Implicit Differentiation

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(Mr. C)

Implicit Functions and Differentiation

- In Calculus,
- ***Y*** *is known as the dependent variable*
- *X is known as the independent variable*
- Implicit functions are functions in which:
- y is expressed implicitly with x
- y is not expressed in terms of x; rather the function contains the sum, difference, product and/or quotient of both variables together
- Implicit Differentiation is:
- the differentiation of implicit functions
- the rate of change of y with respect to (wrt) changes in x of implicit functions

What do we need to know before we can differentiate implicitly?

- **Rules of Differentiation**

➢ ***Power Rule***: if $y = ax^n$

then $dy/dx = nax^{n-1}$

➢ ***Sum Rule***: if $y = u + v$

where y, u and v are functions of x

then $dy/dx = du/dx + dv/dx$

Rules of Differentiation

➢ ***Product Rule***: if y = u * v

- Where u and v are functions of x,
- then dy/dx = u* (dv/dx) + v * (du/dx)

➢ ***Function of a Function Rule or Chain Rule***:

- If y is a function of u and u is a function of x,
- If y = f(u) and u = f(x),
- Then dy/dx = dy/du * du/dx

Rules of Differentiation

- ***Quotient Rule***: if $y = u/v$
- Where y, u and v are functions of x,
- Then $dy/dx = (v * (du/dx) - u * (dv/dx)) / v^2$

What else do I need to know?

- Besides these rules, it is also important to know that:
- Differentiating:

- y wrt x $\longrightarrow$ dy/dx
- y^2 wrt x $\longrightarrow$ 2ydy/dx
- y^3 wrt x $\longrightarrow$ $3y^2$dy/dx

and so on……

Can we do some examples?

- Differentiate implicitly $x^3y + y^3x = -7$
- **Solution**
- What rules do we need: **Power, Product and Sum Rules**
- Differentiating gives that

✓ $3x^2y + x^3dy/dx + y^3 + 3xy^2dy/dx = 0$

✓ $x^3dy/dx + 3xy^2dy/dx = 0 – 3x^2y – y^3$

✓ $dy/dx\ (x^3 + 3xy^2) = -3x^2y – y^3$

✓ $dy/dx = -\ (3x^2y + y^3) /\ (x^3 + 3xy^2)$

- **Please ask your questions.**
- **Ok. Go to the “Test” section and attempt the questions.**