**Algebra**

Algebra at its core is made up of **terms** and **expressions**.

These are **terms:**

* **Constant:** Value that doesn’t change i.e. 6, 70, -4, ⅘
* **Variable:** A value that can change i.e. X, Y, α**, ■**
* **Coefficient:** The constant multiplying a variable i.e. The 6 in 6x, ⅘ in ⁴ˣ⁄₅

**Expressions** are made of terms and operators.  **Algebraic expressions** are expressions that use variables. **Polynomials**(poly meaning many) are expressions where every variable has a non-negative whole number as a power. For example, each of these is both an **algebraic expression** and a **polynomial**:

* 8α2
* 4x - 2
* -23y + 9z
* 2x2 - 3x - 4

The **degree** of a polynomial refers to the highest power of a variable in the polynomial. The important degrees are:

* **Linear**(degree=1): 4x - 2
* **Quadratic**(degree=2): 2x2 - 3x - 4
* **Cubic**(degree=3): x3 - 6x2 + 11x - 6
* **Quartic**(degree=4): 3x4 - 2x3 + x2 + 8

Basic ideas:

* Like terms with like terms.
  + Addition and subtraction between terms with the same variable to the same power i.e. 4x2 + 6x2 = 10x2, whereas 4x2 + 6x and 4x2 + 6y2 cannot be simplified.
* All terms can be multiplied/divided together.
  + When multiplying terms, all of the coefficients and variables are being multiplied together. For example (4x2)(6y2), is really (4)(x2)(6)(y2). The only multiplication we can do is (4)(6)=24, therefore we get 24x2y2 as our result.
  + When dividing, the easiest method is to write one expression over the other, and divide whatever we can into both the bottom and the top. For example, 12x4/8y3 becomes 4x4/3y3, by dividing 2 into the top and the bottom.
  + When multiplying terms with the same variable, we add their powers together. For example (4x2)(6x2), we can simplify (4)(6) to 24, and also (x2)(x2), to x2+2, to x4. This gives us 24x4. Similarly, when dividing we subtract the powers, for example 12x4/6x3 = 2x.

Expanding brackets:

* Multiplication is **distributive**. This means that when you multiply a term by an expression in brackets i.e. a(b + c), you can get the same answer by multiplying the first term by all terms in the brackets separately. So:
  + a(b + c) 🡪 a(b) + a(c), or
  + 3x(4x2 - 6x) 🡪 3x(4x2) + 3x(-6x)
* When multiplying an expression with another expression, we apply this concept multiple times. For example:
  + (4x2 + 6x)(3x - 4) 🡪 4x2(3x - 4) + 6x(3x - 4)
  + 4x2(3x - 4) + 6x(3x - 4) 🡪 4x2(3x) + 4x2(-4) + 6x(3x) + 6x(-4)
  + 12x3 - 16x2 + 18x - 24x
  + 12x3 - 16x2 - 6x

Factorising: