



तत् त्वं पुण्यं अप्रमृणु  
केंद्रीय विद्यालय संगठन

$$\frac{2}{3} + \frac{1}{6} = \frac{5}{6}$$

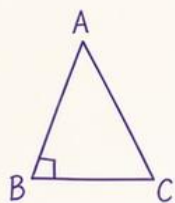


**KENDRIYA VIDYALAYA SANGATHAN (KVS)**

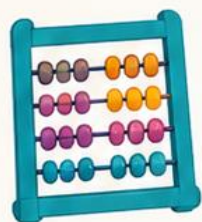
**ZIET CHANDIGARH**

$$3x + 5 = 11$$

$$4 \times 2 = 8$$



# SUPPORT MATERIAL MATHEMATICS



**FOR**

**CLASS VII**

**(PART I)**

$$-3 + 7 = 4$$



**CONCEPTUAL  
UNDERSTANDING**



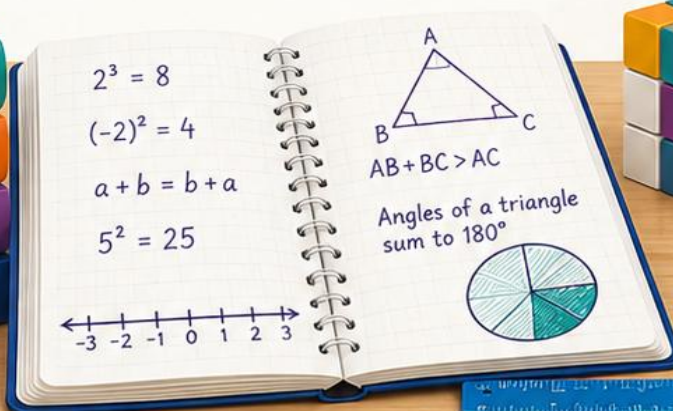
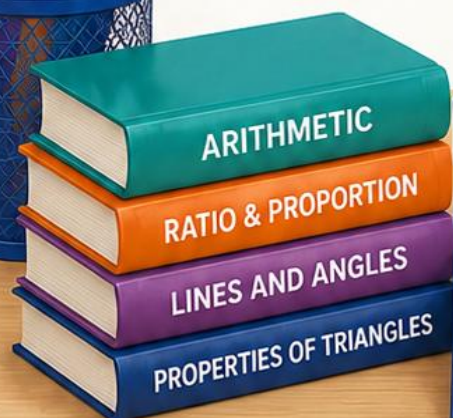
**PROBLEM  
SOLVING**



**REAL LIFE  
APPLICATIONS**



**PRACTICE  
& MASTERY**



**LEARN WITH  
UNDERSTANDING**



**PRACTICE  
REGULARLY**



**THINK  
LOGICALLY**



**SUCCEED  
CONFIDENTLY**

# संरक्षक

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उपायुक्त एवं निदेशक  
आंचलिक शिक्षा एवं प्रशिक्षण संस्थान, चंडीगढ़

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## FOREWORD

It gives me immense pleasure to present the "**Support Material for Class VII Mathematics (Part I) based on the New NCERT Textbook – Ganita Prakash.**" This resource has been thoughtfully developed to support teachers in implementing the vision of the **National Education Policy (NEP) 2020**, the National Curriculum Framework for School Education (NCFSE) 2023, and the competency-based approach envisaged by CBSE and Kendriya Vidyalaya Sangathan.

The new NCERT textbook introduces mathematics through meaningful contexts, hands-on learning, logical reasoning, and problem-solving. It encourages students to explore concepts through activities, discussions, and real-life situations rather than relying solely on procedural learning. This support material has been prepared with the objective of assisting teachers in translating these pedagogical principles into effective classroom practices.

The material includes chapter-wise learning objectives, concept summaries, competency-based questions, higher-order thinking tasks. It is designed to strengthen conceptual understanding, promote mathematical thinking, and encourage joyful learning among students.

I appreciate the sincere efforts of the Associate Course Director, Resource Persons and Mathematics teachers who have contributed their expertise and dedication to the preparation of this publication. Their commitment towards enhancing the quality of mathematics education is truly commendable.

I am confident that this support material will serve as a valuable companion for teachers and will contribute significantly to improving students' mathematical understanding, confidence, and achievement.

I extend my best wishes to all teachers and students for a rewarding and enriching learning journey.

**Deputy Commissioner & Director**  
Kendriya Vidyalaya Sangathan  
Zonal Institute of Education & Training, Chandigarh

## CONTENT PREPARED BY:

| TOPIC                                 | NAME OF TEACHER<br>(TGT Maths) | NAME OF KV       | REGION |
|---------------------------------------|--------------------------------|------------------|--------|
| LARGE NUMBERS AROUND US               | RAJESH KAMAL                   | NO.1 AKHNOOR     | JAMMU  |
| ARITHMETIC EXPRESSIONS                | AJAY KUMAR                     | AWANTIPUR        | JAMMU  |
| A PEEK BEYOND THE POINT               | ANIL KUMAR                     | JYOTIPURAM       | JAMMU  |
| EXPRESSIONS USING LETTER-<br>NUMBERS  | SANTOSH                        | NO.1<br>UDHAMPUR | JAMMU  |
| PARALLEL AND INTERSECTING LINES       | SARBJEET SINGH                 | KISHTWAR         | JAMMU  |
| NUMBER PLAY                           |                                |                  |        |
| A TALE OF THREE INTERSECTING<br>LINES | ALKA                           | HUMHAMA          | JAMMU  |
| WORKING WITH FRACTIONS                | NIDHI GUPTA                    | NAGROTA          | JAMMU  |

## MODERATED BY:

| TOPIC                                 | NAME OF TEACHER<br>(TGT Maths) | NAME OF KV         | REGION   |
|---------------------------------------|--------------------------------|--------------------|----------|
| LARGE NUMBERS AROUND US               | JILE SINGH                     | NO. 2 CHANDIMANDIR | GURUGRAM |
| ARITHMETIC EXPRESSIONS                |                                |                    |          |
| A PEEK BEYOND THE POINT               | MUKESH KUMAR                   | KARNAL             | GURUGRAM |
| EXPRESSIONS USING LETTER-<br>NUMBERS  |                                |                    |          |
| PARALLEL AND INTERSECTING<br>LINES    |                                |                    |          |
| NUMBER PLAY                           |                                |                    |          |
| A TALE OF THREE INTERSECTING<br>LINES | DEEPAK AGARWAL                 | AFS NO. 1 SIRSA    | GURUGRAM |
| WORKING WITH FRACTIONS                |                                |                    |          |

# SUMMARY OF CONCEPTS & DEFINITIONS

## CHAPTER 1 LARGE NUMBERS AROUND US

### 1. WHAT IS MATHEMATICS?

- Mathematics is the search for **patterns** and the **explanations** for why those patterns exist.
- Patterns exist all around us—in nature, in our homes, in activities and in the motion of the sun, moon and stars.
- Understanding patterns helps us in many real-life situations and in advancing science, technology and humanity.

#### Examples



### 2. LARGE NUMBERS – INDIAN & AMERICAN SYSTEMS

|                         | Indian System              | American (International) System |
|-------------------------|----------------------------|---------------------------------|
| Thousand                | 1,000<br>One thousand      | 1,000<br>One thousand           |
| Lakh                    | 1,00,000<br>One lakh       | 100,000<br>Hundred thousand     |
| Ten lakh                | 10,00,000<br>Ten lakh      | 1,000,000<br>One million        |
| Crore                   | 1,00,00,000<br>One crore   | 10,000,000<br>Ten million       |
| Ten crore               | 10,00,00,000<br>Ten crore  | 100,000,000<br>Hundred million  |
| Arab<br>(Hundred crore) | 1,00,00,00,000<br>One arab | 1,000,000,000<br>One billion    |

- Indian system follows 3-2-2-2.... pattern (thousand, lakh, crore, arab...)
- American system follows 3-3-3-3... pattern (thousand, million, billion...)

### 3. ROUNDING & NEAREST NEIGHBOURS

- We often use approximate values.
- Rounding up → use a larger value.
- Rounding down → use a smaller value.

#### Nearest Neighbours

(Example: 6,72,85,183)

|                      |               |
|----------------------|---------------|
| Nearest thousand     | → 6,72,85,000 |
| Nearest ten thousand | → 6,72,90,000 |
| Nearest lakh         | → 6,73,00,000 |
| Nearest ten lakh     | → 6,70,00,000 |
| Nearest crore        | → 7,00,00,000 |



Rounding helps us quickly estimate and compare large numbers.

### 4. VISUALISING NUMBER SEQUENCES

Numbers can be shown using pictures to see patterns clearly.

All 1's



Counting numbers



Odd numbers



Even numbers



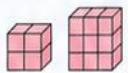
Triangular numbers



Squares  
(square numbers)



Cubes  
(cube numbers)



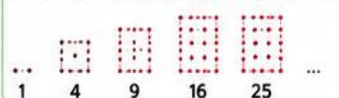
Example:  $1 + 3 + 5 + 7 + 9 + 11 = 36 = 6^2$   
(Sum of first  $n$  odd numbers  $= n^2$ )

### 5. RELATIONS AMONG NUMBER SEQUENCES

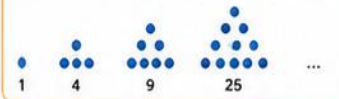
- Number sequences are often related in beautiful and surprising ways.

Examples:

$$1 + 3 + 5 + \dots \text{ (first } n \text{ odd numbers)} = n^2$$



$$1 + 2 + \dots + n + (n-1) + \dots + 2 + 1 = n^2$$



- Visualisation helps us understand why such patterns exist.
- Adding 1 to powers of 2 gives: 2, 4, 8, 16, ...

### 6. PATTERNS IN SHAPES (GEOMETRY)

Shapes also follow patterns.

|                   | Sequence | Pattern                                                                             |
|-------------------|----------|-------------------------------------------------------------------------------------|
| Regular Polygons  |          | Number of sides<br>$= 3, 4, 5, 6, \dots$                                            |
| Complete Graphs   |          | Number of lines<br>$= 1, 3, 6, 10, \dots$<br>(triangular numbers)                   |
| Stacked Squares   |          | Number of dots<br>$= 1, 4, 9, 16, \dots$<br>(square numbers)                        |
| Stacked Triangles |          | Number of dots<br>$= 1, 3, 6, 10, \dots$<br>(triangular numbers)                    |
| Koch Snowflake    |          | Total line segments<br>$= 3, 12, 48, \dots$<br>( $= 3 \times \text{powers of } 4$ ) |

### 7. MULTIPLICATION SHORTCUTS & PATTERNS

#### Shortcut Examples

$$116 \times 5 = 116 \times 10 \div 2 \\ = 58 \times 10 = 580$$

$$824 \times 25 = 824 \times 100 \div 4 \\ = 206 \times 100 = 20600$$

#### Patterns in Products

1-digit  $\times$  1-digit → 1-digit or 2-digit

2-digit  $\times$  1-digit → 2-digit or 3-digit

2-digit  $\times$  2-digit → 3-digit or 4-digit

3-digit  $\times$  3-digit → 5-digit or 6-digit

In general:

( $m$ -digit)  $\times$  ( $n$ -digit) → ( $m + n - 1$ )

or ( $m + n$ )-digit



### 8. INTERESTING LARGE NUMBER FACTS



Purandaradāsa composed 4,75,000 (475 thousand) kirtanas.



Average distance between the Earth and the Sun is about 14,70,00,000 km.



Amazon river discharges about 4,00,00,000 litres of water every second.



Longest train journey in the world: 9,288 km.



Weight of an adult blue whale can be more than 1,50,00,000 kg.

### 9. KEY TAKEAWAYS

- Patterns are everywhere—in numbers, shapes and in real life.
- Large numbers are written and read using Indian and American systems.
- Rounding and estimation help us deal with large numbers easily.
- Visualisation (pictures, diagrams) helps us understand patterns better.
- Number sequences and shape sequences are connected in many beautiful ways.
- Mathematics makes us curious, creative and helps solve real-life problems.



### 10. THINK & EXPLORE!

Ask questions, look for patterns, try different methods, make connections and enjoy the beauty of mathematics!



Practice more. Share your ideas. Challenge your classmates!

# LARGE NUMBERS AROUND US

## Learning Outcomes:

LO1: Read and write large numbers (up to 9 digits) in Indian and International systems.

LO2: Understand place value and expanded form of large numbers.

LO3: Compare, order and perform operations (addition, subtraction, multiplication) on large numbers.

LO4: Estimate and round large numbers to nearest tens, lakhs, crores etc.

LO5: Apply large numbers in real-life contexts (population, distance, money etc.).

## Competencies:

C1: Number sense and place value understanding

C2: Logical reasoning and comparison

C3: Computational skills and operations

C4: Estimation and approximation

C5: Application in real-life situations

| Q.No                        | Question                                                                                                                                                           | LO  | Competency |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------------|
| <b>MCQs (One Mark Each)</b> |                                                                                                                                                                    |     |            |
| 1                           | One crore is equal to how many millions?<br>a) 1                      b) 10                      c) 100                      d) 1000                               | LO1 | C1         |
| 2                           | The place value of 6 in 56,78,901 is:<br>a) 6,00,000      b) 60,000      c) 6,000      d) 600                                                                      | LO2 | C1         |
| 3                           | The smallest 8-digit number is:<br>a) 99,99,999                      b) 1,00,00,000<br>c) 10,00,000                      d) 1,00,00,001                            | LO1 | C1         |
| 4                           | 1 million is equal to how many lakhs?<br>a) 10                      b) 100                      c) 1,000                      d) 10,000                            | LO1 | C1         |
| 5                           | Which is the correct International numeral for 2,34,56,789?<br>a) 23456789                      b) 23,456,789<br>c) 2,34,56,789                      d) 234,56,789 | LO1 | C1         |
| 6                           | The predecessor of 10,00,00,000 is:<br>a) 9,99,99,999                      b) 99,99,999<br>c) 1,00,00,001                      d) 9,99,99,900                      | LO3 | C2         |

|                                             |                                                                                                                                                                |      |    |
|---------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|------|----|
| 7                                           | Approximate 67,89,432 to the nearest ten lakh:<br>a) 60,00,000                      b) 70,00,000<br>c) 68,00,000                      d) 67,90,000             | LO4  | C4 |
| 8                                           | How many zeros are there in one crore?<br>a) 6                      b) 7                      c) 8                      d) 5                                   | LO1  | C1 |
| 9                                           | In International system, 1,23,45,678 is written as: a)<br>123,456,78                      b) 12,345,678<br>c) 1,2345,678                      d) 12345678      | LO1  | C1 |
| 10                                          | Which number is greater: 5,67,89,123 or 5,67,89,132?<br>a) 5,67,89,123                      b) 5,67,89,132<br>c) Both equal                      d) Cannot say | LO2  | C2 |
| <b>Short Answer Type (Two Marks Each)</b>   |                                                                                                                                                                |      |    |
| 11                                          | Write the number name of 4,56,78,912 in the Indian system.                                                                                                     | LO1  | C1 |
| 12                                          | Insert commas in 987654321 according to both Indian and International systems                                                                                  | LO1  | C1 |
| 13                                          | Find the place value of 8 and 2 in 8,76,54,321.                                                                                                                | LO2  | C1 |
| 14                                          | Compare: 78,90,123 ____ 78,89,999 using >, < or =.                                                                                                             | LO2  | C2 |
| 15                                          | Write the expanded form of 6,78,90,543 (Indian system).                                                                                                        | LO2  | C1 |
| 16                                          | Estimate the sum of 4,56,789 + 3,45,678 by rounding to nearest lakh                                                                                            | LO4  | C4 |
| 17                                          | How many thousands make one crore? Show calculation                                                                                                            | LO1  | C3 |
| 18                                          | A farmer harvested 12,45,678 kg of rice. Write this number in words                                                                                            | LO1  | C1 |
| 19                                          | Convert 350 lakhs into crores                                                                                                                                  | LO1  | C1 |
| 20                                          | Write any two real-life situations where large numbers are used                                                                                                | LO5  | C5 |
| <b>Short Answer Type (Three Marks Each)</b> |                                                                                                                                                                |      |    |
| 21                                          | Write the place value chart for 9,87,65,432 (Indian system) and its expanded form.                                                                             | LO2  | C1 |
| 22                                          | Add: 67,89,012 + 45,67,890 + 12,34,567.                                                                                                                        | LO3  | C3 |
| 23                                          | Subtract: 5,67,89,432 – 1,98,76,543.                                                                                                                           | LO3  | C3 |
| 24                                          | Round 3,45,67,890 to the nearest crore and write in words                                                                                                      | LO4  | C4 |
| 25                                          | Multiply: 2,345 × 6,789 (use estimation first).                                                                                                                | LO 3 | C3 |
| <b>Long Answer Type (Five Marks Each)</b>   |                                                                                                                                                                |      |    |
| 26                                          | The population of a state is 8,76,54,321. If it increases by 12,34,567, find the new population. Write in both Indian and International systems.               | LO3  | C3 |
| 27                                          | A company earned ₹45,67,89,012 last year and ₹52,34,56,789 this year. How much more did it earn? Estimate first, then calculate exactly                        | LO3  | C4 |
| 28                                          | In three days, 1,45,678; 2,34,567 and 1,89,012 people visited a fair. Find total visitors and round to nearest lakh.                                           | LO4  | C4 |

| Case Study Based |                                                                                                                                                                                                          |     |    |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----|
| 29               | According to the 2011 Census, population of a town was 75,000. In 2024 it became 1,06,000. How much less than one lakh was it in 2011? How much more than one lakh in 2024? By how much did it increase? | LO5 | C5 |
| 30               | If a person eats 3 varieties of rice every day, how many varieties can they taste in 100 years (ignore leap years)? Can they taste one lakh varieties?                                                   | LO5 | C3 |

|     |                                                   |                                          |                      |                                                     |                                           |
|-----|---------------------------------------------------|------------------------------------------|----------------------|-----------------------------------------------------|-------------------------------------------|
| Q   | 1                                                 | 2                                        | 3                    | 4                                                   | 5                                         |
| Ans | b                                                 | a                                        | b                    | a                                                   | b                                         |
| Q   | 6                                                 | 7                                        | 8                    | 9                                                   | 10                                        |
| Ans | a                                                 | b                                        | b                    | b                                                   | b                                         |
| Q   | 11                                                | 12                                       | 13                   | 14                                                  | 15                                        |
| Ans |                                                   | Indian<br>:987,654,321<br>Int:987,654,21 | 8,00,00,000,2<br>=20 | >                                                   | 6,00,00,000+78,00,000+90,000<br>+500+40+3 |
| Q   | 16                                                | 17                                       | 18                   | 19                                                  | 20                                        |
| Ans | 8,00,000                                          | 10,000                                   |                      | 3.5 crore                                           | Population , Budget                       |
| Q   | 21                                                | 22                                       | 23                   | 24                                                  | 25                                        |
| Ans | 9,00,00,000+<br>87,00,000+<br>65,000+400<br>+30+2 | 1,25,91,469                              | 3,69,12.889          | 3,00,00,000                                         | Exact:15,92,0205                          |
| Q   | 26                                                | 27                                       | 28                   | 29                                                  | 30                                        |
| Ans | 8,88,88,888<br>Int.:88,888,888                    | 6,66,67,777                              | 570,000              | 25,000 less ;<br>6,000 more ,<br>increase<br>31,000 | yes                                       |

### Challenging Questions (Stage 1)

Q.1. Form the greatest and smallest 7-digit numbers using digits 0,1,3,5,6,8,9 (without repetition).

Q.2. How many lakhs make one billion?

Q.3. Express 1,23,45,678 in words in both systems.

Q.4. Estimate  $98,76,543 - 45,67,890$  to nearest lakh.

Q.5. What is the successor of the largest 8-digit number?

### Challenging Questions (Stage 2)

Q.1. A number is 7,89,01,234. Write it in expanded form and place value chart.

Q.2. Compare 5 crore and 50 million. Which is larger?

Q.3. Add  $2,34,56,789 + 3,45,67,890 + 1,98,76,543$ .

Q.4. Round 9,87,65,432 to nearest crore.

Q.5. Convert 450 lakhs into International system.

### Challenging Questions (Stage 3)

Q.1. Population of India  $\approx$  1.4 billion. Express in Indian system (crores) and write in words.

Q.2. A factory produced 1,25,67,890 units last year and 1,48,90,765 this year. Find increase. Q.3. Solve:  $8,76,54,321 + 12,34,567 - 5,67,89,012$ .

Q.4. Create a 9-digit number with three different digits (one appears once, one twice, one thrice) and add 2 lakhs.

Q.5. How many days in 274 years (ignore leap years)? How close to one lakh?

### Answers (Challenging Questions)

|             | Q.1                                                | Q.2                  | Q.3                                                                                              | Q.4                         | Q.5                           |
|-------------|----------------------------------------------------|----------------------|--------------------------------------------------------------------------------------------------|-----------------------------|-------------------------------|
| Stage 1/Ans | Greatest:<br>9,86,53,10;<br>Smallest:<br>10,35,689 | 10,000<br>lakhs      | One crore<br>twenty-<br>three lakh<br>forty-five<br>thousand<br>six hundred<br>seventy-<br>eight | 53,10,000<br>(approx.)      | 1,00,00,000                   |
| Stage 2/Ans | $7,00,00,000 + 89,00,000 + 1,000 + 200 + 30 + 4$   | 5 crore is<br>larger | 7,79,01,222                                                                                      | 10,00,00,000<br>- Ten crore | 4,500,000                     |
| Stage 3/Ans | 140 crore (One<br>hundred forty<br>crore)          | 23,22,875            | 5,21,00,000<br>- approx.                                                                         | 9,99,988<br>(example)       | 1,00,010 days<br>(very close) |

# SUMMARY OF CONCEPTS & DEFINITIONS

## CHAPTER 2 : ARITHMETIC EXPRESSIONS

### 1. WHAT IS AN ARITHMETIC EXPRESSION?

A mathematical phrase formed using **numbers and operations** (+, -, ×, ÷) is called an **arithmetic expression**.

► **Every expression has a value** (the number it evaluates to).

**Example:**  $13 + 2 = 15$   
                     ↓                ↓  
                     Expression    Value

Different expressions can have the same value.

For example:

$10 + 2$ ,  $15 - 3$ ,  $3 \times 4$ ,  $24 \div 2$   
all have the value 12.



### 2. TERMS IN AN EXPRESSION

- Terms are the parts of an expression separated by '+' sign.
- All '-' signs are converted to '+' of the inverse (opposite sign).

| Expression             | As sum of terms           | Terms                  |
|------------------------|---------------------------|------------------------|
| $13 - 2 + 6$           | $13 + (-2) + 6$           | 13, -2, 6              |
| $5 + 6 \times 3$       | $5 + 6 \times 3$          | 5, $6 \times 3$        |
| $4 + 15 - 9 + 2$       | $4 + 15 + (-9) + 2$       | 4, 15, -9, 2           |
| $23 - 2 \times 4 + 16$ | $23 + (-2 \times 4) + 16$ | 23, $-2 \times 4$ , 16 |

Examples of terms

7

-5

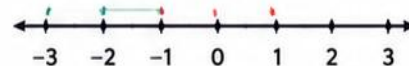
$3 \times 4$

$18 \div 3$

All are single terms.

### 3. COMPARING EXPRESSIONS

We compare expressions based on their values using '>', '<' or '='.



$10 + 2 > 7 + 1$   
(12 is greater than 8)

$13 - 2 < 4 \times 3$   
(11 is less than 12)

$15 - 5 = 2 \times 5$   
(10 is equal to 10)



### 4. BRACKETS AND ORDER OF OPERATIONS

- Brackets ( ) tell us which part to evaluate first.
- Rule: Evaluate inside brackets first, then do the remaining operations.

**Example 1:**

$30 + (5 \times 4) = 30 + 20 = 50$   
(First do  $5 \times 4$ , then add 30)

**Example 2:**

$100 - (15 + 56) = 100 - 71 = 29$   
(First do  $15 + 56$ , then subtract)



### 5. PROPERTIES OF ADDITION (FOR TERMS)

**Commutative Property**

Swapping terms does not change the sum.

$$a + b = b + a$$

**Example:**

$$7 + (-3) = (-3) + 7 = 4$$

**Associative Property**

Grouping terms in any way does not change the sum.

$$(a + b) + c = a + (b + c)$$

**Example:**

$$(5 + 2) + (-4) = 5 + (2 + (-4)) = 3$$

**Conclusion**

In an expression with only addition/subtraction, order and grouping of terms do not change the value.



### 6. REMOVING BRACKETS

When brackets are preceded by a '-' sign, the signs of the terms inside change.

| With Brackets | Without Brackets |
|---------------|------------------|
| $-(a + b)$    | $= -a - b$       |
| $-(a - b)$    | $= -a + b$       |

When brackets are **NOT** preceded by '-' sign, the signs remain same.

$$a + (b + c) = a + b + c$$

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



### 7. DISTRIBUTIVE PROPERTY

The multiple of a sum (or difference) is the same as the sum (or difference) of the multiples.

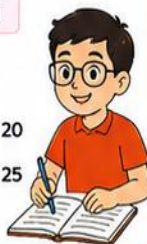
$$a \times (b + c) = a \times b + a \times c$$

$$a \times (b - c) = a \times b - a \times c$$

**Example:**

$$4 \times (3 + 2) = 4 \times 3 + 4 \times 2 = 20$$

$$5 \times (8 - 3) = 5 \times 8 - 5 \times 3 = 25$$



### 8. CHANGING TERMS AND VALUES

Changing a term changes the value of the expression.

| Expression  | Change in term  | Change in value      |
|-------------|-----------------|----------------------|
| $a + b + c$ | Increase a by 1 | Value increases by 1 |
| $a + b + c$ | Decrease b by 1 | Value decreases by 1 |
| $a - b + c$ | Increase c by 1 | Value increases by 1 |
| $a - b - c$ | Decrease b by 1 | Value increases by 1 |

Helps us estimate and compare expressions without full calculation.



### 9. KEY TAKEAWAYS

- ✓ An arithmetic expression uses numbers and operations (+, -, ×, ÷).
- ✓ Terms are parts separated by '+'; convert '-' to '+' of inverse.
- ✓ In addition/subtraction, order and grouping of terms do not change the value.
- ✓ Brackets show what to evaluate first.
- ✓ Removing brackets with a leading '-' changes the signs inside.
- ✓ The distributive property helps expand products over sums or differences.
- ✓ Understanding terms and properties helps us solve quickly and accurately.



### 10. REAL LIFE APPLICATIONS



Calculating total cost while shopping



Finding change after a purchase



Ticket cost for groups in transport



Packing items in equal units



Budgeting and savings



Planning time and daily activities

### 11. REMEMBER

"Understand the terms,  
Use brackets wisely,  
Apply properties smartly,  
Solve expressions easily!"



## ARITHMETIC EXPRESSIONS

### Learning Outcomes

LO1 – Identify and evaluate simple arithmetic expressions

LO2 – Represent and evaluate expressions using terms

LO3 – Compare expressions using reasoning

LO4 – Apply brackets and the commutative, associative & distributive properties

LO5 – Apply expressions to real-life problem solving

### Competencies

C1 – Observation & identification

C2 – Logical reasoning & computation

C3 – Generalisation & application of properties

C4 – Application to real-life / creative contexts

| Q.No                      | Question                                                                                                                                                                                                                                     | LO  | Competency |
|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------------|
| <b>MCQs (1 Mark Each)</b> |                                                                                                                                                                                                                                              |     |            |
| 1                         | What is the value of the expression $15 + 3 \times 4$ ?<br>A. 72                  B. 27                  C. 19                  D. 32                                                                                                        | LO1 | C1         |
| 2                         | What are the terms of the expression $45 - 12 + 7$ ?<br>A. 45, 12, 7    B. 45, -12, 7    C. 45, 12, -7    D. -45, 12, 7                                                                                                                      | LO2 | C1         |
| 3                         | Irfan paid ₹100 for a biscuit packet costing ₹15 and a dal packet costing ₹56. The value of $100 - (15 + 56)$ is:<br>A. ₹141                  B. ₹29                  C. ₹71                  D. ₹39                                         | LO4 | C4         |
| 4                         | The value of the expression $30 + 5 \times 4$ is:<br>A. 140                  B. 50                  C. 35                  D. 20                                                                                                             | LO1 | C1         |
| 5                         | The equality $6 \times 5 + 3 \times 5 = (6 + 3) \times 5$ illustrates which property?<br>A. Commutative property of addition<br>B. Associative property of addition<br>C. Distributive property<br>D. Commutative property of multiplication | LO4 | C3         |
| 6                         | On removing the brackets, $200 - (40 + 3)$ becomes:<br>A. $200 - 40 + 3$ B. $200 - 40 - 3$<br>C. $200 + 40 - 3$ D. $200 - 40 \times 3$                                                                                                       | LO4 | C3         |
| 7                         | On removing the brackets, $28 + (35 - 10)$ becomes:<br>A. $28 + 35 - 10$ B. $28 - 35 + 10$<br>C. $28 + 35 + 10$ D. $28 - 35 - 10$                                                                                                            | LO4 | C3         |

|                                           |                                                                                                                                                                                    |     |    |
|-------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----|
| 8                                         | Using the distributive property, $5 \times (8 - 3)$ is equal to:<br>A. $5 \times 8 + 5 \times 3$ B. $5 \times 8 - 5 \times 3$<br>C. $5 \times 8 - 3$ D. $8 - 5 \times 3$           | LO4 | C3 |
| 9                                         | Which of these expressions has the value 12?<br>A. $6 + 6$ B. $5 \times 3$ C. $20 - 6$ D.<br>$36 \div 4$                                                                           | LO1 | C1 |
| 10                                        | Without fully calculating, compare: $245 + 289$ and $246 + 285$ . Which is greater?<br>A. $245 + 289$ B. $246 + 285$<br>C. They are equal                  D. Cannot be determined | LO3 | C2 |
| <b>Short Answer Type (Two Marks Each)</b> |                                                                                                                                                                                    |     |    |
| 11                                        | Find the value of $28 - 7 + 8$ by first writing out its terms.                                                                                                                     | LO2 | C1 |
| 12                                        | Find the value of $39 - 2 \times 6 + 11$ by first writing out its terms.                                                                                                           | LO2 | C1 |
| 13                                        | Write the terms of the expression $83 - 14$ and hence find its value.                                                                                                              | LO2 | C1 |
| 14                                        | Compare $273 - 145$ and $272 - 144$ using reasoning, without doing the full subtraction. Write $<$ , $>$ or $=$ , and justify.                                                     | LO3 | C2 |
| 15                                        | Aisha bought a notebook for ₹35 and a pen for ₹12. She gave the shopkeeper ₹100. Write an expression using brackets for her change, and evaluate it.                               | LO5 | C4 |
| 16                                        | Remove the brackets and simplify: $500 - (250 - 100)$ .                                                                                                                            | LO4 | C3 |
| 17                                        | Using the distributive property, evaluate $97 \times 25$ by first writing it as $(100 - 3) \times 25$ .                                                                            | LO4 | C3 |
| 18                                        | Using reasoning about how terms change (not by full calculation), fill in the blank so both sides are equal: $423 + 4 = 419 + \underline{\hspace{2cm}}$ .                          | LO3 | C2 |
| 19                                        | A customer pays a shopkeeper ₹432 using notes and coins. Write two different expressions (each using multiplication and addition) that both represent ₹432.                        | LO2 | C2 |
| 20                                        | Meera is flying a drone. It goes up 8 m and then comes down 5 m. Write an expression, as a sum of terms, for its final height above the ground, and evaluate it.                   | LO5 | C4 |

**Short Answer Type (Three Marks Each)**

|    |                                                                                                                                                                                                                                                                               |     |    |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----|
| 21 | Kabir bought 4 chocolates at ₹18 each and paid the delivery person a tip of ₹6. Write an expression describing the total amount he spent, identify its terms, and evaluate it.                                                                                                | LO5 | C4 |
| 22 | Find the value of $48 - 10 \times 2 + 16 \div 2$ by writing out the terms of the expression.                                                                                                                                                                                  | LO2 | C1 |
| 23 | A book costs ₹85. A tax of ₹15 is added, and then a discount of ₹20 is given. Write this as a single expression using terms (without unnecessary brackets), find the final price, and explain why the order in which tax and discount are applied does not change the answer. | LO4 | C3 |
| 24 | Show, with a numerical example, that swapping two terms of an addition expression does not change its value. Then show, with an example, that swapping the numbers in a subtraction expression (like $15 - 7$ ) DOES change the value.                                        | LO4 | C3 |
| 25 | A window has a border, a grill, and a gap repeated 6 times, with one extra border strip at the top. The border is 3 cm, the grill is 2 cm and the gap is 5 cm. Write an expression for the total height of the window using multiplication and addition, and evaluate it.     | LO5 | C4 |

**Long Answer Type (Five Marks Each)**

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |            |          |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|----------|
| 26 | <p>Amir, Bilal and Chetan go to a hotel. Each orders a plate of momos costing ₹45 and a lassi costing ₹30.</p> <p>(i) Write an expression for the amount one person pays.</p> <p>(ii) Write an expression, using brackets, for the total amount all three of them must pay together.</p> <p>(iii) Write a second, different-looking expression (without brackets around the sum) that gives the same total.</p> <p>(iv) Show that both expressions in (ii) and (iii) evaluate to the same value.</p> <p>(v) Name the property of expressions that this illustrates.</p> | LO4<br>LO5 | C3<br>C4 |
| 27 | <p>Consider the expression <math>100 - 15 \times 4 + 24 \div 3</math>.</p> <p>(i) Identify the terms of the expression.</p> <p>(ii) Evaluate each term separately.</p> <p>(iii) Find the value of the whole expression.</p> <p>(iv) Rewrite the expression using brackets so that the order of operations is completely explicit.</p> <p>(v) Explain, in your own words, how the idea of 'terms' removes confusion when reading an expression that has no brackets.</p>                                                                                                 | LO2<br>LO4 | C2<br>C3 |

|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                          |                      |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|----------------------|
| 28                      | <p>A shop sold 8 notebooks at ₹25 each on Monday. On Tuesday, it sold 3 more notebooks than on Monday, still at ₹25 each.</p> <p>(i) Write an expression for Monday's sales amount.</p> <p>(ii) Write an expression, using brackets, for Tuesday's sales amount.</p> <p>(iii) Write a single expression, using the distributive property, for the combined number of notebooks sold over both days multiplied by the price.</p> <p>(iv) Evaluate the total sales over the two days.</p> <p>(v) Verify your answer by finding each day's sales separately and adding them</p>                                                                                           | LO4<br>LO5               | C3<br>C4             |
| <b>Case study based</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                          |                      |
| 29                      | <p><b>The School Canteen</b></p> <p>The canteen at PM Shri KV No. 3, Srinagar sells samosas for ₹12 each and cold drinks for ₹18 each. Riya bought 3 samosas and 2 cold drinks and paid with a ₹100 note.</p> <p>1. Write an expression for the total cost of the samosas alone.</p> <p>2. Write an expression, using brackets appropriately, for the total amount Riya spent.</p> <p>3. Write an expression for the change Riya receives from ₹100, and evaluate it.</p> <p>4. The next day, the price of each item increases by ₹2. Write a new expression for the cost of the same order (3 samosas, 2 cold drinks), and find how much more Riya would now pay.</p> | LO1<br>LO2<br>LO4<br>LO5 | C1<br>C2<br>C3<br>C4 |
| 30                      | <p><b>The Apple Orchard</b></p> <p>Farmer Tariq has 120 kg of apples from his orchard, which he packs into boxes of 5 kg each. He already had 6 boxes packed from an earlier harvest.</p> <p>1. Write an expression for the number of new boxes made from the 120 kg of apples, and identify its terms.</p> <p>2. Write an expression, as a sum of terms, for the total number of boxes Tariq now has.</p> <p>3. Evaluate the total number of boxes Tariq has.</p> <p>4. Tariq sells each box for ₹250 but gives a flat discount of ₹500 on the total sale. Write a single expression for his total earnings, and evaluate it.</p>                                     | LO1<br>LO2<br>LO4<br>LO5 | C1<br>C2<br>C3<br>C4 |

## ANSWERS

|     |                                                                                                                                                                                            |                                                                                                                                                                                       |                                                                                                                                                                                    |                                                                                                                                                                                                                |                                                                                           |
|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| Q.  | 1                                                                                                                                                                                          | 2                                                                                                                                                                                     | 3                                                                                                                                                                                  | 4                                                                                                                                                                                                              | 5                                                                                         |
| Ans | B                                                                                                                                                                                          | B                                                                                                                                                                                     | B                                                                                                                                                                                  | B                                                                                                                                                                                                              | C                                                                                         |
| Q.  | 6                                                                                                                                                                                          | 7                                                                                                                                                                                     | 8                                                                                                                                                                                  | 9                                                                                                                                                                                                              | 10                                                                                        |
| Ans | B                                                                                                                                                                                          | A                                                                                                                                                                                     | B                                                                                                                                                                                  | A                                                                                                                                                                                                              | A                                                                                         |
| Q.  | 11                                                                                                                                                                                         | 12                                                                                                                                                                                    | 13                                                                                                                                                                                 | 14                                                                                                                                                                                                             | 15                                                                                        |
| Ans | 29                                                                                                                                                                                         | 38                                                                                                                                                                                    | 69                                                                                                                                                                                 | 273 – 145 = 128 and<br>272 – 144 = 128, so 273<br>– 145 = 272 – 144 (272<br>is 1 less than 273, and<br>144 is 1 less than 145,<br>so the change cancels<br>out).                                               | 100 – (35 + 12) =<br>100 – 47 = ₹53<br>change.                                            |
| Q.  | 16                                                                                                                                                                                         | 17                                                                                                                                                                                    | 18                                                                                                                                                                                 | 19                                                                                                                                                                                                             | 20                                                                                        |
| Ans | 500 – (250<br>– 100) =<br>500 – 250 +<br>100 = 350                                                                                                                                         | $97 \times 25 = 100$<br>$\times 25 - 3 \times 25$<br>$= 2500 - 75 =$<br>2425.                                                                                                         | $423 + 4 =$<br>427; so 419<br>$+ \square = 427 \rightarrow$<br>$\square = 8$ .                                                                                                     | Sample: $432 = 4 \times 100 +$<br>$1 \times 20 + 1 \times 10 + 2 \times 1$ ; also<br>$432 = 8 \times 50 + 1 \times 10 +$<br>$4 \times 5 + 2 \times 1$ .                                                        | $8 + (-5) \rightarrow$ value =<br>3 m above the<br>ground.                                |
| Q.  | 21                                                                                                                                                                                         | 22                                                                                                                                                                                    | 23                                                                                                                                                                                 | 24                                                                                                                                                                                                             | 25                                                                                        |
| Ans | Expression:<br>$4 \times 18 + 6$ .<br>Terms:<br>$4 \times 18, 6$ .<br>Value = $72$<br>$+ 6 = ₹78$ .                                                                                        | $48 + (-10 \times 2)$<br>$+ (16 \div 2) = 48$<br>$- 20 + 8 \rightarrow$<br>value = 36                                                                                                 | $85 + 15 - 20$<br>$= 80$ . Terms<br>are 85, 15<br>and -20                                                                                                                          | Swapping addition<br>terms: $15 + (-7) = 8$ and<br>$(-7) + 15 = 8$ , same<br>value. Swapping in<br>subtraction: $15 - 7 = 8$<br>but $7 - 15 = -8$ , which is<br>different — subtraction<br>is NOT commutative. | 45 cm.                                                                                    |
| Q.  | 26                                                                                                                                                                                         | 27                                                                                                                                                                                    | 28                                                                                                                                                                                 | 29                                                                                                                                                                                                             | 30                                                                                        |
| Ans | (i) 75 per<br>person.<br>(ii) $3 \times (45$<br>$+ 30)$ .<br>(iii) $3 \times 45 +$<br>$3 \times 30$ .<br>(iv) Both<br>equal $3 \times 75$<br>$= ₹225$ .<br>(v)<br>Distributive<br>property | (i) Terms:<br>100, (ii) 8.<br>(iii) 48. (iv)<br>$100 - (15 \times 4)$<br>$+ (24 \div 3)$ .<br>(v) so the<br>expression<br>has one<br>unambiguous<br>value even<br>without<br>brackets | (i) $8 \times 25 =$<br>₹200.<br>(ii) ₹275.<br>(iii) $8 \times 25 +$<br>$(8 + 3) \times 25$ .<br>(iv) ₹475.<br>(v) Monday<br>₹200 +<br>Tuesday<br>₹275 =<br>₹475, which<br>matches. | 1: $3 \times 12 = ₹36$ .<br>2: ₹72.<br>3: = ₹28 .<br>4: New cost = ₹82;<br>extra paid = ₹10.                                                                                                                   | 1: $120 \div 5 = 24$<br>new boxes;<br>2: $6 + 120 \div 5$ .<br>3: 30 boxes.<br>4: ₹7,000. |



# SUMMARY OF CONCEPTS & DEFINITIONS



## CHAPTER 3 : A PEEK BEYOND THE POINT



### 1. NEED FOR SMALLER UNITS

- Sometimes the basic unit (cm, g, ₹ etc.) is not enough to measure accurately.
- So, we divide the unit into smaller equal parts to get more exact measurements.

#### Example:

Two screws look the same but have slightly different lengths.

Measure using smaller divisions on a scale (mm, tenths, etc.).



### 2. TENTHS ( ONE-TENTHS )

- 1 unit is divided into 10 equal parts. Each part is  $\frac{1}{10}$  or one-tenth.
- 10 one-tenths make 1 unit.
- Numbers with tenths are written using decimal point.

| Fraction        | Decimal | Read as                 |
|-----------------|---------|-------------------------|
| $\frac{4}{10}$  | 0.4     | four-tenths             |
| $\frac{4}{10}$  | 4.4     | four and four-tenths    |
| $\frac{41}{10}$ | 4.1     | four and one-tenth      |
| $\frac{41}{10}$ | 41.1    | forty-one and one-tenth |



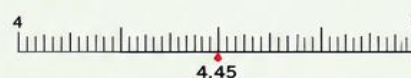
1.4 is 1 unit and 4 one-tenths.

### 3. HUNDREDTHS ( ONE-HUNDREDTHS )

Each one-tenth is divided into 10 equal parts.

- Each part is  $\frac{1}{100}$  or one-hundredth.
- 10 hundredths = 1 tenth
- 100 hundredths = 1 unit

**Example:** The folded paper has length  $4\frac{4}{10} \cdot \frac{5}{100}$  units (or 4.45 units)



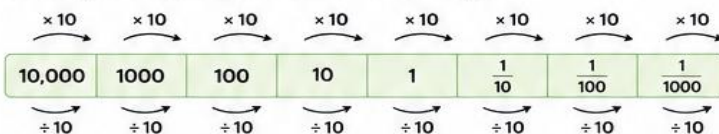
#### Some equivalent forms:

- $4\frac{4}{10} \cdot \frac{5}{100}$  = four and four-tenths and five-hundredths
- 4.45 = decimal notation
- $\frac{445}{100}$  = four hundred forty-five hundredths

### 4. DECIMAL PLACE VALUE SYSTEM

| Place   | Hundreds | Tens | Units | Tenths         | Hundredths      | Thousandths      |
|---------|----------|------|-------|----------------|-----------------|------------------|
| Value   | 100      | 10   | 1     | $\frac{1}{10}$ | $\frac{1}{100}$ | $\frac{1}{1000}$ |
| Example | 7        | 0    | 5     | .              | 5               | → 70.50          |

- The decimal point (.) separates the whole number part from the fractional part.
- Moving right → place value becomes 10 times smaller.
- Moving left → place value becomes 10 times bigger.



### 5. READING & WRITING DECIMALS

- Read as "... point ..." (e.g., 4.05 → four point zero five)
- Trailing zeros after decimal do not change the value.

| Decimal | Read as                  | Same as             |
|---------|--------------------------|---------------------|
| 4.5     | four point five          | 4.50, 4.500         |
| 0.2     | zero point two           | 0.20, 0.200         |
| 0.02    | zero point zero two      | — (not same as 0.2) |
| 1.005   | one point zero zero five | —                   |

**Compare decimals:** Compare digits from left to right at each place value.

### 6. ADDITION & SUBTRACTION OF DECIMALS

- Write numbers one below the other so that the decimal points are in the same column.
- Add or subtract as in whole numbers.
- Put the decimal point in the answer in the same column.

#### Addition

$$\begin{array}{r} 75.345 \\ + 86.691 \\ \hline 162.036 \end{array}$$

#### Subtraction

$$\begin{array}{r} 84.691 \\ - 77.345 \\ \hline 7.346 \end{array}$$

Regroup if needed (just like in whole numbers).

### 7. UNITS OF MEASUREMENT

#### Length

$$\begin{aligned} 1 \text{ cm} &= 10 \text{ mm} \\ 1 \text{ mm} &= \frac{1}{10} \text{ cm} = 0.1 \text{ cm} \\ 1 \text{ m} &= 100 \text{ cm} \\ 1 \text{ cm} &= \frac{1}{100} \text{ m} = 0.01 \text{ m} \\ 1 \text{ mm} &= \frac{1}{1000} \text{ m} = 0.001 \text{ m} \end{aligned}$$



#### Weight

$$\begin{aligned} 1 \text{ kg} &= 1000 \text{ g} \\ 1 \text{ g} &= \frac{1}{1000} \text{ kg} = 0.001 \text{ kg} \end{aligned}$$



#### Money

$$\begin{aligned} 1 \text{ rupee} &= 100 \text{ paise} \\ 1 \text{ paise} &= \frac{1}{100} \text{ rupee} = 0.01 \text{ rupee} \end{aligned}$$

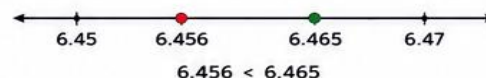
### 8. ESTIMATION & COMPARISON

- To estimate sums/differences, compare whole number parts first.
- Sum of two decimals is greater than the sum of their whole parts and less than the sum of their whole parts + 2.

**Example:** For  $25.936 + 8.202$

$$\begin{aligned} 25 + 8 &< \text{Sum} < (25 + 1) + (8 + 1) \\ 33 &< \text{Sum} < 35 \end{aligned}$$

- Locate decimals on the number line to compare.



### 9. REAL LIFE APPLICATIONS



Measuring lengths & weights



Money transactions



Shopping & pricing



Medicine doses (decimals are important!)



Fuel, distance & more

Wrong decimal placement or unit conversion can lead to serious mistakes.



### 10. KEY TAKEAWAYS

- Use smaller units (tenths, hundredths, thousandths) for accuracy.
- Decimal system extends place value system to the right of 1.
- Decimal point separates whole and fractional parts.
- Trailing zeros after decimal do not change the value.
- Add & subtract decimals by aligning decimal points.
- Convert between units carefully (mm ↔ cm, g ↔ kg, paise ↔ rupee).
- Understand, estimate and compare decimals using place value.



Remember: Precision in decimals brings accuracy in mathematics and in life!



## A PEAK BEYOND THE POINT

### Learning Outcomes

LO1: Understand and represent tenth and hundredth.

LO2: Compare and order tenth and hundredth.

LO3: Apply operations on decimals in real-life situations.

LO4: Solve problems involving decimals.

LO5: Develop logical reasoning and mathematical thinking.

### Competencies

C1: Observation and representation

C2: Logical reasoning and calculation

C3: Problem solving ability

C4: Application of concepts in daily life

| Q.No                      | Question                                                                                                                                                                            | LO  | Competency |
|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------------|
| <b>MCQs (1 Mark Each)</b> |                                                                                                                                                                                     |     |            |
| 1                         | What is the decimal representation of 7 tenths?<br>(a) 0.07      (b) 0.7      (c) 7.1      (d) 7.0                                                                                  | LO1 | C1         |
| 2                         | How do you write "forty-two and five hundredths" in decimal form?<br>(a) 42.5      (b) 42.05      (c) 42.50      (d) 42.005                                                         | LO1 | C1         |
| 3                         | What is the fraction representation of the decimal 0.25?<br>(a) $\frac{2}{5}$ (b) $\frac{1}{4}$ (c) $\frac{25}{100}$ (d) $\frac{1}{25}$                                             | LO1 | C1         |
| 4                         | Which decimal number is the greatest?<br>(a) 0.507      (b) 0.57      (c) 0.75      (d) 0.5                                                                                         | LO2 | C2         |
| 5                         | Which of the following is equivalent to 0.4?<br>(a) 0.04      (b) 0.40      (c) 0.004      (d) 0.404                                                                                | LO3 | C2         |
| 6                         | Convert 85 paise into rupees.<br>(a) ₹8.50      (b) ₹0.85      (c) ₹85.0      (d) ₹0.085                                                                                            | LO3 | C4         |
| 7                         | Sita purchases 0.75 kg of wheat, 0.5 kg of barley, and 0.45 kg of oats.<br>What is the total weight of the items?<br>(a) 1.50 kg      (b) 1.65 kg      (c) 1.70 kg      (d) 1.25 kg | LO3 | C4         |
| 8                         | What is the sum of <b>15.87</b> and <b>2.005</b> ?<br>(a) 15.875      (b) 1.5875      (c) 17.875      (d) 17.075                                                                    | LO5 | C3         |
| 9                         | How much less is <b>10</b> km than <b>30.6</b> km?<br>(a) 10.6 km      (b) 20.6 km      (c) 30.6 km      (d) 40.6 km                                                                | LO5 | C3         |

|                                             |                                                                                                                                                                     |     |    |
|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----|
| 10                                          | Divide <b>3.9</b> by <b>100</b> .<br>(a) 0.39      (b) 3.9      (c) 0.039      (d) 39.0                                                                             | LO5 | C3 |
| <b>Short Answer Type (Two Marks Each)</b>   |                                                                                                                                                                     |     |    |
| 11                                          | Represent 0.45 in the form of a fraction and state which place value the 5 represents.                                                                              | LO1 | C1 |
| 12                                          | Represent 1.3 on a number line.                                                                                                                                     | LO1 | C1 |
| 13                                          | Arrange the following decimals in increasing order: 3.45, 3.5, 3.05, 3.005.                                                                                         | LO2 | C2 |
| 14                                          | John bought 2.5 kg of apples and 3.25 kg of oranges. What is the total weight of the fruits he bought?.                                                             | LO3 | C4 |
| 15                                          | A pencil has a length of 12.5 cm. If 3.2 cm of it is sharpened and used, what is the length of the remaining pencil?                                                | LO3 | C4 |
| 16                                          | Find: $3.25 - 0.43$                                                                                                                                                 | LO3 | C2 |
| 17                                          | The thickness of one coin is 1.45 mm. What will be the thickness of 10 such coins stacked on top of each other?                                                     | LO3 | C3 |
| 18                                          | Maria's height is 1.45 m and her brother's height is 1.6m. What is the difference in their heights?.                                                                | LO4 | C3 |
| 19                                          | If a rope of length 5.4 m is divided into 3 equal pieces, what is the length of each piece?                                                                         | LO4 | C3 |
| 20                                          | A carpenter has a wooden board that is 12.75 m long. He cuts a piece of 8.25 m from it. What is the length of the remaining board?                                  | LO3 | C4 |
| <b>Short Answer Type (Three Marks Each)</b> |                                                                                                                                                                     |     |    |
| 21                                          | Riya went to the market and purchased 6.345 kg of rice 2.350 kg of sugar, and 10.350 kg of flour. What is the total weight of her purchases?                        | LO3 | C4 |
| 22                                          | A tailor has three pieces of cloth measuring 2.45 m, 1.35m and 0.75 m. The dress he plans to make requires a minimum of 4.5 m of cloth. Does he have enough fabric? | LO4 | C3 |
| 23                                          | The thickness of 15 notebooks is 22.5 cm. Find the thickness of one notebook                                                                                        | LO4 | C2 |
| 24                                          | A pipe is 6.8 m long. 2.45 m is cut off. Find remaining length.                                                                                                     | LO4 | C3 |
| 25                                          | Simplify the given expression: $25/10 + 34/100$ and convert it into a decimal.                                                                                      | LO4 | C2 |

**Long Answer Type (Five Marks Each)**

|    |                                                                                                                                                 |     |    |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------|-----|----|
| 26 | A shopkeeper has 25.75 kg of rice. He sells 8.45 kg in the morning and 7.80 kg in the evening. How much rice is left?                           | LO4 | C3 |
| 27 | Three water bottles contain 1.25 L, 2.75 L and 3.5 L of water respectively. If 2.5 L water consumed Find the total remaining quantity of water. | LO3 | C4 |
| 28 | A school purchased 25 notebooks costing ₹18.75 each and 15 notebooks costing ₹22.50 each. Find the total amount spent.                          | LO4 | C4 |

**Case study based**

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |     |    |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----|
| 29 | <p>Well-known jeweller in the city was approached by a regular customer who brought in three gold chains for repair. Each chain was of a different weight — Chain A weighed 45.75 g, Chain B weighed 32.8 g, and Chain C weighed 38.925 g. To restore their shine and strength, the jeweller planned to use additional gold dust during the repairs. He wanted to know the total gold he had received, the final weight after repairs, and its total value in the market.</p>  <p>(a) Find the total weight of gold received.<br/>         (b) If 5.5 g of gold dust is used in repairs and added to the chains, what is the final weight?<br/>         (c) Convert the final weight into kilograms.<br/>         (d) If 1 g of gold costs ₹5,400, find the total value of the final gold.</p> | LO3 | C4 |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----|

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |     |    |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----|
| 30 | <p>A local sports club was preparing its swimming pool for a summer training camp. The filling was done in two stages: 12.5 kilolitres on the first day and 8.375 kilolitres on the second day. However, due to the hot weather, some water evaporated before the pool was fully covered. The club manager wanted to calculate the total water initially filled, the remaining amount after evaporation, and the cost of the remaining water to manage the club's budget for upcoming swimming sessions</p>  <p>(a) Find the total water filled in litres.<br/> (b) If 1500 litres evaporated, how much water remains?<br/> (c) Convert the remaining water into kilolitres.<br/> (d) If each kilolitre costs ₹35 to supply, find the total cost of the remaining water.</p> | LO5 | C3 |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----|

### ANSWERS

|     |           |                            |                         |                                                                    |                                                                              |
|-----|-----------|----------------------------|-------------------------|--------------------------------------------------------------------|------------------------------------------------------------------------------|
| Q.  | 1         | 2                          | 3                       | 4                                                                  | 5                                                                            |
| Ans | b         | b                          | c                       | c                                                                  | b                                                                            |
| Q.  | 6         | 7                          | 8                       | 9                                                                  | 10                                                                           |
| Ans | b         | c                          | c                       | b                                                                  | c                                                                            |
| Q.  | 11        | 12                         | 13                      | 14                                                                 | 15                                                                           |
| Ans | 45/100    | Number line representation | 3.005, 3.05, 3.45, 3.5, | 5.75 Kg                                                            | 9.3 cm                                                                       |
| Q.  | 16        | 17                         | 18                      | 19                                                                 | 20                                                                           |
| Ans | 2.82      | 14.5 mm                    | 0.15 m                  | 1.8 m                                                              | 4.5 m                                                                        |
| Q.  | 21        | 22                         | 23                      | 24                                                                 | 25                                                                           |
| Ans | 19.045 Kg | Yes, he has enough fabric  | 1.5 cm                  | 4.35 m                                                             | 2.84                                                                         |
| Q.  | 26        | 27                         | 28                      | 29                                                                 | 30                                                                           |
| Ans | 9.50 kg   | 5 L                        | Rs 806.25               | (a) 117.475 g<br>(b) 122.975g<br>(c) 0.122975 kg<br>(d) Rs 664065. | (a) 20.875 KL<br>=20875 L .<br>(b) 19375L<br>(c) 19.375 KL.<br>(d) Rs 678.13 |

### Challenging Questions (Stage1)

- Q1. What should be added to 4.75 to get 8.20?
- Q2. A rope is 8.5 m long. Another rope is 2.75 m longer. Find the length of the second rope.
- Q3 Find the sum of 2.45, 1.35 and 3.2
- Q4. Write 45/100 as a decimal.
- Q5. A notebook costs ₹25.75. Find the cost of 2 notebooks.

### Challenging Questions (Stage2)

- Q1. A runner completed 2.75 km, 3.15 km and 1.85 km. Total distance?
- Q2. Find the average of 2.4, 3.6 and 4.8
- Q3. A ribbon of 12.5 m is cut into pieces of 2.5 m each. How many pieces are obtained?
- Q4. The difference between two decimals is 3.45. The larger number is 8.90. Find the smaller.
- Q5. A milkman sold 15.75 L milk from 25.5 L. How much is left?

### Challenging Questions (Stage3)

- Q1. Three friends collected 2.35 kg, 3.45 kg and 1.75 kg waste paper. How much more is needed to make 10 kg?
- Q2. A bucket contains 12.5 L water. Every hour 1.75 L is used. How much water remains after 4 hours?
- Q3. A train travels 125.75 km in first part and 84.65 km in second part. Distance left is 39.6 km. Find total route length.
- Q4. A water tank contains 50 L. It loses 2.75 L daily. How much water remains after 12 days?
- Q5. A merchant mixed 12.5 kg rice with 7.75 kg rice. He sold 8.25 kg. How much remains?

### Answers (Challenging Questions)

|             | Q.1            | Q.2            | Q.3           | Q.4         | Q.5             |
|-------------|----------------|----------------|---------------|-------------|-----------------|
| Stage1 /Ans | <b>3.45</b>    | <b>11.25 m</b> | <b>7</b>      | 0.45        | <b>Rs 51.50</b> |
| Stage2 /Ans | 7.75 KM        | <b>3.6</b>     | <b>5</b>      | <b>5.45</b> | <b>9.75 L</b>   |
| Stage3 /Ans | <b>2.45 kg</b> | <b>5.5 L</b>   | <b>250 km</b> | <b>17 L</b> | <b>12 kg</b>    |



# 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 ( $2 \times 2$ 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 ( $3 \times 3$ 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 LETTERS AND NUMBERS

### Learning Outcomes:

LO1: Understand variables, constants, and operations.

LO2: Evaluate algebraic expressions for given values.

LO3: Recognize patterns and express them using letters.

### Competencies:

C1: Algebraic thinking

C2: Generalization and pattern recognition

C3: Symbolic representation

| Q.No                      | Question                                                                                                                          | LO  | Competency |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-----|------------|
| <b>MCQs (1 Mark Each)</b> |                                                                                                                                   |     |            |
| 1                         | Which of the following is an algebraic expression?<br>a) $7 + 5 = 12$ b) $3x + 4$ c) $9 > 4$ d) $15 \div 3$                       | LO1 | C1         |
| 2                         | In the expression $(5a + 7)$ , the variable is:<br>a) 5      b) 7      c) a      d) +                                             | LO1 | C1         |
| 3                         | The numerical coefficient of $(9m)$ is:<br>a) m      b) 9      c) 0      d) 1                                                     | LO1 | C1         |
| 4                         | Simplify: $(x + x + x)$<br>a) $x^3$ b) $3x$ c) $x + 3$ d) $2x$                                                                    | LO2 | C2         |
| 5                         | Which expression represents “7 less than a number (p)”?<br>a) $(7 - p)$ b) $(p + 7)$ c) $(p - 7)$ d) $(7p)$                       | LO3 | C2<br>C3   |
| 6                         | The value of $(2x + 5)$ when $x = 3$ is:<br>a) 6      b) 8      c) 11      d) 15                                                  | LO2 | C2<br>C3   |
| 7                         | Which of the following are like terms?<br>a) $(3x)$ and $(3y)$ b) $(5a)$ and $(7a)$<br>c) $(2m)$ and $(2mn)$ d) $(x)$ and $(x^2)$ | LO1 | C1         |
| 8                         | The expression $4n - 9$ has:<br>a) One term      b) Two terms      c) Three terms      d) Four terms                              | LO1 | C2         |
| 9                         | If $(a = 2)$ , then the value of $(a^2 + 3a)$ is:<br>a) 8      b) 10      c) 12      d) 14                                        | LO2 | C2<br>C3   |

|                                             |                                                                                                                                     |     |                |
|---------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-----|----------------|
| 10                                          | Which expression means “double of x added to 9”?<br>a) $(2 + x + 9)$ b) $(2x + 9)$ c) $(9x + 2)$ d) $(x + 18)$                      | LO3 | C2<br>C3       |
| <b>Short Answer Type (Two Marks Each)</b>   |                                                                                                                                     |     |                |
| 11                                          | Identify the variables and constants in $(7x + 12)$ .                                                                               | LO1 | C1             |
| 12                                          | Write an algebraic expression for: “5 more than twice a number (n).”                                                                | LO3 | C2<br>C3       |
| 13                                          | Find the value of $(3a - 4)$ when $(a = 6)$ .                                                                                       | LO2 | C1<br>C2       |
| 14                                          | Simplify: $(2x + 5x)$                                                                                                               | LO3 | C1<br>C2       |
| 15                                          | Write whether the following are like terms or unlike terms:<br><br>$(4m)$ and $(9m)$                                                | LO1 | C1             |
| 16                                          | Form an expression for: “The product of 8 and a number (y).”                                                                        | LO3 | C2<br>C3       |
| 17                                          | Find the value of: $(2p + 7)$ when $(p = 10)$                                                                                       | LO2 | C2<br>C3       |
| 18                                          | Simplify: $(9a - 2a + 4)$                                                                                                           | LO3 | C1             |
| 19                                          | Write the coefficient of:<br><br>a) $(6x)$ b) $(-9y)$                                                                               | LO1 | C1             |
| 20                                          | Translate into algebraic expression:<br><br>“Three times a number decreased by 4.”                                                  | LO3 | C2<br>C3       |
| <b>Short Answer Type (Three Marks Each)</b> |                                                                                                                                     |     |                |
| 21                                          | Simplify: $(5x + 3y - 2x + 7y)$                                                                                                     | LO2 | C1             |
| 22                                          | Find the value of: $(2a + 3b)$ when $(a = 4)$ and $(b = 5)$                                                                         | LO2 | C2<br>C3       |
| 23                                          | Write algebraic expressions for:<br><br>a) 10 less than a number k<br>b) 4 times a number m increased by 7<br>c) Half of a number p | LO3 | C1<br>C2<br>C3 |
| 24                                          | Simplify: $(8m + 5 - 3m + 2)$                                                                                                       | LO2 | C1             |

|                                           |                                                                                                                                                                                                                                                             |            |                |
|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|----------------|
| 25                                        | The length of a rectangle is $(x + 3)$ cm and breadth is 5 cm.<br><br>Write the expression for its perimeter.                                                                                                                                               | LO3        | C2<br>C3       |
| <b>Long Answer Type (Five Marks Each)</b> |                                                                                                                                                                                                                                                             |            |                |
| 26                                        | Simplify the following:<br><br>a) $(7x + 4y - 2x + 5y)$ b) $(9a - 3 + 2a + 7)$                                                                                                                                                                              | LO2        | C1<br>C2       |
| 27                                        | Find the value of:<br><br>$(3x + 2y - z)$ when $x = 4, y = 5, z = 6$                                                                                                                                                                                        | LO2        | C2<br>C3       |
| 28                                        | A notebook costs ₹ $(x)$ and a pen costs ₹15.<br><br>Write an algebraic expression for:<br>a) Cost of 3 notebooks and 2 pens<br>b) Total cost when $(x = 20)$                                                                                               | LO2<br>LO3 | C1<br>C2<br>C3 |
| <b>Case study based</b>                   |                                                                                                                                                                                                                                                             |            |                |
| 29                                        | <b>School Canteen</b><br>In a school canteen, the cost of one sandwich is ₹ $(x)$ and one juice costs ₹20.<br><b>Questions:</b><br>1. Write the algebraic expression for the cost of 2 sandwiches and 3 juices.<br>2. Find the total cost when $(x = 40)$ . | LO2<br>LO3 | C1<br>C2<br>C3 |
| 30                                        | <b>Book Store</b><br>A student buys $(n)$ notebooks costing ₹25 each and one geometry box costing ₹80.<br><b>Questions:</b><br>1. Write the algebraic expression for the total cost.<br>2. Find the total cost when $(n = 4)$ .                             | LO2<br>LO3 | C1<br>C2<br>C3 |

### ANSWERS

|     |                |        |                   |              |               |
|-----|----------------|--------|-------------------|--------------|---------------|
| Q   | 1              | 2      | 3                 | 4            | 5             |
| Ans | b              | c      | b                 | b            | c             |
| Q   | 6              | 7      | 8                 | 9            | 10            |
| Ans | c              | b      | b                 | b            | b             |
| Q   | 11             | 12     | 13                | 14           | 15            |
| Ans | $x, 12$        | $2n+5$ | 14                | $7x$         | like          |
| Q   | 16             | 17     | 18                | 19           | 20            |
| Ans | $8y$           | 27     | $7a+4$            | 6, -9        | $3x-4$        |
| Q   | 21             | 22     | 23                | 24           | 25            |
| Ans | $3x+10y$       | 23     | $k-10, 4m+7, p/2$ | $5m+7$       | $2x+16$       |
| Q   | 26             | 27     | 28                | 29           | 30            |
| Ans | $5x+9y, 11a+4$ | 16     | $3x+30, 90$       | $2x+60, 140$ | $25n+80, 180$ |

### Challenging Questions – Stage 1

1. Simplify:  $(4x + 7 - 2x + 3)$
2. If  $(a = 5)$ , find the value of  $(2a^2 - 3a)$
3. Write an expression for: “7 more than triple a number.”
4. Find the perimeter of a square whose side is  $(x + 2)$ .
5. Simplify:  $(8m - 3m + 2m)$

### Challenging Questions – Stage 2

1. Simplify:  $(6a + 4b - 2a + 7b)$
2. The age of Rahul is  $(x)$  years. His sister is 5 years younger. Write an expression for her age.
3. Find the value of:  $(2p^2 + 3p - 1)$  when  $(p = 2)$
4. A rectangle has length  $(2x)$  and breadth  $(x + 1)$ . Write the expression for perimeter.
5. Simplify:  $(9y - 4 + 2y + 6 - y)$

### Challenging Questions – Stage 3

1. Simplify:  $(3x + 5y - 2x + 7 - 3y + 4)$
2. The cost of one pencil is ₹ $(p)$ . Write an expression for the cost of:  
a) 12 pencils    b) 12 pencils and 5 erasers costing ₹3 each
3. If  $(m = 3)$  and  $(n = 2)$ , find the value of:  $(2m^2 + 3n^2 - mn)$
4. The length of a rectangle is  $(x + 5)$  and breadth is  $(x - 2)$ . Write the expression for:  
a) Perimeter                      b) Sum of length and breadth
5. Simplify and find the value when  $(x = 2)$ :  $(5x + 3 - 2x + 4 + x)$

### Answers (Challenging Questions)

|             | Q.1       | Q.2           | Q.3    | Q.4          | Q.5        |
|-------------|-----------|---------------|--------|--------------|------------|
| Stage1 /Ans | $2x+10$   | 35            | $3x+7$ | $4x+8$       | $7m$       |
| Stage2 /Ans | $4a+11b$  | $x-5$         | 13     | $6x+2$       | $10y+2$    |
| Stage3 /Ans | $x+2y+11$ | $12p, 12p+15$ | 24     | $4x+6, 2x+3$ | $4x+7, 15$ |



# CHAPTER 5 : PARALLEL AND INTERSECTING LINES



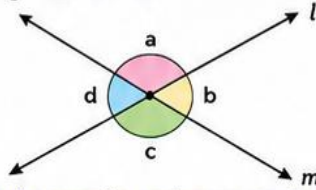
## SUMMARY OF CONCEPTS

### 1. BASIC IDEAS

- ★ A line is a straight path that extends infinitely in both directions.
- ★ Two lines that meet at a point are said to **intersect**.
- ★ The point where they meet is called the **point of intersection**.
- ★ Two lines that never meet, however far they are extended on a plane, are called **parallel lines**.

### 2. INTERSECTING LINES

When two lines  $l$  and  $m$  intersect at a point, four angles are formed.



- ♦ Vertically opposite angles are equal.

$$\angle a = \angle c \quad \text{and} \quad \angle b = \angle d$$

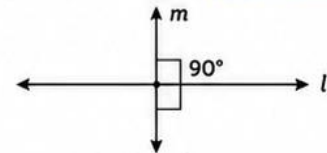
- ♦ Linear pairs add up to  $180^\circ$ .

$$\angle a + \angle b = 180^\circ \quad \angle b + \angle c = 180^\circ$$

(Similarly for other linear pairs)

### 3. PERPENDICULAR LINES

Two lines intersecting each other at right angles ( $90^\circ$ ) are called **perpendicular lines**.



Notation :  $l \perp m$

### 4. PARALLEL LINES

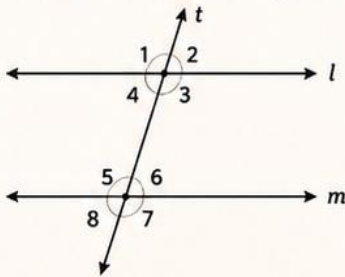
Two lines on the same plane that do not meet, however far they are extended, are called **parallel lines**.



Notation :  $l \parallel m$

### 5. TRANSVERSAL AND ANGLES FORMED

A transversal is a line that intersects two (or more) lines at distinct points.



#### Corresponding angles

Angles in the same relative position at each intersection.

Pairs : (1,5), (2,6), (3,7), (4,8)

#### Alternate angles

Angles on opposite sides of the transversal and between the two lines.

Pairs : (3,6) and (4,5)

#### Interior angles on the same side

Angles between the two lines and on the same side of the transversal.

Pairs : (3,5) and (4,6)

#### Key Properties

- ✓ If a transversal intersects a pair of parallel lines, then corresponding angles are equal.
- ✓ If corresponding angles are equal, then the two lines are parallel.
- ✓ Alternate angles formed by a transversal intersecting a pair of parallel lines are equal.
- ✓ Interior angles on the same side of a transversal intersecting a pair of parallel lines add up to  $180^\circ$ .

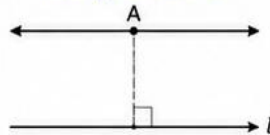
### 6. DRAWING PARALLEL LINES

#### Using Set Square

1. Draw a line  $l$ .
2. With a set square, draw a line perpendicular to  $l$ .
3. Shift the set square along a ruler and draw another perpendicular line.
4. The two perpendicular lines are parallel to each other.



#### Through a Point A



1. Draw a line perpendicular to  $l$ .
2. Through point A, draw a line perpendicular to this.
3. The new line through A is parallel to  $l$ .

### 7. IMPORTANT DEFINITIONS

- **Intersecting lines** : Lines that meet at a point.
- **Perpendicular lines** : Lines that intersect at right angles ( $90^\circ$ ).
- **Parallel lines** : Lines on the same plane that never meet.
- **Transversal** : A line that intersects two (or more) lines at distinct points.
- **Corresponding angles** : Angles in the same relative position.
- **Alternate angles** : Angles on opposite sides of the transversal and between the lines.
- **Interior angles on the same side** : Angles between the lines and on the same side of the transversal.
- **Linear pair** : A pair of adjacent angles whose sum is  $180^\circ$ .
- **Vertically opposite angles** : Opposite angles formed by two intersecting lines; they are equal.

### 8. QUICK REFERENCE

| Concept                      | Condition                              | Result / Property                                                           |
|------------------------------|----------------------------------------|-----------------------------------------------------------------------------|
| Vertically opposite angles   | Two lines intersect                    | Opposite angles are equal ( $\angle a = \angle c$ , $\angle b = \angle d$ ) |
| Linear pair                  | Two adjacent angles on a straight line | Sum = $180^\circ$                                                           |
| Corresponding angles         | Transversal cuts two lines             | Equal (if lines are parallel)                                               |
| Alternate angles             | Transversal cuts two parallel lines    | Equal                                                                       |
| Interior angles on same side | Transversal cuts two parallel lines    | Sum = $180^\circ$                                                           |

### 9. REAL LIFE CONNECTIONS



Railway tracks are parallel.



Zebra crossings have parallel white lines.



Window frames have perpendicular horizontal and vertical lines.



Ladder rungs are parallel.

#### ★ REMEMBER!

- ✓ Use a set square to draw perpendicular lines.
- ✓ Use equal corresponding angles to check if lines are parallel.
- ✓ Always identify the type of angles before applying any property.
- ✓ Visualise carefully and reason – that's geometry!

## PARALLEL AND INTERSECTING LINES

### Learning Outcomes:

LO1: Identify parallel, intersecting, and perpendicular lines.

LO2: Draw these lines using ruler and set squares.

LO3: Observe such lines in the environment.

LO4: Analyze simple geometric figures using line relationships.

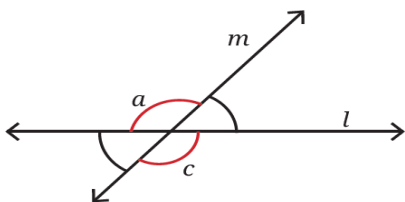
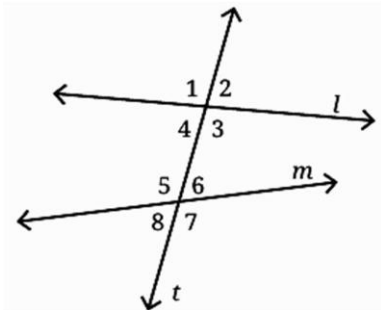
LO5: Develop spatial reasoning skills.

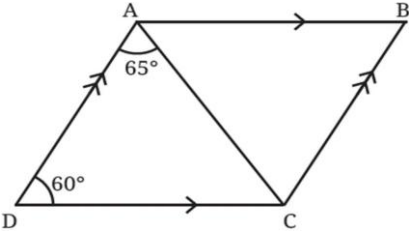
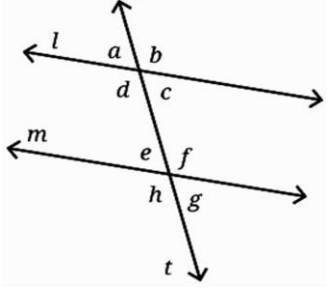
### Competencies:

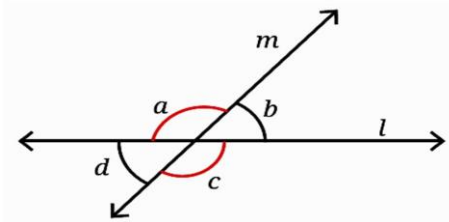
C1: Geometrical visualization

C2: Classification and reasoning

C3: Use of instruments

| Q.No                      | Question                                                                                                                                                                                                                                                                                                                                                                                      | LO | Competency |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|------------|
| <b>MCQs (1 Mark Each)</b> |                                                                                                                                                                                                                                                                                                                                                                                               |    |            |
| 1                         | <p>In the below figure, if <math>\angle a = 70^\circ</math>, then <math>\angle c = ?</math></p>  <p>(a) <math>70^\circ</math>                      (b) <math>110^\circ</math>                      (c) <math>180^\circ</math>                      (d) <math>90^\circ</math></p>                            |    |            |
| 2                         | <p>In the above figure, if <math>\angle a = 0^\circ</math>, which term best describes line <math>l</math> and <math>m</math></p> <p>a) Parallel                      (b) Intersecting                      (c) Perpendicular                      (d) Skew</p>                                                                                                                                |    |            |
| 3                         | <p>Two adjacent angles form a linear pair. If one angle is <math>45^\circ</math>, the other is –</p> <p>(a) <math>135^\circ</math>                      (b) <math>145^\circ</math>                      (c) <math>90^\circ</math>                      (d) <math>180^\circ</math></p>                                                                                                         |    |            |
| 4                         | <p>In the adjoining figure, line <math>t</math> intersects <math>l</math> and <math>m</math>. How many pairs of vertically opposite angles are formed?</p>  <p>(a) 2                                      (b) 3                                      (c) 4                                      (d) 8</p> |    |            |

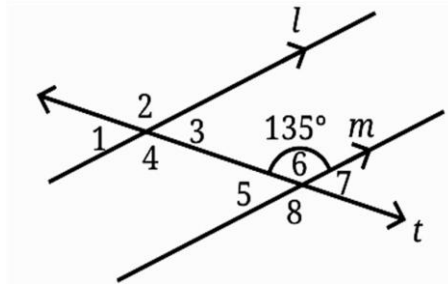
|   |                                                                                                                                                                                                                                                                                                                                                                                                    |  |  |
|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|
| 5 | <p>If a transversal intersects two parallel lines, which of the following is always true?</p> <p>a) Corresponding angles unequal<br/> b) Alternate angles equal<br/> c) Interior angles on same side = <math>90^\circ</math><br/> d) Vertically opposite angles unequal</p>                                                                                                                        |  |  |
| 6 | <p>When a transversal intersects two parallel lines, what is the sum of all four interior angles?</p> <p>(a) <math>360^\circ</math>      (b) <math>180^\circ</math>      (c) <math>720^\circ</math>      (d) <math>540^\circ</math></p>                                                                                                                                                            |  |  |
| 7 | <p>In the adjoining figure, <math>\angle DAC = 65^\circ</math>, <math>\angle ADC = 60^\circ</math>. Find <math>\angle CAB</math>.</p>  <p>(a) <math>50^\circ</math>      (b) <math>55^\circ</math>      (c) <math>60^\circ</math>      (d) <math>65^\circ</math></p>                                              |  |  |
| 8 | <p>A railway bridge has vertical pillars and the ground. What kind of angle is formed between pillar and ground?</p> <p>(a) Acute      (b) Right      (c) Obtuse      (d) Reflex</p>                                                                                                                                                                                                               |  |  |
|   | <p>In the following questions 9 and 10, a statement of assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices.</p> <p>(a) Both A and R are true and R is the correct explanation of A.<br/> (b) Both A and R are true but R is not the correct explanation of A.<br/> (c) A is true but R is false.<br/> (d) A is false but R is true.</p> |  |  |
| 9 | <p><b>Assertion (A):</b> In the adjoining figure, <math>\angle f = \angle d</math>.<br/> <b>Reason (R):</b> Alternate interior angles formed by transversal on parallel lines are equal.</p>                                                                                                                   |  |  |

|                                           |                                                                                                                                                                                                                                       |  |  |
|-------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|
| 10                                        | <p><b>Assertion (A):</b> Corresponding angles equal <math>\Rightarrow</math> lines are parallel.</p> <p><b>Reason (R):</b> Equality of corresponding angles is both necessary and sufficient condition for parallelism.</p>           |  |  |
| <b>Short Answer Type (Two Marks Each)</b> |                                                                                                                                                                                                                                       |  |  |
| 11                                        | <p>In the adjoining figure, if <math>\angle a = 115^\circ</math>, find <math>\angle b</math>, <math>\angle c</math> and <math>\angle d</math>.</p>  |  |  |
| 12                                        | A transversal intersects two lines such that corresponding angles are $78^\circ$ each. Are the lines parallel? Why                                                                                                                    |  |  |
| 13                                        | Two complementary angles are such that one angle is $30^\circ$ less than twice the other. Find the measure of the larger angle.                                                                                                       |  |  |
| 14                                        | Draw two lines intersecting at a point such that one angle is $35^\circ$ . Find the remaining three angles.                                                                                                                           |  |  |
| 15                                        | State whether the following pair of angles are:<br>Linear Pair or Vertically Opposite Angles, If two angles are adjacent and their sum is $180^\circ$                                                                                 |  |  |
| 16                                        | If two lines intersect and one angle measures $125^\circ$ , find its vertically opposite angle.                                                                                                                                       |  |  |
| 17                                        | Draw a pair of perpendicular lines and write the measure of each angle formed.                                                                                                                                                        |  |  |
| 18                                        | If one angle of a linear pair is $115^\circ$ , find the other angle.                                                                                                                                                                  |  |  |
| 19                                        | If one alternate angle is $60^\circ$ , find the other alternate angle.                                                                                                                                                                |  |  |
| 20                                        | Explain why two perpendicular lines cannot be parallel to each other.                                                                                                                                                                 |  |  |

### Short Answer Type (Three Marks Each)

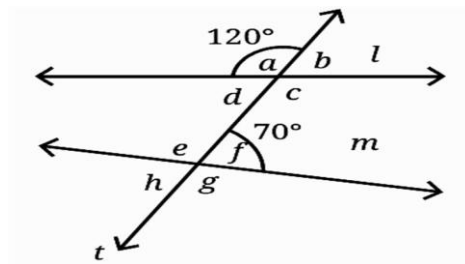
21

In the below left sided figure,  $\angle 6 = 135^\circ$ . Find measures of  $\angle 1, \angle 2, \angle 3, \angle 4, \angle 5, \angle 7, \angle 8$ .



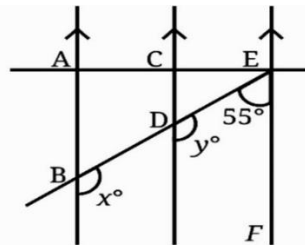
22

In the above right sided figure,  $\angle a = 120^\circ$  and  $\angle f = 70^\circ$ . Are  $l$  and  $m$  parallel? Give reason.



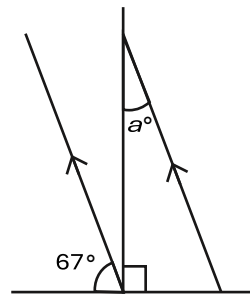
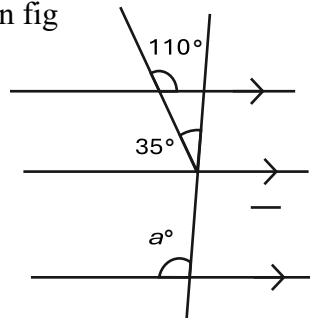
23

In the below figure,  $AB \parallel CD \parallel EF$  and  $EA \perp AB$ . If  $\angle BEF = 55^\circ$ , find  $x$  and  $y$



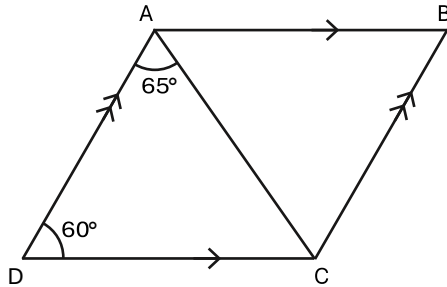
24

Find angle  $a$  in given fig



25

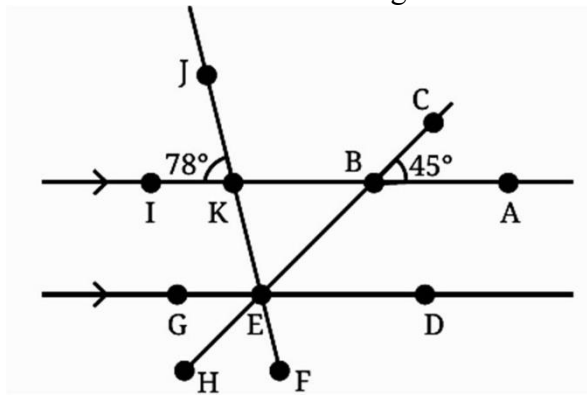
In Fig. segment AB is parallel to CD and AD is parallel to BC.  $\angle DAC$  is  $65^\circ$  and  $\angle ADC$  is  $60^\circ$ . What are the measures of angles  $\angle CAB$ ,  $\angle ABC$ , and  $\angle BCD$ ?



**Long Answer Type (Five Marks Each)**

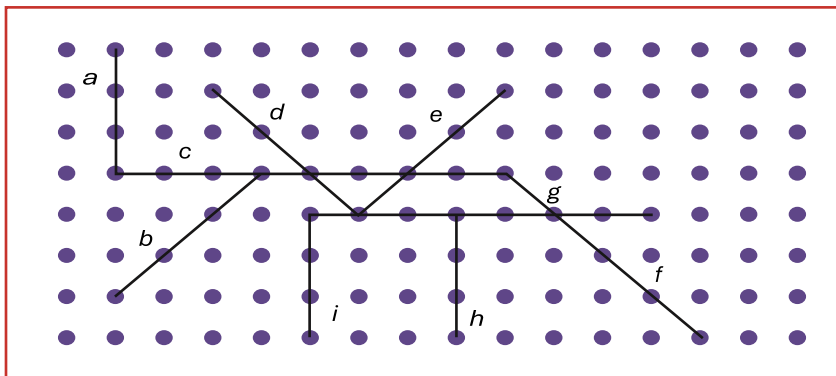
26

In the below figure,  $\angle ABC = 45^\circ$  and  $\angle IKJ = 78^\circ$ . Find angles  $\angle GEH$ ,  $\angle HEF$  and  $\angle FED$  with reasoning.



27

Identify pair of parallel lines and perpendicular lines in given below.

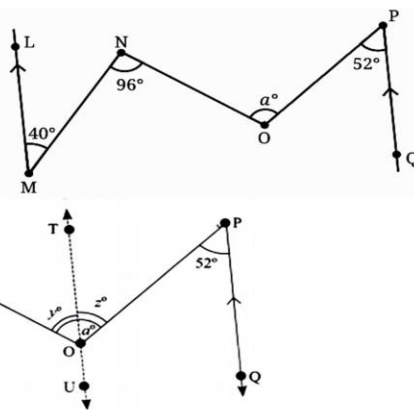
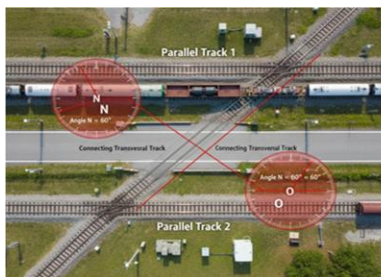


|    |                                                                                                                                                                                                                     |  |  |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|
| 28 | <p>In Fig. , parallel lines <math>l</math> and <math>m</math> are intersected by the transversal <math>t</math>. If <math>\angle 6</math> is <math>115^\circ</math>, what are the measures of the other angles?</p> |  |  |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|

### Case study based

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |  |  |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|
| 29 | <p>To alleviate rush hour congestion, City Planners are designing a new flyover over two major, parallel avenues, Elm Street and Oak Avenue. A crucial connector road is being added to link them, acting as a transversal line. For optimal traffic flow and driver safety, the engineers must rigorously measure the corresponding angles where the connector road meets the main avenues, ensuring they are equal to guarantee the smoothest possible transition between the parallel road</p> <p>i) Which angles are corresponding angles in the above figure?<br/> ii) If <math>\angle a = 65^\circ</math>, what is <math>\angle b</math>?<br/> iii) Why must <math>\angle a = \angle b</math> for parallelism?<br/> iv) Write one real-life importance of parallel roads in city planning.</p> |  |  |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |  |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|
| 30 | <p>At the bustling New Delhi Railway Junction, two main tracks, LM and PQ, run perfectly parallel. A new high-speed connecting track cuts across both, creating crucial intersection points N and O where engineers must manage traffic flow. To test safety and signalling, the head engineer sketched two virtual test lines: line RS through point N, parallel to LM, and line TU through point O, parallel to PQ, creating a network of angles to analyse.</p> |  |  |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|



a) If  $\angle NOP = a^\circ$ , what type of angle relation must be checked to confirm parallelism of the tracks?

b) Find the angle  $x^\circ$ .

c) Find the angle  $z^\circ$ .

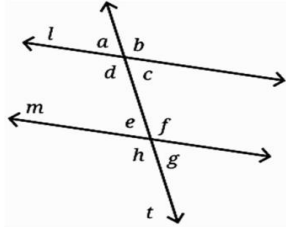
d) Find the angle  $a^\circ$ .

### ANSWERS

|     |                                                                                                                             |                                                                                                                           |                                                                                                                             |                                                         |                                                                                                   |
|-----|-----------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| Q   | 1                                                                                                                           | 2                                                                                                                         | 3                                                                                                                           | 4                                                       | 5                                                                                                 |
| Ans | a                                                                                                                           | a                                                                                                                         | a                                                                                                                           | c                                                       | b                                                                                                 |
| Q   | 6                                                                                                                           | 7                                                                                                                         | 8                                                                                                                           | 9                                                       | 10                                                                                                |
| Ans | a                                                                                                                           | b                                                                                                                         | b                                                                                                                           | a                                                       | a                                                                                                 |
| Q   | 11                                                                                                                          | 12                                                                                                                        | 13                                                                                                                          | 14                                                      | 15                                                                                                |
| Ans | $b=65^\circ$<br>$c=115^\circ$<br>$d=65^\circ$                                                                               | yes                                                                                                                       | $50^\circ$                                                                                                                  | Construction                                            | Linear Pair                                                                                       |
| Q   | 16                                                                                                                          | 17                                                                                                                        | 18                                                                                                                          | 19                                                      | 20                                                                                                |
| Ans | $125^\circ$                                                                                                                 | Construction                                                                                                              | $65^\circ$                                                                                                                  | $60^\circ$                                              | Explanation                                                                                       |
| Q   | 21                                                                                                                          | 22                                                                                                                        | 23                                                                                                                          | 24                                                      | 25                                                                                                |
| Ans | $\angle 6 = \angle 2 =$<br>$\angle 4 = \angle 8 = 135^\circ$<br>$\angle 1 = \angle 3 = \angle 5 =$<br>$\angle 7 = 45^\circ$ | NO                                                                                                                        | $x = y = 125^\circ$                                                                                                         | i) $105^\circ$<br>ii) $23^\circ$                        | $55^\circ$<br>$60^\circ$<br>$65^\circ$                                                            |
| Q   | 26                                                                                                                          | 27                                                                                                                        | 28                                                                                                                          | 29                                                      | 30                                                                                                |
| Ans | $45^\circ$<br>$57^\circ$<br>$78^\circ$                                                                                      | Perpendicular lines:<br>(a & c), (i & g)<br>(h & g)<br>Parallel lines:<br>(a & i), (i & h)<br>(a & h),<br>(b & e) (d & f) | $\angle 6 = \angle 2 =$<br>$\angle 4 = \angle 8 = 115^\circ$<br>$\angle 1 = \angle 3 = \angle 5 =$<br>$\angle 7 = 65^\circ$ | i) a & b<br>ii) $65^\circ$<br>iii) Corresponding angles | a) Corresponding and alternate interior angles<br>b) $44^\circ$<br>c) $52^\circ$<br>d) $96^\circ$ |

### Challenging question stage-1

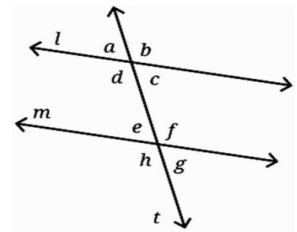
1. Two lines intersect and one angle is  $65^\circ$ . Draw diagram label it and find the other three angles.
2. List all linear pairs and vertically opposite angles in the given intersecting lines diagram.



3. Draw two perpendicular lines and mark all angles formed and label it.
4. Can two straight lines intersect at more than one point? Explain.
5. Draw a pair of parallel lines and a transversal. Mark all pair of corresponding angles.

### Challenging question stage-2

1. A transversal cuts two parallel lines. One corresponding angle is  $72^\circ$ . Find all eight angles.
2. If alternate angles are equal, what can you conclude about the lines?
3. Construct parallel lines using ruler and set square.
4. Find all angles if angle d is  $48^\circ$  in given diagram
5. Identify parallel and perpendicular pairs in a classroom object.

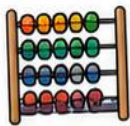


### Challenging question stage-3

1. If an interior angle is  $(2x+10)^\circ$  and the co-interior angle is  $(3x-20)^\circ$ , find x.
2. Design a real-life pattern using at least three pairs of parallel lines and two pairs of perpendicular lines.
3. Two parallel lines are cut by a transversal. The ratio of corresponding angles is 4:4. Find all angles.
4. One angle formed by intersecting lines is x. Express all other angles in terms of x.
5. Explain why two non-parallel lines can never have equal corresponding angles.

### Answers (Challenging questions)

|        | Q.1                | Q.2                                                                                                                                                  | Q.3                                                                                                                                          | Q.4                                                       | Q.5          |
|--------|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|--------------|
| Stage1 | $65^0$ and $115^0$ | Linear pairs:<br>(a, b), (a, d),<br>(b, c), (c, d),<br>(e, f), (f, g),<br>(h, g), (e, h)<br>Opposite<br>angles:<br>(a, c), (b, d),<br>(e, g), (f, h) | Construction                                                                                                                                 | Explanation                                               | Construction |
| Stage2 | $72^0$ and $108^0$ | Parallel lines                                                                                                                                       | Construction                                                                                                                                 | $b=f=h=48^0$<br>$a=c=e=g=132^0$                           | Observation  |
| Stage3 | $38^0$             | Drawing                                                                                                                                              | infinitely many possibilities<br>Four Corresponding angles = $x^0$<br>Four alternate angles = $(180^0 - x^0)$<br>where $0^0 < x^0 < 180^0$ . | Opposite<br>angle= $x$<br>Adjacent<br>angles= $180^0 - x$ | Explanation  |



# CHAPTER 6 : NUMBER PLAY

## SUMMARY OF CONCEPTS



### 1. NUMBERS TELL US THINGS

A sequence can be represented by numbers showing a rule or pattern.

#### Example Rule:

Each child calls out the number of people in front of them who are taller than them.



0 0 1 0 3 0 3

#### Key Observations

- First person always says 0.
- Tallest person always says 0.
- Largest number said can be  $(n - 1)$  in a group of  $n$  people.

### 2. PICKING PARITY

Parity means whether a number is EVEN or ODD.



#### Even Numbers

Can be arranged in pairs.



Examples:

2, 4, 6, 8, ...

#### Odd Numbers

Cannot be arranged in pairs.



Examples:

1, 3, 5, 7, ...

#### Important Parity Rules

- even + even = even
- odd + odd = even
- even + odd = odd
- even - even = even
- odd - odd = even
- even - odd = odd
- odd - even = odd

#### Helpful Facts

- Sum of two consecutive numbers is always odd.
- Sum of any two odd numbers is even.
- Sum of numbers 1 to  $2n$  is even.

### 3. SUMS IN GRIDS & MAGIC SQUARES

Row and column sums help us check if a grid can be filled.

Example:

|    |    |    |    |
|----|----|----|----|
| 4  | 7  | 5  | 16 |
| 6  | 1  | 2  | 9  |
| 3  | 9  | 8  | 20 |
| 13 | 17 | 15 |    |

#### Key Points

- In a  $3 \times 3$  grid with numbers 1 - 9:
  - Each row sum = 15
  - Each column sum = 15
  - Total of all row or column sums = 45
- A magic square is a square grid in which each row, column and diagonal has the same sum.

#### General Form (with centre number $m$ )

|         |         |         |
|---------|---------|---------|
| $m + 3$ | $m - 4$ | $m + 1$ |
| $m - 2$ | $m$     | $m + 2$ |
| $m - 1$ | $m + 4$ | $m - 3$ |

Magic sum  
=  $3m$   
(three times the centre number)

### 4. VIRAHĀṆKA-FIBONACCI NUMBERS

The sequence : 1, 2, 3, 5, 8, 13, 21, 34, 55, ...

#### Rule:

Each number is the sum of the two previous numbers.

- Discovered in India in the context of poetry (rhythms of short (1 beat) and long (2 beats) syllables).
- First described by Virahāṇka (around 700 CE).
- Later known in the West as Fibonacci numbers.
- Appears in nature (flowers, leaves, pinecones, etc.), art, architecture and science.

#### Parity Pattern

Odd, Even, Odd, Odd, Even, Odd, Odd, Even, ...

1 2 3 5 8 13 21 34 55 89 ...  
O E O O E O O E O E ...



### 5. CRYPTARITHMS (DIGITS IN DISGUISE)

Digits are replaced by letters.  
Each letter stands for a digit (0 - 9).  
Use logical reasoning to find the digits.

#### Example 1

$$\begin{array}{r} T \\ + T \\ \hline UT \end{array}$$

#### Solution:

$T = 5, U = 1$   
Because  
 $5 + 5 = 10$   
 $5 + 5 + 5 = 15$   
 $\rightarrow UT = 15$

#### Example 2

$$\begin{array}{r} K2 \\ + K2 \\ \hline HMM \end{array}$$

#### Solution:

$K = 6, M = 2, H = 1$   
 $62 + 62 = 124$

#### Other Examples

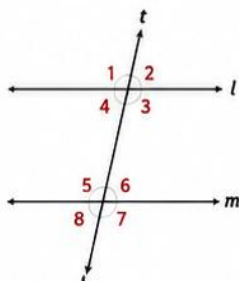
$$\begin{array}{r} YY \ B5 \\ + Z \ + 3D \\ \hline ZOO \ ED5 \end{array}$$

$$\begin{array}{r} KP \ C1 \\ + KP \ + C \\ \hline PRR \ 1FF \end{array}$$

### 6. IMPORTANT DEFINITIONS

- **Intersecting lines** : Lines that meet at a point.
- **Linear pair** : A pair of adjacent angles on a straight line; their sum is  $180^\circ$ .
- **Vertically opposite angles** : Opposite angles formed when two lines intersect; they are equal.
- **Perpendicular lines** : Two lines that intersect at right angles ( $90^\circ$ ).
- **Parallel lines** : Lines on the same plane that never meet, however far they are extended.
- **Transversal** : A line that intersects two (or more) lines at distinct points.
- **Corresponding angles** : Angles in the same relative position at each intersection.
- **Alternate angles** : Angles on opposite sides of the transversal and between the two lines.
- **Interior angles on the same side** : Angles between the two lines on the same side of the transversal; their sum is  $180^\circ$ .

### 7. KEY PROPERTIES (TRANSVERSALS & PARALLEL LINES)



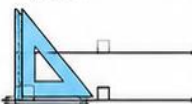
#### Properties

- ✓ If  $l \parallel m$ , then corresponding angles are equal. ( $1 = 5, 2 = 6, 3 = 7, 4 = 8$ )
- ✓ If corresponding angles are equal, then  $l \parallel m$ .
- ✓ Alternate angles are equal. ( $3 = 5, 4 = 6$ )
- ✓ Interior angles on the same side are supplementary. ( $3 + 6 = 180^\circ, 4 + 5 = 180^\circ$ )

### 8. DRAWING PARALLEL LINES

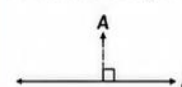
#### Using Set Square

1. Draw a line  $l$ .
2. Place set square against  $l$ .
3. Slide it along a ruler and draw a line  $\perp l$ .
4. Two  $\perp$  lines to  $l$  are parallel.



#### Through a Point A

1. Draw  $l$ .
2. Draw a line  $\perp l$ .
3. Through point A on this line, draw another  $\perp$  line.
4. This new line is  $\parallel$  to  $l$ .



### 9. REAL LIFE CONNECTIONS



Railway tracks are parallel.



Window frames have perpendicular horizontal & vertical lines.



Zebra crossings have parallel white lines.



Stair rails and steps show parallel & perpendicular lines.



#### REMEMBER!

Think of parity before adding or subtracting.

Check row/column sums before filling a grid.

Use patterns to extend sequences.

Look for relationships in positions of angles.

Use logic in cryptarithms!

## NUMBER PLAY

### Learning Outcomes:

**LO1:** Understand place value in large numbers.

**LO2:** Compare and orders whole numbers.

**LO3:** Perform operations involving whole numbers.

**LO4:** Use divisibility rules.

**LO5:** Solve real life problems involving numbers.

### Competencies:

**C1:** Numbers sense

**C2:** Arithmetic reasoning

**C3:** Problem solving

| Q.No                        | Question                                                                                                                                                                                                            | LO  | Competency |
|-----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------------|
| <b>MCQs (One Mark Each)</b> |                                                                                                                                                                                                                     |     |            |
| 1                           | What is the place value of the digit 6 in the number 4,65,284?<br>A) 600      B) 6,000      C) 60,000      D) 6,00,000                                                                                              | LO1 | C1         |
| 2                           | In the International system, how is “Seven million” written in Indian numbers?<br>A) 70 Lakhs    B) 7 Crores    C) 7 Lakhs    D) 70 Crores                                                                          | LO1 | C1         |
| 3                           | Smallest 7-digit number starting with the digit 5 at the highest place:<br>A) 50,00,000      B) 51,00,000<br>C) 50,00,001      D) 50,00,111                                                                         | LO1 | C1         |
| 4                           | Q1. Which of the following statements is true?<br>(a) 0 is the smallest natural number.<br>(b) 1 is the smallest whole number.<br>(c) 0 is the smallest whole number.<br>(d) All whole numbers are natural numbers. | LO2 | C1         |
| 5                           | On a number line, which whole number is on the immediate left of 501?<br>(a) 500      (b) 502      (c) 499      (d) 510                                                                                             | LO2 | C2         |

|                                             |                                                                                                                                                                                                                           |     |    |
|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----|
| 6                                           | If we have to make the smallest 4-digit number using the digits 4, 0, 9, 2 exactly once, the first digit from the left will be:<br>(a) 4                      (b) 9                      (c) 0                      (d) 2 | LO2 | C2 |
| 7                                           | When a non-zero whole number is divided by itself, the quotient is:<br>A) 0                      B) the number itself    C) 1                      D) not defined                                                         | LO3 | C2 |
| 8                                           | 8. The product of a whole number (other than zero) and its successor is always:<br>A) an odd number                      B) an even number<br>C) divisible by 3                      D) divisible by 5                    | LO3 | C2 |
| 9                                           | A number is divisible by 5 if its last digit is:<br>a) 0 or 2                      b) 0 or 5                      c) 2 or 5                      d) Only 5                                                                | LO4 | C2 |
| 10                                          | To check if a number is divisible by 6, the number must be divisible by:<br>a) 2 and 3                      b) 3 and 4                      c) 2 and 4                      d) 3 and 5                                    | LO4 | C2 |
| <b>Short Answer Type (Two Marks Each)</b>   |                                                                                                                                                                                                                           |     |    |
| 11                                          | Add: $45,678 + 23,456$                                                                                                                                                                                                    | LO3 | C1 |
| 12                                          | Subtract 28,459 from 95,230.                                                                                                                                                                                              | LO3 | C1 |
| 13                                          | Multiply $345 \times 24$ .                                                                                                                                                                                                | LO3 | C2 |
| 14                                          | Divide 4,860 by 12.                                                                                                                                                                                                       | LO3 | C2 |
| 15                                          | A shop sold 1,245 pens on Monday and 1,589 on Tuesday. Find the total number of pens.                                                                                                                                     | LO3 | C3 |
| 16                                          | Is 456 divisible by 2? Give reason.                                                                                                                                                                                       | LO4 | C1 |
| 17                                          | Check whether 1,245 is divisible by 5.                                                                                                                                                                                    | LO4 | C1 |
| 18                                          | Use divisibility rule to check if 3,672 is divisible by 3.                                                                                                                                                                | LO4 | C2 |
| 19                                          | Find whether 7,128 is divisible by 9.                                                                                                                                                                                     | LO4 | C2 |
| 20                                          | By which number/s( from 2 to 10) does 5330 is divisible ?                                                                                                                                                                 | LO4 | C3 |
| <b>Short Answer Type (Three Marks Each)</b> |                                                                                                                                                                                                                           |     |    |
| 21                                          | Ravi read 125 pages daily for 8 days. How many pages did he read in 6 days?                                                                                                                                               | LO5 | C1 |
| 22                                          | A bus travels 294 km daily. How far will it travel in 5 days?                                                                                                                                                             | LO5 | C1 |

|                                           |                                                                                                                                                                                                                  |     |          |
|-------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----------|
| 23                                        | A factory packed 2,450 boxes equally into 7 trucks. Find the number of boxes per truck.                                                                                                                          | LO5 | C2       |
| 24                                        | Sita saved ₹250 every month for 12 months. How much did she save annually?                                                                                                                                       | LO5 | C2       |
| 25                                        | A school bought 325 notebooks for each of the 15 classes. Find the total number of notebooks.                                                                                                                    | LO5 | C3       |
| <b>Long Answer Type (Five Marks Each)</b> |                                                                                                                                                                                                                  |     |          |
| 26                                        | Test the divisibility of following numbers by 11 :<br>a) 5335    b) 9020814<br>Also find the quotient along with remainder.                                                                                      | LO4 | C1<br>C2 |
| 27                                        | The population of a town is 450772. In a survey it was reported that one out of every 14 persons is illiterate. In all how many illiterate persons are there in the town also find the number of literate?       | LO3 | C3       |
| 28                                        | Insert commas and write the following numbers in American number system: 145672 ,3529814, 25103406, 502365119 & 1050900                                                                                          | LO1 | C1       |
| <b>Case Study Based</b>                   |                                                                                                                                                                                                                  |     |          |
| 29                                        | A bus driver filled his car petrol tank with 50 litres petrol on Friday .The next day,he filled the tank with 65 litres of petrol .If the petrol costs Rs 98 per litre ,how much did he spent in all on petrol ? | LO5 | C3       |
| 30                                        | A factory has a container filled with 5874 litres of cold drink . In how many bottles of 200 ml capacity each it can be filled ? How many more bottles are required if the capacity is increase to 300 ml?       | LO5 | C3       |

### Answers:

|     |                                  |                  |                                                                                                                                                                                                                                                                                                                                                                               |        |                          |
|-----|----------------------------------|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--------------------------|
| Q.  | 1                                | 2                | 3                                                                                                                                                                                                                                                                                                                                                                             | 4      | 5                        |
| Ans | C                                | A                | A                                                                                                                                                                                                                                                                                                                                                                             | C      | A                        |
| Q.  | 6                                | 7                | 8                                                                                                                                                                                                                                                                                                                                                                             | 9      | 10                       |
| Ans | D                                | B                | B                                                                                                                                                                                                                                                                                                                                                                             | B      | A                        |
| Q.  | 11                               | 12               | 13                                                                                                                                                                                                                                                                                                                                                                            | 14     | 15                       |
| Ans | 69,134                           | 66,771           | 8,280                                                                                                                                                                                                                                                                                                                                                                         | 405    | 2,834                    |
| Q.  | 16                               | 17               | 18                                                                                                                                                                                                                                                                                                                                                                            | 19     | 20                       |
| Ans | Yes                              | Yes              | Yes                                                                                                                                                                                                                                                                                                                                                                           | Yes    | Divisible by 2, 5 and 10 |
| Q.  | 21                               | 22               | 23                                                                                                                                                                                                                                                                                                                                                                            | 24     | 25                       |
| Ans | 750 pages                        | 1,470 km         | 350 boxes                                                                                                                                                                                                                                                                                                                                                                     | ₹3,000 | 4,875 notebooks          |
| Q.  | 26                               | 27               | 28                                                                                                                                                                                                                                                                                                                                                                            | 29     | 30                       |
| Ans | (Q-485, R- 0)<br>(Q-820074, R-0) | 32198 and 418574 | <ul style="list-style-type: none"> <li>One hundred forty-five thousand six hundred seventy-two. Three million five hundred twenty-nine thousand eight hundred fourteen. Twenty-five million one hundred three thousand four hundred six. Five hundred two million three hundred sixty-five thousand one hundred nineteen. One million fifty thousand nine hundred.</li> </ul> | 11270  | 29370,19580              |

### Challenging Questions (Stage 1)

Q.1. Determine the sum and product of the place value and face value of the number 6 in the number 86245.

Q.2. A school district is comparing two annual budgets. Budget X is Rs.23,547,500 and Budget Y is "Twenty-three million five hundred seventy-four thousand rupees".

a) Write Budget Y as a whole number .

b) Compare the two budgets using the symbols :  $<$ ,  $>$ , or  $=$ .

Q.3. When the largest 4-digit number is divided by the largest 2 -digit number, what are the quotient and the remainder?

Q.4. A vendor supplies 32 litres of milk to a hostel in the morning and 68 litres of milk in the evening. If the milk costs Rs 45 per litre, how much money does the vendor earn a) per day b) in a week

Q.5. The digits of 6 and 9 of the number 36490 are interchanged. Find the difference between the original number and the new number.

### Challenging Questions (Stage 2)

Q.1. The digits in the tens and the thousands place of a number are 3 and 9, respectively. The digit in the ones and the ten thousands places are 3 and 4 more than the digit in tens place. If the digit in the hundreds place is three less than the digit in ten thousands place, find the number

Q.2. A digital lock has a 6-digit code. The code uses each of the digits {0, 1, 2, 4, 5, 8} exactly once. The code is the smallest possible number that can be formed, but it must be greater than 200,000. What is the code?

Q.3. A local school bookshop sells 32 mathematics textbooks on Monday and 68 textbooks on Tuesday. Each textbook costs Rs 45. On Wednesday, the bookshop sells 50 storybooks, with each storybook costing Rs.20. Calculate the amount the bookshop made across all three days.

Q.4. On dividing 4,56,789 by a certain number, the quotient is 1,952 and the remainder is 21. Find the unknown divisor.

Q.5. Write the number 10,075,302. Then, rearrange its digits to form both the **smallest** and the **largest** 8-digit numbers possible using each digit once?

### Challenging Questions (Stage 3)

Q.1. Identify the number which has 4 in tens place and 8 in thousands place. The digit in ones is half the sum of the digits in tens and thousands, and the digit in hundreds place is six less than the digit in ones place. Find the number.

Q.2. Find the smallest 6-digit number divisible by 2, 3, 5, and 10 ?

Q.3. A school is planning a trip for 162 students and 24 teachers. If each one is given a lunch pack containing 2 sandwiches and 1 drink, and sandwiches come in packs of 12, how many full packs of sandwiches must the school buy to ensure everyone gets their meal?

Q.4. A magic square is an array of numbers having the same number of rows and columns and the sum of numbers in each row, column or diagonal being the same. Fill in the blank cells( without repeating numbers )of the following magic squares:

|    |    |    |
|----|----|----|
|    | 8  | 13 |
|    | 12 |    |
| 11 |    |    |

Q.5. Form a Greatest 5-digit number divisible by 6 using {3, 0, 6, 5, 4}

### Answers (Challenging Questions)

|            | Q.1   | Q.2                      | Q.3     | Q.4                                                                                                                                         | Q.5                             |   |    |    |    |    |    |    |   |       |
|------------|-------|--------------------------|---------|---------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|---|----|----|----|----|----|----|---|-------|
| Stage 1Ans | 36000 | a)23,574,000<br>b) Y > X | 101 & 0 | 4500                                                                                                                                        | 2970                            |   |    |    |    |    |    |    |   |       |
| Stage 2Ans | 79436 | 201458                   | 5500    | 234                                                                                                                                         | 10,023,577<br>and<br>77,532,100 |   |    |    |    |    |    |    |   |       |
| Stage 3Ans | 8046  | 1,000,20                 | 31      | <table><tr><td>15</td><td>8</td><td>13</td></tr><tr><td>10</td><td>12</td><td>14</td></tr><tr><td>11</td><td>16</td><td>9</td></tr></table> | 15                              | 8 | 13 | 10 | 12 | 14 | 11 | 16 | 9 | 65430 |
| 15         | 8     | 13                       |         |                                                                                                                                             |                                 |   |    |    |    |    |    |    |   |       |
| 10         | 12    | 14                       |         |                                                                                                                                             |                                 |   |    |    |    |    |    |    |   |       |
| 11         | 16    | 9                        |         |                                                                                                                                             |                                 |   |    |    |    |    |    |    |   |       |



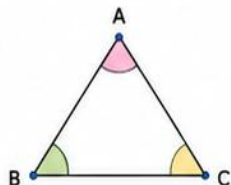
# CHAPTER 7 : A TALE OF THREE INTERSECTING LINES



## SUMMARY OF CONCEPTS

### 1. TRIANGLE – BASICS

- A triangle is a closed figure with 3 vertices and 3 sides.
- It has 3 angles.



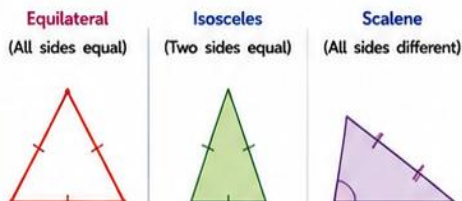
#### Naming a Triangle

A triangle is named using its vertices. The order of vertices can be any.

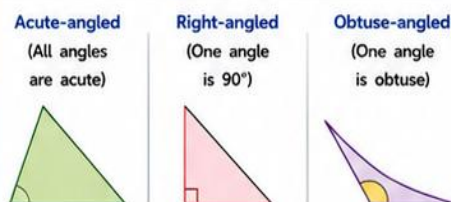
Example:  $\triangle ABC$ ,  $\triangle BCA$ ,  $\triangle CAB$

### 2. TYPES OF TRIANGLES

#### (A) By Sides



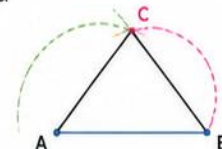
#### (B) By Angles



### 3. CONSTRUCTING TRIANGLES

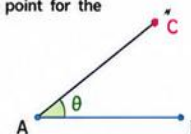
#### (A) When Three Sides are Given (SSS)

- Draw the base  $AB$  = given longest side.
- With centres  $A$  and  $B$ , draw arcs with the other two lengths as radii.
- Their intersection is  $C$ .
- Join  $AC$  and  $BC$ .



#### (B) When Two Sides and Included Angle are Given (SAS)

- Draw the base (one given side).
- At one end, construct the given angle.
- On the other arm, mark the point for the other side length.
- Join the two points.



### 4. TRIANGLE INEQUALITY

For any triangle with sides  $a$ ,  $b$ ,  $c$ :

$$a < b + c \quad b < c + a \quad c < a + b$$

- If the three lengths satisfy the above inequalities, a triangle exists.
- If any one inequality is not satisfied, a triangle does not exist.

#### Visual Test (Using Circles)

Take the longest side as base  $AB$ . Draw circles with the other two lengths as radii from  $A$  and  $B$ .

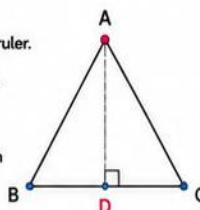
- Circles intersect internally  $\rightarrow$  Triangle exists
- Circles touch at one point  $\rightarrow$  No triangle
- Circles do not intersect  $\rightarrow$  No triangle

### 5. CONSTRUCTING ALTITUDES

An **altitude** is a perpendicular from a vertex to the opposite side.

Steps to construct altitude from  $A$  to  $BC$ :

- Place ruler along  $BC$ .
- Place set square along the ruler. Slide it till the vertical edge passes through  $A$ .
- Draw the perpendicular from  $A$  to meet  $BC$  at  $D$ .

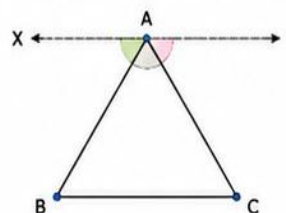


#### Key Points

- Right triangle: One side is an altitude.
- Other altitudes: From  $B$  to  $AC$ , and from  $C$  to  $AB$ .
- Altitudes lie inside the triangle.

### 6. ANGLE SUM PROPERTY

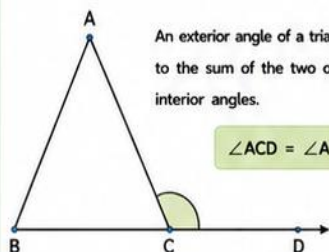
The sum of the three angles of any triangle is  $180^\circ$ .



Proof idea:

- Draw a line  $XY$  through  $A$  parallel to  $BC$ .
- By alternate angles:  $\angle XAB = \angle B$  and  $\angle YAC = \angle C$ .
- $\angle XAB + \angle BAC + \angle YAC = 180^\circ$  (straight line).
- Hence,  $\angle A + \angle B + \angle C = 180^\circ$ .

### 7. EXTERIOR ANGLE PROPERTY



An exterior angle of a triangle is equal to the sum of the two opposite interior angles.

$$\angle ACD = \angle A + \angle B$$

Useful for finding unknown angles.

### 8. IMPORTANT DEFINITIONS

- Vertex** : A corner point of a triangle.
- Side** : A line segment joining two vertices.
- Angle** : Formed by two sides at a vertex.
- Altitude** : Perpendicular from a vertex to the opposite side.
- Equilateral Triangle** : All sides equal.
- Isosceles Triangle** : Two sides equal.
- Scalene Triangle** : All sides different.
- Right Triangle** : One angle is  $90^\circ$ .
- Acute Triangle** : All angles are acute (less than  $90^\circ$ ).
- Obtuse Triangle** : One angle is obtuse (greater than  $90^\circ$ ).

### 9. KEY TAKEAWAYS

- Triangle inequality tells whether a triangle can exist.
- Triangles can be constructed using SSS, SAS or ASA (two angles and included side).
- The sum of interior angles of a triangle is  $180^\circ$ .
- An exterior angle equals the sum of the two opposite interior angles.
- Altitudes help in many constructions and proofs.
- Triangles are classified by sides and by angles.



Remember: Observe  $\rightarrow$  Visualise  $\rightarrow$  Reason  $\rightarrow$  Construct  $\rightarrow$  Conclude



## A TALE OF THREE INTERSECTING LINES

### Learning Outcomes:

- LO1: Construct triangles using given sides, angles, and appropriate geometrical tools.  
 LO2: Apply the triangle inequality to determine whether a triangle can be formed from given lengths.  
 LO3: Classify triangles based on their sides and angles.  
 LO4: Use the angle sum property and exterior angle property of triangles to solve problems.  
 LO5: Identify, construct, and interpret altitudes in different types of triangles.  
 LO6: Develop logical reasoning and spatial visualization through triangle constructions and investigations.  
 LO7: Apply properties of triangles in real-life and mathematical situations.

### Competencies:

- C1: Geometrical Visualization  
 C2: Logical and Deductive Reasoning  
 C3: Measurement and Verification  
 C4: Pattern Recognition  
 C5: Mathematical Communication  
 C6: Problem Solving  
 C7: Construction Skills

| Q.No                        | Question                                                                                                                                                                                                                 | LO         | Competency |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------|
| <b>MCQs (One Mark Each)</b> |                                                                                                                                                                                                                          |            |            |
| 1                           | Three rods have lengths 8 cm, 11 cm and 20 cm. What can be concluded?<br>A) Acute triangle can be formed<br>B) Isosceles triangle can be formed<br>C) No triangle can be formed<br>D) Equilateral triangle can be formed | LO2<br>LO7 | C2<br>C6   |
| 2                           | If two angles of a triangle are $48^\circ$ and $72^\circ$ , then the third angle is:<br>A) $50^\circ$ B) $60^\circ$ C) $70^\circ$ D) $80^\circ$                                                                          | LO4        | C2<br>C3   |
| 3                           | Which of the following is always true?<br>A) Every isosceles triangle is equilateral<br>B) Every equilateral triangle is isosceles<br>C) Every scalene triangle is right-angled<br>D) Every right triangle is isosceles  | LO3        | C2<br>C5   |
| 4                           | A triangle has angles $40^\circ$ , $60^\circ$ and $80^\circ$ . This triangle is:<br>A) Right-angled triangle      B) Obtuse-angled triangle<br>C) Acute-angled triangle      D) Isosceles triangle                       | LO3        | C2<br>C4   |
| 5                           | Which set of lengths can definitely form a triangle?<br>A) 5, 6, 12      B) 4, 4, 9      C) 7, 8, 10      D) 3, 4, 7                                                                                                     | LO2        | C2<br>C6   |

|                                           |                                                                                                                                                                                                                                |            |          |
|-------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|----------|
| 6                                         | A triangle has sides 9 cm, 9 cm and 14 cm. It is:<br>A) Equilateral                      B) Scalene<br>C) Isosceles                          D) Right-angled triangle                                                          | LO3        | C2<br>C5 |
| 7                                         | Which of the following pairs of angles cannot be the two angles of a triangle?<br>A) 40°, 50°    B) 70°, 80°    C) 90°, 95°    D) 35°, 45°                                                                                     | LO4<br>LO6 | C2<br>C6 |
| 8                                         | A triangle has angles 90°, 30° and:<br>A) 50°              B) 60°              C) 70°              D) 80°                                                                                                                      | LO4        | C2<br>C3 |
| 9                                         | Which triangle cannot exist?<br>A) Isosceles right triangle                      B) Scalene acute triangle<br>C) Equilateral right triangle                      D) Isosceles obtuse triangle                                  | LO3<br>LO6 | C2<br>C6 |
| 10                                        | The sum of two angles of a triangle is 110°. The third angle is:<br>A) 60°              B) 70°              C) 80°              D) 90°                                                                                         | LO4        | C2<br>C3 |
| <b>Short Answer Type (Two Marks Each)</b> |                                                                                                                                                                                                                                |            |          |
| 11                                        | A student says that lengths 6 cm, 9 cm and 16 cm can form a triangle. Check whether the student is correct.                                                                                                                    | LO2<br>LO7 | C2<br>C6 |
| 12                                        | A triangle has two angles measuring 58° and 67°. Without drawing the triangle, find the third angle and explain the property used.                                                                                             | LO4        | C2<br>C5 |
| 13                                        | Ravi claims that every equilateral triangle is also an isosceles triangle. Do you agree? Give a reason.                                                                                                                        | LO3        | C2<br>C5 |
| 14                                        | A triangle has side lengths 12 cm, 12 cm and 18 cm. Identify the type of triangle and justify your answer.                                                                                                                     | LO3        | C2<br>C5 |
| 15                                        | A student wants to construct a triangle using sides 5 cm, 5 cm and 11 cm. Will the construction be possible? Explain without drawing.                                                                                          | LO2        | C2<br>C6 |
| 16                                        | Can an altitude of a triangle lie outside the triangle? Explain your answer with an example.                                                                                                                                   | LO5<br>LO6 | C1<br>C2 |
| 17                                        | Two students are constructing a triangle using sides 4 cm, 6 cm and 9 cm. One student says that there can be only one triangle with these measurements, while the other says there can be many. Who is correct? Give a reason. | LO1<br>LO6 | C1<br>C7 |
| 18                                        | A triangle has sides 7 cm, 7 cm and 7 cm. Without measuring any angle, predict the measure of each angle. Give a reason.                                                                                                       | LO3<br>LO4 | C2<br>C4 |
| 19                                        | Two angles of a triangle are 75° and 45°. A student says that the triangle is obtuse-angled. Do you agree? Justify your answer.                                                                                                | LO3<br>LO4 | C2<br>C6 |

|                                             |                                                                                                                                                                                                                                                                                  |                   |                |
|---------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|----------------|
| 20                                          | While constructing a triangle, a student draws arcs of radius 4 cm and 5 cm from the endpoints of a base of length 12 cm. Will the arcs intersect? What does this tell you about the triangle?                                                                                   | LO1<br>LO2        | C1<br>C7       |
| <b>Short Answer Type (Three Marks Each)</b> |                                                                                                                                                                                                                                                                                  |                   |                |
| 21                                          | A triangular park is planned using three boundary ropes of lengths 12 m, 15 m and 20 m.<br>(i) Check whether a triangular park can be formed.<br>(ii) Name the property used.                                                                                                    | LO2<br>LO7        | C2<br>C6       |
| 22                                          | The angles of a triangle are in the ratio 2: 3: 4.<br>Find all three angles and classify the triangle based on its angles.                                                                                                                                                       | LO3<br>LO4        | C2<br>C4       |
| 23                                          | Construct a triangle ABC with:<br>AB = 6 cm<br>AC = 5 cm<br>$\angle A = 60^\circ$<br>Write the construction steps.                                                                                                                                                               | LO1               | C7<br>C5       |
| 24                                          | An exterior angle of a triangle measures $135^\circ$ .<br>One remote interior angle is $55^\circ$ .<br>Find:<br>(i) The other remote interior angle<br>(ii) The interior angle adjacent to the exterior angle                                                                    | LO4               | C2<br>C6       |
| 25                                          | Draw a rough sketch of an acute-angled triangle and an obtuse-angled triangle. Show the altitude from the same vertex in both triangles and state where the altitude lies.                                                                                                       | LO5<br>LO6        | C1<br>C3       |
| <b>Long Answer Type (Five Marks Each)</b>   |                                                                                                                                                                                                                                                                                  |                   |                |
| 26                                          | Three sticks have lengths 10 cm, 15 cm and 18 cm.<br>(i) Verify whether a triangle can be formed.<br>(ii) Name the triangle based on sides.<br>(iii) If one angle is $80^\circ$ and another is $50^\circ$ , find the third angle.<br>(iv) Classify the triangle based on angles. | LO2<br>LO3<br>LO4 | C2<br>C3<br>C6 |
| 27                                          | Construct an isosceles triangle ABC with:<br>AB = AC = 7 cm<br>BC = 8 cm<br>Then:<br>(i) Draw the altitude from A to BC.<br>(ii) Measure the altitude.<br>(iii) State where the altitude lies.                                                                                   | LO1<br>LO5        | C3<br>C7       |
| 28                                          | A triangle has angles $x^\circ$ , $2x^\circ$ and $3x^\circ$ .<br>(i) Find x.<br>(ii) Find all three angles.<br>(iii) Classify the triangle.<br>(iv) Draw a rough sketch of the triangle.                                                                                         | LO3<br>LO4<br>LO6 | C1<br>C2<br>C6 |

| Case Study Based |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                   |                |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|----------------|
| 29               | <p>A student is given three sticks of lengths 6 cm, 8 cm and 10 cm to make a triangular frame.</p> <p>(i) Can a triangle be formed using these lengths?</p> <p>(ii) Which property is used to check whether a triangle can be formed?</p> <p>(iii) (a) Can a triangle be formed using lengths 5 cm, 7 cm and 13 cm? Give reason.</p> <p style="text-align: center;"><b>OR</b></p> <p>(b) Name the triangle formed by lengths 6 cm, 8 cm and 10 cm based on its sides.</p> | LO2<br>LO3<br>LO7 | C2<br>C5<br>C6 |
| 30               | <p>A triangle has two angles measuring <math>65^\circ</math> and <math>55^\circ</math>.</p> <p>(i) Find the third angle.</p> <p>(ii) Find the exterior angle adjacent to the third angle.</p> <p>(iii) (a) Verify the exterior angle property for this triangle.</p> <p style="text-align: center;"><b>OR</b></p> <p>(b) Classify the triangle based on its angles.</p>                                                                                                   | LO3<br>LO4<br>LO7 | C2<br>C3<br>C6 |

### Answers

|     |                                                                                                |                                      |                                       |                                                               |                                                                  |
|-----|------------------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------|---------------------------------------------------------------|------------------------------------------------------------------|
| Q.  | 1                                                                                              | 2                                    | 3                                     | 4                                                             | 5                                                                |
| Ans | C                                                                                              | B                                    | B                                     | C                                                             | C                                                                |
| Q.  | 6                                                                                              | 7                                    | 8                                     | 9                                                             | 10                                                               |
| Ans | C                                                                                              | C                                    | B                                     | C                                                             | B                                                                |
| Q.  | 11                                                                                             | 12                                   | 13                                    | 14                                                            | 15                                                               |
| Ans | No                                                                                             | $55^\circ$                           | Yes                                   | Isosceles Triangle                                            | No                                                               |
| Q.  | 16                                                                                             | 17                                   | 18                                    | 19                                                            | 20                                                               |
| Ans | Yes                                                                                            | First Student is correct             | Each angle= $60^\circ$                | No                                                            | No                                                               |
| Q.  | 21                                                                                             | 22                                   | 23                                    | 24                                                            | 25                                                               |
| Ans | i)Yes<br>ii) Triangle Inequality property                                                      | $40^\circ, 60^\circ, 80^\circ$       | Construction                          | i) $80^\circ$<br>ii) $45^\circ$                               | Construction                                                     |
| Q.  | 26                                                                                             | 27                                   | 28                                    | 29                                                            | 30                                                               |
| Ans | i)Triangle can be formed<br>ii)Scalene Triangle<br>iii) $50^\circ$<br>iv)Acute angled triangle | Altitude=5.74<br>Inside the triangle | $x=30^\circ$<br>Right angled triangle | Yes<br>Triangle inequality property<br>No OR Scalene triangle | 600<br>$120^\circ$<br>$120^\circ$<br>OR<br>Acute angled triangle |

### Challenging Questions (Stage 1)

- Q.1. An equilateral triangle has side length 8 cm. Find the measure of each angle.  
Q.2. Can sides 5 cm, 6 cm and 12 cm form a triangle? Give reason.  
Q.3. Two angles of a triangle are  $55^\circ$  and  $75^\circ$ . Find the third angle.  
Q.4. An exterior angle of a triangle is  $110^\circ$ . One opposite interior angle is  $45^\circ$ . Find the other.  
Q.5. Identify the triangle whose sides are 7 cm, 7 cm and 10 cm.

### Challenging Questions (Stage 2)

- Q.1. Construct a triangle having sides 5 cm, 6 cm and 7 cm.  
Q.2. Two sides of a triangle are 8 cm and 11 cm. Write any five possible integer values of the third side.  
Q.3. The angles of a triangle are in the ratio 2 : 3 : 4. Find all angles.  
Q.4. Draw an obtuse-angled triangle and show an altitude. State whether the altitude lies inside or outside the triangle.  
Q.5. Can a triangle be both isosceles and right-angled? Draw a rough figure to support your answer.

### Challenging Questions (Stage 3)

- Q.1. Two sides of a triangle are 15 cm and 20 cm. Find the smallest and largest possible integer values of the third side.  
Q.2. The angles of a triangle are  $3x^\circ$ ,  $2x^\circ$  and  $4x^\circ$ . Find  $x$  and all the angles.  
Q.3. An exterior angle of a triangle is  $140^\circ$ . The two opposite interior angles are in the ratio 3: 4. Find the two angles.  
Q.4. Construct an isosceles triangle with sides 6 cm, 6 cm and 8 cm. Draw the altitude from the vertex between the equal sides and state one observation.  
Q.5. Can all three altitudes of a triangle lie inside the triangle? If yes, name the type of triangle. If not, explain.

### Answers (Challenging Questions)

|         | Q.1                                                | Q.2                                                                | Q.3                                     | Q.4                                                       | Q.5                                               |
|---------|----------------------------------------------------|--------------------------------------------------------------------|-----------------------------------------|-----------------------------------------------------------|---------------------------------------------------|
| Stage 1 | $60^\circ$                                         | NO,<br>$5+6<12$                                                    | $50^\circ$                              | $65^\circ$                                                | Isosceles triangle                                |
| Stage 2 | Construction                                       | Possible                                                           | $40^\circ$ , $60^\circ$ ,<br>$80^\circ$ | Altitude of an obtuse triangle lies outside the triangle. | Yes.<br>( $45^\circ$ , $45^\circ$ , $90^\circ$ ). |
| Stage 3 | Smallest integer = 6 cm<br>Largest integer = 34 cm | $x=20^\circ$<br>Angles:<br>$60^\circ$ , $40^\circ$ ,<br>$80^\circ$ | Angles =<br>$60^\circ$ and $80^\circ$   | Observation                                               | Yes                                               |



# CHAPTER 8 : WORKING WITH FRACTIONS



## SUMMARY OF CONCEPTS

### 1. FRACTION – BASICS

- A fraction represents a part of a whole or a collection.
- A fraction  $\frac{a}{b}$  has:
  - a – numerator (top part)
  - b – denominator (bottom part,  $b \neq 0$ )

**Numerator**  
(How many parts we take)

**Denominator**  
(Total equal parts)

$$\frac{3}{4} = \text{Three-fourths}$$

### 2. MULTIPLICATION OF FRACTIONS

**Rule (Brahmagupta)**  $\frac{a}{b} \times \frac{c}{d} = \frac{a \times c}{b \times d}$

#### Steps

- Multiply the numerators.
- Multiply the denominators.
- Simplify the result (cancel common factors) to lowest form.

#### Examples

$$\frac{1}{2} \times \frac{1}{4} = \frac{1 \times 1}{2 \times 4} = \frac{1}{8}$$

$$\frac{2}{3} \times \frac{3}{5} = \frac{2 \times 3}{3 \times 5} = \frac{6}{15} = \frac{2}{5}$$

$$3 \times \frac{3}{4} = \frac{3}{1} \times \frac{3}{4} = \frac{9}{4} = 2\frac{1}{4}$$

- ★ When one of the numbers is 1, the product remains the other number.

### 3. DIVISION OF FRACTIONS

#### Rule (Brahmagupta)

$$\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c} = \frac{a \times d}{b \times c}$$

#### Steps

- Find the reciprocal of the divisor ( $\frac{c}{d} \rightarrow \frac{d}{c}$ ).
- Multiply the dividend by this reciprocal.
- Simplify the result.

#### Examples

$$1 \div \frac{2}{3} = 1 \times \frac{3}{2} = \frac{3}{2} = 1\frac{1}{2}$$

$$\frac{3}{4} \div \frac{2}{5} = \frac{3}{4} \times \frac{5}{2} = \frac{15}{8} = 1\frac{7}{8}$$

$$\frac{5}{12} \div \frac{7}{18} = \frac{5}{12} \times \frac{18}{7} = \frac{90}{84} = \frac{15}{14} = 1\frac{1}{14}$$

- ★ Reciprocal of  $\frac{a}{b}$  is  $\frac{b}{a}$ .  
 $\left(\frac{a}{b}\right) \times \left(\frac{b}{a}\right) = 1$

### 4. RELATION BETWEEN NUMBERS

| Situation                                                             | Condition                                               | Product is                                                             |
|-----------------------------------------------------------------------|---------------------------------------------------------|------------------------------------------------------------------------|
| 1. Both $> 1$<br>(e.g., $3 \times 5$ )                                | Both numbers greater than 1                             | Greater than both numbers                                              |
| 2. Both between 0 and 1<br>(e.g., $\frac{3}{4} \times \frac{2}{5}$ )  | Both numbers between 0 and 1                            | Less than both numbers                                                 |
| 3. One $> 1$ , one between 0 and 1<br>(e.g., $\frac{3}{4} \times 5$ ) | One number greater than 1 and the other between 0 and 1 | Less than the number $> 1$ but greater than the number between 0 and 1 |

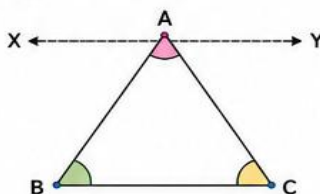
#### Order of Multiplication

$$\frac{3}{b} \times \frac{c}{d} = \frac{c}{d} \times \frac{a}{b}$$

(Order does not matter)

### 5. ANGLE SUM PROPERTY

The sum of the interior angles of a triangle is always  $180^\circ$ .

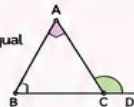


#### Proof idea:

- Draw a line XY through A parallel to BC.
- By alternate angles,  $\angle XAB = \angle B$  and  $\angle YAC = \angle C$ .
- $\angle XAB + \angle BAC + \angle YAC = 180^\circ$  (straight line)
- Hence,  $\angle A + \angle B + \angle C = 180^\circ$ .

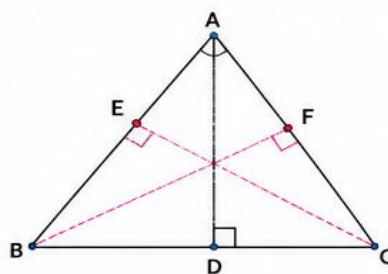
#### Exterior Angle Property

An exterior angle of a triangle is equal to the sum of the two opposite interior angles.



### 6. ALTITUDES OF A TRIANGLE

An **altitude** is a perpendicular from a vertex to the opposite side.



- AD, BE and CF are the three altitudes.
- In a right triangle, one side is also an altitude.

### 7. TYPES OF TRIANGLES

#### (A) By Sides

**Equilateral**  
(All sides equal)



**Isosceles**  
(Two sides equal)



**Scalene**  
(All sides different)



#### (B) By Angles

**Acute-angled**  
(All angles  $< 90^\circ$ )



**Right-angled**  
(One angle  $= 90^\circ$ )



**Obtuse-angled**  
(One angle  $> 90^\circ$ )



All types of triangles satisfy:  $\angle A + \angle B + \angle C = 180^\circ$

### 8. KEY FORMULAS

- $\frac{a}{b} \times \frac{c}{d} = \frac{a \times c}{b \times d}$
- $\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c} = \frac{a \times d}{b \times c}$
- Reciprocal of  $\frac{a}{b}$  is  $\frac{b}{a}$
- $\frac{a}{b} \times \frac{b}{a} = 1$
- $\angle A + \angle B + \angle C = 180^\circ$
- Exterior angle = Sum of two opposite interior angles.

### 9. IMPORTANT TAKEAWAYS

- ★ Fractions represent equal parts of a whole or a collection.
- ★ Use multiplication to solve problems involving "of", "times", "in".
- ★ To divide fractions, multiply by the reciprocal of the divisor.
- ★ Simplify (cancel common factors) before multiplying.
- ★ Triangle inequality helps to check if a triangle is possible.
- ★ The sum of angles in any triangle is  $180^\circ$ .
- ★ Altitudes help in many constructions and proofs.
- ★ Triangles are classified by sides and by angles.

#### QUICK TIPS



$1\frac{1}{2}$  Convert mixed fractions to improper fractions before operation.

$\frac{6}{8} = \frac{3}{4}$  Cancel common factors before multiplying to make it easy.

$\frac{a}{b} \div \frac{c}{d}$  Flip the divisor (take reciprocal) while dividing.

 Draw diagrams (squares, fraction bars) to understand better.

## Working with Fractions

### Learning Outcomes:

LO1: Represent fractions visually and numerically.

LO2: Compare and order fractions.

LO3: Identify equivalent fractions.

LO4: Add and subtract fractions with like denominators.

LO5: Use fractions in practical contexts.

### Competencies:

C1: Part-whole understanding

C2: Comparison and equivalence

C3: Computational fluency

| Q.No                        | Question                                                                                                                                                                                                                       | LO  | Competency |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------------|
| <b>MCQs (One Mark Each)</b> |                                                                                                                                                                                                                                |     |            |
| 1                           | Riya ate 3 out of 8 pieces of pizza. What fraction of the pizza did she eat?<br>A) $\frac{3}{8}$ B) $\frac{5}{8}$ C) $\frac{8}{3}$ D) $\frac{1}{8}$                                                                            | LO1 | C1         |
| 2                           | A chocolate bar is divided into 6 equal parts. Neena eats 2 parts. What fraction is left?<br>A) $\frac{2}{6}$ B) $\frac{4}{6}$ C) $\frac{5}{6}$ D) 1                                                                           | LO1 | C1         |
| 3                           | Riya uses $\frac{2}{5}$ of a rope and Aman uses $\frac{1}{5}$ . What fraction of the rope is used in total?<br>A) $\frac{3}{5}$ B) $\frac{1}{5}$ C) $\frac{2}{5}$ D) $\frac{1}{2}$                                             | LO1 | C1         |
| 4                           | A recipe requires $\frac{3}{4}$ cup of sugar and another recipe requires $\frac{1}{2}$ cup of sugar. What is the total quantity of sugar needed?<br>A) $\frac{5}{4}$ B) $\frac{3}{8}$ C) $\frac{7}{4}$ D) $\frac{1}{4}$        | LO2 | C2         |
| 5                           | If you multiply $\frac{4}{5}$ by $\frac{3}{2}$ , what is the result?<br>A) $\frac{12}{10}$ B) $\frac{1}{10}$ C) $\frac{6}{5}$ D) $\frac{9}{10}$                                                                                | LO5 | C3         |
| 6                           | A car travels $\frac{5}{9}$ of its route in the morning and $\frac{2}{9}$ of its route in the evening. How much of the route has it travelled in total?<br>A) $\frac{2}{9}$ B) $\frac{3}{2}$ C) $\frac{4}{9}$ D) $\frac{1}{3}$ | LO4 | C3         |

|    |                                                                                                                                                                                                                                                         |     |    |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----|
| 7  | A fraction with numerator smaller than the denominator is called:<br>A) Improper Fraction    B) Mixed Fraction<br><br>C) Proper Fraction        D) Equivalent Fraction                                                                                  | LO1 | C1 |
| 8  | If $a + b = \frac{17}{6}$ and $a - b = 2$ , what is the value of $(a - b)$ ?<br>A) $\frac{1}{3}$ B) $\frac{2}{3}$ C) $\frac{1}{6}$ D) 2                                                                                                                 | LO4 | C3 |
| 9  | The product of two rational numbers is $-\frac{40}{3}$ . If one of them is $-\frac{5}{2}$ and the reciprocal of the other is n, what is the value of $(8n + 2\frac{1}{4})$ ?<br>A) $4\frac{1}{2}$ B) $4\frac{3}{4}$ C) $3\frac{1}{2}$ D) $3\frac{3}{4}$ | LO4 | C3 |
| 10 | By what number should $\frac{5}{3}$ be multiplied to get $4\frac{1}{2}$ ?<br>A) $\frac{16}{10}$ B) $\frac{27}{10}$ C) $\frac{27}{3}$ D) $\frac{10}{16}$                                                                                                 | LO4 | C3 |

**Short Answer Type (Two Marks Each)**

|    |                                                                                                                                                             |     |    |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----|
| 11 | Seema has ₹750. This is $\frac{3}{8}$ of the amount she earned. How much did she earn?                                                                      | LO5 | C1 |
| 12 | Arrange the following fractions in ascending order: $\frac{5}{6}, \frac{1}{2}, \frac{5}{8}$                                                                 | LO2 | C1 |
| 13 | Arrange the following fractions in descending order: $\frac{2}{5}, \frac{3}{10}, \frac{1}{6}$                                                               | LO2 | C1 |
| 14 | A student studies for $\frac{3}{4}$ hour daily. How many hours does the student study in 2 days?                                                            | LO5 | C3 |
| 15 | A rope of length $\frac{9}{10}$ m is cut into pieces of length $\frac{3}{10}$ m each. How many pieces are formed?                                           | LO2 | C2 |
| 16 | A tank contains $\frac{4}{5}$ litre of water. If each glass holds $\frac{1}{5}$ litre, how many glasses can be filled?                                      | LO5 | C3 |
| 17 | A bottle contains $\frac{5}{6}$ litre of juice. Riya drinks $\frac{1}{3}$ litre. How much juice is left?                                                    | LO4 | C3 |
| 18 | A Cattle requires $\frac{17}{18}$ kg of feed per day. Find the quantity of feed needed for 12 such cattle in one day.                                       | LO2 | C2 |
| 19 | Riya and her friend ordered a pizza for a party. Riya ate $\frac{2}{8}$ of the pizza and her friend ate $\frac{3}{8}$ of the pizza. How much pizza is left? | LO4 | C3 |
| 20 | A gardener planted flowers in $\frac{2}{7}$ of the garden and vegetables in $\frac{3}{7}$ of the garden. What fraction of the garden is still empty?        | LO5 | C3 |

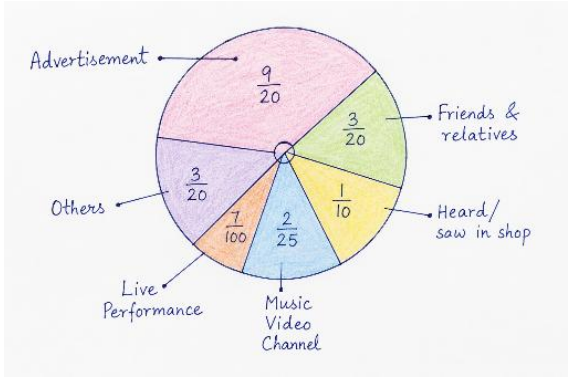
**Short Answer Type (Three Marks Each)**

|    |                                                                                                                                                                                                                                                        |     |    |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----|
| 21 | Rani used $\frac{1}{4}$ cup of rice, $\frac{1}{4}$ cup of sugar, and $\frac{3}{4}$ cup of milk to make kheer. Find the total quantity of ingredients used.                                                                                             | LO4 | C3 |
| 22 | A rectangular paper sheet is $12\frac{1}{2}$ cm long and $10\frac{2}{3}$ cm wide. Rani wants to color its boundary. Find the length of the boundary.                                                                                                   | LO5 | C3 |
| 23 | If a bicycle wheel makes $16\frac{1}{2}$ rounds in 5 minutes, find the time taken to make $49\frac{1}{2}$ rounds.                                                                                                                                      | LO5 | C3 |
| 24 | If $\frac{21}{4}$ litres of mustard oil is present in 7 bottles, find the quantity of oil present in 1 bottle. Also find how many bottles will contain 15 litres of oil.                                                                               | LO2 | C2 |
| 25 | In a school, $\frac{1}{4}$ of the students study in the primary section. Of the remaining students, $\frac{2}{3}$ study in the middle section and the rest study in the high school section. What fraction of the total students study in high school? | LO4 | C2 |

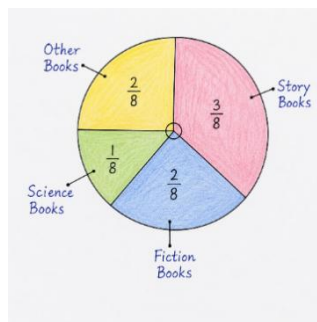
**Long Answer Type (Five Marks Each)**

|    |                                                                                                                                                                                                            |     |    |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----|
| 26 | Rima used $\frac{3}{5}$ of a ball of wool to knit a sweater for her daughter and $\frac{1}{6}$ of it to make a pair of socks for her son. If the ball of wool was 60 m long, find the length of wool left. | LO4 | C3 |
| 27 | A bicycle wheel makes $16\frac{1}{2}$ rounds in 5 minutes. Find the time taken to make $49\frac{1}{2}$ rounds.                                                                                             | LO5 | C3 |
| 28 | Neena plants 8 saplings in a row. The distance between two adjacent saplings is $\frac{3}{4}$ m. Find the distance between the first and the last sapling.                                                 | LO5 | C3 |

**Case Study Based**

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |     |    |
|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----|
| 29 | <p>A survey of 200 students was conducted to determine what influenced them most to buy their latest CD. The results are shown in a circle graph.</p>  <p>Answer the following:</p> <p>(a) How many students were influenced by advertisements?</p> <p>(b) How many students were influenced by friends and relatives?</p> <p>(c) Which influenced more students: Music Video Channel or Live Performance?</p> | LO4 | C3 |
|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----|

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |     |    |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----|
| 30 | <p>A school library contains 12,000 books. The books are distributed as follows:</p> <ul style="list-style-type: none"> <li>• Story Books = <math>\frac{3}{8}</math></li> <li>• Fiction Books = <math>\frac{2}{8}</math></li> <li>• Science Books = <math>\frac{1}{8}</math></li> <li>• Other Books = <math>\frac{2}{8}</math></li> </ul> <p>Answer the following:</p> <p>(a) What fraction of the books are story books?</p> <p>(b) How many science books are there in the library?</p> <p>(c) How many fiction books are there in the library?</p> | LO4 | C3 |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----|



### Answers:

|      |               |                   |               |                                         |                                             |                                                       |            |                                            |
|------|---------------|-------------------|---------------|-----------------------------------------|---------------------------------------------|-------------------------------------------------------|------------|--------------------------------------------|
| Q.   | 1             | 2                 | 3             | 4                                       | 5                                           | 6                                                     | 7          | 8                                          |
| Ans. | A             | B                 | A             | A                                       | C                                           | C                                                     | C          | D                                          |
| Q.   | 9             | 10                | 11            | 12                                      | 13                                          | 14                                                    | 15         | 16                                         |
| Ans. | D             | B                 | ₹2000         | $\frac{1}{2}, \frac{5}{8}, \frac{5}{6}$ | $\frac{2}{5}, \frac{3}{10}, \frac{1}{6}$    | 1½ hours                                              | 3          | 4                                          |
| Q.   | 17            | 18                | 19            | 20                                      | 21                                          | 22                                                    | 23         | 24                                         |
| Ans. | $\frac{1}{2}$ | $\frac{34}{3}$ kg | $\frac{3}{8}$ | $\frac{2}{7}$                           | $\frac{5}{4}$                               | $\frac{461}{3}$                                       | 15 minutes | $\frac{3}{4}$ litre per bottle, 20 bottles |
| Q.   | P[25          | 26                | 27            | 28                                      | 29                                          | 30                                                    |            |                                            |
| Ans. | $\frac{1}{4}$ | 14                | 15 minutes    | 4 $\frac{2}{4}$ m                       | (a) 90<br>(b) 30<br>(c) Music Video Channel | (a) $\frac{3}{8}$<br>(b) 1500 books<br>(c) 3000 books |            |                                            |

### Challenging Questions (Stage 1)

Q.1. A bus travelled  $\frac{4}{9}$  of its journey in the morning and  $\frac{2}{9}$  in the afternoon. What fraction of the journey has been completed?

Q.2. Find the fraction which when added to  $\frac{5}{12}$  gives 1.

Q.3. A number is multiplied by  $\frac{4}{7}$  to get  $\frac{16}{21}$ . Find the number.

Q.4. Create two fractions whose sum is  $\frac{7}{8}$  and whose difference is  $\frac{1}{8}$ .

Q.5. Which is greater:  $\frac{5}{6}$  or  $\frac{7}{9}$ ? By how much?

### Challenging Questions (Stage 2)

Q.1. A farmer used  $\frac{3}{10}$  of his land for wheat and  $\frac{2}{5}$  for rice. What fraction of land is left unused?

Q.2. 474 surgeons were invited to a conference and  $\frac{5}{6}$  of them actually participated. Find the number of participants.

Q.3.  $\frac{20}{3}$  litres of milk is distributed among 10 persons. How much milk does each person get?

Q.4. A garden is divided into 4 equal plots. Each plot is further divided into 3 equal sections. If  $\frac{2}{3}$  of each section is planted with flowers and the total garden area is  $120 \text{ m}^2$ , find the planted area.

Q.5. A painter mixes red and blue paint in the ratio 2:3. The total paint is 15 litres. How much red paint is used? If  $\frac{4}{5}$  of the red paint is used, how much red paint remains?

### Challenging Questions (Stage 3)

Q.1. Three friends shared a cake. Aman ate  $\frac{1}{4}$ , Ravi ate  $\frac{1}{3}$ , and Neha ate  $\frac{1}{6}$  of the cake.

(a) Who ate the most?

(b) How much cake is left?

Q.2. Sunita bought 10 kg of rice. She gave  $3\frac{1}{2}$  kg to her friend and  $2\frac{1}{4}$  kg to Anita. How much rice is left?

Q.3. Ravi jogs  $1\frac{1}{2}$  km in one hour. How many kilometers can he cover in  $2\frac{1}{2}$  hours?

Q.4. If 12 identical books together weigh  $6\frac{1}{3}$  kg, what is the weight of each book?

Q.5. A rectangular plot has dimensions  $\frac{5}{6}$  m  $\times$   $\frac{3}{4}$  m. It is divided into equal squares of side  $\frac{1}{12}$  m.

(a) How many squares fit in the plot?

(b) If  $\frac{2}{5}$  of the squares are planted with grass, how many squares are planted?

### Answers (Challenging Questions)

|         | Q.1                           | Q.2               | Q.3                 | Q.4                             | Q.5                                            |
|---------|-------------------------------|-------------------|---------------------|---------------------------------|------------------------------------------------|
| Stage 1 | $\frac{2}{3}$                 | $\frac{7}{12}$    | $\frac{4}{3}$       | $\frac{4}{8}$ and $\frac{3}{8}$ | $\frac{5}{6}$ ,<br>difference = $\frac{1}{18}$ |
| Stage 2 | $\frac{3}{10}$                | 395               | $\frac{2}{3}$ litre | 80 m <sup>2</sup>               | $\frac{6}{5}$ litres                           |
| Stage 3 | Ravi, $\frac{1}{4}$ cake left | $4\frac{1}{4}$ kg | $3\frac{3}{4}$ km   | $\frac{19}{36}$ kg              | (a) 90<br>(b) 36                               |