Revisiting Arithmetic Expressions and Omission of Multiplication Symbol

i. Definition and Explanation

As we move from basic arithmetic to algebra, the way we write mathematical expressions changes to become simpler and clearer. One of the most common changes is omitting (leaving out) the multiplication symbol (×) in certain situations.

Arithmetic Expression: A combination of numbers, operators (+, -, ×, ÷), and sometimes grouping symbols (like parentheses).

- Example: 5 + (3 × 4)

Algebraic Expression: An expression that includes at least one variable (a letter representing an unknown number), along with numbers and operators.

- Example: 5 + (3 × a)

The main reason we omit the multiplication symbol is to avoid confusion, especially with the variable 'x'. The expression 5 × x looks very similar to 5xx. By writing it as 5x, we make it cleaner and easier to read.

ii. Key Points and Important Terms

Variable: A letter or symbol that represents an unknown value (e.g., x, y, a, b).

Constant: A number with a fixed value (e.g., 7, -2, 100).

Coefficient: The number that is multiplied by a variable. It is written directly in front of the variable.

- In the term 7y, the coefficient is 7. This means 7 × y.

Term: A single number, a single variable, or numbers and variables multiplied together. Terms are separated by + or - signs.

- In the expression 4x + 3y - 9, the terms are 4x, 3y, and 9.

The Rules for Omitting the Multiplication Symbol (×):

We can omit the × symbol in the following cases:

1. Between a number (coefficient) and a variable:
   - 6 × y is written as 6y.
   - a × 10 is written as 10a (Conventionally, the coefficient is written first).

2. Between two or more variables:
    - a × b is written as ab.
    - x × y × z is written as xyz (Conventionally, variables are written in alphabetical order).
3. Between a number and a set of parentheses:
    - 4 × (x + 2) is written as 4(x + 2).
4. Between a variable and a set of parentheses:
    - a × (b - 5) is written as a(b - 5).
5. Between two sets of parentheses:
    - (x + 1) × (y + 3) is written as (x + 1)(y + 3).

CRITICAL RULE: You CANNOT omit the multiplication symbol between two numbers.

- 5 × 6 must be written as 5 × 6. It cannot be written as 56.

iii. Detailed Examples with Solutions

Here are examples showing how to rewrite expressions by omitting the multiplication symbol.

Original Expression	Simplified Algebraic Expression	Explanation
8 × m	8m	**Rule 1:** Between a number and a variable.
p × q	pq	**Rule 2:** Between two variables.
b × a × 5	5ab	**Rule 1 & 2:** The number (coefficient) comes first, then variables alphabetically.
7 × (a + 3)	7(a + 3)	**Rule 3:** Between a number and parentheses.
(x - 4) × (y + 2)	(x - 4)(y + 2)	**Rule 5:** Between two sets of parentheses.
(2 × x) + (3 × y)	2x + 3y	Apply the rule to each term separately.
1 × n	n	When the coefficient is 1, we don't need to write it. 1n is the same as n.
-4 × c	-4c	The rule also applies to negative numbers.

iv. Summary of Main Concepts

- In algebra, we omit the multiplication symbol (×) to make expressions cleaner and avoid confusion with the variable x.
- This is done between a number and a variable (5a), between variables (xy), and involving parentheses (4(x+2)).
- Crucially, never omit the multiplication symbol between two numbers (7 × 8 is not 78).
- The number in front of a variable is called the coefficient. It is being multiplied by the variable.
- Standard convention is to write the coefficient first, followed by variables in alphabetical order (e.g., 2ab).
- A term like 1x is simply written as x.