Chapter 18

Basic algebra

Learn the ideas below, follow each worked example, then attempt the practice before checking the answers.

18.1 Variables expressions and equations

A variable represents a number that may change or be unknown. An expression has terms connected by operations. An equation states that two expressions are equal. In $4x + 7$, x is the variable, 4 is its coefficient and 7 is a constant. Multiplication between a number and a variable is usually unwritten.

Worked example If x is the price of one ticket, $3x + 20$ represents the price of three tickets plus a 20 rupee booking fee. The statement $3x + 20 = 170$ is an equation.

18.2 Collecting like terms

Like terms have exactly the same variable part, including powers. Add or subtract their coefficients. Constants combine with constants. Unlike terms remain separate. Remember that x means $1x$ and $-x$ means $-1x$.

Worked example $5x + 3y - 2x + 4 = 3x + 3y + 4$. In contrast, $2x + 3x^2$ cannot be combined because x and x^2 are different variable parts.

18.3 Substitution and evaluating formulae

Replace each variable with its stated value and use brackets around negative values. Then apply the operation hierarchy. Repeated letters must receive the same value throughout. Include units when a formula represents a measurement.

Worked example Evaluate $2a^2 - 3b$ when $a = -2$ and $b = 5$. The result is $2(-2)^2 - 3(5) = 8 - 15 = -7$.

18.4 Expanding and factorising

Expand a bracket by multiplying every term inside by the outside factor. A negative factor changes the sign of each term. Factorising reverses expansion by taking out a common factor. Check by multiplying back.

Worked example $3(2x - 5) = 6x - 15$. Also, $-2(x + 4) = -2x - 8$. The expression $12x + 18$ factorises as $6(2x + 3)$.

18.5 Solving simple equations

An equation stays balanced when you perform the same valid operation on both sides. Undo operations in reverse order. For variables on both sides, collect variable terms on one side and constants on the other. Check the solution in the original equation.

Worked example Solve $3x + 7 = 22$. Subtract 7 to get $3x = 15$, then divide by 3 to get $x = 5$. Check: $3 \times 5 + 7 = 22$. For $5x - 4 = 2x + 11$, subtract $2x$ and add 4 to get $3x = 15$.

18.6 Translating word problems

Choose a variable and say what it means. Translate the relationships into an equation before solving. Consecutive integers can be written n, $n + 1$ and $n + 2$. State the final answer in words and check it fits the situation.

Worked example A number doubled and then increased by 9 gives 31. Let the number be n. Then $2n + 9 = 31$, so $2n = 22$ and $n = 11$. Check: $22 + 9 = 31$.

Chapter 18 practice

Work in your notebook. Show your method and include units where needed.

1. Simplify $7a - 2a + 4 - 9$.
2. Evaluate $3x + 2y$ when $x = -4$ and $y = 7$.
3. Expand $4(2x - 3)$.
4. Solve $5x - 6 = 29$.
5. Three consecutive integers total 48. Find them.

Answers with methods

1. $5a - 5$.

2. $3(-4) + 2(7) = -12 + 14 = 2$.

3. $8x - 12$.

4. Add 6: $5x = 35$. Divide by 5: $x = 7$.

5. $n + (n + 1) + (n + 2) = 48$, so $3n + 3 = 48$ and $n = 15$. The integers are 15, 16 and 17.

Common mistake to avoid

$3(x + 2)$ means $3x + 6$. Multiplying only the first term inside the bracket gives an incorrect expression.