8.1: Basic Approaches to Integration

Learning Objectives. Upon successful completion of Section 8.1, you will be able to...

- Answer conceptual questions involving basic approaches to integration.
- Find indefinite integrals using basic methods.
- Evaluate definite integrals using basic methods.
- Find the area of a region bounded by two curves using basic methods.
- Find the volume of a solid of revolution using basic methods.

Review of Integration Techniques

So far, we know a few different techniques for evaluating integrals...

- Basic integration rules (e.g., recognizing antiderivatives, applying "reverse power rule")
- Using algebra to simplify the integrand
- The substitution method (u-substitution)
- Using trig identities to simplify the integrand

Some common **trig identities** that can be used to simplify integrals are included below.

Pythagorean Identities

$$\cos^2 x + \sin^2 x = 1 \qquad\qquad 1 + \tan^2 x = \sec^2 x$$

Half-Angle Formulas

$$\cos^2 x = \frac{1 + \cos(2x)}{2} \qquad\qquad \sin^2 x = \frac{1 - \cos(2x)}{2}$$

In this chapter, we'll be building on these techniques and introducing some new ones!

✍ **Example.** Evaluate $\int e^x (1+e^x)^9 (1-e^x)\ dx$.

✍ **Example.** Evaluate $\int \frac{x+2}{x^2+4}\, dx$.

✍ **Example.** Evaluate $\displaystyle\int \frac{dx}{\sec x - 1}$.

✍ **Example.** Evaluate $\displaystyle\int \frac{x^2+2}{x-1}\,dx$.

✍ **Example.** Evaluate $\displaystyle\int \frac{dx}{\sqrt{27-6x-x^2}}$.

✍ **Example.** Evaluate $\displaystyle\int_{-1}^{0} \frac{x}{x^2+2x+2}\,dx$.