# Algebra knowledge organiser

GCSE Foundation · expressions, substitution, formulae, expanding and factorising

Name _____

## THE TEN LESSONS

| | TOPIC | LEARNING QUESTION | KEY WORDS | HOW SURE AM I? |
|---|---|---|---|---|
| 1 | **The language of algebra** | How can you tell if a statement is true for every value, or only for some? | term, variable, coefficient, constant, expression, equation, formula, identity | ○ ○ ○ |
| 2 | **Collecting like terms** | Why can we add $3x$ and $4x$, but not $3x$ and $4y$? | like terms, unlike terms, simplify, collect | ○ ○ ○ |
| 3 | **Multiplying and dividing terms** | Why is $a \times a$ not the same as $2a$? | product, coefficient, simplify, cancel | ○ ○ ○ |
| 4 | **Index laws** | Why do we add the powers when we multiply, instead of multiplying them? | index, power, base, index notation | ○ ○ ○ |
| 5 | **Writing expressions** | Why is 5 less than $x$ written as $x - 5$, not $5 - x$? | variable, expression, more than, less than, in terms of | ○ ○ ○ |
| 6 | **Substitution** | When $x = 4$, why is $3x$ equal to 12 and not 34? | substitute, value, order of operations | ○ ○ ○ |
| 7 | **Formulae** | What makes a formula more useful than an expression? | formula, subject, word formula, substitute | ○ ○ ○ |
| 8 | **Expanding brackets** | Why must everything inside the bracket be multiplied? | bracket, expand, term, multiply | ○ ○ ○ |
| 9 | **Expand and simplify** | Why do we expand before we collect like terms? | expand, simplify, like terms | ○ ○ ○ |
| 10 | **Factorising** | How can you check that a factorised answer is correct and complete? | factor, common factor, highest common factor (HCF), factorise, identity | ○ ○ ○ |

How sure am I? Shade one circle after each lesson: 1 circle = not yet, 2 circles = getting there, 3 circles = I can explain it to someone else.

**How to revise with this sheet**

1. Cover the key words. Say what each one means, then check on the back.
2. Answer each learning question out loud or in writing. Use an example.
3. Copy an example from the back, cover the answer, and try it again from memory.
4. Go back to any lesson where you shaded fewer than 3 circles.

# What I need to know

Key words, rules with examples, and mistakes to avoid

## KEY WORDS

**Variable**
A letter that stands for a number. Its value can change.
$x$

**Term**
A number, a letter, or numbers and letters multiplied together.
$3x$, $7$, $ab$

**Coefficient**
The number multiplying a letter.
In $3x$ it is 3

**Expression**
Terms joined by + or −. No equals sign.
$3x + 5$

**Equation**
Has an equals sign. Only true for some values.
$3x + 5 = 11$

**Formula**
A rule that links two or more variables.
$A = bh$

**Identity**
True for every value. Uses the ≡ sign.
$2n + 3n \equiv 5n$

**Like terms**
Same letter and same power.
$3x$ and $7x$

**Substitute**
Replace each letter with its number.
$x = 4$: $3x = 3 \times 4$

**Expand**
Multiply out the bracket.
$3(x + 2) = 3x + 6$

**Factorise**
Put the bracket back in. The reverse of expanding.
$3x + 6 = 3(x + 2)$

**HCF**
Highest common factor. The biggest factor the terms share.
HCF of 12 and 18 is 6

## RULES AND EXAMPLES (THE NUMBER SHOWS THE LESSON)

### 2 Collect like terms

Add or subtract the like terms. Keep the sign with each term.

$3a + 6b - a - 9b = 2a - 3b$

### 3 Multiply and divide terms

Numbers first, then letters in alphabetical order.

$2a \times 3b = 6ab$

$a \times a = a^2$

$\frac{10x}{2} = 5x$

### 4 Index laws

Multiplying: add the powers.
Dividing: subtract the powers.

$x^2 \times x^4 = x^6$

$x^7 \div x^4 = x^3$

### 5 Write expressions

More than: add. Less than: subtract.
Lots of: multiply. Shared: divide.

6 more than $x$ is $x + 6$

3 lots of $m$ is $3m$

### 6 Substitute

Put the × back in. Replace the letters. Multiply before you add.

$a = 5, b = 2$

$4a - 2b = 4 \times 5 - 2 \times 2 = 16$

### 7 Use a formula

Write the formula. Replace the letters. Work it out.

$F = ma, m = 5, a = 3$

$F = 5 \times 3 = 15$

### 8 Expand a bracket

Multiply every term inside by the term outside.

$3(x + 2) = 3x + 6$

$-2(a + 5) = -2a - 10$

### 9 Expand and simplify

Expand each bracket first. Then collect like terms.

$2(x + 1) + 3(x + 2)$

$= 2x + 2 + 3x + 6$

$= 5x + 8$

### 10 Factorise

Find the HCF. Divide each term by it. Check by expanding.

$10y + 25 = 5(2y + 5)$

$x^2 + 5x = x(x + 5)$

## MISTAKES TO AVOID

× $3x + 4y = 7xy$
✓ $3x + 4y$ cannot be simplified

× $a \times a = 2a$
✓ $a \times a = a^2$

× $x^2 \times x^3 = x^6$
✓ $x^2 \times x^3 = x^5$

× When $x = 4$, $3x = 34$
✓ $3x = 3 \times 4 = 12$

× $3(x + 2) = 3x + 2$
✓ $3(x + 2) = 3x + 6$

× $-2(x - 3) = -2x - 6$
✓ $-2(x - 3) = -2x + 6$