



CHAPTER 4 : EXPRESSIONS USING LETTER-NUMBERS



SUMMARY OF CONCEPTS

1. LETTER-NUMBERS & ALGEBRAIC EXPRESSIONS

- Letters used to represent numbers are called letter-numbers (or variables).
- Expressions containing letter-numbers are called algebraic expressions.
- They help express general relationships in a concise way.



Examples

- Shabnam is 3 years older than Aftab.
If Aftab's age = a , then Shabnam's age = s

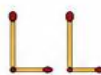
$$s = a + 3$$

- Aftab's age in terms of s :

$$a = s - 3$$

- Matchstick pattern (each L uses 2 sticks)
If number of L's = n , then

$$\text{Number of sticks} = 2n$$



- Cost of c coconuts (₹35 each) and j kg jaggery (₹60 per kg)



$$\text{Total amount} = 35c + 60j$$

2. ARITHMETIC EXPRESSIONS – KEY IDEAS

- Terms can be added in any order (swapping).
- Terms can be grouped conveniently (grouping).
- Brackets show which part to evaluate first.
- A minus before a bracket changes the signs inside.
- Distributive Property:

$$k(a + b) = ka + kb$$

Examples

- $23 - 10 \times 2 = 23 + (-20) = 3$
- $83 + 28 - 13 + 32$
 $= (83 + 32) + (28 - 13) = 115 + 15 = 130$
- $68 - (18 + 13) = 68 - 31 = 37$
or $68 - 18 - 13 = 37$
- $20 + 8 \times (16 - 6) = 20 + 8 \times 10 = 100$

3. OMITTING MULTIPLICATION SIGN

- $\times$ is usually omitted between a number and a letter.
- Write the number first, then the letter.

Examples

$$4 \times n = 4n \quad 7 \times k = 7k \quad 5 \times m = 5m$$

Value of expressions

- If $k = 4$, then $7k = 7 \times 4 = 28$
- If $m = 2$, then $5m + 3 = 5 \times 2 + 3 = 13$

Do not confuse!

$5u$ means
 $5 \times u$
(five times u)

$5 + u$ means
5 more than u

Check with values

u	2	5	8	11
$5u$	10	25	40	55
$5 + u$	7	10	13	16

Different values $\rightarrow$ Not equal expressions.

4. SIMPLIFICATION OF ALGEBRAIC EXPRESSIONS

Like Terms

- Terms with the same letter(s) are called like terms.
- They can be added or subtracted.
- Examples: $5c$, $3c$, $-8c$ are like terms.

Unlike Terms

- Terms with different letter(s) are unlike terms.
- They cannot be combined.
- Examples: $5c$ and $3d$ are unlike terms.

Rules of Simplification

- Remove brackets using sign rules.
- Combine like terms.
- Add or subtract the numbers.
- Use distributive property.

Common forms

- $2a + 3a = 5a$
- $7a - 2a = 5a$
- $(a + b) + (c + d) = a + b + c + d$
- $2(a + b) = 2a + 2b$
- $a - (b + c) = a - b - c$

Examples

Expression	Simplified form	Expression	Simplified form
$5c + 3c + 10c$	$18c$	$7p - 3q + 8p - 4q + 6p - 2q$	$21p - 9q$
$(40x + 75y) - (6x + 10y)$	$34x + 65y$	$3a + 9b - 6 + 8a - 4b - 7a + 16$	$4a + 5b + 10$
$4(x + y) - y$	$4x + 3y$		

5. ALGEBRA TO DESCRIBE PATTERNS

(A) Repeating Design Pattern



- Positions of A : $3n - 2$
- Positions of B : $3n - 1$
- Positions of C : $3n$

To find design at any position p :

$$\begin{aligned} p \equiv 0 \pmod{3} &\rightarrow C \\ p \equiv 1 \pmod{3} &\rightarrow B \\ p \equiv 2 \pmod{3} &\rightarrow A \end{aligned}$$

(B) Calendar Pattern (2×2 Square)

a	$a + 1$
$a + 7$	$a + 8$

Diagonal sums:

$$\begin{aligned} a + (a + 8) &= 2a + 8 \\ (a + 1) + (a + 7) &= 2a + 8 \end{aligned}$$

$\therefore$ Diagonal sums are always equal.

(C) Calendar Cross (3×3 Shape)

	$a - 7$	
$a - 1$	a	$a + 1$
	$a + 7$	

Sum of all numbers = $5a$
(Five times the centre number)

Works for any value of a .

6. MATCHSTICK PATTERN



Observations

- Each step adds 2 matchsticks.
- Pattern of total matchsticks:
3, 5, 7, 9, 11, 13, ...

Formula

$$\begin{aligned} \text{Number of matchsticks in Step } y \\ = 3 + 2(y - 1) = 2y + 1 \end{aligned}$$

7. KEY RULES WHILE WORKING WITH EXPRESSIONS

- Use letters to represent unknown or varying numbers.
- Write expressions for given situations.
- Swap and group terms to simplify.
- Combine like terms only.
- Omit multiplication sign between number and letter.
- Use distributive property:

$$k(a + b) = ka + kb$$

- Be careful with brackets and signs.

Common Mistakes to Avoid

- Not following order of operations
- Ignoring negative signs
- Combining unlike terms
- Forgetting to open brackets
- Confusing $5u$ with $5 + u$

8. PERIMETER FORMULAS (FOR REGULAR SHAPES)



Square
Side = q
Perimeter = $4q$



Equilateral Triangle
Side = a
Perimeter = $3a$



Regular Pentagon
Side = a
Perimeter = $5a$



Regular Hexagon
Side = a
Perimeter = $6a$

9. TAKEAWAYS

- Algebraic expressions help us generalize patterns and relationships.
- Like terms can be combined; unlike terms cannot.
- Expressions can be simplified but their value remains the same.
- Patterns in numbers, shapes, and calendars can be described using algebra.
- Algebra makes it easy to think, explain and predict!



Practice More $\rightarrow$ Observe Patterns $\rightarrow$ Write Expressions $\rightarrow$ Simplify $\rightarrow$ Understand Relationships



EXPRESSIONS USING LETTER-NUMBERS

WORKSHEET-1

Section A: MCQs (PART-1) ($10 \times 1 = 10$ marks)

1.If Aftab's age is represented by **a**, then Shabnam's age (3 years older) is:

- a) $a - 3$ b) $a + 3$ c) $3a$ d) $a/3$

2.Number of matchsticks required to make **n** L-shapes is:

- a) n b) $n + 2$ c) $2n$ d) n^2

3.The perimeter of a square of side **q** is:

- a) q^2 b) $2q$ c) $3q$ d) $4q$

4.Which expression represents 5 more than a number **x**?

- a) $5x$ b) $x - 5$ c) $x + 5$ d) $5 - x$

5.If $k = 4$, then $7k =$

- a) 11 b) 28 c) 74 d) 3

6.Simplified form of $p + p + p + p$ is:

- a) p^4 b) $4p$ c) $p + 4$ d) $4 + p$

7.Which pair are like terms?

- a) $5x$ and $3y$ b) $4a$ and $2a$
c) $2p$ and $3q$ d) $6m$ and $5n$

8.Simplify: $5c + 3c + 10c$

- a) 18 b) $15c$ c) $18c$ d) $8c$

9.The expression for perimeter of a rectangle is:

- a) $l \times b$ b) $l + b$ c) $2l + 2b$ d) $2lb$

10.Which expression means “13 less than 2 times a number **n**”?

- a) $13 - 2n$ b) $2n - 13$ c) $13 + 2n$ d) $2(n - 13)$

MCQs (PART-2) ($10 \times 1 = 10$ marks)

11. A toy shop sells a ball for ₹45 each. If n balls are sold, which expression represents the total amount earned?

- a) $n + 45$ b) $45n$ c) $45 + n$ d) $45 - n$

12. The length of a rectangle is x cm and its breadth is 6 cm. Which expression represents its perimeter?

- a) $x + 6$ b) $2x + 6$ c) $2(x + 6)$ d) $x \times 6$

13. If $m = 7$, what is the value of $5m - 8$?

- a) 27 b) 35 c) 43 d) 29

14. Which pair consists of like terms?

- a) $4x$ and $4y$ b) $6a$ and $3a$ c) $5m$ and 5 d) $2p$ and $2q$

15. Simplify the expression: $8x + 5 - 3x + 7$

- a) $11x + 12$ b) $5x + 12$ c) $5x + 2$ d) $11x + 2$

16. The number of books on one shelf is b . There are 6 identical shelves. Which expression represents the total number of books?

- a) $b + 6$ b) $6b$ c) $b - 6$ d) $6 + b^2$

17. A pattern begins with 6 tiles, and 4 tiles are added at every new step. Which expression gives the number of tiles in the n^{th} step?

- a) $4n$ b) $6 + 4n$ c) $6 + 4(n - 1)$ d) $4(n + 1)$

18. Which expression is equivalent to $3(a + 5)$?

- a) $3a + 5$ b) $3a + 15$ c) $15a$ d) $8a$

19. If $x = 4$ and $y = 3$, what is the value of $2x + 3y$?

- a) 15 b) 16 c) 17 d) 18

20. Which statement is correct?

- a) $7a + 5a = 12a$ b) $7a + 5 = 12a$ c) $7a \times 5a = 12a$ d) $7a - 5a = 35a$

WORKSHEET-2

Section B: Short Answer ($10 \times 2 = 20$ marks)

1. Write an algebraic expression for: 4 more than a number x .

2. Write an algebraic expression for: 7 less than a number y .

3. If $a = 18$, find the value of $a + 3$.

4. Find the value of $5m + 3$ when $m = 2$.

5. Write the formula for the perimeter of a regular pentagon of side p .

6. A pipe of length 20 m is joined with another pipe of length k m. Write the expression for total length.

7.Simplify: $3b - 2b - b$

8.Simplify: $p + q - p + q$

9.Write an expression for the total cost of x coconuts at ₹35 each.

10.Write an expression for the total cost of y kg jaggery at ₹60 per kg.

Section C: Short Answer Questions ($6 \times 3 = 18$ Marks)

11.Simplify: $7p - p + 5q - 2q$

12.Simplify: $4(x + y) - y$

13.Find the perimeter of a square with side length 7 cm using the formula $4q$.

14.A shopkeeper sells 5 pencils, 3 pencils and 10 pencils on three days. If one pencil costs c rupees, write and simplify the expression for total earnings.

15.Simplify: $(40x + 75y) - (6x + 10y)$

16.Charu's quiz scores are: $7p - 3q$, $8p - 4q$ and $6p - 2q$. Find her total score.

Section D: Long Answer Questions ($4 \times 5 = 20$ Marks)

17.The price of one coconut is ₹35 and one kg jaggery is ₹60. Write an expression for the total amount paid for c coconuts and j kg jaggery.

18.A rectangle has length l and breadth b . Derive the simplified expression for its perimeter.

19.Explain why: $4v + 3v = 7v$ using the distributive property.

20. Simplify completely: $(4x + 3y) - (3x + 4y)$

Case Study Based Questions ($2 \times 4 = 8$ Marks)

21. Matchstick Pattern

Parthiv makes L-shapes using matchsticks. Each L requires 2 matchsticks.

- (i) How many matchsticks are needed for 8 L-shapes?
- (ii) Write an expression for n L-shapes.

22. Furniture Rental

A shop rents:

- Chair = ₹40
- Table = ₹75

If x chairs and y tables are rented:

- (i) Write an expression for total amount paid.
- (ii) If 2 chairs and 3 tables are rented, find the amount paid.

Self Assessment:

I understood all the concepts:

☐ Yes☐ No

I need more practice:

☐ Yes☐ No

Name of Concepts having doubts/Not Cleared: _____

Parent's Assessment:

My ward understood all the concepts:

☐ Yes

☐ No

He/She needs more practice:

☐ Yes

☐ No

Name of Concepts having doubts/Not cleared: _____

Signature of Parent:

Teacher's Assessment:

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Answers of Worksheet-1

Q.No.	1	2	3	4	5	6	7	8	9	10
Ans	b	c	d	c	b	b	b	c	c	b
Q.No.	11	12	13	14	15	16	17	18	19	20
Ans	b	c	a	b	b	b	c	b	c	a

Answers of Worksheet-2

Q.No.	1	2	3	4	5	6	7	8
Ans	$x + 4$	$Y - 7$	21	13	$5p$	$20 + k$	0	$2q$
Q.No.	9	10	11	12	13	14	15	16
Ans	$35x$	$60y$	$6p + 3q$	$4x + 3y$	28cm	18c	$34x + 65y$	$21p - 9q$
Q.No.	17	18	19	20	21	22		
Ans	$35c + 60j$	$2l + 2b$	Like terms: $(4 + 3)v = 7v$	$x - y$	16, 2n	$40x + 75y$, ₹305,		