NAME: Solutions

HOMEWORK FOR WORKSHEET 11 **MATH 1300** **DUE April 4, 2008**

1. The product rule for derivatives states that if $F(x) = f(x)g(x)$ then $F'(x) = f'(x)g(x) + f(x)g'(x)$. In each of the problems below, find $f(x)$ and $g(x)$ so that $F(x) = f(x)g(x)$ has the indicated derivative.

(a) $F'(x) = 2x\cos x - x^2 \sin x$ (Hint: Try $f(x) = x^2$ and $g(x) = \cos x$.)

This is the solution. Good Hint!

$$\frac{d}{dx}\left[x^2\cos x\right] = \underbrace{2x}_{f'}\cdot\underbrace{\cos x}_{g} + \underbrace{x^2}_{f}\cdot\underbrace{(-\sin x)}_{g'}$$

(b) $F'(x) = 2xe^x + x^2e^x$

$f(x) = x^2$ $\quad g(x) = e^x$

$\Rightarrow f'(x) = 2x$ $\quad g'(x) = e^x$

(c) $F'(x) = \frac{1}{x}\sin x + \ln x \cos x$

$f(x) = \ln x$ $\quad g(x) = \sin x$

$\Rightarrow f'(x) = \frac{1}{x}$ $\quad g'(x) = \cos x$

(d) $F'(x) = e^x \sin x + e^x \cos x$

$f(x) = e^x$ $\quad g(x) = \sin x$

$f'(x) = e^x$ $\quad g'(x) = \cos x$

(e) $F'(x) = 1 + \ln x$

$f(x) = \ln x$ $\quad g(x) = x$

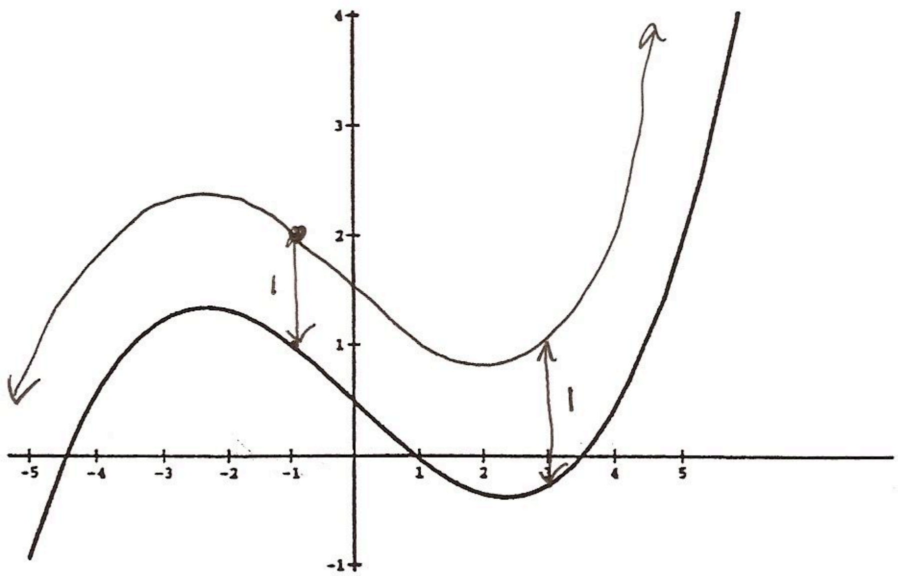
$f'(x) = \frac{1}{x}$ $\quad g'(x) = 1$

$$\Rightarrow F'(x) = \frac{1}{x}\cdot x + \ln x \cdot 1$$
$$= 1 + \ln x.$$

2. Below is the graph of a function f, Suppose another function g has the following properties:

$$g(-1) = 2 \text{ and, for all } x, g'(x) = f'(x).$$

Sketch the graph of g using the same axes.



By the Constant Diff Thm, there exists c s.t.

$$g(x) = f(x) + c$$

But $g(-1) = 2$ while $f(-1) = 1$. So, $c = 1$. That is,

$$g(x) = f(x) + 1.$$