# CORRECTION TO THE EXAMPLE ON IMPLICIT DIFFERENTIATION

Abstract. In my 10–11am class on Friday I completely mangled an example involving implicit differentiation. Here is what I should have said.

## 1. The example

Suppose that $y$ is defined in terms of $x$ by the equation

$$\sin x + \cos y = \sin x \cos y$$

Compute $\frac{dy}{dx}$.

## 2. The solution

Put

$$F(x, y) = \sin x + \cos y - \sin x \cos y$$

Then $y$ is defined in terms of $x$ by the equation

$$F(x, y) = 0$$

and so we can apply the formula which we derived in class

$$\frac{dy}{dx} = -\frac{F_x}{F_y}$$

Here

$$F_x = \cos x - \cos x \cos y$$

and

$$F_y = -\sin y + \sin x \sin y$$

so

$$\frac{dy}{dx} = \frac{\cos x - \cos x \cos y}{\sin y - \sin x \sin y}$$

## 3. Key points from the rest of class

- The directional derivative of a function $f(x, y)$ in the direction of a unit vector $\hat{u}$ is

  $$D_{\hat{u}} f = \nabla f \cdot \hat{u}$$

  When calculating directional derivatives, remember to turn your direction vector into a unit vector!
- The direction of most-rapid increase of a function $f(x, y)$ at the point $(a, b)$ is the direction of $\nabla f(a, b)$. The rate of this increase is $\|\nabla f(a, b)\|$.