Name

Date

Unit 2 · Expressions, formulae and equations — revision sheet

Everything you need from every section. Read it before the end-of-unit test.

2.1 Constructing expressions

- In algebra a letter stands for an **unknown** number.
- An **expression** has no equals sign; an **equation** does.
- Write the number before the letter: $x \times 3$ is written $\mathbf{3x}$, never x3.
- Never write the 1: $1 \times a$ is written **a**.
- Write division as a fraction: $n \div 4$ is written **n/4**.
- $a \times a$ is written $\mathbf{a^2}$ and $a \times a \times a$ is written $\mathbf{a^3}$.
- “More than” means add; “less than” means subtract, but watch the order — “x less than y” is $y - x$, not $x - y$.
- “Doubled” means × 2, “tripled” means × 3, “half of” means ÷ 2.

Key words: *expression · equation · term · variable · unknown · coefficient · constant · equivalent expression*

```
n sweets in the bag
Take 3 out → n − 3 sweets left
Put 2 in → n + 2 sweets
5n + 4 is an expression
5n + 4 = 19 is an equation
In 5n + 4 there are two terms: 5n and 4
In 5n the coefficient of n is 5
```

2.2 Using expressions and formulae

• A **formula** is a rule connecting quantities. It always has an equals sign.
• To **substitute**, replace each letter with its number and then calculate.
• Keep the order of operations: brackets and indices before × ÷, and those before + −.
• Be careful with negatives: when $x = -4$, $3x^2$ means $3 \times (-4)^2 = 3 \times 16 = 48$.
• You can **derive** your own formula. Choose letters that suggest what they stand for, and always say what each one means.
• You can work backwards from a formula: if $T = 25h + 40$ and $T = 190$, then $h = 6$.

Key words: *formula · formulae · substitute · derive · variable*

```
Area of rectangle = length × width
A = l × w (or just A = lw)
A = lw with l = 5, w = 4 → A = 5 × 4 = 20 cm²
3x + 2 with x = 4 → 3 × 4 + 2 = 14
3x + 2 with x = 4 → 12 + 2 = 14 (not 3 × 6 = 18)
4(y + 1) with y = 6 → 4 × 7 = 28
x² + 1 with x = 5 → 25 + 1 = 26
```

2.3 Collecting like terms

• **Like terms** contain exactly the same letters to the same powers.
• Only like terms can be combined: $3x + 2x = 5x$, but $3x + 4y$ cannot be simplified.
• x and x^2 are **not** like terms.
• Deal with each letter separately, and treat the plain numbers as another group.
• Write algebra tidily: **a** not 1a, **2a** not a + a, **ab** not b × a, **a²** not a × a.
• A negative coefficient is fine: $4a - 7a = -3a$.
• For fraction terms, use a common denominator: $3a/4 + 5a/12 = 9a/12 + 5a/12 = 14a/12 = 7a/6$.

Key words: *like terms · collecting like terms · simplify · term*

```
x + x + x = 3x
y + y = 2y
3x + 2y stays as 3x + 2y
5a and 2a ✓ like
4p and 4 ✗ not like
2m and m² ✗ not like
2ab and 5ab ✓ like
```

2.4 Expanding brackets

- To **expand**, multiply **every** term inside the brackets by the term outside.
- $4(n + 3)$ means $4 \times (n + 3)$, so it equals $4 \times n + 4 \times 3 = 4n + 12$.
- Keep the signs: $2(x - 5) = 2x - 10$, not $2x + 10$.
- A letter can be outside the brackets too: $x(x + 6) = x^2 + 6x$.
- A negative outside changes every sign inside: $-2(x + 3) = -2x - 6$.
- A minus in front of a bracket means multiply by -1: $-(x + 7) = -x - 7$.
- After expanding two brackets, collect the like terms.
- Check your expansion by substituting a number — both forms must give the same value.

Key words: *brackets · expand · term*

```
4(n + 3) = 4 × n + 4 × 3
= 4n + 12
4(n + 3) = 4n + 3 ✗ wrong
4(n + 3) = 4n + 12 ✓ right
2(x − 5) = 2 × x − 2 × 5 = 2x − 10
7(2 − d) = 14 − 7d
3(2g + h − 7)
```

2.5 Constructing and solving equations

- An equation is a balance: the two sides are equal.
- To **solve**, do the **same thing to both sides** until the letter is alone.
- Use **inverse operations**: undo + with −, undo × with ÷.
- Undo in reverse order — deal with the + or − first, then the × or ÷.
- $x + 5 = 12 \rightarrow$ subtract 5 $\rightarrow x = 7$. $2y + 4 = 16 \rightarrow$ subtract 4 $\rightarrow 2y = 12 \rightarrow$ divide by 2 $\rightarrow y = 6$.
- With brackets you can divide by the number outside first: $4(x - 2) = 20 \rightarrow x - 2 = 5 \rightarrow x = 7$.
- **Always check** by substituting your solution back into the original equation.

Key words: *equation · solve · solution · inverse operation · balance*

```
x + 5 = 12
x + 5 − 5 = 12 − 5
x = 7
x − 3 = 12 → add 3 → x = 15
3n = 18 → divide by 3 → n = 6
m/4 = 5 → multiply by 4 → m = 20
2y + 4 = 16
```

2.6 Inequalities

- **<** means “is less than”, **>** means “is greater than”. The wide end always faces the larger quantity.
- $x > 5$ means x is bigger than 5. The smallest **integer** is 6, because 5 itself is not allowed.
- $y < 2$ means y is smaller than 2. The largest integer is 1.
- On a number line use an **open circle** at the boundary, because that value is not included.
- The arrow points **right** for > and **left** for <.
- You cannot list every solution — there are infinitely many — so list the first few and write “…”.
- Two inequalities together trap a value: $x > 2$ and $x < 7$ gives the integers 3, 4, 5, 6.
- You solve an inequality just like an equation: $3x + 1 > 16 \rightarrow 3x > 15 \rightarrow x > 5$.

Key words: *inequality · less than (<) · greater than (>) · integer · open circle*

```
x < 10 reads “x is less than 10”
x > 10 reads “x is greater than 10”
x < −4 reads “x is less than −4”
x > 5: open circle at 5, arrow pointing right
y < 2: open circle at 2, arrow pointing left
x > 5 → smallest integer 6
y < 2 → largest integer 1
```