TYBA COACHING CENTRE, AJMER

RMS / RMC CLASS VI MATHEMATICS • CHAPTER 19: ALGEBRAIC EXPRESSIONS & SIMPLE EQUATIONS — MASTER NOTES

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1. INTRODUCTION TO ALGEBRA: CONSTANTS, VARIABLES & TERMS — Section 1

1.1 What is Algebra? (बीजगणित क्या है?): Algebra is the branch of mathematics in which letters (symbols) are used to represent unknown numbers. These letters follow all arithmetic rules (+, −, ×, ÷).
• **Variable (चर):** A symbol (x, y, z, m, n) that can take different numerical values.
• **Constant (अचर):** A symbol with a fixed numerical value (e.g., 4, −9, 100, π).
• **Term (पद):** Parts of an expression separated by **+** or **−** signs (in 5x − 3y + 8, the terms are 5x, −3y, and 8).
• **Numerical Coefficient (संख्यात्मक गुणांक):** The number multiplying the variable in a term (in −7xy, the coefficient is **−7**).

बीजगणित में अज्ञात संख्याओं को अक्षरों (चर) से दर्शाया जाता है। '+' या '−' चिह्न से अलग होने वाले भाग 'पद' कहलाते हैं।

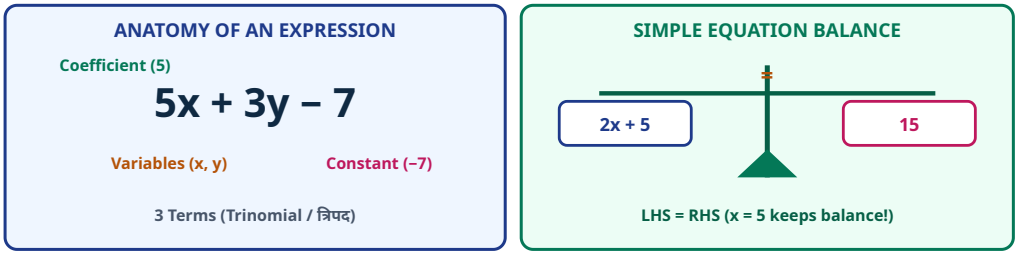

Figure 1: Parts of an Algebraic Expression (व्यंजक के भाग) & Equation Balance (समीकरण संतुलन)

2. LIKE vs UNLIKE TERMS & POLYNOMIAL TYPES — Section 2

2.1 Like Terms & Unlike Terms (सजातीय एवं विजातीय पद):
• **Like Terms:** Terms having the **exact same algebraic factors (same letters with same exponents)**. Example: $4x^2y$ and $-9x^2y$ are like terms.
• **Unlike Terms:** Terms with different variables or different powers. Example: 3x and $3x^2$ are unlike terms; 5xy and 5x are unlike terms.
• **Golden Addition Rule:** Only **Like Terms** can be combined by adding/subtracting their coefficients! Unlike terms stay separate.

समान चर और समान घात वाले पद सजातीय (Like) होते हैं। केवल सजातीय पदों को ही जोड़ा या घटाया जा सकता है।

Solved Example 1 (Identify Coefficient & Terms): In the expression $7x^2 - 5xy + 12$, state: (a) Number of terms (b) Coefficient of xy (c) Constant term.
Solution: (a) **3 terms** (Trinomial); (b) Coefficient of xy = **−5**; (c) Constant term = **12**.

हल: (a) 3 पद (त्रिपदी); (b) xy का गुणांक = −5; (c) अचर पद = 12।

Solved Example 2 (Group Like Terms): Simplify: 5x + 3y − 2x + 7y − 4.
Solution: Group like terms: (5x − 2x) + (3y + 7y) − 4 = **3x + 10y − 4**.

हल: सजातीय पदों को मिलाने पर: (5x − 2x) + (3y + 7y) − 4 = 3x + 10y − 4।

3. ADDITION, SUBTRACTION & EVALUATION OF EXPRESSIONS — Section 3

3.1 Rules for Operations & Value Finding:
• **Addition:** Put expressions together and combine like terms.
• **Subtraction ("Subtract A from B" = B − A):** Reverse the sign of EVERY term in the expression being subtracted (+ becomes −, − becomes +)!
• **Evaluation (मान ज्ञात करना):** Replace each variable with its given numerical value inside brackets and simplify using BODMAS.

'A को B में से घटाएँ' का अर्थ है B − A; घटाते समय दूसरे व्यंजक के सभी चिह्न बदल दें।

Solved Example 3 (Addition of Expressions): Add (3a + 5b − 2c) and (4a − 2b + 7c).
Solution: (3a + 4a) + (5b − 2b) + (−2c + 7c) = **7a + 3b + 5c**.

हल: (3+4)a + (5−2)b + (−2+7)c = 7a + 3b + 5c।

Solved Example 4 (Subtraction Trap!): Subtract (2x − 5y + 3) from (7x + 2y − 4).
Solution: (7x + 2y − 4) − (2x − 5y + 3) = 7x + 2y − 4 − 2x + 5y − 3 = **5x + 7y − 7**.

हल: 7x + 2y − 4 − 2x + 5y − 3 = 5x + 7y − 7।

Solved Example 5 (Evaluating Expression): Find the value of $3x^2 - 4x + 7$ when x = 3.
Solution: $3(3)^2 - 4(3) + 7 = 3(9) - 12 + 7 = 27 - 12 + 7 =$ **22**.

हल: x = 3 रखने पर: 3(9) − 12 + 7 = 27 − 12 + 7 = 22।

Solved Example 6 (Two Variables): Evaluate 5a − 2b + ab when a = 4 and b = 3.
Solution: 5(4) − 2(3) + (4)(3) = 20 − 6 + 12 = **26**.

हल: 5(4) − 2(3) + 12 = 20 − 6 + 12 = 26।

4. TRANSLATING WORD STATEMENTS TO ALGEBRA (कथनों से समीकरण) — Section 4

English Phrase (अंग्रेजी कथन)	Meaning	Algebraic Form
Sum of x and 8 / x increased by 8	Addition	x + 8
5 less than x / 5 subtracted from x	Subtraction	**x − 5** (not 5 − x!)
Product of 6 and y / 6 times y	Multiplication	6y
Half of m / m divided by 2	Division	m / 2
3 more than twice x equals 19	Equation	2x + 3 = 19

Solved Example 7 (Age Expression): Rahul's present age is x years. Express: (a) his age 5 years ago, (b) his father's age if father is 3 times as old as Rahul plus 4 years.
Solution: (a) **(x − 5) years**; (b) **(3x + 4) years**.

हल: (a) 5 वर्ष पूर्व आयु = (x − 5) वर्ष; (b) पिता की आयु = (3x + 4) वर्ष।

5. SOLVING SIMPLE LINEAR EQUATIONS (सरल रेखीय समीकरण हल करना) — Section 5

5.1 What is a Simple Equation? An equation is a statement of equality (containing **=**) between two expressions: **LHS = RHS**. The value of the variable that satisfies LHS = RHS is called the **Solution (Root)** of the equation.
• **Transposition Method:** Shift constants to RHS and variables to LHS, reversing signs (+ ↔ −, × ↔ ÷).

समीकरण में '=' चिह्न होता है (बायाँ पक्ष = दायाँ पक्ष)। पक्षांतरण विधि से चर को एक तरफ व संख्याओं को दूसरी तरफ ले जाकर हल करते हैं।

Solved Example 8 (One-Step): Solve: x + 13 = 29.
Solution: x = 29 − 13 = **16**.

हल: x = 29 − 13 = 16।

Solved Example 9 (Two-Step): Solve: 4x − 9 = 23.
Solution: 4x = 23 + 9 = 32 ⇒ x = 32 ÷ 4 = **8**.

हल: 4x = 23 + 9 = 32 ⇒ x = 8।

Solved Example 10 (Variables on Both Sides): Solve: 5x + 4 = 2x + 19.
Solution: 5x − 2x = 19 − 4 ⇒ 3x = 15 ⇒ x = **5**.

हल: 5x − 2x = 19 − 4 ⇒ 3x = 15 ⇒ x = 5।

Solved Example 11 (Fraction Equation): Solve: (x / 3) + 5 = 11.
Solution: x / 3 = 11 − 5 = 6 ⇒ x = 6 × 3 = **18**.

हल: x/3 = 11 − 5 = 6 ⇒ x = 6 × 3 = 18।

Solved Example 12 (Bracket Equation): Solve: 3(x − 4) = 21.
Solution: Divide by 3: x − 4 = 21 ÷ 3 = 7 ⇒ x = 7 + 4 = **11**.

हल: x − 4 = 21 ÷ 3 = 7 ⇒ x = 7 + 4 = 11।

6. RMS CET HIGH-YIELD WORD PROBLEMS (EXAMPLES 13–20) Section 6

Solved Example 13 (Number Puzzle): When 7 is added to 4 times a number, the result is 35. Find the number.
Solution: 4x + 7 = 35 ⇒ 4x = 28 ⇒ x = **7**.

हल: 4x + 7 = 35 ⇒ 4x = 28 ⇒ x = 7।

Solved Example 14 (Consecutive Integers): The sum of three consecutive natural numbers is 48. Find the numbers.
Solution: Let numbers be x, x+1, x+2. Sum = 3x + 3 = 48 ⇒ 3x = 45 ⇒ x = 15. Numbers are **15, 16, 17**.

हल: x + (x+1) + (x+2) = 48 ⇒ 3x + 3 = 48 ⇒ x = 15। संख्याएँ 15, 16, 17 हैं।

Solved Example 15 (Perimeter Equation): The length of a rectangle is 4 cm more than its breadth. If its perimeter is 36 cm, find its breadth.
Solution: Let breadth = x, length = x + 4. 2(x + x + 4) = 36 ⇒ 2x + 4 = 18 ⇒ 2x = 14 ⇒ x = **7 cm**.

हल: 2(x + x + 4) = 36 ⇒ 2x + 4 = 18 ⇒ चौड़ाई = 7 सेमी।

Solved Example 16 (Age Word Problem): A father is 4 times as old as his son. If the sum of their ages is 45 years, find the son's age.
Solution: Let son = x, father = 4x. x + 4x = 45 ⇒ 5x = 45 ⇒ x = **9 years**.

हल: x + 4x = 45 ⇒ 5x = 45 ⇒ पुत्र की आयु = 9 वर्ष।

Solved Example 17 (Fraction Word Problem): One-fifth of a number is 3 more than one-sixth of the same number. Find the number.
Solution: (x/5) − (x/6) = 3 ⇒ (6x − 5x)/30 = 3 ⇒ x/30 = 3 ⇒ x = **90**.

हल: x/5 − x/6 = 3 ⇒ x/30 = 3 ⇒ x = 90।

Solved Example 18 (Coin / Money Problem): Raju has ₹50 in ₹5 and ₹2 coins. If he has 6 coins of ₹5, how many ₹2 coins does he have?
Solution: 6(5) + 2x = 50 ⇒ 30 + 2x = 50 ⇒ 2x = 20 ⇒ x = **10 coins**.

हल: 30 + 2x = 50 ⇒ 2x = 20 ⇒ ₹2 के 10 सिक्के हैं।

Solved Example 19 (Triangle Angles Algebra): The three angles of a triangle are x°, 2x°, and 3x°. Find each angle.
Solution: x + 2x + 3x = 180° ⇒ 6x = 180° ⇒ x = 30°. Angles = **30°, 60°, 90°**.

हल: 6x = 180° ⇒ x = 30°। कोण 30°, 60°, 90° हैं।

Solved Example 20 (Distributive Multiplication): Expand and simplify: 4(x + 3) + 2(x − 5).
Solution: 4x + 12 + 2x − 10 = **6x + 2**.

हल: 4x + 12 + 2x − 10 = 6x + 2।

7. EXTRA ALGEBRAIC IDENTITIES & ADVANCED EXAMPLES (EX 21–26) Section 7

Solved Example 21 (Cross-Multiplication): Solve: (2x + 1) / 3 = 5.
Solution: 2x + 1 = 5 × 3 = 15 ⇒ 2x = 14 ⇒ x = **7**.

हल: 2x + 1 = 15 ⇒ 2x = 14 ⇒ x = 7।

Solved Example 22 (Negative Substitution): Find the value of $2a^2 - 3a + 1$ when a = −2.
Solution: $2(-2)^2 - 3(-2) + 1 = 2(4) + 6 + 1 = 8 + 6 + 1 =$ **15**.

हल: 2(4) + 6 + 1 = 15।

Solved Example 23 (Degree of Polynomial): What is the degree (highest power) of $4x^3 + 7x^2 - 2x + 9$?
Solution: Highest power of variable x is **3**, so degree = **3**.

हल: चर x की अधिकतम घात 3 है, अतः बहुपद की घात = 3।

Solved Example 24 (Ratio Equation): Two numbers are in ratio 3 : 5 and their difference is 18. Find the numbers.
Solution: 5x − 3x = 18 ⇒ 2x = 18 ⇒ x = 9. Numbers = **27 and 45**.

हल: 5x − 3x = 18 ⇒ x = 9। संख्याएँ 27 व 45 हैं।

Solved Example 25 (Matchstick Pattern): A square uses 4 matchsticks, 2 joined squares use 7, 3 use 10. Write the general rule for n squares.
Solution: Rule = **3n + 1** (Check: n=1 → 4, n=2 → 7, n=3 → 10).

हल: सामान्य नियम = 3n + 1।

Solved Example 26 (Check Solution): Is x = 4 a solution of 3x − 2 = 10?
Solution: Put x = 4 in LHS: 3(4) − 2 = 12 − 2 = 10 = RHS. **Yes!**

हल: LHS = 3(4) − 2 = 10 = RHS। हाँ, x = 4 सही हल है!

8. COMMON EXAM TRAPS & 100% SCORE CHECKLIST Section 8

Common RMS Exam Mistake (सामान्य गलती)	Correct Rule (सही नियम)
Adding unlike terms: 3x + 2y = 5xy	Unlike terms CANNOT be added — leave as **3x + 2y**
Writing "5 less than x" as 5 − x	"5 less than x" means **x − 5**
Forgetting sign change on subtraction	Subtracting (2x − 3) gives **−2x + 3**

Common RMS Exam Mistake (सामान्य गलती)	Correct Rule (सही नियम)
Saying coefficient of −x is 1	Coefficient of −x is **−1** (always include the minus sign!)

9. HIGH-YIELD RMS CET ALGEBRA SOLVED BANK & QUICK FORMULAS (EX 27–30) Section 9

Solved Example 27 (Two-Step Fraction Equation): Solve: (3x − 2) / 4 = 7.
Solution: 3x − 2 = 7 × 4 = 28 ⇒ 3x = 30 ⇒ x = **10**.

हल: 3x − 2 = 28 ⇒ 3x = 30 ⇒ x = 10।

Solved Example 28 (Sum of Three Consecutive Even Numbers): The sum of three consecutive even numbers is 42. Find the numbers.
Solution: x + (x+2) + (x+4) = 42 ⇒ 3x + 6 = 42 ⇒ 3x = 36 ⇒ x = 12. Numbers = **12, 14, 16**.

हल: 3x + 6 = 42 ⇒ x = 12। संख्याएँ = 12, 14, 16।

Solved Example 29 (Perimeter of Triangle): The sides of a triangle are (x + 1), (2x − 3), and (3x + 2). Find its perimeter.
Solution: Perimeter = (x + 2x + 3x) + (1 − 3 + 2) = **6x**.

हल: परिमाप = (1+2+3)x + (1−3+2) = 6x।

Solved Example 30 (Cost Equation): 5 pens and 1 notebook of ₹20 cost ₹65 in total. Find the cost of 1 pen.
Solution: 5x + 20 = 65 ⇒ 5x = 45 ⇒ x = **₹9**.

हल: 5x + 20 = 65 ⇒ 5x = 45 ⇒ 1 पेन = ₹9।

Algebraic Rule (बीजगणितीय नियम)	Formula / Example (सूत्र / उदाहरण)
Commutative Law of Addition	a + b = b + a (e.g., x + 5 = 5 + x)
Commutative Law of Multiplication	a × b = b × a (e.g., 3x = x × 3)
Distributive Law	a(b + c) = ab + ac (e.g., 3(x + 2) = 3x + 6)

10. RMS CET ALGEBRA ONE-LINER REVISION BANK (EX 31–34) Section 10

Solved Example 31 (Opposite of Expression): Find the additive inverse (opposite) of (4x − 7y + 9).
Solution: Reverse all signs: **−4x + 7y − 9**.

हल: सभी चिह्न बदलने पर: −4x + 7y − 9।

Solved Example 32 (Product of Monomials): Multiply (3x) × ($5x^2$) × (2y).
Solution: Multiply numbers (3×5×2 = 30) and add powers of x (1+2 = 3): **$30x^3y$**.

हल: (3×5×2) × x^{1+2} × y = $30x^3y$।

Solved Example 33 (Square of Binomial): Find $(x + 5)^2$ using $(a + b)^2 = a^2 + 2ab + b^2$.
Solution: $x^2 + 2(x)(5) + 5^2$ = **$x^2 + 10x + 25$**.

हल: $x^2 + 10x + 25$।

Solved Example 34 (Speed & Distance Equation): A car covers 50x km in 5 hours. Express its speed.
Solution: Speed = Distance ÷ Time = 50x ÷ 5 = **10x km/hr**.

हल: चाल = दूरी ÷ समय = 50x ÷ 5 = 10x किमी/घंटा।

Narayan Sir's Final Revision Mantra: (1) Only **Like Terms** add or subtract. (2) Always reverse signs when transposing across '=' or subtracting an expression. (3) Substitute your final answer back into LHS to verify **LHS = RHS** in 5 seconds!

अंतिम मंत्र: (1) केवल सजातीय पद जुड़ते-घटते हैं। (2) घटाते व पक्षांतरण करते समय चिह्न अवश्य बदलें। (3) LHS = RHS की जाँच करें!