RMS

EXCELLENCE

MATHEMATICS

CLASS VI

Rashtriya Military School

Aligned with NCERT & CBSE Syllabus

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PREFACE

A Message to Our Cadets

Dear Cadet,

Mathematics is the language of precision, logic, and discipline — values at the heart of the Rashtriya Military School tradition. This textbook has been crafted to give you a strong mathematical foundation through clear concept explanations, fully worked examples, and challenging exercises that build both speed and accuracy.

Each chapter follows the NCERT Class 6 curriculum and is enriched with problems that develop analytical thinking. You will find: **concept boxes** that summarise key ideas, **solved examples** with step-by-step working, **formula boxes** for quick revision, and **graded exercises** ranging from basic to higher-order thinking.

Remember: every great officer was once a determined cadet who refused to give up on a hard problem. Approach each question with the same discipline you bring to the parade ground.

How to Use This Book:

1. Read each concept section carefully *before* looking at examples.
2. Work through Solved Examples with pen and paper — do not just read them.
3. Attempt all Exercise problems independently before checking answers.
4. Use the Key Formulas box at the end of each chapter for revision.
5. For the Model Test Paper, time yourself strictly.

— The Mathematics Faculty, RMS

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KNOWING OUR NUMBERS

Chapter 1

1.1 Introduction

Numbers are the foundation of all mathematics. In Class 5 you learned to work with numbers up to the crore. In this chapter we extend that knowledge to much larger numbers, study two different systems of writing numbers (Indian and International), learn to compare and order large numbers, and develop the skill of estimation — finding a reasonably close answer quickly without exact calculation.

1.2 Indian Number System

In the Indian system, digits are grouped from the right as: **ones (O), tens (T), hundreds (H)** — then in pairs: **thousands (Th), ten-thousands (T-Th), lakhs (L), ten-lakhs (T-L), crores (C), ten-crores (T-C)**. Commas are placed after every two digits from the right (starting after hundreds).

Place	T-C	C	T-L	L	T-Th	Th	H	T	O
Value	10,00,00,000	1,00,00,000	10,00,000	1,00,000	10,000	1,000	100	10	1

Solved Example 1.1 — Reading and Writing Large Numbers
Write 475238162 using Indian system commas and then in words.
Step 1 — Place commas: 47,52,38,162
Step 2 — Read: Forty-seven crore fifty-two lakh thirty-eight thousand one hundred sixty-two.

Write 908050070 in the Indian system.
Answer: 90,80,50,070 — Ninety crore eighty lakh fifty thousand seventy.

Write 7,06,04,008 in expanded form.
Answer: 7,00,00,000 + 6,00,000 + 4,000 + 8.

1.3 International Number System

In the International system, digits are grouped in threes from the right: **ones, tens, hundreds** (units period) | **thousands, ten-thousands, hundred-thousands** (thousands period) | **millions, ten-millions, hundred-millions** (millions period). Commas separate each group of three.

1 Million = 10 Lakhs = 10,00,000 10 Millions = 1 Crore = 1,00,00,000 1 Billion = 1,000 Millions = 100 Crores = 1,00,00,00,000

Solved Example 1.2 — Converting Between Systems
Write 23,045,678 (International) in the Indian system.
23,045,678 → 2,30,45,678 (Indian)
In words: Two crore thirty lakh forty-five thousand six hundred seventy-eight.

Write 4,75,23,816 (Indian) in the International system.
4,75,23,816 → 47,523,816 (International)
In words: Forty-seven million five hundred twenty-three thousand eight hundred sixteen.

1.4 Comparing and Ordering Large Numbers

Rule 1: A number with **more digits** is always greater. Rule 2: If digit counts are equal, compare digit by digit from the **leftmost** position. Rule 3: To arrange numbers in **ascending** order place smallest first; **descending** order means largest first.

Solved Example 1.3 — Comparing Numbers
(a) Compare 47,83,256 and 9,85,43,102.
9,85,43,102 has 9 digits; 47,83,256 has 7 digits.
Therefore 9,85,43,102 > 47,83,256.

(b) Compare 3,84,92,751 and 3,84,27,950.
Both have 9 digits. Compare left to right:
3=3, 8=8, 4=4, 9>2 → 3,84,92,751 > 3,84,27,950.

(c) Arrange in descending order: 5,32,148 ; 53,21,480 ; 5,32,14,800 ; 53,214.
Digits: 6, 7, 8, 5 → 5,32,14,800 > 53,21,480 > 5,32,148 > 53,214.

1.5 Estimation and Rounding Off

Rounding makes numbers easier to work with. The rule: look at the digit **immediately to the right** of the place you are rounding to. If it is **0–4**, round down (keep the digit, replace all digits to its right with zeros). If it is **5–9**, round up (increase the digit by 1, replace all to the right with zeros).

Solved Example 1.4 — Rounding Off
(a) Round 75,284 to nearest thousand.
Thousands digit = 5. Digit to its right = 2 < 5. Round down → 75,000.

(b) Round 3,68,910 to nearest ten-thousand.
Ten-thousands digit = 6. Digit to its right = 8 ≥ 5. Round up → 3,70,000.

(c) Estimate: 7,83,495 + 3,42,178 (round to nearest ten-thousand).
7,83,495 ≈ 7,80,000 and 3,42,178 ≈ 3,40,000
Estimated sum = 7,80,000 + 3,40,000 = 11,20,000.

(d) Estimate: 8,36,247 × 9 (round to nearest lakh).
8,36,247 ≈ 8,00,000 → Estimated product = 8,00,000 × 9 = 72,00,000.

Exercise 1 — Practice Problems

1. Write using Indian system commas and in words: (a) 987654321 (b) 100100100
2. Write using International system and in words: (a) 4,75,23,816 (b) 3,07,00,405
3. Convert: (a) 15,000,000 to Indian (b) 3,25,67,890 to International
4. Compare using <, > or =: (a) 87,65,432 __ 8,76,54,320 (b) 9,99,99,999 __ 10,00,00,000
5. Arrange in ascending order: 4,56,123 ; 45,61,230 ; 4,56,12,300 ; 456,123
6. Round to nearest thousand: (a) 47,836 (b) 3,64,500 (c) 9,99,501
7. Round to nearest lakh: (a) 45,67,890 (b) 3,49,999 (c) 8,50,001
8. Estimate by rounding to nearest ten-thousand: (a) 86,247 + 54,891 (b) 7,83,456 – 3,19,721
9. A city has population 47,83,216. Round to nearest lakh. Write in International system.
10. The distance from Earth to Sun is 149,600,000 km. Write in Indian system.

WHOLE NUMBERS

Chapter 2

2.1 Natural Numbers and Whole Numbers

Natural Numbers (N): 1, 2, 3, 4, 5, … — the counting numbers. They are infinite; there is no largest natural number. **Whole Numbers (W)**: 0, 1, 2, 3, 4, … — natural numbers plus zero. Zero is the only whole number that is **not** a natural number.

Key Facts

- Every natural number is a whole number.
- 0 is a whole number but NOT a natural number.
- There is no largest whole number — the set is infinite.
- The predecessor of 1 is 0; 0 has no predecessor in whole numbers.

2.2 The Number Line

A number line represents whole numbers as equally-spaced points. Numbers increase to the right. **Addition** = moving right. **Subtraction** = moving left. For example, 3 + 4: start at 3, move 4 steps right → reach 7. And 8 – 5: start at 8, move 5 steps left → reach 3.

2.3 Properties of Whole Numbers

Property	Operation	Mathematical Statement	Example
Closure	Addition & Mult.	$a+b \in W$; $a \times b \in W$	$5+3=8 \in W$
Commutativity	Addition & Mult.	$a+b = b+a$; $a \times b = b \times a$	$4+7=7+4=11$
Associativity	Addition & Mult.	$(a+b)+c = a+(b+c)$	$(2+3)+4=2+(3+4)$
Distributivity	Mult. over Add/Sub	$a \times (b+c)=a \times b+a \times c$	$3 \times (4+5)=3 \times 4+3 \times 5$
Identity (Add)	Addition	$a + 0 = a$	$17 + 0 = 17$
Identity (Mult)	Multiplication	$a \times 1 = a$	$25 \times 1 = 25$
Zero Mult.	Multiplication	$a \times 0 = 0$	$99 \times 0 = 0$
Closure fails	Subtraction & Div.	$a-b$ or $a \div b$ may not be in W	$3-5 \notin W$

Solved Example 2.1 — Using Properties for Fast Calculation

(a) Find 74 × 102 using distributivity.
74 × 102 = 74 × (100 + 2) = 7400 + 148 = 7,548

(b) Find 625 × 98 using distributivity.
625 × 98 = 625 × (100 – 2) = 62,500 – 1,250 = 61,250

(c) Find 345 + 478 + 655 using commutativity and associativity.
= (345 + 655) + 478 = 1,000 + 478 = 1,478 (group pairs that sum to 1000)

(d) Simplify: 36 × 5 × 2 × 4.
= (36 × 4) × (5 × 2) = 144 × 10 = 1,440

2.4 Patterns in Whole Numbers

Whole numbers exhibit beautiful arithmetic patterns. Recognising patterns helps in mental calculation and builds number sense.

Pattern	Rule	Illustration
Sum of first n odd numbers	$= n^2$	$1+3+5+7 = 16 = 4^2$
Sum of first n natural numbers	= n(n+1)/2	1+2+…+10 = 55
Triangular numbers	1, 3, 6, 10, 15, …	Difference increases by 1
Square numbers	1, 4, 9, 16, 25, …	Difference: 3, 5, 7, 9, …
Multiplication by 9	Digit sum = 9	9×8=72; 7+2=9

Solved Example 2.2 — Pattern Recognition

(a) Using the pattern 1+3+5+…, find the sum of first 12 odd numbers.
Sum = 12^2 = 144.

(b) Find 1+2+3+…+50.
Sum = 50×51/2 = 1,275.

(c) Identify the pattern and write next 3 terms: 2, 6, 12, 20, 30, __, __, __
Differences: 4, 6, 8, 10 → next differences 12, 14, 16
Next terms: 42, 56, 72.

Exercise 2 — Practice Problems

1. Write predecessor and successor of: (a) 1,00,000 (b) 9,99,999 (c) 5,00,000,000
2. Fill blanks: (a) $0 \div 7 =$ __ (b) $15 \div 0 =$ __ (c) $0 \times 1{,}234 =$ __ (d) $1 \times 9{,}876 =$ __
3. Use distributive property: (a) 47×103 (b) 625×98 (c) 345×999 (d) 1005×96
4. Verify associativity: (a) $(45+78)+22 = 45+(78+22)$ (b) $(12 \times 5) \times 4 = 12 \times (5 \times 4)$
5. Find using smart grouping: (a) $348+527+452+673$ (b) $25 \times 47 \times 4$ (c) $8 \times 125 \times 16$
6. Find sum of first 15 odd numbers. Verify using pattern.
7. Find $1+2+3+\ldots+100$ using formula.
8. A book costs Rs 348. Find cost of 102 books using distributive property.
9. A factory produces 1,25,999 items a day. How many in 7 days? Round to nearest lakh.
10. Find the pattern: 1, 8, 27, 64, ___, ___. Name this sequence.

PLAYING WITH NUMBERS

Chapter 3

3.1 Factors and Multiples

If a × b = c, then a and b are **factors** of c, and c is a **multiple** of both a and b. For example, 3 × 4 = 12, so 3 and 4 are factors of 12, and 12 is a multiple of 3 and of 4.

- 1 is a factor of every whole number.
- Every number is a factor of itself.
- Every number is a multiple of itself.
- The number of factors of any number is finite; multiples are infinite.
- A number is a perfect number if the sum of its proper factors equals itself (e.g. 6 = 1+2+3).

Solved Example 3.1 — Finding Factors
Find all factors of 36.
1×36, 2×18, 3×12, 4×9, 6×6
Factors of 36: 1, 2, 3, 4, 6, 9, 12, 18, 36 (9 factors)

Find all factors of 120.
1,2,3,4,5,6,8,10,12,15,20,24,30,40,60,120 (16 factors)

Is 7 a factor of 105? 105 ÷ 7 = 15 (remainder 0) → Yes.

3.2 Prime and Composite Numbers

A **prime number** has exactly 2 factors: 1 and itself. A **composite number** has more than 2 factors. **1** is neither prime nor composite — it has only 1 factor. **2** is the only even prime number.

Primes up to 100: 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, 97

Twin Primes: prime pairs differing by 2 — (3,5), (5,7), (11,13), (17,19), (29,31), (41,43). **Co-primes**: two numbers whose HCF is 1 — e.g. 8 and 15 (need not individually be prime). **Prime triplet**: (3, 5, 7) is the only prime triplet.

3.3 Tests of Divisibility

Divisible by	Rule	Test on 7,92,540
2	Last digit even (0,2,4,6,8)	Last digit 0 → ✓
3	Sum of all digits divisible by 3	7+9+2+5+4+0=27 → ✓
4	Last two digits divisible by 4	40 ÷ 4 = 10 → ✓
5	Last digit 0 or 5	Last digit 0 → ✓
6	Divisible by both 2 AND 3	✓ and ✓ → ✓
8	Last three digits divisible by 8	540 ÷ 8 = 67.5 → ✗

9	Sum of digits divisible by 9	27 ÷ 9 = 3 → ✓
10	Last digit 0	Last digit 0 → ✓
11	(Sum of odd-place digits) – (Sum of even-place digits) = 0 or multiple of 11	(0+5+9)–(4+2+7)=14–13=1 → ✗

Solved Example 3.2 — Divisibility Tests
Check 5,34,678 for divisibility by 2, 3, 6, 9, and 11.
By 2: last digit 8 (even) → Yes.
By 3: 5+3+4+6+7+8 = 33, 33÷3=11 → Yes.
By 6: divisible by both 2 and 3 → Yes.
By 9: 33 is not divisible by 9 → No.
By 11: (8+6+3)–(7+4+5) = 17–16 = 1 → No.

3.4 Prime Factorisation

Every composite number can be expressed as a product of primes in exactly one way (Fundamental Theorem of Arithmetic). Use a **factor tree** or **repeated division** by primes.

Solved Example 3.3 — Prime Factorisation
Find the prime factorisation of 360.
360 = 2×180 = 2×2×90 = 2×2×2×45 = 2×2×2×3×15 = 2×2×2×3×3×5
$= 2^3 \times 3^2 \times 5$

Find prime factorisation of 2520.
$2520 = 2^3 \times 3^2 \times 5 \times 7$

3.5 HCF — Highest Common Factor

The HCF (also called GCD) of two or more numbers is the greatest number that divides all of them exactly. Methods: (1) Prime factorisation — take product of **common prime factors with lowest powers**. (2) Repeated division (Euclid's method).

Solved Example 3.4 — HCF
Find HCF of 84 and 120 by prime factorisation.
$84 = 2^2 \times 3 \times 7$
$120 = 2^3 \times 3 \times 5$
Common primes: 2 (lowest power 2^2) and 3 (power 3^1)
$HCF = 2^2 \times 3 = 4 \times 3 = 12$

Find HCF of 45, 60, 75.
$45=3^2\times5$; $60=2^2\times3\times5$; $75=3\times5^2$
$HCF = 3^1 \times 5^1 = 15$

3.6 LCM — Lowest Common Multiple

The LCM of two or more numbers is the smallest number that is a multiple of all of them. By prime factorisation: take the product of **all prime factors with the highest power** in any of the numbers.

For two numbers: HCF × LCM = Product of the two numbers

Solved Example 3.5 — LCM and Application

Find LCM of 36 and 48.

36 = $2^2 \times 3^2$ 48 = 2■ × 3

LCM = 2■ × 3^2 = 16 × 9 = 144

Check: HCF(36,48) = 12. 12 × 144 = 1728 = 36 × 48 ✓

Three bells ring every 8, 12, and 18 minutes. They all ring at 9:00 AM.
When will they next all ring together?

LCM(8,12,18): $8=2^3$; $12=2^2\times3$; $18=2\times3^2$ → LCM = $2^3\times3^2$ = 72 minutes.

Answer: 9:00 AM + 72 min = 10:12 AM.

Exercise 3 — Practice Problems

1. Find all factors of: (a) 72 (b) 144 (c) 225
2. Write first 6 multiples of: (a) 13 (b) 17 (c) 25
3. Using divisibility tests, check 8,64,720 for divisibility by 2,3,4,5,6,8,9,10,11.
4. Find prime factorisation: (a) 180 (b) 252 (c) 3375 (d) 1764
5. Find HCF: (a) 56 and 98 (b) 84,120 and 156 (c) 625 and 3125
6. Find LCM: (a) 24 and 36 (b) 15,20 and 25 (c) 8,12,15 and 18
7. HCF of two numbers is 12 and LCM is 360. One number is 60. Find the other.
8. Find the greatest number that divides 455 and 572 leaving remainders 5 and 7.
9. Three pipes fill a tank in 6, 8, and 12 hours. If all three open together, when is the tank full?
10. Find the smallest number divisible by 12, 15, 18, and 27.

INTEGERS

Chapter 6

6.1 Introduction — Need for Negative Numbers

Whole numbers cannot represent situations like temperatures below zero, depths below sea level, money owed, or floors below ground. **Integers** extend the number system to include negative numbers. The set of integers is: … –4, –3, –2, –1, 0, 1, 2, 3, 4, …

Positive integers: 1, 2, 3, … (right of 0 on number line)
Negative integers: –1, –2, –3, … (left of 0 on number line)
Zero (0): neither positive nor negative
Opposite (Additive Inverse): the opposite of +5 is –5; opposite of –8 is +8
Absolute Value |n|: distance from zero; |–7| = 7, |+7| = 7

6.2 Ordering Integers

On the number line, numbers increase to the right. So any negative integer is less than zero, and less than any positive integer. Among negative integers, the one farther from zero is smaller: –10 < –3.

Solved Example 6.1 — Ordering and Comparing
(a) Arrange in ascending order: –7, 3, –2, 0, 5, –10, 1.
–10, –7, –2, 0, 1, 3, 5

(b) Which is greater: –45 or –54?
–45 is closer to 0, so –45 > –54.

(c) Write all integers between –4 and 3.
–3, –2, –1, 0, 1, 2 (not including –4 and 3)

6.3 Addition of Integers

Case	Rule	Example
(+) + (+)	Add, keep positive sign	(+8)+(+5) = +13
(–) + (–)	Add absolute values, keep –	(–6)+(–4) = –10
(+) + (–)	Subtract smaller |value|, keep sign of larger	(+8)+(–5) = +3
(–) + (+)	Subtract smaller |value|, keep sign of larger	(–9)+(+4) = –5

Solved Example 6.2 — Addition
(a) (–17) + (+9) = –(17–9) = –8
(b) (–23) + (–15) = –38
(c) (+34) + (–50) = –(50–34) = –16
(d) Simplify: (–8) + (+5) + (–3) + (+12)
Positives: 5+12=17; Negatives: 8+3=11; Result: 17–11 = +6

6.4 Subtraction of Integers

a – b = a + (–b) [Change subtraction to adding the opposite]

Solved Example 6.3 — Subtraction
(a) 8 – (–3) = 8 + 3 = 11
(b) –5 – 7 = –5 + (–7) = –12
(c) –4 – (–9) = –4 + 9 = 5
(d) 0 – (–15) = 0 + 15 = 15

Word problem: Temperature at noon = 12°C. It fell 18°C by midnight.
Midnight temperature = 12 – 18 = 12 + (–18) = –6°C.

6.5 Properties of Integer Addition

Property	Statement	Example
Closure	a + b ∈ Z	(–3)+(+5) = 2 ∈ Z
Commutativity	a + b = b + a	(–4)+7 = 7+(–4) = 3
Associativity	(a+b)+c = a+(b+c)	(–2+5)+3 = –2+(5+3)
Identity	a + 0 = a	(–9)+0 = –9
Inverse	a + (–a) = 0	7+(–7) = 0

Exercise 6 — Practice Problems

1. Write the additive inverse of: (a)+17 (b)–39 (c) 0 (d)–100 (e)+1000
2. Find absolute value: (a)|–23| (b)|+45| (c)|0| (d)|–1000|
3. Arrange in descending order: –15, 8, –3, 0, –20, 12, –8
4. Add: (a)(–45)+(+28) (b)(–37)+(–53) (c)(+62)+(–85) (d)(–100)+(+100)
5. Subtract: (a)15–(–8) (b)(–12)–9 (c)(–20)–(–15) (d)0–(–50)
6. Simplify: (–15)+(+8)–(–12)+(–5)–(+20)
7. A diver is 85 m below sea level. She rises 37 m. Find her new position.
8. In Leh, temperature fell from 4°C to –9°C overnight. Find the fall in temperature.
9. A submarine descends 300 m, then ascends 175 m. Find its final position relative to sea level.
10. Verify: (–8 + 5) + (–3) = –8 + (5 + (–3)) using both sides.

FRACTIONS

Chapter 7

7.1 Types of Fractions

Type	Definition	Examples
Proper	Numerator < Denominator	3/5, 7/9, 11/15
Improper	Numerator ≥ Denominator	7/4, 11/3, 5/5
Mixed	Whole number + proper fraction	2■, 5¾, 3■
Like	Same denominator	2/7, 5/7, 9/7
Unlike	Different denominators	1/2, 2/3, 3/5
Equivalent	Same value (multiply/divide n & d by same number)	1/2=2/4=3/6=4/8
Unit	Numerator = 1	1/2, 1/5, 1/11

Solved Example 7.1 — Conversions
Convert 23/7 to a mixed number.
23 ÷ 7 = 3 remainder 2 → 3²⁄■

Convert 4³⁄■ to an improper fraction.
4×5 + 3 = 23 → 23/5

Write 3 equivalent fractions for 2/5.
2/5 = 4/10 = 6/15 = 8/20

7.2 Comparing Fractions

Like fractions: compare numerators directly. Unlike fractions: convert to equivalent fractions with the LCM as common denominator, then compare numerators.

Solved Example 7.2 — Comparing and Ordering
(a) Compare 3/4 and 5/6.
LCM(4,6)=12. 3/4=9/12; 5/6=10/12. 9<10 → 3/4 < 5/6.

(b) Arrange in ascending order: 5/6, 3/4, 7/12, 2/3.
LCM(6,4,12,3)=12.
5/6=10/12; 3/4=9/12; 7/12=7/12; 2/3=8/12.
Ascending: 7/12, 2/3, 3/4, 5/6.

7.3 Addition and Subtraction

Like fractions: a/c ± b/c = (a±b)/c Unlike fractions: Find LCM of denominators → convert → add/subtract numerators

Solved Example 7.3 — Addition and Subtraction
(a) 2/3 + 3/4. LCM=12. 8/12 + 9/12 = 17/12 = 1■⁄■■

(b) 5¾ – 2■. = 23/4 – 8/3. LCM=12. = 69/12 – 32/12 = 37/12 = 3¹⁄■■

(c) A rope 8½ m long. A piece of 3¾ m cut off. Remaining length?
8½ – 3¾ = 17/2 – 15/4 = 34/4 – 15/4 = 19/4 = 4¾ m.

7.4 Multiplication of Fractions

(a/b) × (c/d) = (a×c)/(b×d) [Simplify before multiplying if possible]

Solved Example 7.4 — Multiplication
(a) (3/5) × (10/9) = 30/45 = 2/3 [cancel: 3÷3 and 9÷3; 5÷5 and 10÷5 → 2/3]
(b) 2½ × 3■ = 5/2 × 10/3 = 50/6 = 25/3 = 8■
(c) A tank holds 45½ litres. It is ¾ full. How much water is in it?
45½ × ¾ = 91/2 × 3/4 = 273/8 = 34■ litres.

7.5 Division of Fractions

(a/b) ÷ (c/d) = (a/b) × (d/c) [Multiply by the reciprocal]

Solved Example 7.5 — Division
(a) (5/6) ÷ (5/12) = (5/6) × (12/5) = 60/30 = 2
(b) 3½ ÷ 1¾ = (7/2) ÷ (7/4) = (7/2) × (4/7) = 4/2 = 2
(c) A ribbon 5¼ m long is cut into pieces of ¾ m each. How many pieces?
5¼ ÷ ¾ = 21/4 ÷ 3/4 = 21/4 × 4/3 = 84/12 = 7 pieces.

Exercise 7 — Practice Problems

1. Convert: (a)17/5 to mixed (b)45/8 to mixed (c)3½ to improper (d)5¾ to improper
2. Write 4 equivalent fractions for: (a)3/7 (b)5/12 (c)11/15
3. Reduce to lowest terms: (a)48/72 (b)105/315 (c)144/216
4. Arrange ascending: 5/6, 4/9, 7/12, 11/18
5. Add: (a)3/8+5/8 (b)2/3+3/4 (c)4/9+5/6 (d)2■+1¾+3■
6. Subtract: (a)7/8–3/8 (b)5/6–3/10 (c)8–5¼ (d)9■–4■
7. Multiply: (a)2/3×9/14 (b)1¾×2■ (c)3■×1■
8. Divide: (a)(5/6)÷(5/12) (b)3½÷1¾ (c)6÷1½
9. Sita walked 2¾ km on Monday and 3■ km on Tuesday. Total distance? How much more on Tuesday?
10. A vessel holds 15¾ litres. Each cup holds ¾ litre. How many full cups can be filled?

MENSURATION

Chapter 10

10.1 Perimeter

Perimeter is the total length of the boundary of a closed plane figure. It is measured in units of length (cm, m, km). To find the perimeter of any polygon, add all its side lengths.

Shape	Perimeter Formula	Area Formula	Units
Square (side a)	P = 4a	A = a^2	cm^2, m^2
Rectangle (l × b)	P = 2(l + b)	A = l × b	cm^2, m^2
Triangle (a, b, c)	P = a + b + c	A = ½ × base × height	cm^2, m^2
Equilateral Δ (side a)	P = 3a	A = (√3/4)a^2	cm^2, m^2
Parallelogram (base b, h)	P = 2(a + b)	A = base × height	cm^2, m^2
Rhombus (side a)	P = 4a	A = ½ × d■ × d■	cm^2, m^2

Solved Example 10.1 — Rectangle
A rectangular park is 85 m long and 63 m wide.
(a) Perimeter = 2(l+b) = 2(85+63) = 2×148 = 296 m
(b) Area = l×b = 85×63 = 5,355 m^2
(c) Cost of fencing at Rs 40/m = 296×40 = Rs 11,840
(d) Cost of levelling at Rs 15/m^2 = 5355×15 = Rs 80,325

Solved Example 10.2 — Square and Triangle
(a) Perimeter of square = 96 m. Find side and area.
Side = 96÷4 = 24 m. Area = 24^2 = 576 m^2.

(b) A right triangle has legs 9 cm and 12 cm; hypotenuse = 15 cm.
Perimeter = 9+12+15 = 36 cm.
Area = ½×9×12 = 54 cm^2.

(c) Area of a triangle = 84 cm^2, base = 14 cm. Find height.
½×14×h = 84 → 7h = 84 → h = 12 cm.

10.2 Area of Irregular Shapes on Graph Paper

For an irregular shape on squared paper with each square = 1 sq. unit:

Type of square	Count as
Fully inside boundary	1 unit
More than half inside	1 unit
Exactly half covered	½ unit
Less than half inside	0 units

10.3 Applied Problems

Solved Example 10.3 — Path Inside a Rectangle

A lawn 50 m × 30 m has a path 2 m wide running all around inside.
Outer rectangle area = 50×30 = 1500 m^2.
Inner rectangle: (50–4)×(30–4) = 46×26 = 1196 m^2.
Area of path = 1500 – 1196 = 304 m^2.
Cost of paving at Rs 120/m^2 = 304×120 = Rs 36,480.

Exercise 10 — Practice Problems

1. Find perimeter and area of a square with side: (a)13.5 cm (b)2.4 m
2. Rectangle: length 24 m, breadth 18 m. Find P, A, and cost of fencing at Rs 35/m.
3. Rectangle area = 168 cm^2, length = 14 cm. Find breadth and perimeter.
4. ∆ base 18 cm, height 12 cm. Find area. If perimeter = 48 cm, find 3rd side (base=18, one side=15).
5. A square field of side 80 m. Find cost of: (a)fencing at Rs 50/m (b)levelling at Rs 8/m^2
6. Floor 15 m × 12 m tiled with square tiles side 0.3 m. Find number of tiles.
7. A room 9 m × 6 m has walls 3.5 m high. Find total wall area (ignore doors and windows).
8. Hall 20 m × 15 m. Carpet covers all but a 1 m border around. Find carpet area.
9. A parallelogram has base 16 cm and area 256 cm^2. Find height.
10. A path 1.5 m wide runs outside a garden 40 m × 25 m. Find path area.

ALGEBRA

Chapter 11

11.1 Introduction to Algebra

Algebra generalises arithmetic by using letters to represent numbers. This lets us write rules and relationships that hold for all values, not just specific ones. For example, the perimeter of any square with side a is 4a.

Variable: A letter (x, y, n, a, …) whose value is unknown or can vary.
Constant: A fixed number (3, –7, ½, …).
Algebraic expression: constants and variables combined by operations ($3x^2–5x+7$).
Term: a single part of an expression separated by + or – signs.
Coefficient: the numerical factor of a term (in $5x^2$, coefficient = 5).
Equation: a statement that two expressions are equal (3x+5=14).

Solved Example 11.1 — Identifying Parts of an Expression
In $5x^2 – 3xy + 7y – 9$:
• Terms: $5x^2$, –3xy, 7y, –9
• Coefficient of x^2: 5 Coefficient of xy: –3 Coefficient of y: 7
• Constant term: –9
• Like terms: none (all different variables)

In $4a^2 + 3ab – 2a^2 + 5ab – 7$:
• Like terms: $4a^2$ and $–2a^2$ → combined: $2a^2$
• Like terms: 3ab and 5ab → combined: 8ab
• Simplified: $2a^2 + 8ab – 7$

11.2 Forming Algebraic Expressions

Statement in words	Algebraic expression
5 more than y	y + 5
3 times a number minus 8	3n – 8
Half of m added to 12	m/2 + 12
Product of x and y decreased by 4	xy – 4
Square of p increased by 2p	$p^2 + 2p$
7 less than 3 times y	3y – 7

11.3 Solving Simple Equations

An **equation** is like a balance. Whatever operation you apply to one side, you must apply to the other. The goal is to isolate the variable.

To solve ax + b = c: → Step 1: Subtract b from both sides → Step 2: Divide both sides by a

Solved Example 11.2 — Solving Equations

(a) Solve: $3x + 7 = 22$
$3x = 22 – 7 = 15 \rightarrow x = 5$
Check: $3(5)+7 = 15+7 = 22$ ✓

(b) Solve: $5y – 8 = 27$
$5y = 35 \rightarrow y = 7$

(c) Solve: $z/4 + 3 = 9$
$z/4 = 6 \rightarrow z = 24$

(d) Solve: $4(m – 3) = 28$
$m – 3 = 7 \rightarrow m = 10$
Check: $4(10–3) = 4×7 = 28$ ✓

(e) A number when tripled and then increased by 5 gives 26. Find the number.
$3n + 5 = 26 \rightarrow 3n = 21 \rightarrow n = 7$

Exercise 11 — Practice Problems

1. Write expressions: (a)8 more than twice y (b)3 less than 5 times m (c)sum of a, 2a, 3a
2. Find value when $x=4$, $y=–2$: (a)$3x–5$ (b)$x^2+2x–1$ (c)$2x^2–xy+y^2$
3. Simplify by combining like terms: $5x^2–3x+2+2x^2+7x–8+x$
4. Solve: (a)$x+13=25$ (b)$y–8=17$ (c)$4n=72$ (d)$z/6=9$ (e)$2x+5=19$
5. Solve: (a)$3y–7=20$ (b)$5z+3=28$ (c)$x/4–2=6$ (d)$3(x+4)=33$
6. Sum of three consecutive integers is 96. Find them.
7. A number is doubled and 7 is added; result is 43. Find the number.
8. Rajan is 3 times Mohan's age. Sum of ages is 48. Find both ages.
9. Perimeter of a rectangle is 56 cm and length is 18 cm. Form an equation and find breadth.
10. A train travels at x km/h. It covers 240 km in 3 hours. Find x.

RATIO AND PROPORTION

Chapter 12

12.1 Ratio

A **ratio** compares two quantities of the same kind expressed in the same unit. Ratio of a to b is written a : b or a/b. Always express a ratio in its **simplest form** (divide both terms by their HCF). Ratio has no unit.

Solved Example 12.1 — Forming Ratios
(a) Ratio of 48 cm to 1.2 m.
Convert: 1.2 m = 120 cm. Ratio = 48:120 = 2:5 (HCF=24)

(b) Divide Rs 5400 in ratio 4:5.
Total parts = 9. One part = 5400÷9 = 600.
First share = 4×600 = Rs 2400. Second share = 5×600 = Rs 3000.

(c) In a class of 48, boys:girls = 5:7. Find boys and girls.
Total parts = 12. Boys = (5/12)×48 = 20. Girls = (7/12)×48 = 28.

12.2 Proportion

Four quantities a, b, c, d are in **proportion** if a:b = c:d, written a:b::c:d. Here a and d are called **extremes**; b and c are called **means**.

Cross-multiplication rule: a × d = b × c (Product of extremes = Product of means)

Solved Example 12.2 — Proportion
(a) Are 15, 25, 36, 60 in proportion?
15×60 = 900 and 25×36 = 900 → Yes, 15:25::36:60 ✓

(b) Find x if 4:7::x:35.
4×35 = 7×x → 140 = 7x → x = 20.

(c) Find the 4th proportional to 3, 7, 12.
3:7::12:x → 3x = 84 → x = 28.

12.3 Unitary Method

The unitary method finds the value of one unit, then scales up or down. **Direct proportion**: more quantity → more cost (or time, etc). **Inverse proportion**: more workers → less time.

Solved Example 12.3 — Unitary Method

(a) 12 kg of wheat costs Rs 480. Find cost of 35 kg.
Cost of 1 kg = 480÷12 = Rs 40.
Cost of 35 kg = 40×35 = Rs 1,400.

(b) 18 workers build a wall in 15 days. In how many days will 27 workers build it?
Inverse proportion: more workers → fewer days.
Workers × Days = constant: 18×15 = 27×d
d = 270÷27 = 10 days.

(c) A map uses scale 1:50,000. A road is 8.5 cm on the map. Find actual length.
Actual length = 8.5 × 50,000 cm = 4,25,000 cm = 4.25 km.

Exercise 12 — Practice Problems

1. Find ratio in simplest form: (a)48:72 (b)2.5 kg:500 g (c)1 h 20 min : 2 h
2. If A:B=3:4 and B:C=5:6, find A:B:C.
3. Check if in proportion: (a)6,9,14,21 (b)4,6,8,12 (c)5,8,15,24
4. Find missing value: (a)5:8::15:? (b)?:6::14:21 (c)3:?::12:20
5. Divide 2100 in ratio 3:4:7.
6. If 15 men can do a job in 8 days, how many men do it in 6 days?
7. A car covers 168 km in 3 h. How long for 448 km at same speed?
8. 35 metres of cloth costs Rs 4,375. Find cost of 48 metres.
9. Scale 1:25,000. Find map distance for 7.5 km actual road.
10. In a mixture, cement:sand = 1:4. How much sand mixed with 35 kg cement?

FORMULA QUICK REFERENCE

All Chapters — Class VI

Numbers

1 Crore = 100 Lakhs = 1,00,00,000

1 Million = 10 Lakhs; 1 Billion = 100 Crores

Sum of first n natural numbers = $n(n+1)/2$

Sum of first n odd numbers = n^2

HCF & LCM

HCF × LCM = Product of the two numbers

HCF by prime factorisation: common factors, lowest powers

LCM by prime factorisation: all factors, highest powers

Integers

$a - b = a + (-b)$

$|-a| = a$ (for $a > 0$)

On number line: numbers increase rightward

Fractions

$(a/b) \times (c/d) = ac/bd$

$(a/b) \div (c/d) = (a/b) \times (d/c)$

To compare unlike fractions: use LCM of denominators

Mensuration

Square: $P = 4a$; $A = a^2$

Rectangle: $P = 2(l+b)$; $A = l \times b$

Triangle: $A = \frac{1}{2} \times b \times h$

Parallelogram: $A = b \times h$

Algebra

$ax + b = c \rightarrow x = (c-b)/a$

$4(x + k) = c \rightarrow x + k = c/4 \rightarrow x = c/4 - k$

Ratio & Proportion

$a:b::c:d \rightarrow ad = bc$ (cross multiply)

Unitary method: find value of 1, then scale

MODEL TEST PAPER

Class VI — Full Syllabus (80 Marks)

Instructions
Time: 3 Hours | Maximum Marks: 80 | All questions are compulsory unless stated. Show all working clearly.

Section A — Very Short Answer (1 mark × 10 = 10)

1. Write the place value of 7 in 3,74,52,816.
2. What is the HCF of 18 and 24?
3. Is 91 a prime number? State reason.
4. Find: (–13) + (+8).
5. Convert 3^{2}⁄■ to an improper fraction.
6. Simplify the ratio 63:84.
7. Find area of a square whose perimeter is 48 cm.
8. Solve: 3x = 45.
9. Write the additive inverse of –17.
10. Are 3, 5, 12, 20 in proportion? Verify.

Section B — Short Answer (2 marks × 10 = 20)

11. Find LCM of 15, 20, and 25.
12. Check 7,65,432 for divisibility by 4, 6, and 9 using tests.
13. Arrange in descending order: –7, 3, –2, 5, –10, 0, –1.
14. Add: 3/4 + 5/6 + 1/3.
15. Find x: 4:9::x:54.
16. Area of a triangle with base 18 cm and height 12 cm.
17. Simplify: (–15) – (–7) + (+12) – (+4).
18. Solve: 2y – 5 = 11.
19. A car covers 450 km in 6 hours. Distance in 9 hours at same speed.
20. Cost of fencing a square plot, side 75 m, at Rs 40/m.

Section C — Long Answer (5 marks × 6 = 30)

21. Find HCF and LCM of 84, 120, and 210 by prime factorisation. Verify HCF×LCM = product for the first two.
22. Solve and check: (a) 5x–8=27 (b) 4(y+3)=28.
23. A rectangular garden is 60 m by 40 m. A 2 m wide path runs all around inside. Find the area of the path and cost of paving at Rs 150/m^2.
24. Two numbers are in ratio 5:8. Their HCF is 9. Find the numbers and their LCM.
25. Simplify: (5/8 ÷ 1¼) + (2/3 × 1½) – (7/12).
26. The sum of three consecutive even numbers is 126. Form an equation and find them.

Section D — Application / HOTS (5 marks × 4 = 20)

27. Three buses leave at intervals of 18, 24, and 36 minutes, all together at 8:00 AM. When do they next all leave together? How many times before 12 noon?

28. Pipes A and B fill a cistern in 15 h and 20 h respectively. Both are opened together. How long to fill the cistern? Express as fraction of a day.

29. A map has scale 1:2,50,000. A road appears 5.6 cm on the map. (a) Find actual length. (b) A car travels at 60 km/h. Find time for this journey.

30. A class of 48: boys to girls = 5:7. (a) How many more girls than boys? (b) If 6 boys and 6 girls join, find new ratio. (c) Is the new ratio greater than, less than, or equal to the original ratio?