Homework Assignment 23: Due at the beginning of class 12/16/02

The specific learning goals of this assignment are for you to:

- Apply the Chain Rule to differentiate expressions that involve both the independent variable (x) and the dependent variable (y).
- Rearrange equations to make a derivative ($\frac{dy}{dx}$) the subject of the equation.
- Calculate formulas for derivatives using the Technique of Implicit Differentiation.

This is the very last homework assignment for the course. In contrast to the complicated homework assignments in which you have examined pressing world issues with considerable authenticity, the point of this homework assignment is to simply practice a mathematical technique (Implicit Differentiation).

Calculations of derivatives using the Technique of Implicit Differentiation can be organized into steps:

  i.   Go through the given equation differentiating each term using the rules of differentiation (product, quotient, chain rules, etc.) that you have learned.

  ii.   Any time that you are differentiating something that involves the dependent variable y, you will use y as the inside function and create a factor of $\frac{dy}{dx}$ when you multiply by the derivative of the inside function.

  iii.   When you have finished differentiating, rearrange the terms of the equation so that every term that includes $\frac{dy}{dx}$ appears on one side of the equation and every term that *does not include* $\frac{dy}{dx}$ appears on the other side of the equation.

  iv.   Factor and divide to make $\frac{dy}{dx}$ the subject of the equation.

In each case, apply these steps to calculate a formula for the derivative $\frac{dy}{dx}$. You are **not** required to simplify any of your final answers for the derivative, $\frac{dy}{dx}$.

1. $x^2 + x \cdot y + y^2 = 1$

2. $x \cdot y + y^2 = \ln(x)$

3. $x \cdot \sqrt{y} + y \cdot \sqrt{x} = 1$

4. $2^y + \dfrac{1}{\sqrt{x^2 + y^2}} = e^x$

5. $\ln(x + y) = x + y.$