

3.7 Implicit Differentiation

- In the expression $y = f(x)$, the variable y is expressed **explicitly** in terms of x .
- Relationships between x and y can also be expressed **implicitly**, e.g. $x^2 + y^2 = 1$.
- Sometimes it is difficult (or impossible) to convert an implicit form into an explicit form.

Problem

Can we calculate y' without converting an implicit form into an explicit form?

- Implicit Differentiation:

Consider y as a function of x , and use the Chain Rule.

In particular, $[f(y)]' = f'(y)y'$.

- Examples

- Graphs

- Consider the ellipse $\frac{x^2}{9} + \frac{y^2}{16} = 1$. Find the values of x , for which the ellipse has vertical tangent lines.

A. $x = 0$ B. $x = \pm 3$ C. $x = \pm 4$ D. $x = \pm 9$ E. $x = \pm 16$