# Integration by Parts

*IntegrationByParts.tns*

**Name** _____

**Class** _____

**Problem 1 – Using the Product Rule**

1. State the product rule for a function of the form $u(x)\cdot v(x)$.

2. Now apply the product rule to the function $\sin(x)\cdot\ln(x)$.

3. Which part(s) of the following statement do you agree with? Disagree with? Explain.

$$\int \frac{d}{dx}(f(x))dx = \frac{d}{dx}\left(\int f(x)dx\right) = f(x)$$

4. What is the integral of the left side of the product rule?

$$\int\left(\frac{d}{dx}(u(x)\cdot v(x)\right)dx =$$

5. What is the integral of the right side?

$$\int(u(x)\cdot\frac{dv}{dx} + v(x)\cdot\frac{du}{dx})dx =$$

6. Explain the relationship between the areas shown in the graph (page 1.12) and the equation shown below.

$$\int_{v_1}^{v_2} u\cdot dv = u\cdot v - \int_{u_1}^{u_2} v\cdot du$$

**Problem 2 – Examples of Integration by Parts**

7. Use the method of **integration by parts** to compute the integral of **ln(*x*)**. (Check your result by running the program **intbyparts(ln(*x*),1)** typing **result**, and pressing enter.)

8. Find $\int\cos(\ln(x))dx$

9. Substitute the previous result for **cos(ln(*x*))** into the integration by parts result for **sin(ln(*x*))**.

**Problem 3 – Practice using Integration by Parts**

10. Now try the following using integration by parts, then check your answers using the **intbyparts()** program and typing **result** and press enter.

    a. $\int \tan^{-1}(x)dx$

    b. $\int x^2 \cdot e^x dx$

    c. $\int x\tan^{-1}(x)dx$

    d. $\int x\cos(2x+1)dx$

**11. (Extension 1)** Does it matter in which order ***u*(*x*)** and ***v*(*x*)** are selected for the method of integration by parts?

**12. (Extension 2)** Is there likely to be an integration rule based upon the quotient rule just as integration by parts was based upon the product rule?