If two algebraic equations are set equal to one another, then their corresponding terms must be equal. In fact, it is more correct to say that the **coefficients** of their common terms are equal.

A **coefficient** is a number that is placed in front an algebraic term e.g. in $3x^2$, 3 is the coefficient of x^2. An **undetermined coefficient** is where we do not know that number in front of an algebraic term and so replace it with a letter e.g. ax^2, here a is the undetermined coefficient of x^2.All undetermined coefficients are found by **comparison**, **forming equations** and **solving** them.

It is important to remember that only similar terms are compared with one another i.e. x^3's with x^3's, x^2's with x^2's, x's with x's and constants with constants.

For example: If $3x^2 - 4x + 9 = ax^2 + bx + c$, then $3x^2 = ax^2, -4x = bx$ and $9 = c$. This forms three equations from which we remove the common terms to get 3 = a, -4 = b and 9 = c.

To work out the value of the undetermined coefficients follow this procedure:

- Remove all brackets and fractions.
- Equate the coefficients of all common terms. This will form some simple equations.
- Use these equations to find the value of the undetermined coefficients.
- If there are variables present in the equations formed that are not present in the final answer, we must find ways to substitute a letter that is needed for the ones we do not wish to keep.

<u>EXAMPLE</u>: If $x^3 + px^2 + qx + r = (x+h)^3$ for all x, show that (i) $p^2 = 3q$ (ii) $q^3 = 27r^2$.

(i) Expand $(x+h)^3$ to get $x^3 + 3x^2h + 3xh^2 + h^3$.

This gives $x^3 + px^2 + qx + r = x^3 + 3x^2h + 3xh^2 + h^3$

Equating common terms gives

	$x^3 = x^3$	this is of no value.
	$px^2 = 3x^2h$	(cancel the x^2) $\Rightarrow p = 3h$
	$qx = 3xh^2$	(cancel the x) $\Rightarrow q = 3h^2$
	$r = h^3$	(will be used in substitution)

Now square the p line and multiply the q line by 3 as the question requires.

$\Rightarrow p^2 = 9h^2$ and $3q = 9h^2 \Rightarrow p^2 = 3q$.

(ii) Since $q = 3h^2 \Rightarrow q^3 = (3h^2)^3 \Rightarrow q^3 = 27h^6$

Since $r = h^3 \Rightarrow r^2 = h^6 \Rightarrow 27h^6 = 27r^2 \Rightarrow q^3 = 27r^2$