MATH 136 – Calculus 2
Practice Day on integration "by parts"
February 7, 2020

Background

Note: At this point we will move to Chapter 7 in the textbook. We will return to discuss some of the applications of integration from Chapter 6 after we do the techniques of integration from Chapter 7.

The integration by parts method is based on the product rule for derivatives, but we usually apply it by remembering the "parts formula:"

$$\int u\ dv = uv - \int v\ du.$$

The idea is that we break up an integral we want to compute into a u and a dv. We compute $du = \frac{du}{dx}\ dx$ and $v = \int dv$ and apply the parts formula. *We then have to finish by integrating* $\int v\ du$. If we have made a good choice, then the integral $\int v\ du$ is simpler, or at least no harder than the integral we started from.

Questions

Integrate by parts

1. $\displaystyle\int xe^{2x}\ dx$
2. $\displaystyle\int x^2 \cos(\pi x)\ dx$
3. $\displaystyle\int x^7 \ln(3x)\ dx$
4. $\displaystyle\int \sin^{-1}(x)\ dx$
5. A more challenging one: $\displaystyle\int e^{3x} \sin(5x)\ dx$. Hint: you'll need to integrate by parts twice, and it will seem as though you are going in circles. But be of good cheer and persist – things will work out!

6. Check by differentiating (and simplifying!):

$$\int \sec(x)\ dx = \ln|\sec(x) + \tan(x)| + C$$

7. Another challenging one: $\displaystyle\int \sec^3(x)\ dx$. Hint: Try making $u = \sec(x)$ and $dv = \sec^2(x)\ dx$. You'll also need the trig identity $1 + \tan^2(x) = \sec^2(x)$ and the previous formula for $\int \sec(x)\ dx$.