Section 5.6: Integration by Parts

Practice HW from Stewart Textbook (not to hand in)
p. 398 # 1-23 odd, 29, 31

Integration by Parts

Integration by parts undoes the product rule of differentiation.

Suppose the have two functions *u* and *v*. Differentiating the product of these two functions by the product rule gives

$$\frac{d}{dx}(uv) = u\frac{dv}{dx} + v\frac{du}{dx}$$

Integrating both sides with respect to *x* gives

$$\int \frac{d}{dx}(uv)\,dx = \int u\frac{dv}{dx}\,dx + \int v\frac{du}{dx}\,dx$$

or

$$uv = \int u\,dv + \int v\,du$$

Solving for $\int u\,dv$ gives the following integration by parts formula.

Integration by Parts Formula

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

Example 1: Integrate $\int xe^{-3x}\,dx$

Solution:

Example 2: Integrate $\int t^4 \ln t\,dt$

Solution:

Repeated Use of Integration by Parts

Example 3: Integrate $\int x^2 \cos 3x \ dx$

Solution:

Example 4: Integrate $\int e^{2x} \sin x \ dx$

Solution:

Example 5: Integrate $\int_0^1 \tan^{-1} x \, dx$

Solution: