Exercises

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

2. Apply the product rule to the function **sin(*x*)*ln(*x*).**

3. Do you agree or disagree with the following statement? Explain.

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

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

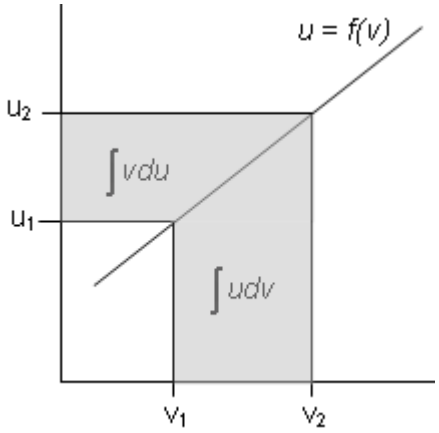
$$\int \left(\frac{d}{dx}(u(x)\cdot v(x))dx\right) =$$

5. What is the integral of the right side?

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

6. Explain the relationship between the areas shown on the graph and the following equation:

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



7. Use the method of **integration by parts** to compute the integral of **ln(x).**

   Remember the formula for Integration by parts is $\int u \cdot dv = u \cdot v - \int v \cdot du$

   $\int \ln(x) \cdot 1\,dx \rightarrow\ u = \ln(x)$ and $dv = 1\,dx$

   $du =$ $v =$

   Result =

   Check by integration directly. (**Home > F3:Calc > 2:Integrate) or (Home > 2nd 7)**

Consider the function $f(x) = \sin(\ln(x))$.

$$u = \sin(\ln(x)) \rightarrow du = \frac{\cos(\ln(x))}{x}dx$$
$$dv = dx \rightarrow v = x\ (+C)$$

$$\int \sin(\ln(x)) \cdot 1\,dx = x \cdot \sin(\ln(x)) - \int x \cdot \frac{\cos(\ln(x))}{x}\,dx\ (+C)$$
$$= x \cdot \sin(\ln(x)) - \int \cos(\ln(x))dx\ (+C)$$

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

   $u =$ $du =$ $dv =$ $v =$

   $\int \cos(\ln(x))dx =$

9. Substitute the result for **cos(ln(x))** into the result for **sin(ln(x)).**
   $u =$ $du =$ $dv =$ $v =$

   $\int \sin(\ln(x))\,dx =$

10. Use integration by parts to solve the following. If you need to use integration by parts more than once, do so. Check your result.

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

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

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

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

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?