

## Section 8.1: Integration by Parts

**Integration by parts:**

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

Proof: Recall by the product rule that  $(uv)' = u'v + uv'$ . Integrate both sides:

$$\int (uv)' = \int u'v + \int uv'. \text{ Thus } uv = \int u'v + \int uv', \text{ hence } \int uv' = uv - \int u'v$$

1. Integrals of the form  $\int x^n e^{kx} dx$

a.)  $\int xe^{2x} dx$

b.)  $\int_0^1 3xe^{-x} dx$

c.)  $\int x^5 e^{x^3} dx$

2. Integrals of the form  $\int x^n \sin(kx) dx$  or  $\int x^n \cos(kx) dx$

a.)  $\int (x + 1) \sin(5x) dx$

b.)  $\int x^2 \cos(x) dx$

3. Integrals of the form  $\int x^n \ln x dx$

a.)  $\int x^9 \ln x dx$

b.)  $\int_1^4 \ln \sqrt{x} dx$

4. Integrals involving Inverse Trig Functions:

a.)  $\int \arcsin x dx$

b.)  $\int_0^1 \arctan x \, dx$

5. Integrals involving loops:

a.)  $\int e^{2x} \cos(4x) \, dx$

b.)  $\int \sec^3 x \, dx$