Unit 15 · Algebraic Expressions

STUDY NOTES

Key terms

Algebra: the maths of numbers we don't know yet, written with letters.

Variable: a quantity whose value can change, written with a letter: x, y, z, a, b.

Constant: a quantity whose value is fixed: 3, 5, the 7 days of a week.

Term: a number, a variable, or numbers and variables multiplied together: $3x$, 2, $5xy$.

Algebraic expression: one term, or several joined by + or −: $x + 3y - 2$.

Coefficient: the number that multiplies the variable: 3 in $3x$.

Like terms: the same variables: $3x$, x, $100x$.

Unlike terms: different variables: $3x$, $2y$, 5.

Writing with a letter

Sentence	Expression
3 more marbles than Bina's x	$x + 3$
x chocolates, 5 more given	$x + 5$
spent one fourth of Rs. x	$x \div 4$, or $x/4$
sold for 3 times Rs. x	$3x$
2 km less than 3 times x km	$3x - 2$
Rs. x, Rs. 25 given away	$x - 25$
n cups of tea at Rs. 20	$20n$; 6 cups: Rs. 120

- a letter does the job of the box in $\square + 3$

Writing rules

- $3x$ means $\mathbf{3 \times x}$; the × sign is left out
- $x = 4 \rightarrow 3x = 12$, not 34
- number first: $3x$, never $x3$
- no number written → coefficient **1**: $x = 1x$
- $x/3$ is one third of x: coefficient $1/3$

Terms and their names

- terms are separated by **+ and −**
- the number and letter stay together in one term: $5a$
- in $3x + 4y - 5$: coefficient of x is 3, of y is 4; 5 is a constant

Terms	Name	Examples
1	**monomial**	x, $4x$, $10a$
2	**binomial**	$3x + 2$, $7x - y$
3	**trinomial**	$x + 3y - 2$, $8x - 9y + 3$

Like and unlike terms

- only the **letters** decide, not the numbers in front
- like
  - $5x$, $7x$
  - $2abc$, $5abc$
  - $6pq$, pq
- unlike
  - $10b$, $12c$
  - $2x$ and 2
  - $3y$, $3y^2$
- x^2 ("x squared") $= x \times x$, not x: $7x^2$, $3x^2$ like; $6y^3$, $3y$ unlike
- x^2y ($x \times x \times y$) and xy^2 ($x \times y \times y$): unlike

Adding and subtracting like terms

- **add or subtract the coefficients, keep the variable**
- unlike terms can't join: write them with + or − between

$$3x + 5x = 8x \qquad 18a - 6a = 12a$$

1. bring like terms side by side; each keeps the **sign in front of it**
2. join each kind
3. the unlike ones stay apart

$$4a + b + 2a - 4b = 4a + 2a + b - 4b = 6a - 3b$$

- $b - 4b$: one b, four taken away → $-3b$
- $7x - 2y + 3x = 10x - 2y$
- buffaloes and cows: $3b + 5c + 4b + 3c = 7b + 8c$, still two terms
- in columns: like terms **under like terms**, add each column
- **take A from B** $= B - A$: take $3x + 4y$ from $7x + 9y$ → $4x + 5y$
- **what must be added** to $x + y$ to make $7x + 3y$? each kind: $7 - 1$, $3 - 1 \rightarrow 6x + 2y$
- a segment in parts: add them: $2x + 3x = 5x$; a stick $x + x$ with $x = 12$ cm → 24 cm

Check with a number

- $a = 5$: $4a + 2a = 20 + 10 = 30$; $6a = 30$ ✓
- Bina x, Sonam $x + 3$: together $x + x + 3 = 2x + 3$; Bina $10 \rightarrow 2 \times 10 + 3 = 23$
- $3x + 2$ is not $5x$: $x = 10$ gives 32 and 50

COMMON MISTAKES

✗ $3x$ with $x = 4$ read as 34
✓ $3x = 3 \times 4 = 12$.

✗ $3x + 2 = 5x$
✓ the 2 has no x: unlike, they stay apart.

✗ $3y$ and $3y^2$ called like
✓ the letters must match exactly.

✗ $4a + b + 2a - 4b = 6a + 3b$
✓ each term keeps its own sign: $6a - 3b$.

✗ $5a - 2b + 7$ has 5 terms
✓ terms are split by + and −: 3 terms.