5.4 Integration and Substitution

In this section we will do integration the easy way, by finding an antiderivative and using the Fundamental Theorem of Calculus. As we progress to more complicated problems, we realize that finding a formula for an antiderivative is not always possible. In fact for most real-world problems finding the exact answer may be impossible, but also not terribly important. If we have good approximation techniques, we can always get the answer to within some specified tolerance. But for now, we are going to practice with the formulas.

**Antiderivatives**     Up to now we didn’t need to be too careful. Here we will be a little more precise. Notice that both \( f(x) = x^3 + x^2 + 5 \) and \( g(x) = x^3 + x^2 - 17 \) are antiderivatives of \( v(x) = 3x^2 + 2x \). Since \( v = f' \) and \( v = g' \). Given \( v(x) = 3x^2 + 2x \), any function of the form \( f(x) = x^3 + x^2 + C \), where \( C \) is any real number, is an antiderivative function of \( v \). The set of all antiderivatives of a given function form a family of curves, which are vertical translations of one another. They all share a common slope at the same input value. \( y = x^3 + x^2 + 5 \)

At \( x = 2 \), for each one of these graphs, the slope is \( v(2) = 16 \).

**Homework:** Read Section 5.3, pp. 187-192. Complete Read-through questions, a-w. Work excerciess, 1-15, odd.