



1. OBSERVING SIMILARITY IN CHANGE

Digital images can be resized and oriented.
We observe how changes in width and height affect the look of an image.

Set of Images



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

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

- 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.

2. RATIOS

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

Key Points

- 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
 - Image A = 60 : 40
 - Image C = 30 : 20
 - Image D = 90 : 60

The ratios of width to height of images A, C and D are proportional. (Their terms change by the same factor.)

3. RATIOS IN THEIR SIMPLEST FORM

Two ratios are in proportion if their simplest forms are the same.
To get the 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, so their ratios are not proportional to A, C and D.

We use $a :: b :: c :: d$ to show that the ratios $a : b$ and $c : d$ are proportional.

Examples: • 60 : 40 :: 30 : 20 • 60 : 40 :: 90 : 60

4. INCREMENTS IN PRODUCTS (USING DISTRIBUTIVITY)

Let the initial two numbers be a and b (product = ab).
Using distributive property:

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

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

- 1 If second number b is increased by 1:

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

Increase = a

- 2 If first number a is increased by 1:

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

Increase = b

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

$$(a + 1)(b + 1)$$

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

Increase = $a + b + 1$

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

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

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

Increase = $b - a - 1$

General Case

If a is increased by m and b by n :

$$(a + m)(b + n)$$

$$= ab + mb + an + mn$$

Increase = $an + bm + mn$
(Identity 1)

	b	n
a	ab	an
m	mb	mn

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

5. PROBLEM SOLVING WITH PROPORTIONAL REASONING

Example 1

Are 3 : 4 and 72 : 96 proportional?

3 : 4 is in simplest form.
HCF of 72 and 96 = 24.
72 : 96 = 3 : 4

→ Both ratios are same in simplest form.
Hence, they are proportional. ✓

Example 2

6 glasses of lemonade need 10 spoons of sugar.

How many spoons for 18 more glasses (same sweetness)?

Ratio of glasses : spoons = 6 : 10

For 18 more glasses → 18 : x

Since ratios are proportional:

$$6 : 10 = 18 : x \Rightarrow x = \frac{18 \times 10}{6} = 30$$

→ She should add 30 spoons of sugar.



KEY TAKEAWAYS – ★

- ✓ Similarity comes from proportional change in dimensions.
- ✓ Ratio compares two quantities.
- ✓ Simplify ratios using HCF.
- ✓ Equal simplest forms ⇒ Ratios are proportional.
- ✓ Distributive property helps find changes in products.
- ✓ Proportional reasoning helps solve real-life problems.



CORE MESSAGE: When quantities change in the same proportion, relationships stay the same.
Ratios and proportional reasoning help us understand patterns and solve everyday problems!



PROPORTIONAL REASONING-I

WORKSHEET-1

Section A: MCQs(PART –I) ($10 \times 1 = 10$ marks)

1. A Ratio is a form of comparison by _____.
(a) Addition (b) Subtraction (c) Multiplication (d) Division
2. If 5 notebooks cost ₹ 80, then the cost of 1 notebook is:
(a) ₹15 (b) ₹20 (c) ₹ 16 (d) ₹30
3. If a ratio Expressed in Lowest form has no common factor other ____ In its terms
(a) zero (b) 1 (c) 10 (d) HCF
4. If 8 kg of rice costs ₹480, then 12 kg of rice will cost:
(a) ₹600 (b) ₹720 (c) ₹760 (d) ₹840
5. The ratio of 15 to 25 in simplest form is:
(a) 3 : 5 (b) 1 : 5 (c) 15 : 25 (d) 25 : 15
6. If $x:12=5:6$ then the value of x is:
(a) 8 (b) 10 (c) 12 (d) 15
7. The HCF of 72 and 96?
(a) 8 (b) 9 (c) 12 (d) 24
8. Which two ratios are equal to 4:11 ?
(a) 18:20 (b) 16:20 (c) 12 :30 (d) 24: 66
9. $19 : 76 = 9 : \underline{\hspace{1cm}}$
(a) 36 (b) 9 (c) 27 (d) 18
10. The Ratio of side of a square and its perimeter is always
(a) 1 : 4 (b) 3 : 1 (c) 4 : 1 (d) none of these

Section A: MCQs(PART –2) ($10 \times 1 = 10$ marks)

11. A school map is enlarged so that every length becomes three times its original size. What happens to the ratio of length to breadth of every rectangular classroom?
- (a) It becomes three times. (b) It becomes one-third.
(c) It remains unchanged. (d) It doubles.
12. A recipe uses flour and sugar in the ratio 5 : 2. If 700 g of flour is used, how much sugar is required?
- (a) 240 g (b) 260 g (c) 280 g (d) 300 g
13. Which pair of ratios is proportional?
- (a) 15 : 20 and 9 : 12 (b) 8 : 15 and 12 : 25 (c) 7 : 9 and 14 : 16 (d) 5 : 12 and 15 : 40
14. A farmer divides 84 mangoes between two children in the ratio 4 : 3. How many mangoes does the child with the larger share receive?
- (a) 42 (b) 48 (c) 52 (d) 56
15. A car covers 180 km using 15 litres of petrol. At the same efficiency, how much petrol will be needed to travel 300 km?
- (a) 20 litres (b) 22 litres (c) 24 litres (d) 25 litres
16. A mixture contains red and blue beads in the ratio 3 : 5. If there are 80 beads altogether, how many are blue?
- (a) 25 (b) 30 (c) 40 (d) 50
17. A bottle contains 2 litres of juice. How many millilitres of juice does it contain?
- (a) 200 mL (b) 500 mL (c) 1000 mL (d) 2000 mL
18. A photograph has dimensions 24 cm $\times$ 16 cm. Which of the following dimensions will produce a similar photograph without distortion?
- (a) 30 cm $\times$ 24 cm (b) 36 cm $\times$ 24 cm (c) 30 cm $\times$ 18 cm (d) 42 cm $\times$ 30 cm
19. A shopkeeper packs rice in bags weighing 2 kg each. If 15 such bags are prepared, what is the total weight of rice?
- (a) 25 kg (b) 28 kg (c) 30 kg (d) 32 kg
20. A ribbon 72 m long is cut into two pieces in the ratio 5 : 4. What is the length of the longer piece?
- (a) 32 m (b) 36 m (c) 40 m (d) 45 m

WORKSHEET-2

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

1. Length of the rectangle is 30 metre And the breadth is 25 metre, Write the ratio between Its length and breadth.

2. Write the ratio of 3 m to 480 cm in simplest form.

3. In a school, there are 5 teachers and 150 students. The ratio of teachers to students in school is 5 : 150. What will be the number of teachers if there are 1500 students in school?

4. If 9 kg sugar costs ₹405, find the cost of 10 kg sugar.

5. A shopkeeper sells 5 kg of apples for ₹350. Find the cost of 8 kg apples.

6. $36 : 81 = x : 63$ find x

7. Mathematics book of class 8 (part 1) has total 180 pages And the chapter proportional reasoning (part one runs from page number 159 to 218. What is the ratio between Number of pages of this chapter and total number of pages in the book.

8. Are these ratios equal 13: 39 and 27: 84?

9. A train travels 240 km in 4 hours. How far will it travel in 7 hours at the same speed?

10. Find the missing number: $63 : 105 = 39 : x$

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

11. The cost of 12 identical chairs is ₹9,600. Find the cost of 18 such chairs.

12. There are 102 teachers in a school of 3300 Students find the ratio of -- (a) number of teachers to the number of students (b) number of students to the total number of staff including 1 principal, 1 vice principal and 6 office employees.

13. In a recipe, 4 cups of flour and one cup of sugar are needed for 16 cookies. How many cups of flour and sugar are needed for 28 such cookies?

14. A cyclist covers 90 km in 6 hours.

(a) How many hours will he take to cover 150 km at the same speed?

(b) how much he covers in total 13 hours if he takes rest of 2 hours and moves with same speed.

15. Divide 72 Chocolates In the ratio 5:4.

16. State TRUE or FALSE (a) $35:70::2:4$ (b) $7:12 :: 9 : 27$

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

17. A factory produces 450 bottles in 6 hours.

(a) How many bottles are produced in 10 hours? (b) How many bottles are produced in 15 hours?

18. The ratio of boys to girls in a class is 3 : 5. If there are 15 boys find the number of girls. Find the total number of students in the class. Also find ratio of total students to the number of boys.

19. A farmer uses 28 kg of seeds for sowing 14 acres of land.

- a. How many kilograms of seeds will be required for 18 acres?
- b. How many acres land can be seeded with 63.5 kilograms seeds?

20. A rectangle has length and width 12 m and 9 m respectively. What is the ratio between-

- (a) length : perimeter (b) perimeter : area

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

21. Raman purchases 10 pens for ₹ 160 and Manan buys 6 pens for ₹ 84. Find the ratio of number of Pens to the cost of pens in both cases. Also write whether these two Ratios are Proportional or not?

22. An electric pole, 14 metres high, casts a shadow of 10 metres long.

- (a) Find the height of a tree that casts a shadow of 15 metres under similar conditions.
- (b) If the height of a tower near the tree is 28 m what is the length of its shadow of 15 metres under similar conditions.

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:

I understood all the concepts:

☐ Yes

☐ No

I 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	d	c	b	b	a	b	d	d	a	a
Q.No.	11	12	13	14	15	16	17	18	19	20
Ans	c	c	a	b	d	d	d	b	c	c

Answers of Worksheet-2:

Q.No.	1	2	3	4	5
Ans	6:5	5:8	50	450	560
Q.No.	6	7	8	9	10
Ans	28	11:90	1:3 9:24; no	420 km	65
Q.No.	11	12	13	14	15
Ans	14,400	a. 17 : 550 b. 30:1	7; 1.75	10 hrs, 165 km	40 and 32
Q.No.	16	17	18	19	20
Ans	True false	750 , 1125 bottles	25 girls 8:3	36 kg; 31.75 acres	2:7; 7: 18
Q.No.	21	22			
Ans	1:16; 1:14; No	21 m; 20 m			