Lecture Notes 09/23/2020

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1 Implicit Differentiation

The thing you gotta do when you have y on the same side of the equation as x. While you can just isolate y, it's easier to do this, believe it or not. Essentially, any y in the equation is differentiated, but you add a $\frac{dy}{dx}$ to it. If it's just a y by itself, then it turns into $\frac{dy}{dx}$, just like regular derivatives.

For example:

$$\frac{d}{dx}[x^2 + y^2 = 0] \tag{1}$$

$$\frac{d}{dx}[x^2] + \frac{d}{dx}[y^2] = \frac{d}{dx}[0]$$

$$2x + 2y(\frac{dy}{dx}) = 0$$

$$2y(\frac{dy}{dx}) = -2x$$

$$\frac{dy}{dx} = \frac{-2x}{2y} \rightarrow -\frac{x}{y}$$

How to do the hard problem during the lecture:

$$\frac{d}{dx}[4(x^2 + y^2) = (x^2 + y^2 - 2x)^2] \tag{2}$$

$$\frac{d}{dx}[4(x^2 + y^2) = \frac{d}{dx}[(x^2 + y^2 - 2x)^2]$$

Use the chain rule on the left side to get:

$$4(2x + y(\frac{dy}{dx}) = 2(x^2 + y^2 - 2x)(2x + 2y(\frac{dy}{dx}) - 2)$$

Multiply the polynomials on the left side:

$$4(2x + y(\frac{dy}{dx}) =$$