Section 15.4

The Chain Rule

Recall the where and why of the Chain Rule from Calculus 1.

What is the formulation for composition with respect to multivariable functions?

Example 15.4.1. Given $z = e^{x^2-y}$ with $x = \sin 4t$ and $y = t^3 - 9$, determine $\dfrac{dz}{dt}$.

Example 15.4.2. Given $z = 2x^3e^{4y}$ and $y = \cos 6x$ find $\dfrac{dz}{dx}$.

Example 15.4.3. Given $z = x\sin(y^2 - x)$, $x = 3u - v^2$ and $y = u^6$, find $\dfrac{\partial z}{\partial u}$ and $\dfrac{\partial z}{\partial v}$.

Implicit Differentiation

If we assume $F(x, y) = 0$ implicitly defines y as a function x, we can use the chain rule to find $\dfrac{dy}{dx}$:

Example 15.4.4. Compute $\dfrac{dy}{dx}$ for the equation

$$\cos(2x + 3y) = x^5 - 8y^2$$