The algebraic term $3x^5$ is written in **index form**. The 3 is called the **coefficient**. The x part of the term is called the **base**. The 5 is called the **power**, or **index**, or **exponent**. $3x^5$ means $3 \times x \times x \times x \times x \times x \times x$
Indices follow some general rules.

Key point

Rule 1: Any number raised to the power zero is 1 $x^0 = 1$

Rule 2: Negative powers may be written as reciprocals. $x^{-n} = \frac{1}{x^n}$

Rule 3: Any base raised to the power of a unit fraction is a root. $x^{\frac{1}{n}} = \sqrt[n]{x}$

Rule 1 has an exception when $x = 0$, as 0^0 is undefined.

$x^{\frac{1}{2}} = \sqrt{x}$ and $x^{\frac{1}{3}} = \sqrt[3]{x}$

You don't normally write the '2' in a square root.

You can combine terms in index form by following this simple set of rules called the **index laws**.
To use the index laws, the bases of all the terms must be the same.

Key point

Law 1: To multiply terms you add the indices. $x^a \times x^b = x^{a+b}$

Law 2: To divide terms you subtract the indices. $x^a \div x^b = x^{a-b}$

Law 3: To raise one term to another power you multiply the indices. $\left(x^a\right)^b = x^{a \times b}$

By combining the third general rule and the third index law you can see that $\sqrt[b]{\left(x^a\right)} = x^{\frac{a}{b}} = \left(\sqrt[b]{x}\right)^a$

So $\sqrt[3]{\left(125^4\right)} = \left(\sqrt[3]{125}\right)^4 = 5^4 = 625$