Revision topic: Indices or Powers

Objectives:

- Revise and practise using the rules of powers (also called indices)
- Be able to evaluate formulae with powers in

Key points:

Powers (also called indices) are the notation we use to make doing calculations easier. For example, it's much easier to work with

$$4.35 \times 10^8 \quad \text{than} \quad 435000000.$$

Even simple quadratic equations like $x^2 + 4x + 3$ use the notation rather than writing $x \times x$. Working with powers is such a frequent activity that calculators have an x^y or $\square^\square$ button to enable you to calculate 3^8 with three button presses, rather than having to type $3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3$.

You should know the three basic rules: for any a, m and n (even non-integers!)

$$a^m \times a^n = a^{m+n} \qquad \frac{a^m}{a^n} = a^{m-n} \qquad (a^m)^n = a^{mn}$$

If you ever forget one of these rules, try a small example and recreate the rule yourself! Once you know there is a rule, it's actually not too hard to work out what it should be.

For example, suppose you want to work out what $4^{10} \times 4^8$ is and cannot remember if the answer is 4^{18} or 4^{80}. Try a small example with small (different) powers: like $5^1 \times 5^2$ and work out the rule. Well you know $5^2 = 5 \times 5$, so $5^1 \times 5^2 = 5 \times 5 \times 5 = 5^3$, so in this **multiplication** the powers have been **added**: i.e. $1 + 2 = 3$. So in the starting problem $4^{10} \times 4^8 = 4^{10+8} = 4^{18}$.

This notation is used a great deal across maths because it saves so much time when writing, and enables us to spot patterns and cancel numbers in calculations so easily. Just remember, in the end it's just about notation so if you're stuck it's not wrong to think of x^2y^3 as $x \times x \times y \times y \times y$ if you wish to.

For more complex topics like negative powers, see the recommended links.

Recommended links:

Highly recommended: HELM notes on indices, Mathcentre notes on indices