Calculus BC

Section 2.5 - Implicit Differentiation

Obj: - To find the derivative of a function using implicit differentiation.

We know how to differentiate when a function is expressed in explicit form $y = x^2 + 3x + 4$ (y is written in terms of x)

But what if the y is implicitly defined as a function of x such as $y^2 + xy = x$ or $x^2 y + y^3 = 2x$

Implicit Differentiation is used when you are unable to solve for y (get y by itself)

1. $y^2 = x$, find $\frac{dy}{dx}$

a) The long way:

-solve for y

-differentiate

b) **Implicit differentiation** (the better way)

Method 1: Using $\frac{dy}{dx}$

Using the chain rule, every time we take the derivative of y, we multiply by $\frac{dy}{dx}$:

$y^2 = x$

- solve for $\frac{dy}{dx}$

Method 2: Using the differentials dx and dy

every time we take the derivative of y or x, we multiply by the **differentials dy or dx** respectively.

$y^2 = x$

-differentiate - use dy, dx

-solve for $\frac{dy}{dx}$ by moving dx and $2y$

2. given $x^2 + y^2 = 9$ find $\frac{dy}{dx}$

3. Given $y^3 - x^2 y = 2x$ find $\frac{dy}{dx}$

-be careful of the minus
use parentheses

4. Given $(x+2y)^3 = x^4$, find $\frac{dy}{dx}$

5. Given $5x^4 - 2y^2 = 5$ find $\frac{d^2y}{dx^2}$