

## Math 151

### 3.5: Implicit Differentiation Workalong

Based on the Khan Academy videos

**Video 1:** "Implicit Differentiation" with URL <https://youtu.be/sL6MC-IKOrw>

Concept 1: (start 0:00 and end 2:00) Implicit vs. explicit equations

Example of an \_\_\_\_\_ equation:  $y = x^2 + 2x + 3$

Example of an \_\_\_\_\_ equation:  $x^2 + y^2 = 100$

Example 1: (start 2:01 and end 11:25) Find the derivative  $\frac{dy}{dx}$  of the implicitly defined equation

$$x^2 + y^2 = 100$$

Aside on the chain rule

$$g = y^2$$

$$\frac{d}{dx}[g] = \frac{d}{dx}[y^2]$$

Example 2: (start 11:26 and end 15:56) Find the derivative  $\frac{dy}{dx}$  of the implicitly defined equation  $y = x^x$

YOU MAY SKIP THIS EXAMPLE.

THIS REQUIRES LOGS WHICH WE DON'T INTRODUCE UNTIL LATER

**Video 2:** "Implicit Differentiation (part 2)" with URL <https://youtu.be/PUsMyhds5S4>

Example 3: (length 10:44) Find the derivative  $\frac{dy}{dx}$  of the equation  $y^3 - xy^2 + \cos(xy) = 2$  .

Aside

$$g = xy$$

$$\frac{d}{dg} [\cos(g)] = -\sin(g)$$

**Video 3:** "More implicit differentiation" with URL <https://youtu.be/hrg1hCzg3W0>

Example 4: (0:00 - 6:45) Find the derivative  $\frac{dy}{dx}$  of the equation  $x^2 - 24xy + 16y^2 - 400x - 300y = 0$  .

Aside

Note:  $\frac{dy}{dx} = y'$

Example 5: (6:46 - 11:29) Find the derivative  $\frac{dy}{dx}$  of the equation  $(x - y)^2 = 8(y - 6)$  .