The Fundamental Theorem of Calculus (Part 2) If f is continuous on [a, b], then

$$\int_{a}^{b} f(x) \, dx = F(b) - F(a)$$

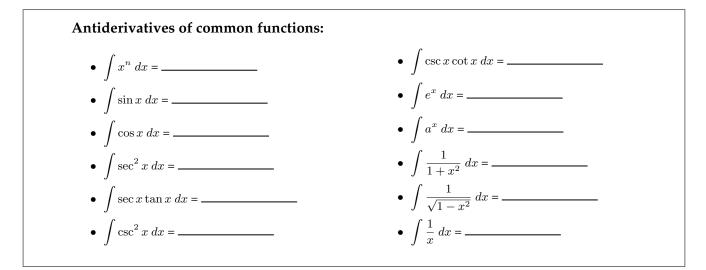
where *F* is **any antiderivative** of *f*, that is, is a function such that F' = f. To evaluate, we write

$$\int_{a}^{b} f(x) \, dx = F(x) \Big|_{a}^{b} = F(b) - F(a).$$

1. Evaluate the following integrals.

(a)
$$\int_0^1 x^2 dx$$
 (b) $\int_1^4 (1+3y-y^2) dy$

2. Review from §4.9: To compute integrals effectively you **must** have your basic antidifferentiation formulas down. You should know that antiderivatives to the following functions. We are using the \int symbol to mean "find the antiderivative" of the function right after the symbol.



3. Evaluate the following integrals.

(a)
$$\int_{2}^{5} \frac{3}{x} dx$$
 (b) $\int_{0}^{\pi/2} \cos x dx$

4. Evaluate the following integrals.

(a)
$$\int_{1}^{8} \sqrt[3]{x} \, dx$$
 (b) $\int_{\pi/6}^{\pi/2} \csc x \cot x \, dx$ (c) $\int_{0}^{1} \frac{9}{1+x^2} \, dx$

5. We do not have any product or quotient rules for antidifferentiation. To evaluate an integral that is expressed as a product or quotient you must try to manipulate the integrand (the stuff inside the \int sign) to look like something you know how to antidifferentiate. The following integrals are examples of this. Evaluate the following integrals.

(a)
$$\int_{1}^{3} \frac{x^3 + 3x^6}{x^4} dx$$
 (b) $\int_{0}^{1} x(3 + \sqrt{x}) dx$

6. Evaluate the following integrals.

(a)
$$\int_0^2 (5^x + x^5) dx$$
 (b) $\int_{1/2}^{\sqrt{2}/2} \frac{1}{\sqrt{1 - x^2}} dx$

7. What is wrong with the following calculation? (Hint: draw a picture!)

$$\int_{-1}^{3} \frac{1}{x^2} \, dx = \left. \frac{x^{-1}}{-1} \right|_{-1}^{3} = -\frac{1}{3} - 1 = -\frac{4}{3}$$