



तत् त्वं पूषन् अपावृणु  
केंद्रीय विद्यालय संगठन

$$4x - 5 = 11$$



KENDRIYA VIDYALAYA SANGATHAN

ZIET CHANDIGARH

$$\frac{4}{7}$$



# WORKBOOK

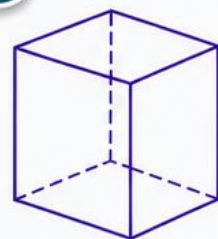
$$\frac{2}{5} + \frac{3}{10} = \frac{7}{10}$$

# MATHEMATICS

FOR

## CLASS VIII

(PART II)



$$-7 + 15 = 8$$



CONCEPTUAL  
UNDERSTANDING



PRACTICE  
REGULARLY



THINK  
LOGICALLY



SUCCEED  
CONFIDENTLY

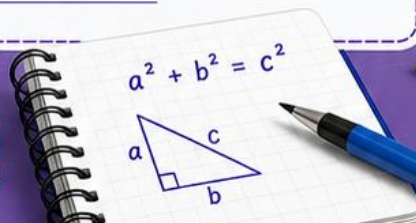
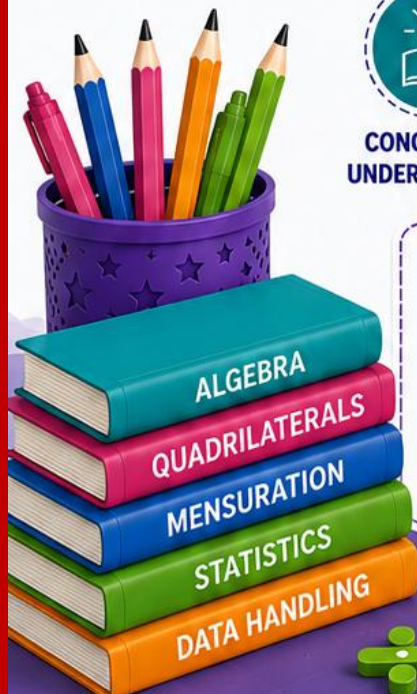
$\pi$

Name of Vidyalaya : \_\_\_\_\_

Name : \_\_\_\_\_

Class : \_\_\_\_\_ Section : \_\_\_\_\_

Roll No. : \_\_\_\_\_



# संरक्षक

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उपायुक्त एवं निदेशक  
आंचलिक शिक्षा एवं प्रशिक्षण संस्थान, चंडीगढ़

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## FOREWORD

Education today aims to develop confident, creative, and competent learners who can apply their knowledge to solve real-life problems. In this context, the implementation of the National Education Policy (NEP) 2020 and the National Curriculum Framework (NCF) 2023 has brought a significant transformation in the teaching and learning of Mathematics. The new NCERT Class VI Mathematics textbook, *Ganita Prakash*, promotes conceptual understanding, logical reasoning, problem-solving, and joyful learning through meaningful experiences.

I am pleased to present the **"Workbook for Students of Class VIII Mathematics (Part II) based on the New NCERT Textbook."** This workbook has been thoughtfully designed to supplement classroom learning and provide students with ample opportunities to practice, explore, and strengthen mathematical concepts.

The workbook contains a variety of competency-based exercises, application-oriented questions, Challenging questions, self-assessment tasks, and real-life situations. These carefully designed learning experiences encourage students to think critically, reason logically, and develop confidence in applying mathematics in everyday life. The exercises also support continuous practice and formative assessment, enabling teachers to monitor students' progress effectively.

I sincerely appreciate the dedicated efforts of the Associate Course Director, Resource Persons and Mathematics faculty who have worked tirelessly to develop this learner-friendly resource. Their commitment towards academic excellence and quality education is truly commendable.

I am confident that this workbook will become a valuable companion for students in their mathematical journey and an effective classroom resource for teachers. I extend my best wishes to all students and teachers for a joyful, engaging, and successful learning experience.

**(Deputy Commissioner)**

Kendriya Vidyalaya Sangathan  
Zonal Institute of Education & Training, Chandigarh

### CONTENT PREPARED BY:

| TOPIC                                | NAME OF TEACHER<br>(TGT Maths) | NAME OF KV             | REGION   |
|--------------------------------------|--------------------------------|------------------------|----------|
| FRACTIONS IN DISGUISE                | GARIMA BHATT                   | ITBP BHANU             | GURUGRAM |
| THE BAUDHĀYANA<br>PYTHAGORAS THEOREM |                                |                        |          |
| PROPORTIONAL<br>REASONING-2          | MEENAKSHI SINGH                | NO. 1 AMBALA<br>CANTT. | GURUGRAM |
| EXPLORING SOME<br>GEOMETRIC THEMES   |                                |                        |          |
| TALES BY DOTS AND LINES              |                                |                        |          |
| ALGEBRA PLAY                         |                                |                        |          |
| AREA                                 | NEELAM YADAV                   | PALWAL                 | GURUGRAM |

### MODERATED BY:

| TOPIC                                | NAME OF TEACHER<br>(TGT Maths) | NAME OF KV                    | REGION     |
|--------------------------------------|--------------------------------|-------------------------------|------------|
| FRACTIONS IN DISGUISE                | INDU SHARMA                    | 3 BRD<br>CHANDIGARH           | CHANDIGARH |
| THE BAUDHĀYANA<br>PYTHAGORAS THEOREM | SUSHIL SHARMA                  | FARIDKOT                      | CHANDIGARH |
| PROPORTIONAL<br>REASONING-2          | SUBE SINGH YADAV               | NO. 4 BHATINDA                | CHANDIGARH |
| EXPLORING SOME<br>GEOMETRIC THEMES   | PARVEEN KUMAR                  | NO. 1 HUSSAINPUR              | CHANDIGARH |
| TALES BY DOTS AND LINES              | RITU                           | NABHA CANTT                   | CHANDIGARH |
| ALGEBRA PLAY                         | BALJIT KAUR                    | NO. 1 PATHANKOT               | CHANDIGARH |
| AREA                                 | KHEM KUMAR                     | REONA UCHA<br>FATEHGARH SAHIB | CHANDIGARH |



## 1

## FRACTIONS IN DISGUISE

## SUMMARY OF CONCEPTS &amp; DEFINITIONS



## 1. UNDERSTANDING PERCENTAGES

- The symbol '%' is read as per cent.
- 'Per cent' comes from the Latin "per centum", meaning "by the hundred" or "out of hundred".
- z% means z out of every 100.

## Key Idea

$$z\% \text{ of a quantity } s = \frac{z}{100} \times s$$

**Example:** 50% of  $s = \frac{50}{100} \times s = \frac{1}{2}s$

Percentages are fractions with denominator 100.

Examples:

$$20\% = \frac{20}{100} = \frac{2}{10} = \frac{1}{5}$$

$$33\% = \frac{33}{100}$$



Percentages help us express parts of a whole in a common and easy-to-understand form.

## 3. RATIOS

A ratio compares two quantities of the same kind. Written as  $a : b$  and read as "a is to b".

- $a$  and  $b$  are the terms of the ratio.
- In  $a : b$ , for every ' $a$ ' units of the first quantity, there are ' $b$ ' units of the second quantity.

## Ratio of width : height

$$\text{Image A} = 60 : 40$$

$$\text{Image C} = 30 : 20$$

$$\text{Image D} = 90 : 60$$

## Example

In image A:  
For every 60 mm of width,  
there are 40 mm of height.



## 2. OBSERVING SIMILARITY IN CHANGE

Digital images can be resized (changed in size or orientation). Some images look similar, while others look different.



Image A



Image B



Image C



Image D



Image E

Measurements (in mm)

| Image   | Width | Height |
|---------|-------|--------|
| Image A | 60    | 40     |
| Image B | 40    | 20     |
| Image C | 30    | 20     |
| Image D | 90    | 60     |
| Image E | 60    | 60     |

- Images A, C and D look similar. Their widths and heights change by the same factor (through multiplication).
- Images B and E look different. Their widths and heights do not change by the same factor.

If width and height change by the same factor, the images look similar. Such changes are **PROPORTIONAL**.

## 4. RATIOS IN THEIR SIMPLEST FORM

Two ratios are **PROPORTIONAL** if their simplest forms are the same. To get simplest form → divide both terms by their HCF.

| Image | Ratio (W : H) | HCF | Simplest Form |
|-------|---------------|-----|---------------|
| A     | 60 : 40       | 20  | 3 : 2         |
| B     | 40 : 20       | 20  | 2 : 1         |
| C     | 30 : 20       | 10  | 3 : 2         |
| D     | 90 : 60       | 30  | 3 : 2         |
| E     | 60 : 60       | 60  | 1 : 1         |

Images A, C and D have the same simplest form (3 : 2). So, their ratios are proportional.

Images B and E have different simplest forms → not proportional to A, C and D.

Use '::' to show proportional ratios.

**Example:**  $60 : 40 :: 30 : 20$  and  $60 : 40 :: 90 : 60$

## 5. INCREMENTS IN PRODUCTS (USING DISTRIBUTIVITY)

Let the initial two numbers be  $a$  and  $b$  (product =  $ab$ ).

## Distributive Property

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

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

- 1 If second number  $b$  is increased by 1:

$$a(b + 1) = ab + a$$

$$\text{Increase} = a$$

- 2 If first number  $a$  is increased by 1:

$$(a + 1)b = ab + b$$

$$\text{Increase} = b$$

- 3 If both  $a$  and  $b$  are increased by 1:

$$(a + 1)(b + 1) = ab + (a + b + 1)$$

$$\text{Increase} = a + b + 1$$

- 4 If  $a$  is increased by 1 and  $b$  is decreased by 1:

$$(a + 1)(b - 1) = ab + b - a - 1$$

$$\text{Increase} = b - a - 1$$

## General Case

If  $a$  is increased by  $m$  and  $b$  by  $n$ :

$$(a + m)(b + n) = ab + mb + an + mn$$

$$\text{Increase} = an + bm + mn$$

(Identity 1)

|          |             |             |
|----------|-------------|-------------|
|          | $b$ columns | $n$ columns |
| $a$ rows | $ab$        | $an$        |
| $m$ rows | $mb$        | $mn$        |

Product = sum of products of each term of  $(a + m)$  with each term of  $(b + n)$ .

## 6. EXPRESSING FRACTIONS AS PERCENTAGES

To express a fraction as a percentage, make the denominator 100.

**Example:**  $\frac{3}{4}$

Method 1:  $\frac{3}{4} = \frac{3 \times 25}{4 \times 25} = \frac{75}{100} = 75\%$

Method 2:  $\frac{3}{4} = \frac{x}{100}$   
 $\Rightarrow x = \frac{3}{4} \times 100 = 75$

Method 3 (Bar Model):  
 Multiply  $\frac{3}{4}$  of 100 =  $\frac{3}{4} \times 100 = 75$

Other Example:  $\frac{2}{5}$

Method 1:  $\frac{2}{5} = \frac{20}{50} = \frac{40}{100} = 40\%$

Method 2:  $\frac{2}{5} = \frac{x}{100}$   
 $\Rightarrow x = \frac{2}{5} \times 100 = 40$

Method 3 (Bar Model):  
 Multiply  $\frac{2}{5}$  of 100 =  $\frac{2}{5} \times 100 = 40$



A fraction is of a unit, while a percentage is per 100.  
 So, Fraction → Percentage =  $\times 100$ .

## 7. EXPRESSING PERCENTAGES AS FRACTIONS

A percentage  $z\%$  is the same as  $\frac{z}{100}$ .

**Example:**  $24\% = \frac{24}{100}$

Equivalent forms:

$$\frac{24}{100} = \frac{12}{50} = \frac{6}{25} = \frac{48}{200}$$

In general,  $z\%$  can be expressed

by any fraction equivalent to  $\frac{z}{100}$ .

## 8. WHY USE PERCENTAGES?

- Same information in fractions may not be easy to compare.
- Percentages make comparison quicker and clearer.

**Example:**

$$\frac{9}{34} = 26.47\% \quad \text{vs} \quad \frac{13}{45} = 28.88\%$$

It is easier to see that 28.88% is larger!



## KEY TAKEAWAYS

- ✓ Percent means "out of 100".
- ✓ Fractions ↔ Percentages ( $\times 100$  or  $\div 100$ ).
- ✓ Ratios compare two quantities.

- ✓ Ratios in simplest form tell if they are proportional.
- ✓ Same factor change in dimensions ⇒ proportional change.
- ✓ Distributive property helps in understanding change in products.





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

11. 40 is what % of 50  
(a) 30% (b) 40% (c) 50% (d) 80%
12. 0.24 when changed to percent-  
(a) 24 % (b) 240% (c) 2.4 % (d) 20%
- 13..  $23\% + 64\% + x\% = 100\%$ , here x will be  
(a) 10% (b) 15 % (c) 20% (d) 100%
14. S.p. = Rs. 785, loss = Rs. 52, cost price is  
(a) 833 (b) 733 (c) 700 (d) 737
- 15.. 30% of 3 hours is \_\_\_\_ min  
(a) 34 (b) 40 (c) 54 (d) 60
16. A fruit seller buys 80 apples. He finds that 12 apples are spoiled before selling. What percentage of the apples are still good?  
(a) 12% (b) 15% (c) 85% (d) 88%
17. A school library has 240 books. During a book donation drive, the number of books increases by 25%. How many books are there now?  
(a) 260 (b) 280 (c) 300 (d) 320
18. A jacket marked at ₹2400 is sold after a 15% discount. The customer pays  
(a) ₹2040 (b) ₹2100 (c) ₹2160 (d) ₹2200
19. Ravi deposits ₹10,000 in a bank that offers 10% interest per year compounded annually. What will be the amount after 2 years?  
(a) ₹11,000 (b) ₹12,000 (c) ₹12,100 (d) ₹12,200
20. A student scored 72 marks out of 90 in Mathematics and 64 marks out of 80 in Science. Which statement is correct?  
(a) The student performed better in Mathematics. (b) The student performed better in Science.  
(c) The performance is the same in both subjects. (d) It cannot be compared.

## WORKSHEET-2

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

1. Convert 145% into a fraction in simplest form.

2. Convert (a) 0.6 (b) 2.23 into a percentage.

3. If 5% of  $x$  is ₹ 80, find  $x$  ?

4. A class has 40 students, out of which 8 are absent. What percentage of students are absent?

5. The article is Sold at loss of 15% On cost price of 1000, what is the S.P. ?

6. A product costs ₹500. If its price is increased by 10%, what is the increase in price and new price?

7. How much Simple Interest on a Principal of Rs 5000 at 5% p.a. will be collected for 3 years?



8.A school has 600 students, of whom 54% are girls. Find the number of girls.

9.The population of a village increased from 4000 to 4600. Find the percentage increase.

10.In a school of 800 students, 50.00 students use school bus. What percentage of students don't come by bus ?

**Section C: Short Answer ( $6 \times 3 = 18$  marks)**

11.A library has 500 books. If 150 books are issued to students,.How many and what percentage of the books are still available in the library?

12.In a test, Riya scored 80% marks out of 500 and Rehana scored 75% marks out of 600.Find their scores and compare them.

13.A shirt costing ₹1200 is sold at a discount of 15%. Find the discount amount and its S.P.

14. In a school, there are 800 students. If 55% are boys:

a. Find the number of boys.

b. Find the number of girls.

15. The price of a bicycle decreased from ₹8000 to ₹7200. Find the percentage decrease. After one year again the price was up by 15%, now what is the new price?

16. Calculate the simple Interest and amount on 3500 at the rate of 2.5% per annum For 4 years.

**Section D: Long Answer ( $4 \times 5 = 20$  marks)**

17. In a survey of 120 students: 45% preferred football, 35% preferred cricket and the remaining preferred badminton. Find the number of students who preferred each sport.

18. During a sale, a customer receives a 25% discount on an item marked ₹ 3000 or above and 15% off on articles priced between 2000 to 3000. If Nafisa purchased one article for rupees 2800 and other for 3400, then how much total amount after discount she gained ?

19. A water tank contains 800 litres of water. If 15% of the water is used:

- a. How much water is used?      b. How much water remains?

20. In a local library, 40% of the total books are on Fiction, 35% books are on Science, and the rest are on History. If the total number of History books is 2,340, calculate:

The total number of books in the library and the number of Fiction books in the library.

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

21. An electronics dealer bought a smartphone for ₹12,000 and spent ₹500 on its transport and handling. He then sold it for ₹14,375. Calculate his profit or loss percentage.

22. A bakery called Cakely is offering a 30% + 20% discount on all cakes. Another bakery called Cakify is offering a 50% discount on all cakes. Would you rather choose Cakely or Cakify if you want the cheaper cost. Ramandeep wants to buy a cake worth ₹ 400. Check offers given by both bakeries, and find which deal is better ?

**Self Assessment:**

I understood all the concepts: ☐ Yes ☐ No

I need more practice: ☐ Yes ☐ No

Name of Concepts having doubts/Not Cleared: \_\_\_\_\_

**Parent's Assessment:**

My ward understood all the concepts: ☐ Yes ☐ No

He/She need more practice: ☐ Yes ☐ No

Name of Concepts having doubts/Not Cleared: \_\_\_\_\_

**Signature of Parent:**

**Teacher's Assessment**

|  |
|--|
|  |
|--|



**Answers of Worksheet-1:**

|     |    |    |    |    |    |    |    |    |    |    |
|-----|----|----|----|----|----|----|----|----|----|----|
| Q   | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 |
| Ans | c  | b  | b  | d  | a  | b  | c  | b  | c  | d  |
| Q   | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| Ans | d  | a  | b  | d  | c  | c  | c  | a  | c  | c  |

**Answers of Worksheet-2:**

|     |                |               |           |             |                  |               |
|-----|----------------|---------------|-----------|-------------|------------------|---------------|
| Q   | 1              | 2             | 3         | 4           | 5                | 6             |
| Ans | 29/20          | 60%,<br>223%  | 1600      | 20%         | 850              | 50            |
| Q   | 7              | 8             | 9         | 10          | 11               | 12            |
| Ans | 750            | 324           | 15%       | 12.5%       | 350, 70%         | 400; 450      |
| Q   | 13             | 14            | 15        | 16          | 17               | 18            |
| Ans | 180, 1028      | 440 boys      | 10%, 8280 | 350, 3850   | 54;<br>42;<br>24 | 4930;<br>1270 |
| Q   | 19             | 20            | 21        | 22          |                  |               |
| Ans | 120 L<br>680 L | 9360;<br>3744 | 15%       | 224;<br>200 |                  |               |

# 2

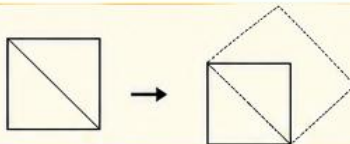
## THE BAUDHĀYANA-PYTHAGORAS THEOREM

### In this chapter

- Doubling a Square
- Halving a Square
- Hypotenuse of an Isosceles Right Triangle
- Value of  $\sqrt{2}$
- Pythagoras Theorem

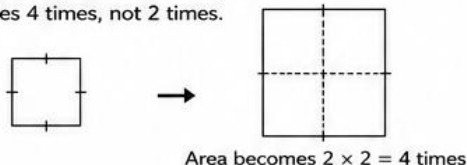
### Key Idea (Baudhāyana's Insight)

The diagonal of a square produces a square of double the area of the original square.



### 1. DOUBLING A SQUARE

- If each side of a square is doubled, the area becomes 4 times, not 2 times.



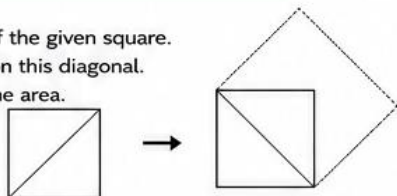
Area becomes  $2 \times 2 = 4$  times

### Baudhāyana's Theorem (Śulba-Sūtra, 1.9)

The diagonal of a square produces a square of double the area of the original square.

### Construction

Draw the diagonal of the given square. Construct a square on this diagonal. It will have double the area.



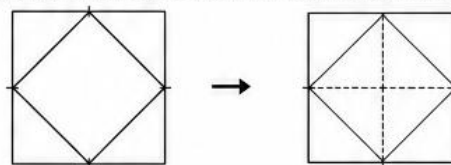
### Why does the new square have double the area?

- Draw horizontal and vertical lines through the midpoints of the sides.
- These lines pass through the vertices of the dotted square because the sides of the original square bisect the angles of the new square.
- The original square is made of 2 congruent small triangles; the new square is made of 4 congruent small triangles.
- Hence,  $\text{Area}(\text{new square}) = 2 \times \text{Area}(\text{original square})$ .

### 2. HALVING A SQUARE

#### Construction

Draw a square inside the given square by joining the midpoints of the sides. The inner square has half the area.

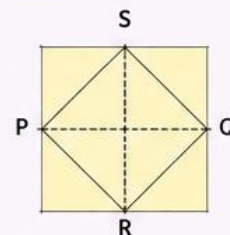


#### Why does the inner square have half the area?

- The diagonals of the inner square divide the figures into 4 congruent right isosceles triangles.
- The outer square is made of 4 such triangles.
- The inner square is made of 2 such triangles.
- Hence,  $\text{Area}(\text{inner square}) = \frac{1}{2} \times \text{Area}(\text{outer square})$ .

### Halving a Square Using Paper

1. Take a square sheet of paper.
2. Fold it inward so that the crease lines pass through the midpoints of the sides.
3. The inner square PQRS is the required square with half the area.



### 3. HYPOTENUSE OF AN ISOSCELES RIGHT TRIANGLE

Consider the isosceles right triangle PEAR.

Legs = 1 unit each.

Let  $ER = c$  be the hypotenuse.

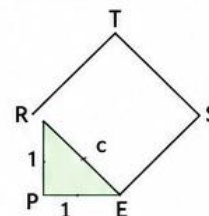
- A square of side 1 is made of two such triangles.
- The square constructed on the diagonal (hypotenuse) has twice the area of the original square.

So,  $\text{Area of square REST} = 2 \times \text{Area of square PEAR}$   
 $= 2 \times 1 = 2$  sq. units.

But the area of square REST =  $c^2$ .

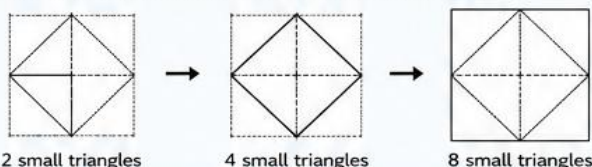
Therefore,  $c^2 = 2 \Rightarrow c = \sqrt{2}$ .

Hence, the hypotenuse of an isosceles right triangle with unit legs is  $\sqrt{2}$  units.



### Sequence of Squares

Each square has double the area of the previous one.



2 small triangles

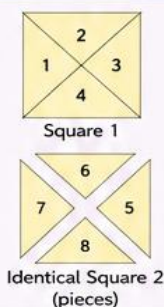
4 small triangles

8 small triangles

Areas in ratio: 1 : 2 : 4 : 8 : ...

### Doubling a Square Using Paper

1. Cut two identical squares of paper.
2. In Square 1, draw both diagonals and cut into 4 pieces (1, 2, 3, 4).
3. In identical Square 2, cut along the diagonals to get pieces (5, 6, 7, 8).
4. Place pieces 5, 6, 7, and 8 around Square 1. The outer shape is a square with double the area.



### Value of $\sqrt{2}$ (Decimal Representation)

We know:  $1^2 = 1$ ,  $2^2 = 4 \Rightarrow 1 < \sqrt{2} < 2$ .

Using the method of closer bounds:

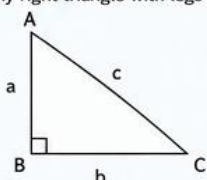
| Lower bound (a) |                | Upper bound (b) |                |
|-----------------|----------------|-----------------|----------------|
| a               | a <sup>2</sup> | b               | b <sup>2</sup> |
| 1.4             | 1.96           | 1.5             | 2.25           |
| 1.41            | 1.9881         | 1.42            | 2.0164         |
| 1.414           | 1.999396       | 1.415           | 2.002225       |
| 1.4142          | 1.9996164      | 1.4143          | 2.0002449      |

Thus,  $\sqrt{2} \approx 1.4142$  (to 4 decimal places).

It is an irrational number (non-terminating, non-repeating decimal).

### 4. PYTHAGORAS THEOREM (THE FINAL THEOREM)

In any right triangle with legs  $a$ ,  $b$  and hypotenuse  $c$  (opposite the right angle):



The square of the hypotenuse is equal to the sum of the squares of the other two sides.

$$c^2 = a^2 + b^2$$

### Key Definitions

- **Square:** A quadrilateral with all sides equal and all angles  $90^\circ$ .
- **Diagonal of a square:** A line segment joining two opposite vertices.
- **Hypotenuse:** The side opposite to the right angle in a right triangle.
- **East-west line:** A horizontal line.
- **North-south line:** A vertical line.
- **Congruent figures:** Figures that have the same shape and size.

### Important Takeaways

- ✓ Diagonal of a square  $\rightarrow$  new square with double the area.
- ✓ Connecting midpoints  $\rightarrow$  new square with half the area.
- ✓ Hypotenuse of an isosceles right triangle with unit legs =  $\sqrt{2}$ .
- ✓  $1 < \sqrt{2} < 2$  and  $\sqrt{2} \approx 1.4142$ .
- ✓ In any right triangle,  $c^2 = a^2 + b^2$ .

# THE BAUDHAYANA – PYTHAGORAS THEOREM

## WORKSHEET

### SECTION A: PART 1 MCQS (10 × 1 = 10 MARKS)

1. In a triangle with sides 3.10 cm, 3.01 cm, and 3.001 cm, which is the longest side?  
(a) 3.10 cm                      (b) 3.01 cm                      (c) 3.001 cm                      (d) All are equal
2. A triangle having one angle equal to  $90^\circ$  is called a:  
(a) Acute triangle      (b) Obtuse triangle      (c) Right-angled triangle      (d) Equilateral triangle
3. The sum of the interior angles of a triangle is:  
(a)  $90^\circ$                       (b)  $180^\circ$                       (c)  $270^\circ$                       (d)  $360^\circ$
4. What is the value of  $8^2 + 8^2$  is  
(a)  $16^2$                       (b)  $8^4$                       (c) 64                      (d) 128
5. What is the square root of 49?  
(a) 6                      (b) 7                      (c) 8                      (d) 9
6. Which of the following is a perfect square?  
(a) 20                      (b) 25                      (c) 30                      (d) 35
7. The diagonal of a rectangle forms:  
(a) two equilateral triangles                      (b) two isosceles triangles  
(c) two right-angled triangles                      (d) two obtuse triangles
8. What is the value of  $13^2 - 5^2$  is  
(a) 225                      (b) 144                      (c) 169                      (d) 81
9. In a right-angled triangle, the longest side will be :  
(a) Base                      (b) Height                      (c) Hypotenuse                      (d) Median
10. Which of the following is NOT a Perfect Square?  
(a) 144                      (b) 164                      (c) 324                      (d) 484

**PART 2 MCQS (10 × 1 = 10 MARKS)**

11. There can be \_\_\_\_\_ Baudhayan Triples  
(a) 1 (b) 10 (c) finite (d) infinitely many
12. Which of the following sets of numbers forms a Baudhayan-Pythagorean triple?  
(a) (8,24,25) (b) (5,12,13) (c) (6,8,11) (d) (3,4,6)
13. According to the Baudhayan Sulba Sutra, if a diagonal of a rectangle is  $c$  and its sides are  $a$  and  $b$ , the relationship between them is:  
(a)  $a+b=c$  (b)  $a^2 - b^2 = c^2$  (c)  $c^2 - b^2 = a^2$  (d)  $a \times b = c^2$
14. The value of  $\sqrt{2}$  lies between:  
(a) 0 and 1 (b) 1 and 2 (c) 1.4 and 1.5 (d) 1.41 and 1.42
15. There may be "two right angles in a triangle or two obtuse angles in a triangle" this statement is ---  
(a) Always true (b) Always false (c) Sometimes true (d) sometimes false
16. If the sides of a triangle are in the ratio 3:4:5, the triangle must be:  
(a) Acute-angled (b) Obtuse-angled (c) Right-angled (d) Equilateral
17. A ladder 10 m long reaches a window of a building 8 m above the ground. The distance of the foot of the ladder from the base of the building is:  
(a) 6 m (b) 7 m (c) 8 m (d) 9 m
18. State to true or false – "The Baudhayan Sulba Sutra holds for all triangles."  
(a) Always TRUE (b) Always FALSE (c) Sometimes TRUE (d) can't say
19. Who finally proved Fermat's last theorem?  
(a) Euclid (b) Pythagoras (c) Bodhayana (d) Andrew Wiles
20. In the right angled triangle, angle opposite to right angle is called  
(a) Attitude (b) Median (c) Hypotenuse (d) Base

## WORKSHEET-2

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

1. A man goes 15 m due east and then 20 m due north. How far is he from his starting point ?

2. If  $(k, 12, 13)$  is a Baudhayana-Pythagorean triple, find the value of  $k$ .

3. True or False: "Any scalar multiple of a Pythagorean triplet (e.g.,  $2 \times (3, 4, 5)$ ) also forms a Pythagorean triplet. Write two such triplets.

4. In an isosceles right-angled triangle, if the hypotenuse is 82 cm, find the length of its equal sides.

5. If the sides of a triangle measure 8 cm, 15 cm, and 16 cm, determine whether it forms a right-angled triangle.

6. Calculate the height of an equilateral triangle whose side length is 6 cm.

7.Determine Which of these triplet is a Primitive Baudhayan triple.(a) (3,4,5) (b) (9,12,15)

8.If a side of an equilateral triangle is a, then what is its altitude?

9.If the diagonal of a rectangle is 13 cm and its width is 5 cm, what is its area?

10.Find the diagonal of a square is  $20\sqrt{2}$  cm ,what is the side?



**Section C: Short Answer ( $6 \times 3 = 18$  marks)**

11. A wire is attached to a vertical pole of height 18 m is 24 m long and has a stake attached to the other end. How far from the base of the pole should the stake be driven so that the wire will be taut?

12. Find the length of the altitude of an isosceles triangle whose equal sides are 13 cm each and the base is 10 cm.

13. A 10 m long ladder is leaned against a vertical wall. If the base of the ladder is 6 m away from the wall, how high up the wall does the ladder reach?

14. An isosceles triangle can be split into two right-angled triangles. If the height of the triangle is 4 cm and the slant side (hypotenuse) is 5 cm:

(a) Find the half-base

(b) What is the total length of the full base?

15. A television screen size is measured diagonally. If a TV screen is 40 inches wide and 30 inches tall, what is the advertised size of the TV (diagonal length)?

16. A soccer field is a rectangle 90 meters wide and  $x$  meters long. The coach asks players to run from one corner to the other corner diagonally across and if players run a distance of 150 m. What is the length of field?

**Section D: Long Answer ( $4 \times 5 = 20$  marks)**

17.State and prove the **Baudhayan-Pythagoras Theorem** . Is the hypotenuse of the right triangle longest side of it? Justify you answer.Give an example of Pythagoras triple which is non primitive.

18.Two poles of heights 6 m and 11 m stand vertically on a plane ground. If the distance between the feet of the poles is 12 m, find the distance between their tops.

19.The diagonals of a rhombus measure 16 cm and 30 cm. Find its perimeter using the Baudhayan theorem.

20. Write three more steps of following pattern. Also show  $11^2$  and  $13^2$  as sum of consecutive odd numbers as given in pattern

### Perfect Squares and Odd Numbers

$$\begin{aligned}
 1 &= 1 = 1^2 \\
 1 + 3 &= 4 = 2^2 \\
 1 + 3 + 5 &= 9 = 3^2 \\
 1 + 3 + 5 + 7 &= 16 = 4^2 \\
 1 + 3 + 5 + 7 + 9 &= 25 = 5^2 \\
 1 + 3 + 5 + 7 + 9 + 11 &= 36 = 6^2
 \end{aligned}$$

### Section E: Case Study-Based Questions (2×4=8)

#### 21. Construction of Vedic Fire Altars (Chiti)

In ancient India, the Sulba Sutras laid out instructions for building ritualistic **fire altars called *Chiti***. Baudhayan documented precise structural specifications to build a square altar that possessed an area identical to the combined total area of two smaller individual square altars.



- Altar 1 has a side length of 6 cubits (units).
- Altar 2 has a side length of 8 cubits (units).

**Questions:** (i) What is the sum of the areas of Altar 1 and Altar 2?

- Using Baudhayan's rule, what should be the side length of the new combined square fire altar?
- What geometric dimension of the two original squares corresponds directly to the side length of the newly constructed square altar?

## 22. The Broken Tree (Natural Disaster)

During a thunderstorm, a tall eucalyptus tree snaps due to heavy wind forces. The tree does not break completely off its base; instead, it bends over.

- The broken top part of the tree touches the flat ground at a distance of 9 meters from the base of the trunk.
- The point where the trunk snapped and bent is at a height of 12 meters from the ground.

**Questions:** (i) Identify the right-angled relationship established by this real-world scenario.

(ii) Find the total length of the broken part of the tree that is leaning toward the ground.

(iii) Determine the original, full height of the tree before it sustained damage.

**Self Assessment:**

I understood all the concepts:

☐ Yes

☐ No

I need more practice:

☐ Yes

☐ No

Name of Concepts having doubts/Not Cleared: \_\_\_\_\_

**Parent's Assessment:**

My ward understood all the concepts:

☐ Yes

☐ No

He/She need more practice:

☐ Yes

☐ No

Name of Concepts having doubts/Not Cleared: \_\_\_\_\_

**Signature of Parent:**

**Teacher's Assessment**



### Answers of Worksheet-1

|     |    |    |    |    |    |    |    |    |    |    |
|-----|----|----|----|----|----|----|----|----|----|----|
| Q   | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 |
| Ans | a  | c  | b  | d  | b  | b  | c  | b  | c  | b  |
| Q   | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| Ans | d  | B  | c  | d  | b  | c  | a  | B  | d  | c  |

### Answers of Worksheet-2

|     |                                                                                                                                                                  |       |                                |                                          |         |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------------------------------|------------------------------------------|---------|
| Q   | 1                                                                                                                                                                | 2     | 3                              | 4                                        | 5       |
| Ans | 25 m                                                                                                                                                             | K = 5 | True<br>(6,8,10)<br>(12,16,20) | $41\sqrt{2}$                             | no      |
| Q   | 6                                                                                                                                                                | 7     | 8                              | 9                                        | 10      |
| Ans | $3\sqrt{3}$ cm                                                                                                                                                   | (a)   | $(\sqrt{3}/2)$                 | Side = 12cm<br>area = $12 \times 5 = 60$ | 20 cm   |
| Q   | 11                                                                                                                                                               | 12    | 13                             | 14                                       | 15      |
| Ans | $6\sqrt{7}$ cm                                                                                                                                                   | 12    | 8 m                            | 3, 6                                     | 50 inch |
| Q   | 16                                                                                                                                                               | 17    | 18                             | 19                                       | 20      |
| Ans | 120 m                                                                                                                                                            | ---   | 13 m                           | 68                                       | -----   |
| Q   | 21                                                                                                                                                               |       |                                | 22                                       |         |
| Ans | The <b>diagonal</b> of a rectangle formed by the sides of the two original squares corresponds directly to the side length of the newly constructed square altar |       |                                | 15 m                                     |         |

# 3

# PROPORTIONAL REASONING-2

## In This Chapter

- ✓ Proportionality (quick recap)
- ✓ Ratios in maps
- ✓ Ratios with more than 2 terms

**Key Idea:** When related quantities change by the same factor, we call that relationship a proportional relationship.

### 1. PROPORTIONALITY—A QUICK RECAP

A proportional relationship between two quantities can be represented using ratios.

**Example:**

Idli batter: 2 cups rice : 1 cup urad dal  $\rightarrow$  2 : 1

Viswanath mixes 6 cups rice and 3 cups urad dal  $\rightarrow$  6 : 3

Puneet mixes 4 cups rice and 2 cups urad dal  $\rightarrow$  4 : 2

#### Cross-Multiplication Method

$$\begin{array}{ccc} 6 : 3 & & 4 : 2 \\ & \times & \\ 6 \times 2 = 12 & \text{and} & 3 \times 4 = 12 \end{array}$$

The products are equal (12). So, the ratios are proportional. (Their idlis will taste the same if all other ingredients are proportional too!)

#### General Rule (Two Ratios)

Two ratios  $a : b$  and  $c : d$  are proportional if

$$a \times d = b \times c \quad \text{or} \quad \frac{a}{c} = \frac{b}{d}$$

### 2. RATIOS IN MAPS

Many maps show a ratio called **Representative Fraction (RF)** (usually in the lower right corner).

RF = 1 : N means 1 unit on the map = N units on the ground (real geographical distance, not road distance).

**Example:**

$$\text{RF} = 1 : 60,00,000$$

1 cm on map  
= 60,00,000 cm on ground  
= 60 km



(Map not to scale)

#### How to find distance between two cities:

1. Measure the distance between the cities on the map using a ruler.
2. Multiply by the scale (N) to get the actual geographical distance.

#### Try This!

- Find the distance between Bengaluru and Chennai.
- Find the distance between Mangaluru and Chennai.
- Use different maps (with different scales) and check if you get approximately the same geographical distance.

#### Note to the Teacher:

Bring maps and atlases to class. Ask students to observe the scale (ratio) on maps. Let them find geographical distances between places of local interest and compare results with peers.

#### Map Making Activity:

Ask students to draw a sketch of their classroom using a scale (e.g., 1 : 50). Mark positions of objects (desks, board, fans, lights, etc.) using suitable symbols.

### 3. RATIOS WITH MORE THAN 2 TERMS

Ratios can have more than two terms if the quantities change by the same factor.

**Example:**

Viswanath's spice mix powder:

8 spoons coriander : 4 red chillies : 2 spoons toor dal : 1 spoon fenugreek (methi) seeds

Ratio = 8 : 4 : 2 : 1 (4 terms)

**?** Puneet has only 2 red chillies (half of Viswanath's 4 chillies). How much of the other ingredients should he use to make the same spice mix powder?

Since he has half the chillies, he must also take half of all other ingredients.

Puneet's mix: 4 : 2 : 1 : 0.5

(4 spoons coriander, 2 red chillies, 1 spoon toor dal, half spoon fenugreek seeds)

Both ratios are proportional:

$$8 : 4 : 2 : 1 :: 4 : 2 : 1 : 0.5$$

#### General Rule (Multiple Terms)

If two ratios with the same number of terms are proportional,

$$a : b : c : d :: p : q : r : s$$

then,  $\frac{a}{p} = \frac{b}{q} = \frac{c}{r} = \frac{d}{s}$

#### Example 1: Mixing Paint

Ratio (Red : Blue : White) = 2 : 3 : 5

Yasmin has 10 litres of white paint. How much red and blue paint should she add?

- White corresponds to 5 parts.
- If 5 parts = 10 L  $\rightarrow$  1 part =  $10 \div 5 = 2$  L
- Red = 2 parts =  $2 \times 2 = 4$  L
- Blue = 3 parts =  $3 \times 2 = 6$  L
- Total volume of purple paint =  $4 + 6 + 10 = 20$  litres



#### Example 2: Cement Concrete Mix

Ratio (Cement : Sand : Aggregate) = 1 : 2 : 4

If 7 kg of cement is used, how much sand and aggregate are needed?

- Cement corresponds to 1 part.
- 1 part = 7 kg
- Sand = 2 parts =  $2 \times 7 = 14$  kg
- Aggregate = 4 parts =  $4 \times 7 = 28$  kg
- Total mix =  $7 + 14 + 28 = 49$  kg



### KEY DEFINITIONS

- **Ratio:** A way to compare two or more quantities using division ( $a : b$  means "a to b").
- **Proportional relationship:** When related quantities change by the same factor.
- **Representative Fraction (RF):** The ratio of a distance on the map to the actual geographical distance on the ground.

### IMPORTANT FORMULAS

- Two ratios  $a : b$  and  $c : d$  are proportional if  $\frac{a}{c} \times d = b \times c$  or  $\frac{a}{c} = \frac{b}{d}$
- For multiple terms  $a : b : c : d :: p : q : r : s \Rightarrow \frac{a}{p} = \frac{b}{q} = \frac{c}{r} = \frac{d}{s}$

### KEY TAKEAWAYS

- ✓ Proportionality helps us compare quantities easily.
- ✓ Maps use a ratio (RF) to represent real distances.
- ✓ Ratios can have more than two terms.
- ✓ Keep the same ratio (or scale) to maintain the same relationship.

## PROPORTIONAL REASONING -2

### WORKSHEET-1

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

1. If 4 notebooks cost ₹120, then the cost of 1 notebook is:  
a) ₹20                      b) ₹25                      c) ₹30                      d) ₹35
2. Which of the following represents a proportional relationship?  
a)  $2:4 = 3:6$               b)  $2:5 = 4:8$               c)  $3:7 = 6:10$               d)  $5:8 = 10:12$
3. If 5 kg rice costs ₹250, then 8 kg rice costs:  
a) ₹350                      b) ₹400                      c) ₹450                      d) ₹500
4. The ratio 15 : 20 in simplest form is:  
a) 3 : 4                      b) 4 : 5                      c) 5 : 6                      d) 15 : 20
5. If x and y are proportional, then:  
a)  $x + y$  is constant                      b)  $x - y$  is constant  
c)  $x/y$  is constant                      d)  $xy$  is constant
6. A car travels 120 km in 3 hours. Distance travelled in 5 hours at the same speed is:  
a) 180 km                      b) 200 km                      c) 220 km                      d) 240 km
7. If 6 pens cost ₹90, then 10 pens cost:  
a) ₹120                      b) ₹130                      c) ₹150                      d) ₹180
8. Which pair is proportional?  
a) 2, 4, 6, 8                      b) 3, 5, 9, 15                      c) 4, 6, 8, 12                      d) 5, 7, 10, 15
9. If 12 workers complete a job in 8 days, then the number of worker-days is:  
a) 20                      b) 96                      c) 80                      d) 100
10. In a map scale of 1 cm = 5 km, 4 cm represents:  
a) 10 km                      b) 15 km                      c) 20 km                      d) 25 km

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

11. A recipe requires flour : sugar = 5 : 2. If 15 cups of flour are used, how many cups of sugar are needed?

- a) 4 cups                      b) 5 cups                      c) 6 cups                      d) 8 cups

12. A map has a scale of 1 : 2,50,000. If the distance between two towns on the map is 8 cm, what is the actual distance?

- a) 10 km                      b) 15 km                      c) 20 km                      d) 25 km

13. Three friends share a prize money of ₹3600 in the ratio 2 : 3 : 4. The largest share is

- a) ₹800                      b) ₹1000                      c) ₹1200                      d) ₹1600

14. A pie chart represents the favourite fruits of students. If  $90^\circ$  of the chart represents apples, what fraction of the students prefer apples?

- a)  $\frac{1}{4}$                       b)  $\frac{1}{3}$                       c)  $\frac{1}{2}$                       d)  $\frac{3}{4}$

15. A car travels 240 km in 4 hours. If the speed remains constant, how far will it travel in 7 hours?

- a) 360 km                      b) 400 km                      c) 420 km                      d) 480 km

16. If 12 workers complete a job in 15 days, how many days will 20 workers take to complete the same job?

- a) 6 days                      b) 8 days                      c) 9 days                      d) 10 days

17. A painter uses Red : Blue : Yellow = 4 : 3 : 1 to prepare a colour mixture. If Yellow = 5 litres, how much Blue paint is required?

- a) 10 litres                      b) 12 litres                      c) 15 litres                      d) 20 litres

18. A school bus travelling at 50 km/h reaches a destination in 4 hours. If the speed increases to 80 km/h, the journey will take

- a) 2.5 hours                      b) 3 hours                      c) 3.5 hours                      d) 4 hours

19. In a pie chart, the sector representing Science measures  $126^\circ$ . If there are 240 students, how many students prefer Science?

- a) 72                      b) 80                      c) 84                      d) 90

20. Which of the following pairs of quantities are inversely proportional?

- a) Distance travelled and time taken at constant speed  
b) Number of notebooks bought and total cost (same price per notebook)  
c) Number of workers and time taken to complete the same work  
d) Age of a person and height of a tree

## WORKSHEET-2

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

1. Find the unit rate if 7 kg apples cost ₹280.

2. Are the ratios 12:18 and 8:12 equivalent? Give reason.

3. A train travels 180 km in 3 hours. Find its speed.

4. Simplify the ratio 24 : 36.

5. If 3 m cloth costs ₹240, find the cost of 5 m cloth.

6. Complete the proportion:  $6 : 9 = \underline{\quad} : 15$

7. A shop sells 8 bottles of juice for ₹320. What is the cost of one bottle?

8. Write one example from daily life where proportional reasoning is used.

9. Find the missing term:  $4 : 7 = 12 : \underline{\hspace{2cm}}$

10. If 15 notebooks cost ₹450, what will be the cost of 20 notebooks?

**Section C: Short Answer ( $6 \times 3 = 18$  marks)**

11. A cyclist covers 45 km in 3 hours. How far will he travel in 7 hours at the same speed?

12. A recipe needs 250 g flour for 5 persons. How much flour is needed for 8 persons?

13. The cost of 12 chairs is ₹5400. Find the cost of 18 chairs.

14. A map uses a scale of  $1 \text{ cm} = 8 \text{ km}$ . What actual distance does  $6.5 \text{ cm}$  represent?

15. A water tanker fills  $600 \text{ litres}$  in  $10 \text{ minutes}$ . How much water will it fill in  $18 \text{ minutes}$ ?

16. Verify whether the following are proportional:  $18 : 24$  and  $27 : 36$

**Section D: Long Answer ( $4 \times 5 = 20$  marks)**

17. A school bus travels  $150 \text{ km}$  using  $15 \text{ litres}$  of diesel. How much diesel will be required for  $250 \text{ km}$ ?

18. The wages of  $8$  workers for one day are  $\text{₹}3200$ . Find the wages of  $15$  workers for one day.



19. A grocer sells 18 kg sugar for ₹900. Find the cost of 1 kg sugar. Find the cost of 25 kg sugar.

20. A factory produces 450 bottles in 5 hours. How many bottles are produced in 8 hours? How many bottles are produced in 12 hours?

**SECTION E: Case Study Based Questions ( $4 \times 2 = 8$  marks)**

21. A map of a state uses the scale 1 cm = 20 km. The distance between City A and City B is shown as 7.5 cm on the map.

Based on the above information, answer the following questions:

- a) What is the actual distance between City A and City B?
- b) What distance on the map would represent an actual distance of 240 km?
- c) If a car travels from City A to City B at an average speed of 50 km/h, how much time will it take to reach City B?
- d) If another city is 300 km away from City A, how many centimetres apart should the two cities be shown on the map?

22. A trekking map uses the scale  $1 \text{ cm} = 8 \text{ km}$ . The distance between the Base Camp and Hill Point is shown as 9 cm on the map. Based on the information, answer the following questions:

- a) What is the actual distance between the Base Camp and Hill Point?
- b) If trekkers walk at an average speed of 4 km/h, how much time will they take to reach Hill Point?
- c) What map distance will represent an actual distance of 120 km?
- d) The distance between Hill Point and River Point is shown as 5.5 cm on the map. Find the actual distance between these two places.

**Self Assessment:**

I understood all the concepts: ☐ Yes ☐ No

I need more practice: ☐ Yes ☐ No

Name of Concepts having doubts/Not Cleared: \_\_\_\_\_

**Parent's Assessment:**

My ward understood all the concepts: ☐ Yes ☐ No

He/She need more practice: ☐ Yes ☐ No

Name of Concepts having doubts/Not Cleared: \_\_\_\_\_

**Signature of Parent:**

**Teacher's Assessment**

### Answers of Worksheet-1

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

### Answers of Worksheet-2

|       |        |                           |                                                 |      |                                                 |       |
|-------|--------|---------------------------|-------------------------------------------------|------|-------------------------------------------------|-------|
| Q.No. | 1      | 2                         | 3                                               | 4    | 5                                               | 6     |
|       | ₹40/kg | Yes                       | 60km/hr                                         | 2:3  | ₹400                                            | 10    |
|       | 7      | 8                         | 9                                               | 10   | 11                                              | 12    |
| Ans.  | ₹40    | Any suitable example      | 21                                              | ₹600 | 105                                             | 400   |
|       | 13     | 14                        | 15                                              | 16   | 17                                              | 18    |
|       | ₹8100  | 52m                       | 1080                                            | yes  | 25                                              | ₹6000 |
|       | 19     | 20                        |                                                 |      |                                                 |       |
|       | ₹1250  | 720 bottles, 1080 bottles | a) 150 km    b) 12 cm<br>c) 3 hours    d) 15 cm |      | a) 72 km    b) 18 hours<br>c) 15 cm    d) 44 km |       |

# 4

## EXPLORING SOME GEOMETRIC THEMES

### In This Chapter

- ✓ Fractals (self-similar shapes)
- ✓ Visualising Solids in Different Ways



We explore two geometric themes in this chapter:

1. **Fractals** – self-similar shapes that repeat the same pattern at smaller and smaller scales.
2. **Visualising Solids** – understanding the same solid from different views and cross-sections.

### 1. FRACTALS

#### Key Idea

A **fractal** is a shape that shows **self-similarity** – the same or similar pattern appears again and again at smaller and smaller scales.

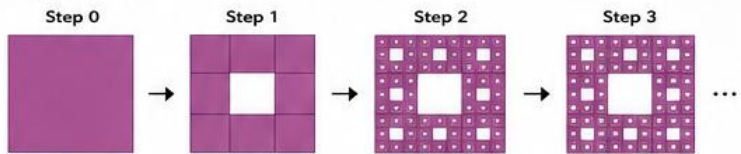
#### Examples in Nature

Ferns, trees, clouds, coastlines, mountains, lightning and many more.



#### A. SIERPINSKI CARPET

Start with a square. Divide it into 9 equal squares and remove the central square. Repeat the same process on the remaining 8 squares, and so on.



#### Number of Squares that Remain ( $R_n$ )

Each remaining square produces 8 squares in the next step.

$$R_{n+1} = 8 R_n$$

$$R_0 = 1 \Rightarrow R_n = 8^n$$

#### Number of Holes ( $H_n$ )

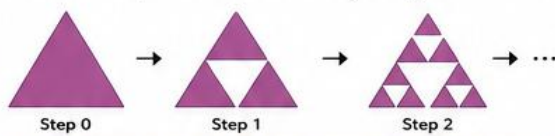
Each remaining square creates a new hole and all previous holes remain.

$$H_{n+1} = H_n + R_n$$

$$H_0 = 0, H_1 = 1, H_2 = 1 + 8, H_3 = 1 + 8 + 8^2, \dots$$

#### B. SIERPINSKI TRIANGLE (GASKET)

Start with an equilateral triangle. Join midpoints of its sides to form 4 smaller congruent triangles and remove the central one. Repeat on the 3 remaining triangles.



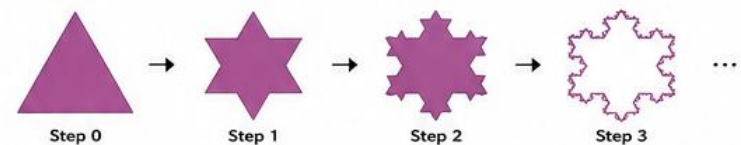
★ Joining the midpoints of an equilateral triangle divides it into 4 identical equilateral triangles. (Hint: Corner triangles are isosceles.)

#### Figure it Out

1. Draw the first few steps (at least till Step 2).
2. Find the number of holes and triangles that remain at each step.
3. Find the area of the region remaining at the  $n^{\text{th}}$  step. (Take the starting triangle to have area = 1 sq. unit.)

#### C. KOCH SNOWFLAKE

Start with an equilateral triangle. Each side is divided into 3 equal parts. On the middle part, an outward equilateral triangle is built and the middle part is removed. Repeat on every side of the new shape, and so on.



#### Figure it Out

1. Draw the first few steps (at least till Step 2).
2. Find the number of sides at the  $n^{\text{th}}$  step.
3. Find the perimeter at the  $n^{\text{th}}$  step. (Take the starting triangle to have side length = 1 unit.)

### FRACTALS IN ART

Fractal patterns have been used in art and architecture for centuries!

- ◆ **Indian temples:** Structures built of smaller copies of the whole form.
- ◆ **African art:** Traditional patterns on textiles (e.g., Nigerian Fulani wedding blankets).
- ◆ **Islamic art:** Intricate repeating fractal-like geometric motifs.



Kandariya Mahadev Temple, Khajuraho, Madhya Pradesh (c. 1025 CE)



Nigerian Fulani Wedding Blanket



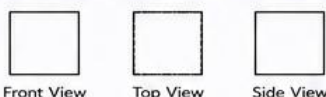
Islamic Geometric Motif

### 2. VISUALISING SOLIDS IN DIFFERENT WAYS

We can look at the same solid in different ways:

#### A. DIFFERENT VIEWS

A solid looks different from different directions.



#### B. CROSS-SECTIONS

A slice (cut) of a solid gives a 2D shape.



#### C. EXPLORE & SKETCH

- ◆ Think, imagine, cut and draw different views and cross-sections to understand solids better.



#### KEY DEFINITIONS

- **Fractal:** A shape that shows self-similarity at different scales.
- **Self-similarity:** Similar pattern repeats at smaller and smaller sizes.
- **Square Hole / Triangle Hole:** A part removed at each step in constructing a fractal.
- **Cross-section:** The 2D shape obtained by slicing a solid with a plane.

#### IMPORTANT FORMULAS

##### Sierpinski Carpet

$$R_{n+1} = 8 R_n \Rightarrow R_n = 8^n$$

$$H_{n+1} = H_n + R_n \quad (\text{with } H_0 = 0)$$

##### Sierpinski Triangle

$$R_{n+1} = 3 R_n \Rightarrow R_n = 3^n$$

$$H_{n+1} = H_n + R_n \quad (\text{with } H_0 = 0)$$

##### Koch Snowflake (perimeter)

$$P_{n+1} = \frac{4}{3} P_n \Rightarrow P_n = \left(\frac{4}{3}\right)^n P_0$$

#### KEY TAKEAWAYS

- ✓ Fractals are everywhere – in nature, art and mathematics.
- ✓ They are built using simple rules repeated many times.
- ✓ Counting patterns (squares, triangles, holes, sides) helps us understand fractals.
- ✓ Visualising solids from different views and cross-sections builds spatial understanding.

# EXPLORING SOME GEOMETRICAL THEMES

## WORKSHEET-1

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

1. A pattern that repeats itself at different scales is called:  
a) Polygon                      b) Fractal                      c) Prism                      d) Pyramid
2. The Koch Snowflake begins with:  
a) Square                      b) Rectangle                      c) Equilateral Triangle                      d) Pentagon
3. The Sierpinski Gasket is formed using:  
a) Square                      b) Circle                      c) Triangle                      d) Rectangle
4. Which property is common to fractals?  
a) Reflection                      b) Translation                      c) Self-similarity                      d) Rotation
5. Isometric paper is made up of:  
a) Squares                      b) Rectangles                      c) Equilateral triangles                      d) Circles
6. A net is:  
a) A graph                      b) A flat pattern that folds into a solid                      c) A tessellation                      d) A fractal
7. A square pyramid has:  
a) 3 triangular faces                      b) 4 triangular faces                      c) 5 triangular faces                      d) 6 triangular faces
8. Which of the following is NOT a fractal?  
a) Fern leaf                      b) Koch Snowflake                      c) Sierpinski Gasket                      d) Rectangle
9. The perimeter of a Koch Snowflake:  
a) Decreases                      b) Remains constant                      c) Increases                      d) Becomes zero
10. Isometric drawings are mainly used to represent:  
a) 2D figures                      b) 3D objects                      c) Graphs                      d) Maps

**MCQs (Part-2) (10 × 1 = 10 marks)**

11. A standard solid cube is made up of how many faces, vertices, and edges respectively?

- a) 6 faces, 8 vertices, 12 edges      b) 6 faces, 12 vertices, 8 edges
- c) 8 faces, 6 vertices, 12 edges      d) 4 faces, 4 vertices, 6 edges

12.What flat geometric shape do you get when you fully open and flatten out the curved side wall of a hollow cylinder?

- a) Circle                      b) Triangle                      c) Rectangle                      d) Semi-circle

13. What 3D solid is constructed by rolling up a sector of a circle (like a slice of pizza) and attaching a matching circular base?

- a) Cylinder      b) Cone      c) Sphere      d) Prism

14. Which of these flat shapes has exactly three straight sides and three corners?

- a) Square                  b) Triangle                  c) Circle                  d) Rectangle

15. How many flat faces does a standard playing dice (cube) have?

- a) 4                      b) 6                      c) 8                      d) 12

16. What shape do you get if you trace around the bottom base of a solid ice cream cone onto a piece of paper?

- a) Circle                      b) Square                      c) Triangle                      d) Oval

17.If you look at a building from directly above, as if you are flying in an airplane, this overhead view is called the:

- a) Front view      b) Side view      c) Top view      d) Bottom view

18. What solid shape do you get if you roll up a flat rectangular sheet of paper so that its opposite ends meet?

- a) Cube                  b) Sphere                  c) Cylinder                  d) Pyramid

19.Which of these flat shapes has exactly three straight sides and three corners?

- a) Square      b) Triangle      c) Circle      d) Rectangle

20. How many straight sides does a regular flat pentagon have?

- a) 4                      b) 5                      c) 6                      d) 8



## WORKSHEET-2

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

1. Define a fractal.

2. What is self-similarity?

3. Name any two fractals found in nature.

4. What is an isometric drawing?

5. Define a net of a solid.



6. Name the shape used to start the construction of a Koch Snowflake.

7. Name the shape used to start the construction of a Sierpinski Gasket.

8. Why is isometric paper useful?

9. State one similarity between Koch Snowflake and Sierpinski Gasket.

10.State one difference between Koch Snowflake and Sierpinski Gasket.

**Section C: Short Answer ( $6 \times 3 = 18$  marks)**

11. Explain self-similarity using the example of a fern leaf.

12. Describe the first stage in constructing a Koch Snowflake.

13. Describe the first stage in constructing a Sierpinski Gasket.

14. Draw a cube using isometric dots.

15. Explain how a net helps in understanding a three-dimensional solid.

16. Draw the net of a square pyramid and label its faces.

**Section D: Long Answer ( $4 \times 5 = 20$  marks)**

17. Explain the construction of a Koch Snowflake up to Stage 2.

18. Explain the construction of a Sierpinski Gasket up to Stage 2.

19. Compare Koch Snowflake and Sierpinski Gasket.

20. Draw and explain the net of a square pyramid. State faces, edges and vertices.

**SECTION E: Case Study Based Questions ( $4 \times 2 = 8$  marks)**

21. Which solid is formed by folding the net of a square pyramid? How many triangular faces does it have?

22. How many vertices does the solid have? If each side of the square base is 6 cm, find the perimeter.

### Self Assessment:

I understood all the concepts:

☐ Yes☐ No

I need more practice:

☐ Yes☐ No

Name of Concepts having doubts/Not Cleared: \_\_\_\_\_

**Parent's Assessment:**

My ward understood all the concepts:

☐ Yes☐ No

He/She need more practice:

☐ Yes

☐ No

Name of Concepts having doubts/Not Cleared: \_\_\_\_\_

**Signature of Parent:**

## Teacher's Assessment

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## Answers of Worksheet-1

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

# 5

# TALES BY DOTS AND LINES

This chapter helps us understand how the mean behaves with data. We use dot plots to visualise and explore important ideas.

## In this chapter

- Mean as the 'centre'
- Effect of including / removing values
- Unchanging Mean
- Relatively Unchanged Mean



Scan to learn more!

## 1. THE BALANCING ACT

### Key Idea

The mean (average) is the 'centre' of a collection of data. It balances the data so that the total distance of values on the left equals the total distance of values on the right.

### For 2 Numbers

Mean is exactly halfway between the two numbers.

Example:

$$(3, 7) \rightarrow \text{Mean} = \frac{3+7}{2} = 5$$

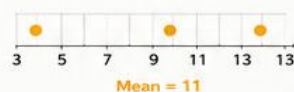
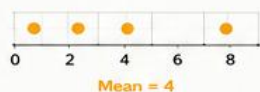
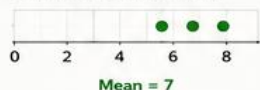


$$(8, 9) \rightarrow \text{Mean} = \frac{8+9}{2} = 8.5$$



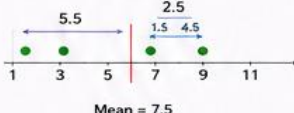
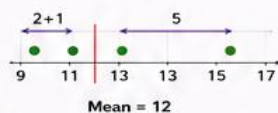
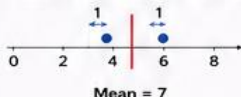
### For 3 Numbers

Calculate and mark the mean.



### Mean as Balance (Examples)

Sum of distances on LHS = Sum of distances on RHS



### Unique Centre

If we move the centre away from the mean, the two sides are no longer balanced.

Collection: 10, 10, 11, 17 (Mean = 12)



Hence, the mean is the **only** centre.

## 3. UNCHANGING MEAN

- It is possible to include or remove values without changing the mean.
- Some possibilities:

Add one value = mean  
(10 added to data with mean 10)

Remove one value = mean  
(any one 10 removed)

Add two below & one above  
(e.g., 8, 8 and 12)



Similarly: add two above & one below.  
There are many such combinations!

### KEY DEFINITIONS

- **Mean (Average):** Sum of all values divided by the number of values.
- **Centre (Balance Point):** A value where the sum of distances of data on the left equals the sum on the right.
- **Dot Plot:** A way to display data using dots on a number line.



### IMPORTANT FORMULAS

- Mean:  $\bar{x} = \frac{x_1 + x_2 + \dots + x_n}{n}$
- When each value changes:  
Add  $k \rightarrow \text{Mean} = \bar{x} + k$   
Subtract  $k \rightarrow \text{Mean} = \bar{x} - k$   
Multiply by  $k \rightarrow \text{Mean} = k\bar{x}$



### KEY TAKEAWAYS

- ✓ Mean is the centre that **balances** data.
- ✓ Adding values greater than the mean increases it; smaller values decrease it.
- ✓ Removing works in the opposite way.
- ✓ Adding/removing a value equal to the mean **does not** change it.
- ✓ Mean changes predictably when all values change together.



## 2. EFFECT OF INCLUDING / REMOVING VALUES

### Including a New Value

- If a new value greater than the mean is added, the mean increases.

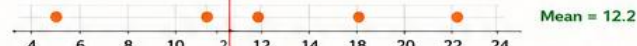


- If a new value smaller than the mean is added, the mean decreases.



### Removing a Value

- Removing a value greater than the mean  $\rightarrow$  mean decreases.

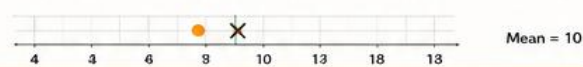
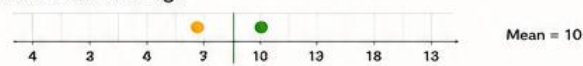


- Removing a value smaller than the mean  $\rightarrow$  mean increases.



### Adding / Removing a Value Equal to the Mean

- Mean does not change.



### Fair-Share Interpretation

- Think of sharing equally (fairly) among all values.
- If one value is larger than the mean, others must share more to keep it fair.
- If one value is smaller, others share less.



### Algebraic Rule

- Let values be  $x_1, x_2, \dots, x_n$  with mean  $a = \frac{x_1 + x_2 + \dots + x_n}{n}$
- Add  $k$  to every value:  
New mean =  $a + k$
- Subtract  $k$  from every value:  
New mean =  $a - k$
- Multiply every value by  $k$ :  
New mean =  $ka$

## 4. RELATIVELY UNCHANGED MEAN

If every value in the collection is:

1. Increased (or decreased) by a fixed number  $k$

$\rightarrow$  Mean also increases (or decreases) by  $k$ .

Example: Add 10 to every value  $\rightarrow$  Mean increases by 10.

Subtract 1 from every value  $\rightarrow$  Mean decreases by 1.

2. Multiplied by a fixed number  $k$

$\rightarrow$  Mean is also multiplied by  $k$ .

Example: Double every value  $\rightarrow$  Mean doubles.

# TALES BY DOTS AND LINES

## WORKSHEET-1

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

1. Which of the following is a statistical question?  
(a) What is your roll number? (b) Who is the class monitor?  
(c) How many hours do Grade VII students study daily? (d) What is the date today?
2. The formula for Arithmetic Mean is:  
(a)  $\text{Sum} \div \text{Largest value}$  (b)  $\text{Sum of all values} \div \text{Number of values}$   
(c)  $\text{Largest value} \div \text{Smallest value}$  (d)  $\text{Middle value} \times 2$
3. The average of 18, 22, 20, 25 and 15 is:  
(a) 18 (b) 19 (c) 20 (d) 21
4. Mean and Median are called measures of:  
(a) Central tendency (b) Dispersion (c) Variation (d) Probability
5. In a Grade 5 class, boys' average height is 142.94 cm and girls' is 146.9 cm. This means:  
(a) Every girl is taller than every boy (b) Girls are taller than boys on average in this class  
(c) Boys will never be taller (d) The data is incorrect
6. What does a dot plot help us observe?  
(a) Only the mean (b) Variability and patterns in data  
(c) Only outliers (d) Only the maximum value
7. The median of the data 3, 5, 7, 8, 10, 12, 15 is:  
(a) 7 (b) 8 (c) 10 (d) 12
8. Which measure of central tendency is least affected by outliers?  
(a) Mean (b) Total (c) Median (d) Range
9. In a dot plot, repeated values are shown by:  
(a) Different colours (b) Dots stacked above the same value  
(c) Bars (d) Lines
10. In a dot plot, repeated values are shown by:  
(a) Different colours (b) Dots stacked above the same value  
(c) Bars (d) Lines



**Section A- Part 2: MCQs (10 × 1 = 10 marks)**

11. What does the mean represent in a dot plot visualization?

- a) The midpoint between the highest and lowest values
- b) The value with the highest frequency
- c) The middle-most value when sorted
- d) The "balance point" where the sum of distances on the left and right is equal

12. If a new value greater than the current mean is added to a dataset, the mean will:

- a) Decrease
- b) Increase
- c) Stay the same
- d) Become zero

13. Which change will not affect the mean of a data set?

- a) Adding a value greater than mean
- b) Adding a value equal to mean
- c) Removing a value smaller than mean
- d) Removing the largest value

14. A frequency table has total frequency 40. The median lies between:

- a) 20th and 21st values
- b) 19th and 20th values
- c) 20th value
- d) 21st value

15. Which graph is best to show change over time?

- a) Bar graph
- b) Pie chart
- c) Dot plot
- d) Line graph

16. In a spreadsheet, which cell reference would indicate the intersection of column D and row 5?

- a) 5D
- b) D5
- c) Cell-D
- d) D + 5

17. Which formula correctly calculates the average of values in cells B2 to B10?

- a) =SUM(B2:B10)
- b) =TOTAL(B2:B10)
- c) =AVERAGE(B2:B10)
- d) =MEAN(B2,B10)

18. If the mean of 10 values is 39.2, what is the sum of these values?

- a) 392
- b) 3.92
- c) 3920
- d) 39.20

19. A clustered-column graph is best suited for:

- a) Showing a single trend line
- b) Comparing two or more sets of data side-by-side
- c) Finding the balance point of a dataset
- d) Representing a 3D solid

20. In a line graph, which axis is typically used to represent time or independent categories?

- a) X-axis
- b) Y-axis
- c) Z-axis
- d) Origin

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

1. Define a 'Dot Plot' visualization and write its one primary advantage.

2. A dataset contains the numbers 4, 7, 7, 8, 10, 12. Find the mean.

3. In Excel/Spreadsheets, what is the purpose of using a colon (:) in a range like A1:A50?

4. If a dataset has a mean of 15 and 5 is subtracted from each data point, what will be the new mean?

5. What type of dataset is best visualized using a dual line graph?

6. Find the median of the following observation points: 22, 11, 15, 19, 32, 25, 27.

7. How can you identify outliers quickly using a dot plot visualization?

8. Write down the spreadsheet formula to find the maximum value from cell C1 to C20.

9. If the total frequency of a data distribution is 25, which term represents the median position?

10. Explain what a trend line in a line graph signifies.

**Section C: Short Answer ( $6 \times 3 = 18$  marks)**

11. The mean of 5 observations is 20. If one observation is excluded, their mean becomes 18. Find the value of the excluded observation.

12. Draw a sample dot plot representing the number of books read by 10 students in a month:  
2, 2, 3, 3, 3, 4, 5, 5, 6, 8.

13. Describe how columns and rows are indexed in modern digital spreadsheet tools like Microsoft Excel or LibreOffice Calc.

14. A line graph shows temperature variations over 6 hours: (1 PM: 30°C, 2 PM: 32°C, 3 PM: 35°C, 4 PM: 33°C, 5 PM: 31°C, 6 PM: 28°C). Identify the peak hour and explain the trend.

15. Prove with an example that adding a constant value 'k' to all observations increases the mean by exactly 'k'.

16. Explain how a spreadsheet's automatic formula calculation saves time compared to manual multi-step statistical tracking.

**Section D: Long Answer ( $4 \times 5 = 20$  marks)**

17. The daily pocket expenses of 8 students are: Rs 45, Rs 50, Rs 40, Rs 60, Rs 55, Rs 45, Rs 70, Rs 80. Calculate the mean and median, then construct a dot plot for this data.

18. Create a spreadsheet plan to track monthly electricity consumption. Explain the cell layout from columns A to D, formulas for total, average, and how you will generate a trend line graph.

19. Discuss the structural differences, benefits, and typical applications between a standard single Bar Graph, a Clustered Column Graph, and a Line Graph.

20. A data operator inputs a dataset of 50 items into a spreadsheet. The original mean was 100. Later, it was discovered that two entries were wrongly entered as 80 and 90 instead of 50 and 60. Find the correct mean up to two decimal places.

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

21: (Dot Plot Analysis)

**Context:** A researcher is studying the test scores of a small remedial batch of students. They plot the scores out of 10 points on a dot plot to find the balance point. The dataset plotted consists of: 4, 5, 5, 6, 6, 6, 7, 7, 8, 10.

Questions:

1. Calculate the exact mathematical mean ("balance point") of the test scores.
2. Identify the value that has the highest frequency from this dataset.
3. If an extreme score of 0 is added to this batch, how will it change the balance point (mean)? Explain.

22: (Spreadsheet Modeling)

**Context:** An electronics retail shop tracks the daily sales of smartphones from Monday to Sunday in a spreadsheet. The cells from B2 to B8 contain the values:

12, 15, 14, 20, 22, 25, 32.

Questions:

Write down the exact cell reference text that represents Friday's sales data if Monday starts at cell B2.

1. Write the exact spreadsheet formula required to compute the total smartphone sales for the entire week.
2. Determine the median sales value among the seven days recorded.

**Self Assessment:**

I understood all the concepts:

☐ Yes

☐ No

I need more practice:

☐ Yes

☐ No

Name of Concepts having doubts/Not Cleared: \_\_\_\_\_

**Parent's Assessment:**

My ward understood all the concepts:

☐ Yes

☐ No

He/She need more practice:

☐ Yes

☐ No

Name of Concepts having doubts/Not Cleared: \_\_\_\_\_

**Signature of Parent:**

**Teacher's Assessment**

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### Answers of Worksheet-1

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

### Answers of Worksheet-2

|       |                                                                                                     |                                                           |                                                                        |                                                                                  |                                       |                                                                          |
|-------|-----------------------------------------------------------------------------------------------------|-----------------------------------------------------------|------------------------------------------------------------------------|----------------------------------------------------------------------------------|---------------------------------------|--------------------------------------------------------------------------|
| Q.No. | 1                                                                                                   | 2                                                         | 3                                                                      | 4                                                                                | 5                                     | 6                                                                        |
| Ans.  | Graphic data using dots over values                                                                 | 8                                                         | Denotes continuous cell grid blocks                                    | 10                                                                               | Comparing tracking parameters simult. | 22                                                                       |
| Q.No. | 7                                                                                                   | 8                                                         | 9                                                                      | 10                                                                               | 11                                    | 12                                                                       |
| Ans.  | Points far removed from the primary cluster                                                         | =MAX(C1:C20)                                              | 13th observation value                                                 | Indicates overall directional drift of numbers over time                         | 28                                    | Plot dots vertically above ticks 2,3,4,5,6,8.                            |
| Q.No. | 13                                                                                                  | 14                                                        | 15                                                                     | 16                                                                               | 17                                    | 18                                                                       |
| Ans.  | Columns via alphabets (A,B,C..), Rows via integers (1,2,3..)                                        | Peak: 3 PM (35°C). Trend rises till 3 PM then cools down. | Mean is additive under linear translations                             | Instantly updates totals upon modifying raw inputs without manual re-calculation | 53.125, 52.50                         | Column A: Month, B: Units, C: Cost. Cell D2: =B2*C2. Total: =SUM(D2:D13) |
| Q.No. | 19                                                                                                  | 20                                                        | 21                                                                     | 22                                                                               |                                       |                                                                          |
| Ans.  | Bar for discrete counts, Column Clustered for side group variables, Line for chronological changes. | Correct Mean = 98.80                                      | Mean = 6.4<br>Mode = 6<br>3. Decreases the balance point significantly | B6<br>=SUM(B2:B8)<br>3. Median = 20                                              |                                       |                                                                          |

# 6

# ALGEBRA PLAY

We use algebra to understand number tricks, create new tricks, and explore patterns in number pyramids.

## In this chapter

- Algebra tricks & puzzles
- Thinking/about 'Think of a Number' tricks
- Number pyramids



Scan to learn more!

## 1. THE BALANCING ACT

### Key Idea

The mean (average) is the 'centre' of the data. It balances the total distance of values on the left and right.

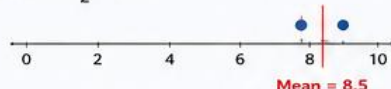
### For 2 Numbers

Mean is exactly halfway between the two numbers.

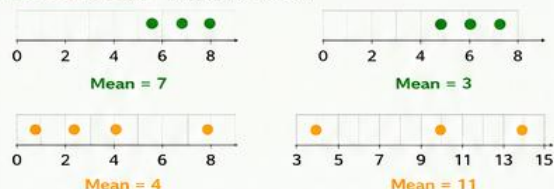
$$(3, 7) \rightarrow \text{Mean} = \frac{3+7}{2} = 5$$



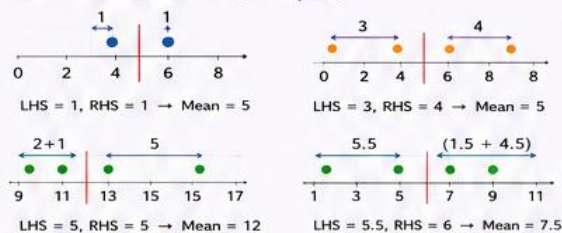
$$(8, 9) \rightarrow \text{Mean} = \frac{8+9}{2} = 8.5$$



### For 3 Numbers – Mark the mean.

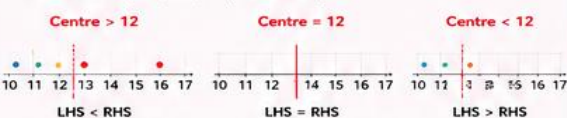


### How Mean is the Centre (Examples)



### Unique Centre

For the data 10, 10, 11, 17 (mean = 12)



Hence, the mean is the **only** centre.

## 4. HOW MEAN CHANGES

|                            |                       |  |
|----------------------------|-----------------------|--|
| Add a value > mean         | Mean increases.       |  |
| Add a value < mean         | Mean decreases.       |  |
| Remove a value > mean      | Mean decreases.       |  |
| Remove a value < mean      | Mean increases.       |  |
| Add or remove value = mean | Mean does not change. |  |

### Relatively Unchanged Mean

- If every value changes by the same amount:
- Add  $k$  to every value  $\rightarrow$  Mean increases by  $k$ .
  - Subtract  $k$  from every value  $\rightarrow$  Mean decreases by  $k$ .
  - Multiply every value by  $k \rightarrow$  Mean becomes  $k$  times.
  - Divide every value by  $k \rightarrow$  Mean becomes  $\frac{1}{k}$  times.

Math Talk

## 2. THINKING ABOUT 'THINK OF A NUMBER' TRICKS

### (A) Always 2 Trick

- Think of a number.
- Double it.
- Add four.
- Divide by two.
- Subtract the original number.

### Algebraic Explanation

- $x$
- $2x$
- $2x + 4$
- $x + 2$
- $x + 2 - x = 2$

No matter what the starting number is, the result is always 2.

### (B) Date Trick

- Think of a date (DD/MM).
- Multiply the month by 5.
- Add 6.
- Multiply by 4.
- Add 9.
- Multiply by 5.
- Add the day.

### Algebraic Explanation

Let month =  $M$ , day =  $D$

- $5M$
- $5M + 6$
- $20M + 24$
- $20M + 33$
- $100M + 165$
- $100M + 165 + D$

Final answer =  $100M + 165 + D$

- Subtract 165 from final answer  $\rightarrow 100M + D$
- Last two digits  $\rightarrow D$  (day)
- Remaining digits  $\rightarrow M$  (month)
- Example:  $291 - 165 = 126 \rightarrow M = 1, D = 26 \rightarrow 26^{\text{th}}$  January

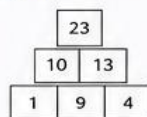
### Explore & Create

- Try other dates and find the pattern.
- Change the steps (add, subtract, multiply etc.) to make new tricks.
- You can also aim for a fixed final answer like 3, 5, 10 and so on.

## 3. NUMBER PYRAMIDS

Rule: Each number is the sum of the two numbers directly below it.

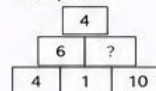
### Example



### How to Fill?

- To find a missing number, subtract the known number from the number above it.

Example:



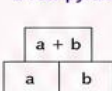
$$6 - 4 = 2$$

$$4 - 1 = 3$$

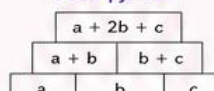
$\rightarrow$  Missing number = 3

### General Pattern

#### 2-row pyramid



#### 3-row pyramid

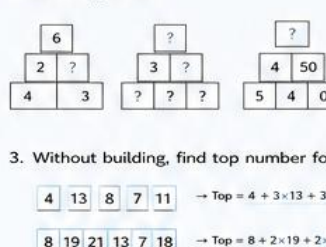


### Observation

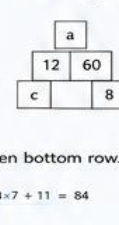
The top number = a weighted sum of the bottom row. (Middle numbers act as coefficients 1, 2, 1.)

### Figure it Out

#### 1. Fill the pyramids.



#### 2. Given pyramid:



Equations:

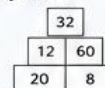
$$a + 12 = 60$$

$$12 + c = a$$

$$c + 8 = 60$$

$$\Rightarrow c = 20, a = 32$$

Pyramid:



#### 3. Without building, find top number for given bottom row.

$$4 \quad 13 \quad 8 \quad 7 \quad 11 \rightarrow \text{Top} = 4 + 3 \times 13 + 3 \times 8 + 3 \times 7 + 11 = 84$$

$$8 \quad 19 \quad 21 \quad 13 \quad 7 \quad 18 \rightarrow \text{Top} = 8 + 2 \times 19 + 2 \times 21 + 2 \times 13 + 2 \times 7 + 18 = 146$$

(Coefficients: 1, 2, 2, ..., 2, 1)

### KEY DEFINITIONS

- Mean (Average):** Sum of all values divided by the number of values.
- Centre (Balance Point):** Value where the sum of distances on the left equals the sum on the right.
- Dot Plot:** Data shown as dots on a number line.
- Number Pyramid:** Each number is the sum of the two numbers below it.

### IMPORTANT FORMULAS

- Mean:  $\bar{x} = \frac{x_1 + x_2 + \dots + x_n}{n}$
- After adding  $k$ : New mean =  $\bar{x} + k$
- After subtracting  $k$ : New mean =  $\bar{x} - k$
- After multiplying by  $k$ : New mean =  $k\bar{x}$
- After dividing by  $k$ : New mean =  $\frac{\bar{x}}{k}$

### KEY TAKEAWAYS

- ✓ The mean balances data.
- ✓ Including/removing values changes the mean predictably.
- ✓ Algebra helps us understand tricks and invent new ones.
- ✓ In number pyramids, the top number is a weighted sum of the bottom row.
- ✓ Patterns in numbers can be explored and explained systematically.

# ALGEBRA PLAY

## WORKSHEET-1

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

1. A student thinks of a number  $x$ , triples it, adds 12 and divides the result by 3. Which expression is obtained before subtracting the original number?  
A.  $x + 12$                       B.  $x + 4$                       C.  $3x + 4$                       D.  $x + 3$
2. A number pyramid has bottom numbers 6, 9 and 4. What is the topmost number?  
A. 22                      B. 28                      C. 25                      D. 30
3. If the top row of a three-level number pyramid is represented by  $a + 2b + c$ , the coefficient of  $b$  is:  
A. 1                      B. 2                      C. 3                      D. 4
4. A  $2 \times 2$  calendar block has top-left number  $n$ . The sum of the four numbers is:  
A.  $4n + 8$                       B.  $4n + 16$                       C.  $2n + 16$                       D.  $4n + 14$
5. To obtain the greatest product using three different digits, the largest digit should generally be used as the:  
A. Tens digit                      B. Ones digit                      C. Multiplier                      D. Smallest digit
6. The difference between a two-digit number and its reverse is always divisible by:  
A. 7                      B. 9                      C. 10                      D. 12
7. Which branch of mathematics helps explain why number tricks always work?  
A. Geometry                      B. Algebra                      C. Data Handling                      D. Mensuration
8. In a number pyramid, every box depends directly on:  
A. The top number                      B. The two boxes below it  
C. The left box only                      D. The right box only
9. A mathematical trick gives the same answer for every starting number because the:  
A. Numbers are equal                      B. Variable gets eliminated  
C. Number becomes zero                      D. Operation changes
10. Which of the following best develops algebraic thinking?  
A. Copying formulas                      B. Explaining why a trick works  
C. Learning tables                      D. Drawing figures

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

11. A student thinks of a number, triples it, adds 9, divides the result by 3, and subtracts the original number. The final answer will always be

- A. 1                      B. 2                      C. 3                      D. 9

12. In a number pyramid, every box is the sum of the two boxes directly below it. If the bottom row is 6, 4, 9, then the top number is

- A. 19                      B. 23                      C. 24                      D. 27

13. A calendar has a  $2 \times 2$  block with top-left number 18. What is the sum of the four numbers?

- A. 84                      B. 88                      C. 92                      D. 96

14. Which expression represents the top number of a three-row number pyramid whose bottom row is a, b, c?

- A.  $a + b + c$                       B.  $2a + b + c$                       C.  $a + 2b + c$                       D.  $a + b + 2c$

15. Using the digits 4, 6, and 8 exactly once to form  $\square \square \times \square$ , the largest product is

- A.  $86 \times 4$                       B.  $84 \times 6$                       C.  $64 \times 8$                       D.  $68 \times 4$

16. If a two-digit number is reversed and added to the original number, the result is always divisible by

- A. 3                      B. 5                      C. 9                      D. 11

17. A number trick gives the expression  $5x + 20$  after some operations. If the final step is to divide by 5, the resulting expression is

- A.  $x + 5$                       B.  $x + 4$                       C.  $5x + 4$                       D.  $x + 20$

18. In a number pyramid, the bottom row is 5, x, 8, and the top number is 30. The value of x is

- A. 4                      B. 5                      C. 6                      D. 7

19. If 42 is reversed to 24, then the difference between the two numbers is

- A. divisible by 3 only                      B. divisible by 5 only  
C. divisible by 9                      D. not divisible by 9

20. Which of the following best describes the purpose of algebra in mathematical puzzles?

- A. To avoid calculations                      B. To replace numbers with shapes only  
C. To explain why mathematical tricks always work                      D. To memorize formulas

## WORKSHEET-2

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

1. A student creates this trick:

**Think of a number  $\rightarrow$  Multiply by 4  $\rightarrow$  Add 20  $\rightarrow$  Divide by 4  $\rightarrow$  Subtract the original number.**

Predict the final answer without choosing any number. Justify your answer algebraically.

2. The bottom row of a number pyramid is **7, x, 9** and the top number is **34**. Find the value of **x**.

3. A number is multiplied by 4 and then 7 is added. The result is 39. Find the number.

4. A  $2 \times 2$  calendar block has a total sum of **100**. Find the four numbers in the block using algebra.

5. Form the greatest possible product using the digits **2, 6 and 8** (use each digit only once). Explain your choice in one or two steps.

6. A two-digit number is represented by  $10a + b$ . Write the algebraic expression for the number obtained after reversing its digits.

7. In an algebra grid,  $\star + \blacktriangle = 24$  and  $\blacktriangle = 9$ . Find the value of  $\star$ . Then verify your answer.

8. The perimeter of a rectangle is 74 cm. Its length is 9 cm more than its breadth. Find its dimensions.

9. The difference between two consecutive odd numbers is always 2. If their sum is 84, find the numbers.

10. A student claims that arranging the remaining digits in decreasing order always helps in obtaining the greatest product when the largest digit is used as the multiplier. Verify the claim using the digits **4, 5 and 9**.

**Section C: Short Answer ( $5 \times 3 = 15$  marks)**

11. A student designs this trick:

**Think of a number  $\rightarrow$  Multiply by 5  $\rightarrow$  Add 15  $\rightarrow$  Divide by 5  $\rightarrow$  Subtract the original number.** Prove algebraically that the final answer is always the same.

12. The bottom row of a number pyramid is **x, 8, 5**. If the top number is **35**, find **x** and complete the pyramid.

13. The cost of 5 pens and 3 pencils is ₹81. If each pencil costs ₹7, find the cost of one pen.

14. Show algebraically that the difference between any two-digit number and its reverse is always divisible by **9**.



15. Using the digits **4, 6 and 8**, verify algebraically why the largest digit should be used as the multiplier to obtain the greatest product.

**Section D: Long Answer ( $4 \times 5 = 20$  marks)**

16. A fruit seller spends ₹1200 as a fixed daily expense and ₹18 on each fruit basket. If he sells each basket for ₹30, how many baskets must he sell to earn a profit of ₹600? Form an algebraic equation and solve it.

17. A father is 4 times as old as his son. After 8 years, the father will be twice the son's age. Find their present ages using algebra.



18. Decode the puzzle and find the final value

$$\begin{aligned}\triangle + \triangle + \triangle &= 6 \\ \triangle + \triangle + \bullet &= 13 \\ \blacklozenge + \blacklozenge + \bullet &= 17 \\ \blacklozenge\blacklozenge + \triangle \times \bullet\bullet &= ?\end{aligned}$$

**SECTION E: Case Study Based Questions (4 × 2 = 8 marks)**

19. Aarav created a number pyramid in which each box is the sum of the two boxes below it. The bottom row is **8, x, 6** and the top number is **38**. **Answer the following:**
- (a) Form an algebraic equation for the top number. (b) Find the value of **x**. (c) Complete the pyramid. (d) State one rule of a number pyramid.

20. Mehak chooses a  $2 \times 2$  block from a calendar. She tells her friend that the sum of the four numbers is **124**. **Answer the following:** (a) Let the top-left number be  $x$ . Write the algebraic expression for the sum. (b) Find the value of  $x$ . (c) Write the four numbers in the block. (d) Explain why this method works for every calendar.

**Self Assessment:**

I understood all the concepts: ☐ Yes ☐ No

I need more practice: ☐ Yes ☐ No

Name of Concepts having doubts/Not Cleared: \_\_\_\_\_

**Parent's Assessment:**

My ward understood all the concepts: ☐ Yes ☐ No

He/She need more practice: ☐ Yes ☐ No

Name of Concepts having doubts/Not Cleared: \_\_\_\_\_

**Signature of Parent:**

**Teacher's Assessment**

### Answers of Worksheet-1

|       |    |    |    |    |    |    |    |    |    |    |
|-------|----|----|----|----|----|----|----|----|----|----|
| Q.No. | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 |
| Ans.  | B  | B  | B  | B  | C  | B  | B  | B  | B  | B  |
| Q.No. | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| Ans.  | C  | B  | A  | C  | C  | D  | B  | C  | C  | C  |

### Answers of Worksheet-2

|       |                                                                                                                               |                                                                |            |                                                                                                                                                                                   |                                  |                                                            |
|-------|-------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|------------------------------------------------------------|
| Q.No. | 1                                                                                                                             | 2                                                              | 3          | 4                                                                                                                                                                                 | 5                                | 6                                                          |
| Ans.  | 5                                                                                                                             | 9                                                              | 8          | 21, 22, 28, 29                                                                                                                                                                    | 496                              | $10b + a$                                                  |
| Q.No. | 7                                                                                                                             | 8                                                              | 9          | 10                                                                                                                                                                                | 11                               | 12                                                         |
| Ans.  | ★ = 15                                                                                                                        | L- 23cm, B- 14cm                                               | 41, 43     | 486                                                                                                                                                                               | Final answer is always <b>3</b>  | $x = 7$<br>Middle row = <b>15, 13</b> ;<br>Top = <b>28</b> |
| Q.No. | 13                                                                                                                            | 14                                                             | 15         | 16                                                                                                                                                                                | 17                               | 18                                                         |
| Ans.  | ₹12                                                                                                                           | Difference = $9(a - b)$ (or $9(b - a)$ ), hence divisible by 9 | <b>512</b> | <b>150 baskets</b>                                                                                                                                                                | Father = 32 years, Son = 8 years | 44                                                         |
| Q.No. | 19                                                                                                                            |                                                                |            | 20                                                                                                                                                                                |                                  |                                                            |
| Ans.  | (a) $8 + 2x + 6 = 38$ (b) $x = 12$ (c) Middle row = 20, 18; Top = 38 (d) Each upper box is the sum of the two boxes below it. |                                                                |            | (a) $4x + 16 = 124$ (b) $x = 27$ (c) <b>27, 28, 34, 35</b> (d) Calendar numbers differ by <b>1</b> horizontally and <b>7</b> vertically, so the algebraic relation remains fixed. |                                  |                                                            |

# 7

# AREA

Algebra helps us explore patterns, solve puzzles and create tricks. In this chapter we use it to understand areas and number pyramids.

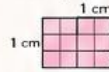
## In This Chapter

- ✓ Area of rectangles and squares
- ✓ Why perimeter is not a measure of area
- ✓ Finding missing lengths and areas
- ✓ Area around shapes (paths)
- ✓ Number pyramids



## Key Idea

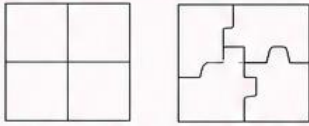
Area is the amount of surface enclosed by a shape. We measure it using unit squares.



Area of 1 square = 1 sq. cm  
Area of  $N$  squares =  $N$  sq. cm or  $N \text{ cm}^2$

## 1. RECTANGLES AND SQUARES

- Many ways to divide a square into 4 equal parts!



- Area can change shape but remains the same.

### Area of a Rectangle

Area = length  $\times$  width  
(or length  $\times$  breadth)  
Units: sq. unit (or unit)

Example:



### Area of a Triangle

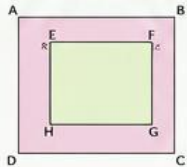
- A diagonal of a rectangle divides it into two congruent triangles.
- Area of each triangle =  $\frac{1}{2} \times \text{length} \times \text{width}$

Example:  $\frac{1}{2} \times 7 \times 4 = 14 \text{ sq. cm}$



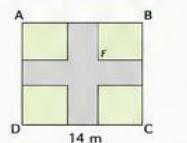
## 4. AREAS AROUND SHAPES (PATHS)

### (i) Path around a rectangular park



Two ways to find area of the path  
**Method 1:**  
Area(Path) = Area(ABCD) - Area(EFGH)  
**Method 2:**  
If width of path =  $x$ ,  
Outer: length =  $L$ , breadth =  $B$   
Inner: length =  $(L - 2x)$ , breadth =  $(B - 2x)$

### (ii) Cross path in a plot



Break the path into rectangles.  
If vertical width =  $x$ ,  
horizontal width =  $y$ ,  
Area(Path) =  $14x + 12y - xy$   
(subtract the overlap  $xy$  counted twice)

## 6. HOW THE MEAN CHANGES

| Operation on data          | Effect on mean | Example (mean = 10)                      |
|----------------------------|----------------|------------------------------------------|
| Add a value > mean         | Mean increases | Add 20 $\rightarrow$ mean > 10           |
| Add a value < mean         | Mean decreases | Add 2 $\rightarrow$ mean < 10            |
| Remove a value > mean      | Mean decreases | Remove 20 $\rightarrow$ mean < 10        |
| Remove a value < mean      | Mean increases | Remove 2 $\rightarrow$ mean > 10         |
| Add or remove value = mean | Mean unchanged | Add or remove 10 $\rightarrow$ mean = 10 |

### Relatively Unchanged Mean

- Add  $k$  to every value  $\rightarrow$  mean increases by  $k$ .
- Subtract  $k$  from every value  $\rightarrow$  mean decreases by  $k$ .
- Multiply every value by  $k \rightarrow$  mean becomes  $k$  times.
- Divide every value by  $k \rightarrow$  mean becomes  $\frac{1}{k}$  times.

Math Talk

## KEY DEFINITIONS

- **Area:** The amount of surface enclosed by a shape, measured in square units.
- **Perimeter:** The total length of the boundary of a shape.
- **Unit Square:** A square with side 1 unit (area = 1 sq. unit).



## IMPORTANT FORMULAS

- Area of rectangle = length  $\times$  width
- Area of square = side  $\times$  side = side<sup>2</sup>
- Area of triangle (from rectangle) =  $\frac{1}{2} \times \text{length} \times \text{width}$
- Path around rectangle (method 1):  
Area = Outer rectangle - Inner rectangle
- Path (cross) in a plot: Area =  $14x + 12y - xy$   
( $x$  = vertical width,  $y$  = horizontal width)



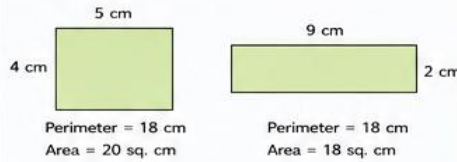
## KEY TAKEAWAYS

- ✓ We measure area using unit squares.
- ✓ Perimeter cannot determine area.
- ✓ Algebra helps us find unknown lengths and areas.
- ✓ In number pyramids, each number is the sum of the two below.
- ✓ Mean changes in predictable ways with operations on data.
- ✓ Patterns in numbers can be explored using algebra.

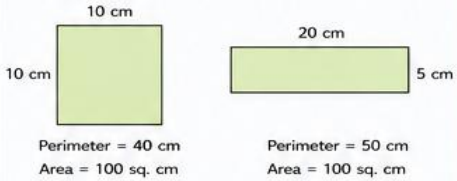


## 2. WHY PERIMETER IS NOT A MEASURE OF AREA

- Same perimeter, different areas:



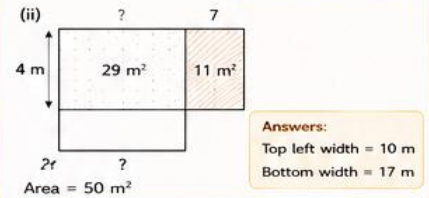
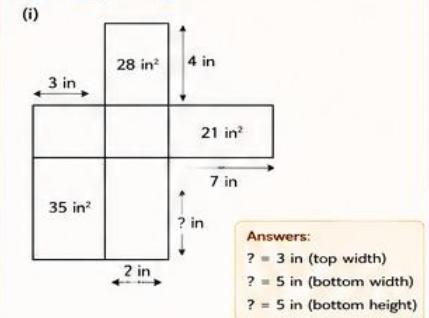
- Larger perimeter, smaller area:



Hence, perimeter does not tell us the area.  
Area depends on how much surface is enclosed inside the boundary.

## 3. FIGURE IT OUT

### (a) Missing Sidelengths



## 5. NUMBER PYRAMIDS

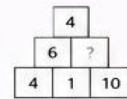
Rule: Each number is the sum of the two numbers directly below it.

### Example



### How to Fill?

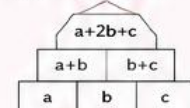
- Work from bottom to top to find known numbers.
- Work from top to bottom to find missing numbers by subtraction.



? = 6 - 4 = 2  
(top - left bottom)

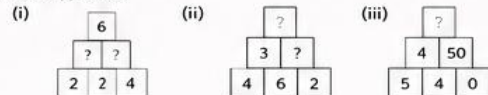
### General Pattern

For bottom row:  $a, b, c$



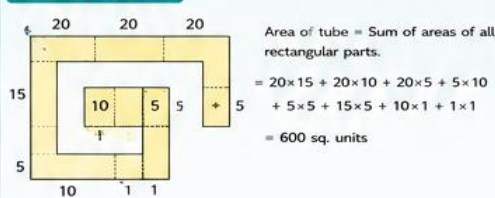
### Figure it Out!

1. Fill the pyramids.



Write expression for top of a 4-row pyramid in terms of bottom row  $a, b, c, d$ .  
Top =  $a + 3b + 3c + d$  (Coefficients: 1, 3, 3, 1)

## 7. SPIRAL TUBE



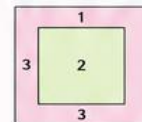
Straight tube with same area

If width = 5, then required length =  $600 \div 5 = 120$  units.

## 8. MORE EXPLORATIONS

### 1. Doubling the side of a square:

- Region 1 (outer square)  $\rightarrow$  4 times area
- Region 2 (inner square)  $\rightarrow$  4 times area
- Region 3 (frame)  $\rightarrow$  4 times area



### 2. Rearranging 4 equal parts:

- Cut square into 4 equal parts.
- Rearrange to get a larger square with a square hole in the centre.



# AREA

## WORKSHEET-1

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

1. The area of a rhombus whose diagonals are 20 cm and 15 cm is:

- a)  $120 \text{ cm}^2$                       b)  $150 \text{ cm}^2$                       c)  $300 \text{ cm}^2$                       d)  $75 \text{ cm}^2$

2. The formula for the area of a trapezium is:

- a)  $\frac{1}{2} \times \text{diagonal} \times \text{diagonal}$                       b)  $\text{base} \times \text{height}$   
c)  $\frac{1}{2} \times \text{height} \times (\text{sum of parallel sides})$                       d)  $\text{side} \times \text{side}$

3. A triangle has base 12 cm and height 8 cm. Its area is:

- a)  $48 \text{ cm}^2$                       b)  $96 \text{ cm}^2$                       c)  $24 \text{ cm}^2$                       d)  $60 \text{ cm}^2$

4. The area of a parallelogram having base 15 cm and height 6 cm is:

- a)  $45 \text{ cm}^2$                       b)  $90 \text{ cm}^2$                       c)  $60 \text{ cm}^2$                       d)  $75 \text{ cm}^2$

5. The area of a square of side 9 cm is:

- a)  $18 \text{ cm}^2$                       b)  $36 \text{ cm}^2$                       c)  $81 \text{ cm}^2$                       d)  $72 \text{ cm}^2$

6. Which figure uses diagonals in its area formula?

- a) Rectangle                      b) Triangle                      c) Rhombus                      d) Trapezium

7. If the side of a square is doubled, its area becomes:

- a) Double                      b) Triple                      c) Four times                      d) Eight times

8. The SI unit of area is:

- a) cm                      b) m                      c)  $\text{m}^2$                       d) km

9. The area of a rectangle of length 8 cm and breadth 5 cm is:

- a)  $13 \text{ cm}^2$                       b)  $40 \text{ cm}^2$                       c)  $80 \text{ cm}^2$                       d)  $26 \text{ cm}^2$

10. A trapezium has parallel sides 12 cm and 18 cm and height 8 cm. Its area is:

- a)  $120 \text{ cm}^2$                       b)  $240 \text{ cm}^2$                       c)  $60 \text{ cm}^2$                       d)  $100 \text{ cm}^2$

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

11. The area of a rhombus whose diagonals are 12 cm and 10 cm is:

- a)  $60 \text{ cm}^2$                       b)  $120 \text{ cm}^2$                       c)  $30 \text{ cm}^2$                       d)  $22 \text{ cm}^2$

12. The area of a triangle with base 16 cm and height 8 cm is:

- a)  $64 \text{ cm}^2$                       b)  $128 \text{ cm}^2$                       c)  $32 \text{ cm}^2$                       d)  $48 \text{ cm}^2$

13. The SI unit of area is:

- a) cm                                  b)  $\text{m}^2$                                   c) m                                  d)  $\text{km}^2$

14. The area of a parallelogram is:

- a) Length  $\times$  Breadth    b) Base  $\times$  Height                      c) Side  $\times$  Side                      d)  $\frac{1}{2} \times$  Base  $\times$  Height

15. The area of a square of side 15 cm is:

- a)  $30 \text{ cm}^2$                       b)  $225 \text{ cm}^2$                       c)  $150 \text{ cm}^2$                       d)  $75 \text{ cm}^2$

16. A rectangular playground is 48 m long and 30 m wide. A square flower bed of side 12 m is made inside it. What is the area of the remaining playground?

- (a)  $1152 \text{ m}^2$                       (b)  $1296 \text{ m}^2$                       (c)  $1440 \text{ m}^2$                       (d)  $1584 \text{ m}^2$

17. A triangular park has a base of 18 m and an area of  $126 \text{ m}^2$ . The height of the park is

- (a) 12 m                                  (b) 14 m                                  (c) 16 m                                  (d) 18 m

18. A parallelogram and a rectangle have the same base (20 cm) and same height (9 cm).

Which statement is correct?

- (a) Rectangle has greater area.                                  (b) Parallelogram has greater area.  
(c) Both have equal area.                                  (d) Their areas cannot be compared.

19. The diagonals of a rhombus are 16 cm and 10 cm. If one diagonal is doubled while the other remains unchanged, the new area becomes

- (a)  $80 \text{ cm}^2$                       (b)  $160 \text{ cm}^2$                       (c)  $240 \text{ cm}^2$                       (d)  $320 \text{ cm}^2$

20. A trapezium has parallel sides measuring 12 cm and 20 cm, and its height is 9 cm. What is its area?

- (a)  $126 \text{ cm}^2$                       (b)  $132 \text{ cm}^2$                       (c)  $144 \text{ cm}^2$                       (d)  $156 \text{ cm}^2$

## WORKSHEET-2

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

1. Find the area of a triangle whose base is 14 cm and height is 9 cm.

2. Find the area of a rectangle of length 18 cm and breadth 7 cm.

3. State the formula for the area of a rhombus.

4. Find the area of a parallelogram whose base is 11 cm and height is 8 cm.

5. Find the area of a rhombus whose diagonals are 16 cm and 10 cm.

6. Find the breadth of a rectangle whose area is  $144 \text{ cm}^2$  and length is 12 cm.

7. Find the area of a trapezium with parallel sides 9 cm and 15 cm and height 6 cm.

8. A triangle has area  $48 \text{ cm}^2$  and base 12 cm. Find its height.

9. Convert  $5 \text{ m}^2$  into  $\text{cm}^2$ .

10. Find the area of an A4 sheet whose dimensions are  $21 \text{ cm} \times 29.7 \text{ cm}$ .

**Section C: Short Answer ( $6 \times 3 = 18$  marks)**

11. Find the area of a rhombus whose diagonals are 24 cm and 18 cm.

12. A trapezium has parallel sides 20 cm and 14 cm and height 12 cm. Find its area.

13. A triangular garden has base 25 m and height 16 m. Find its area.



14. A rectangular field is 30 m long and 18 m wide. Find its area and perimeter.

15. A rhombus-shaped field has diagonals 40 m and 24 m. find its area.

16. A trapezium has area  $180 \text{ cm}^2$ , height 10 cm and one parallel side 12 cm. Find the other parallel side.

**Section D: Long Answer ( $4 \times 5 = 20$  marks)**

17. A rectangular park is 50 m long and 30 m wide. A path of width 2 m runs inside all around the park. Find the area of the path.

18. A farmer owns a rhombus-shaped field with diagonals 50 m and 30 m. Find its area. If wheat is grown at the rate of 2 kg per  $\text{m}^2$ , find the total wheat produced.

19. Find the area of a trapezium whose parallel sides are 16 cm and 24 cm and height is 10 cm.

20. A rectangular hall measures  $25\text{ m} \times 18\text{ m}$ . Tiles of area  $0.25\text{ m}^2$  are used for flooring. Find the number of tiles required.

**SECTION E: Case Study Based Questions ( $4 \times 2 = 8$  marks)**

**21. School Playground**

A school playground is rectangular in shape. Its length is 50 m and breadth is 30 m. A walking track of width 2 m is constructed all around the playground inside it.

Questions

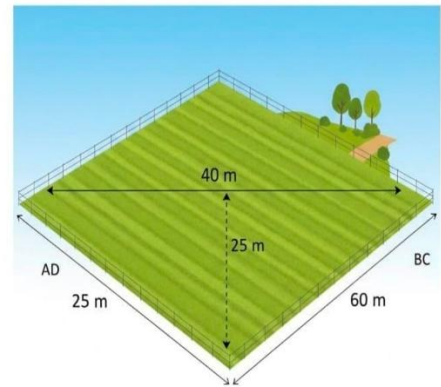
- (i) Find the area of the playground.
- (ii) Find the dimensions of the inner rectangular ground.
- (iii) Find the area of the walking track.
- (iv) If grass is planted on the inner ground at ₹15 per  $\text{m}^2$ , find the total cost.

## 22. Trapezoidal Agricultural Field

A farmer owns a trapezium-shaped field.

$AB \parallel CD$  ,  $AB = 40 \text{ m}$  ,  $CD = 60 \text{ m}$  Height =  $25 \text{ m}$

- (i) Find the area of the field.
- (ii) Convert the area into acres ( $1 \text{ acre} \approx 4000 \text{ m}^2$ ).
- (iii) Divide the field into two equal-area parts.
- (iv) Find the wheat production if yield =  $3 \text{ kg/m}^2$ .



**Self Assessment:**

I understood all the concepts:

☐ Yes

☐ No

I need more practice:

☐ Yes

☐ No

Name of Concepts having doubts/Not Cleared: \_\_\_\_\_

**Parent's Assessment:**

My ward understood all the concepts:

☐ Yes

☐ No

He/She need more practice:

☐ Yes

☐ No

Name of Concepts having doubts/Not Cleared: \_\_\_\_\_

**Signature of Parent:**

**Teacher's Assessment**

|  |
|--|
|  |
|--|

### Answers of Worksheet-1

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

### Answers of Worksheet-2

|       |                     |                                                |                                                                                         |                       |                                                                                             |                                                |
|-------|---------------------|------------------------------------------------|-----------------------------------------------------------------------------------------|-----------------------|---------------------------------------------------------------------------------------------|------------------------------------------------|
| Q.No. | 1                   | 2                                              | 3                                                                                       | 4                     | 5                                                                                           | 6                                              |
| Ans.  | 63 cm <sup>2</sup>  | 126 cm <sup>2</sup>                            | Area of Rhombus = $\frac{1}{2} \times d_1 \times d_2$                                   | 88 cm <sup>2</sup>    | 80 cm <sup>2</sup>                                                                          | 12 cm                                          |
| Q.No. | 7                   | 8                                              | 9                                                                                       | 10                    | 11                                                                                          | 12                                             |
| Ans.  | 72 cm <sup>2</sup>  | 8 cm                                           | 50,000 cm <sup>2</sup>                                                                  | 623.7 cm <sup>2</sup> | 216 cm <sup>2</sup>                                                                         | 204 cm <sup>2</sup>                            |
| Q.No. | 13                  | 14                                             | 15                                                                                      | 16                    | 17                                                                                          | 18                                             |
| Ans.  | 200 m <sup>2</sup>  | Area = 540 m <sup>2</sup> ,<br>Perimeter = 96m | 480 m <sup>2</sup>                                                                      | 24 cm                 | 304 m <sup>2</sup>                                                                          | Area = 750 m <sup>2</sup> ,<br>Wheat = 1500 kg |
| Q.No. | 19                  | 20                                             | 21                                                                                      |                       | 22                                                                                          |                                                |
| Ans.  | 200 cm <sup>2</sup> | 1800 tiles                                     | (i) 1500 m <sup>2</sup><br>(ii) 46 m × 26 m<br>(iii) 304 m <sup>2</sup><br>(iv) ₹17,940 |                       | (i) 1250 m <sup>2</sup><br>(ii) 0.309 acre<br>(iii) 625 m <sup>2</sup> each<br>(iv) 3750 kg |                                                |