

Agenda: 2/15/16

Lesson 124

## Implicit Differentiation II

Ex. 124.1Find  $\frac{dy}{dx}$  where  $x^5 + 4xy^3 - 3y^5 = 2$ 

$$5x^4 + 4y^3 + 12xy^2 \frac{dy}{dx} - 15y^4 \frac{dy}{dx} = 0$$

$$\frac{dy}{dx} = \frac{-5x^4 - 4y^3}{12xy^2 - 15y^4}$$

Ex. 124.2Find  $\frac{d^2y}{dx^2}$ where  $x^2 + y^2 = 100$ 

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

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

$$\frac{d^2y}{dx^2} = \frac{-y(1) - (-x)\frac{dy}{dx}}{y^2} = \frac{-y + x\left(-\frac{x}{y}\right)}{y^2} = \boxed{\frac{-y^2 - x^2}{y^3}}$$

Ex. 124.3 Use implicit differentiation to find  $\frac{d^2y}{dx^2}$  given  $4y^2 = x^3$ .

$$8y \frac{dy}{dx} = 3x^2$$

$$\frac{dy}{dx} = \frac{3x^2}{8y}$$

$$\frac{d^2y}{dx^2} = \frac{6x(8y) - 3x^2\left(8\frac{dy}{dx}\right)}{(8y)^2} = \frac{48xy - 24x^2\left(\frac{3x^2}{8y}\right)}{64y^2}$$

$$= \frac{48xy^2 - 9x^4}{64y^3}$$

$$= \frac{12x^4 - 9x^4}{16x^3y} = \frac{3x^4}{16x^3y} = \boxed{\frac{3x}{16y}}$$