AS Pure – Chapter 1 – Algebraic Expressions

Indices

You can use the laws of indices to simplify powers of the same base:

$$\boldsymbol{a^m \times a^n = a^{m+n}}$$

$$\boldsymbol{a^m \div a^n = a^{m-n}}$$

$$\boldsymbol{(a^m)^n = a^{mn}}$$

$$\boldsymbol{(ab)^n = a^n b^n}$$

You can use the laws of indices with any rational power, including negatives and fractions:

$$\boldsymbol{a^{\frac{1}{n}} = \sqrt[n]{a}}$$

$$\boldsymbol{a^{\frac{m}{n}} = \left(\sqrt[n]{a}\right)^m = \sqrt[n]{a^m}}$$

$$\boldsymbol{a^{-m} = \frac{1}{a^m}}$$

$$\boldsymbol{a^0 = 1}$$

Expansion and Factorisation

Brackets can be expanded ("multiplied out") using various methods. You should be aware of grid multiplication as a valid method, even if it is not your preferred method, as it is useful in Y13 Pure when expanding binomials.

Factorisation is the opposite of expanding brackets.

Quadratic expressions, which have the form $ax^2 + bx + c$, can sometimes be factorised into a pair of brackets.

The difference of two squares can be factorised as follows:

$$\boldsymbol{x^2 - y^2 = (x + y)(x - y)}$$

Surds

In pure mathematics, answers should be given in exact form if possible. Surds are a useful tool for achieving this.

You can manipulate surds using the following rules:

$$\boldsymbol{\sqrt{ab} = \sqrt{a}\sqrt{b}}$$

$$\boldsymbol{\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}}$$

Fractional expressions should be written without surds in the denominator.

If a fractional expression does have a surd in the denominator, you need to **rationalise** it.

The rules to rationalise denominators are:

For fractions of the form $\frac{1}{\sqrt{a}}$, multiply the numerator and denominator by $\sqrt{a}$

For fractions of the form $\frac{1}{a+\sqrt{b}}$, multiply the numerator and denominator by $a - \sqrt{b}$

For fractions of the form $\frac{1}{a-\sqrt{b}}$, multiply the numerator and denominator by $a + \sqrt{b}$

In these last two cases, you are multiplying by what is known as the **conjugate**.