What do I need to be able to do?

By the end of this unit you should be able to:
- Add/ Subtract expressions with indices
- Multiply expressions with indices
- Divide expressions with indices
- Know the addition law for indices
- Know the subtraction law for indices

Keywords

Base: The number that gets multiplied by a power
Power: The exponent – or the number that tells you how many times to use the number in multiplication
Exponent: The power – or the number that tells you how many times to use the number in multiplication
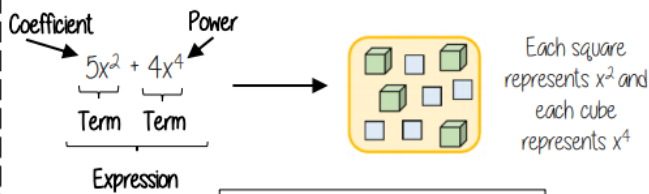**Indices:** The power or the exponent.
**Coefficient:** The number used to multiply a variable
Simplify: To reduce a power to its lowest term
Product: Multiply

Addition/ Subtraction with indices

Coefficient   Power

$5x^2 + 4x^4$

Term   Term

Expression

Each square represents x^2 and each cube represents x^4

Only similar terms can be simplified
If they have different powers, they are unlike terms

$5x^2 + 2x^2 \longrightarrow$ $\longrightarrow 7x^2$

$5x^2 + 6x^4 - 3x^2 + x^4 \longrightarrow$ $\longrightarrow 2x^2 + 7x^4$
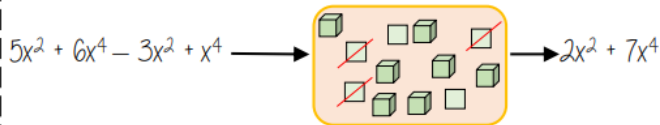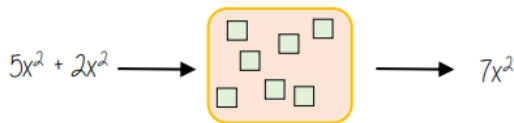
Multiply expressions with indices

$4b \times 3a$
$\equiv 4 \times b \times 3 \times a$
$\equiv 4 \times 3 \times b \times a$
$\equiv 12\, ab$

$5t \times 9t$
$\equiv 5 \times t \times 9 \times t$
$\equiv 5 \times 9 \times t \times t$
$\equiv 45\, t^2$

$2b^4 \times 3b^2$
$\equiv 2 \times b \times b \times b \times b \times 3 \times b \times b$
$\equiv 2 \times 3 \times b \times b \times b \times b \times b \times b$
$\equiv 6\, b^6$

There are often misconceptions with this calculation but break down the powers

Divide expressions with indices

$\dfrac{24}{36} \longrightarrow \dfrac{\cancel{2} \times \cancel{2} \times 2 \times \cancel{3}}{\cancel{2} \times \cancel{3} \times 2 \times \cancel{3}} \longrightarrow \dfrac{2}{3}$

$\dfrac{5\,a^3\,b^2}{15\,a\,b^6} \longrightarrow \dfrac{\cancel{5} \times \cancel{a} \times a \times a \times \cancel{b} \times \cancel{b}}{3 \times \cancel{5} \times \cancel{a} \times \cancel{b} \times \cancel{b} \times b \times b \times b \times b} \longrightarrow \dfrac{a^2}{3b^4}$

Cross cancelling factors shows cancels the expression

$\dfrac{23\,a^7\,y^2}{5\,d\,b^6}$ This expression cannot be divided (cancelled down) because there are no common factors or similar terms

Addition/ Subtraction laws for indices

$3^5 \times 3^2 \longrightarrow 3^7$

$= (3 \times 3 \times 3 \times 3 \times 3) \times (3 \times 3)$

The base number is all the same so the terms can be simplified

Addition law for indices
$$a^m \times a^n = a^{m+n}$$

$3^5 \div 3^2 \longrightarrow 3^3$

$\dfrac{3 \times 3 \times 3 \times \cancel{3} \times \cancel{3}}{\cancel{3} \times \cancel{3}} \longrightarrow \dfrac{3^3}{3^0} \longrightarrow \dfrac{3^3}{1}$

Subtraction law for indices
$$a^m \div a^n = a^{m-n}$$