Topic #20 (Math 31)

1. Goals (Section 4.10)
    a. Anti-derivatives
    b. Initial Value Problems
2. Anti-derivative Definition
    a. The anti-derivative of f(x) is a function F(x) such that $f(x) = F'(x)$
    b. Way to think of anti-derivative: The reverse of differentiation
    c. Examples of Verifying – SECTION 4.10: 465 – 469
3. Examples (do not use formulas!):
    a. e^x, sin (Kx), cos (Kx)
    b. constants; zero
    c. powers of x; include fractional powers
    d. addition of functions
4. Antiderivative Theorem
    a. Observe: Multiple anti-derivatives.
    b. Theorem: Suppose F(x) is an antiderivative of f(x). Then
        i. F(x) + C is also an antiderivative, for every constant C.
        ii. Furthermore, f(x) has no other antiderivatives.
5. Notation and terminology
    a. If F(x) is an antiderivative of f(x), then F(x) + C is called the “most general antiderivative of f(x)” or the “indefinite integral of f(x)”
    b. Write $\int f(x)dx \ = F(x) + C$ “F(x) + C is the most general antiderivative of f(x)”
    c. Distinguish “an antiderivative” from “the most general antiderivative”.
    d. Verification example:
        i. $\int \sqrt{2x+1}\, dx = \left(\frac{1}{3}\right)(2x+1)^{\frac{3}{2}} + C$
    e. Write some of previous examples in notation.
    f. Picture of multiple anti-derivatives (page 488, Figure 4.85)
6. Formulas
    a. See table on Page 489 (Figure 4.13).
    b. See Page 492 – Theorem 4.16
7. Examples
    a. Antiderivative of sin (5x), cos(5x)
    b. Antiderivative of e^5x
    c. SECTION 4.10: 470 – 498
8. Initial Value Problems
    a. Example: Find the “function” whose slope is always 2?? … (okay: and hits the y axis at 1)
    b. Examples: do some of above with an initial value.
    c. Note: It is finding the “function” that satisfies the equation.
    d. Examples – SECTION 4.10: 499 – 503
9. Application to displacement, velocity, and acceleration.
    a. Have opposite relationship from below…
    b. Examples – SECTION 4.10: 509 – 514