloped
    b. Do with breaks.
    c. Do circle pieces.
    d. Do height zero pieces.
4. Notation and intuitive definition of Definite Integral:
    a. "The definite integral from a to b"
    b. Area between the function and the x-axis
5. Extend to area below the x-axis: Count area below the x-axis as negative.
    a. Can do some basic
    b. Do sin from 0 to 2pi.
6. Other probs:
    a. Which is bigger?: Give two functions.
7. Practice Summation/Sigma notation.
    a. Section 5.1 Probs: 2 – 3
    b. Section 5.1 Probs: 4 – 7
8. For Riemann sum, need:
    a. [DO: on example int_0^2 (1 + x^2)]
    b. A function f(x)
    c. An interval [a,b]
    d. Number of rectangles n
    e. How rectangle heights are chosen: Typically left or right endpoint.
9. Example Riemann sum of int_0^2 (x^2) using n rectangles and right endpoints
    a. Find rectangle base length \delta x= (b-a)/n
    b. Draw interval [a,b] and its n subintervals of length \delta x
    c. Choose a sample point in each subinterval (call: x_1, …, x_n)
    d. Make a sum with a term for each subinterval (n). The i^th term is the product (\delta x)f(x_i)
    e. This sum is called the n^th Riemann sum; L_n (left endpoint), R_n (right endpoint), etc
    f. See figures in Section 5.1: 5.6 and 5.7

10. Comments on.
    a. Observe connection to summing areas of rectangles
    b. Other terminology: Sometimes just refer to subintervals instead of rectangles.
    c. If asked, can keep answer unevaluated (no “f” symbol, but no calculation beyond that)
    d. Examples. Section 5.1 probs: 12 – 19
11. Exact value?
    a. What happens to accuracy as n increases?
    b. See Section 5.1: Figures 5.9 and 5.10
    c. Lim R_n: See page 519- “Forming Reimann Sums”
12. Different ways to state Riemann sum question (use particular example):
    a. Find the Riemann sum of f(x) on the interval [a,b], using n rectangles and left endpoints
    b. Estimate the area under the graph f(x) from x = a to x = b, using n approximating rectangles, and right endpoints
    c. Evaluate the Riemann sum for f(x), $a \leq x \leq b$, with n subintervals, taking sample points to be left endpoints.