Outcome 1

Implicit differentiation – with one 'y' term

Key Facts/Formulae:

For some functions, it may not be possible (or practical) to state them with y as the subject.

To differentiate implicitly; $y = x^3$

1. Differentiate x terms "as normal". $\frac{dy}{dx} = 3x^2$
2. Differentiate y terms "as normal" and write $\frac{dy}{dx}$ at the end.
3. Make $\frac{dy}{dx}$ the subject of the formula.

Note: Your final answers will involve x and y.

Worked Example:

For $x^3 = x - y^4$, use implicit differentiation to find $\frac{dy}{dx}$.

1. Differentiate each term "as normal"

$$3x^2 = 1 - 4y^3 \frac{dy}{dx}$$

2. Make $\frac{dy}{dx}$ the subject of the formula

$$4y^3 \frac{dy}{dx} = 1 - 3x^2$$

$$\frac{dy}{dx} = \frac{1 - 3x^2}{4y^3}$$

Questions…

Differentiate each of the following with respect to x…

1. $x^2 = x - y^3$
2. $2x^2 + x = 3y^5$
3. $x^3 = 6x - y^4$
4. $4x^3 - x^2 = 2y^6$
5. $x^4 = x^3 - y$
6. $x^5 + x^3 + y^2 = 0$

Answers

1 $\frac{dy}{dx} = \frac{1-2x}{3y^2}$

2 $\frac{dy}{dx} = \frac{4x+1}{15y^4}$

3 $\frac{dy}{dx} = \frac{6-3x^2}{4y^3}$

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

5 $\frac{dy}{dx} = 3x^2 - 4x^3$

6 $\frac{dy}{dx} = -\frac{5x^4+3x^2}{2y}$