



### Learning Objectives

- To understand the concept of ratio.
- To use ratio notation and simplify ratios.
- To divide a quantity into two parts in a given ratio.
- To recognise the relationship between ratio and proportion.
- To use the unitary method and solve simple ratio problems.

### Recap

- Which of the following fractions is not a proper fraction?  
(a)  $\frac{1}{3}$       (b)  $\frac{2}{3}$       (c)  $\frac{5}{10}$       (d)  $\frac{10}{5}$
- The equivalent fraction of  $\frac{1}{7}$  is \_\_\_\_\_.  
(a)  $\frac{2}{15}$       (b)  $\frac{1}{49}$       (c)  $\frac{7}{49}$       (d)  $\frac{100}{7}$
- Write  $>$ ,  $<$  or  $=$  in the box.  
(i)  $\frac{5}{8}$    $\frac{1}{10}$       (ii)  $\frac{9}{12}$    $\frac{3}{4}$
- Arrange these fractions from the least to the greatest :  $\frac{1}{2}, \frac{1}{4}, \frac{6}{8}, \frac{1}{8}$
- Anban says that  $\frac{2}{6}$  th of the group of triangles given below are blue. Is he correct?



- Joseph has a flower garden. Draw a picture which shows that  $\frac{2}{10}$  th of the flowers are red and the rest of them are yellow.
- Malarkodi has 10 oranges. If she ate 4 oranges, what fraction of oranges was not eaten by her?

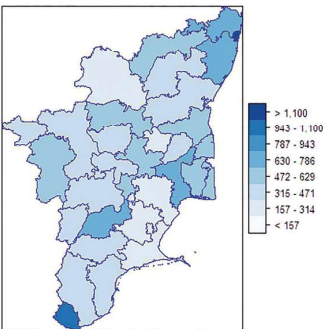
8. After sowing seeds on day one, Muthu observes the growth of two plants and records it. In 10 days, if the first plant grew  $\frac{1}{4}$  th of an inch and the second plant grew  $\frac{3}{8}$  th of an inch, then which plant grew more?

### 3.1 Introduction

In our daily life, we handle lots of situations where we compare quantities. Comparison of our heights, weights, marks secured in examinations, speeds of vehicles, distances travelled, auto fare to taxi fare, bank balances at different periods of time and many more things are done. Comparison is usually between quantities of the same kind and not of different kind. It will not be meaningful to compare the height of a person with the age of another person. Also, we need a standard measure for comparison.

This sort of comparison by expressing one quantity as the number of times the other is called a '**Ratio**'.

**MATHEMATICS ALIVE – RATIO IN REAL LIFE**



**HEIGHT TO WEIGHT RATIO CHART**

| FEMALE |     |        |      | MALE   |     |        |      |
|--------|-----|--------|------|--------|-----|--------|------|
| HEIGHT | Low | Target | High | HEIGHT | Low | Target | High |
| 4' 10" | 100 | 115    | 131  | 5' 1"  | 123 | 134    | 145  |
| 4' 11" | 101 | 117    | 134  | 5' 2"  | 125 | 137    | 148  |
| 5' 0"  | 103 | 120    | 137  | 5' 3"  | 127 | 139    | 151  |
| 5' 1"  | 105 | 122    | 140  | 5' 4"  | 129 | 142    | 155  |
| 5' 2"  | 108 | 125    | 144  | 5' 5"  | 131 | 145    | 159  |
| 5' 3"  | 111 | 128    | 148  | 5' 6"  | 133 | 148    | 163  |
| 5' 4"  | 114 | 133    | 152  | 5' 7"  | 135 | 151    | 167  |
| 5' 5"  | 117 | 136    | 156  | 5' 8"  | 137 | 154    | 171  |
| 5' 6"  | 120 | 140    | 160  | 5' 9"  | 139 | 157    | 175  |
| 5' 7"  | 123 | 143    | 164  | 5' 10" | 141 | 160    | 179  |
| 5' 8"  | 126 | 146    | 167  | 5' 11" | 144 | 164    | 183  |
| 5' 9"  | 129 | 150    | 170  | 6' 0"  | 147 | 167    | 187  |
| 5' 10" | 132 | 153    | 173  | 6' 1"  | 150 | 171    | 192  |
| 5' 11" | 135 | 156    | 176  | 6' 2"  | 153 | 175    | 197  |
| 6' 0"  | 138 | 159    | 179  | 6' 3"  | 157 | 179    | 202  |

555 persons to one square km

Comparison of height and weight by using ratio

### 3.2 Ratio

#### Think about this Situation

Let us consider a situation of cooking rice for two persons. The quantity of rice required for two persons is one cup. To cook every one cup of rice, we need to add two cups of water. Assuming that 8 more guests join for lunch, will the use of ratio help us in handing this situation?

It is possible to trace the origin of the word "**ratio**" to the Ancient Greek Medieval. Writers used the word proprotio ("**proportion**") to indicate ratio and proportionalities ("**proportionality**") for the equality of **ratios**. Early translators rendered this into Latin as ratio ("reason"; as in the word "rational")

The number of cups of rice and water required are given below.

|                                                |   |   |   |   |    |
|------------------------------------------------|---|---|---|---|----|
| Number of cups of rice                         | 1 | 2 | 3 | 4 | 5  |
| Number of cups of water<br>(or) No. of persons | 2 | 4 | 6 | 8 | 10 |

In all the cases, the number of cups of water (or) the number of persons is 2 times the number of cups of rice. So, we write

Number of cups of rice : Number of cups of water (or) the number of persons = 1 : 2

Such comparison is called as a **Ratio**.



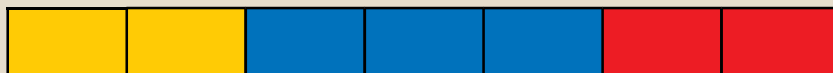
### Note

- A ratio is a comparison of two quantities.
- A ratio can be written as a fraction; ratios are mostly written in the simplest form.
- In the above example, the ratio of rice to water in terms of the number of cups can be written in three different ways as 1 : 2 or  $\frac{1}{2}$  or 1 to 2 .



### Try these

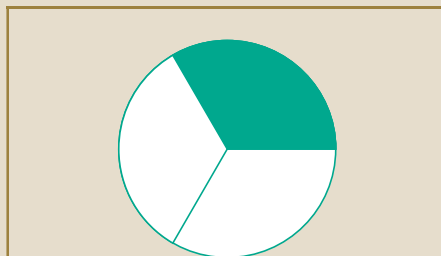
1. Write the ratio of red tiles to blue tiles and yellow tiles to red tiles.



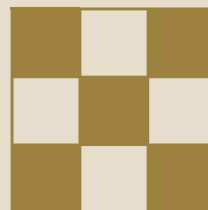
2. Write the ratio of blue tiles to that of red tiles and red tiles to that of total tiles.



3. Write the ratio of shaded portion to the unshaded portions in the following shapes.



Ratio



Ratio

### 3.2.1 Properties of Ratio

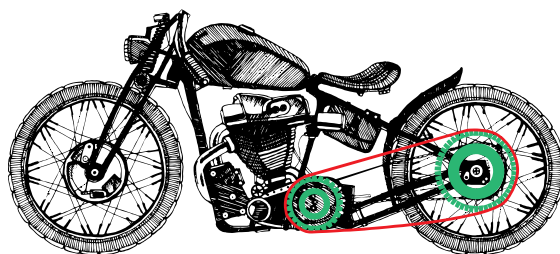
- A ratio has no unit. It is a number. For example, the ratio of 8 km to 4 km is written as  $8 : 4 = 2 : 1$  and not 2 km : 1 km.
- The two quantities of a ratio should be of the **same** unit. The ratio of 4 km to 400 m is expressed as  $(4 \times 1000) : 400 = 4000 : 400 = 10 : 1$
- Each number of the ratio is called a term.
- Order of the terms in a ratio cannot be reversed.

A few examples are given below.



(a)

Fig. 3.1



(b)

Ratio of the number of small fish to the number of big fish is  $5 : 1$

Ratio of number of teeth in front gear to number of teeth in back gear is  $25 : 50$

For example, the ratio of the number of big fish to the number of small fish is  $1 : 5$ . The same information cannot be written as  $5 : 1$  and so,  $1 : 5$  and  $5 : 1$  are not the same.

Similarly, if in a class, there are 12 boys and 12 girls, then the ratio of number of boys to the number of girls is expressed as  $12 : 12$  which is the same as  $1 : 1$ .



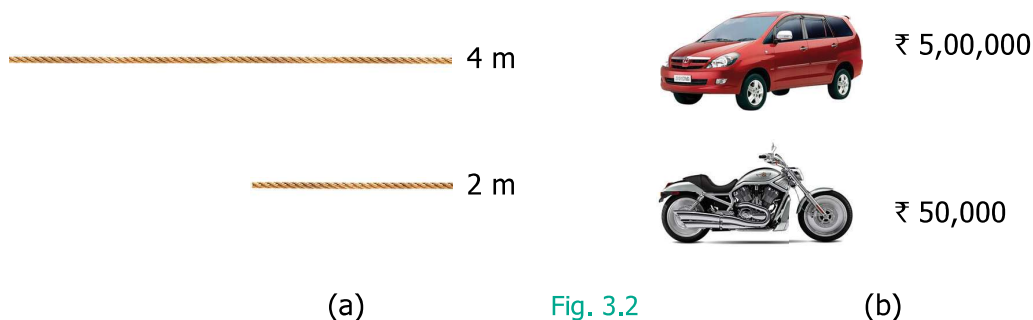
**Try this**

If the given quantity is in the same unit, put  $\checkmark$  otherwise put X in the table below.

| Sl.No | Quantity                         | Put $\checkmark$ or X |
|-------|----------------------------------|-----------------------|
| 1     | 5 cm and 100 cm                  |                       |
| 2     | ₹ 5 and 50 oranges               |                       |
| 3     | 2 m and 75 ml                    |                       |
| 4     | 7 km and 700 m                   |                       |
| 5     | 3 kg of potatoes and 2 kg onions |                       |
| 6     | 10 cm and 32 pencils             |                       |

### 3.2.2 Ratios in simplest form

#### Think about these situations



1. The larger rope is 4 m long and the smaller rope is 2 m long. This is expressed in the form of ratio as 4 : 2 and the simplest form of ratio of the larger rope to the smaller rope is 2 : 1 (See Fig. 3.2 (a))
2. The cost of a car is ₹ 5,00,000 and the cost of a motorbike is ₹ 50,000. This is expressed as 500000 : 50000 = 50 : 5 and the simplest form of ratio of the car to the motorbike is 10 : 1 (See Fig. 3.2 (b))

### 3.2.3 Simplifying ratios of same unit

#### Example 3.1

Simplify the ratio 20 : 5.

#### Solution

**Step 1 :** Write the ratio in fraction form as  $\frac{20}{5}$ .

**Step 2 :** Divide each quantity by 5. That is,  $\frac{20 \div 5}{5 \div 5} = \frac{4}{1} = 4 : 1$

This is the ratio in the simplest form.

#### Example 3.2

Find the ratio of 500 g to 250 g.

#### Solution

$$500 \text{ g to } 250 \text{ g} = 500 : 250 \Rightarrow \frac{500}{250} = \frac{500 \div 250}{250 \div 250} = \frac{2}{1} = 2 : 1$$

This is the ratio in the simplest form.

$$5 \times 1 = 5$$

$$5 \times 2 = 10$$

$$5 \times 3 = 15$$

$$5 \times 4 = 20$$

### Example 3.3

Madhavi and Anbu bought two tables for ₹ 750 and ₹ 900 respectively. What is the ratio of the prices of tables bought by Anbu and Madhavi?

#### Solution

The ratio of the price, of tables bought by Anbu and Madhavi

$$= 900:750 = \frac{900}{750} \Rightarrow \frac{900 \div 150}{750 \div 150} = \frac{6}{5} = 6:5$$

This is the ratio in the simplest form.

### 3.2.4 Simplifying ratios of different units

#### Example 3.4

What is the ratio of 40 minutes to 1 hour?

1 hour = 60 minutes

$$20 \times 1 = 20$$

$$20 \times 2 = 40$$

$$20 \times 3 = 60$$

#### Solution

**Step 1 :** Express the quantity in the same unit. (Hint : 1 Hour = 60 minutes)

**Step 2 :** Now, the ratio of 40 minutes to 60 minutes is  $40:60 \Rightarrow \frac{40}{60} = \frac{40 \div 20}{60 \div 20} = \frac{2}{3} = 2:3$

This is the ratio in the simplest form.



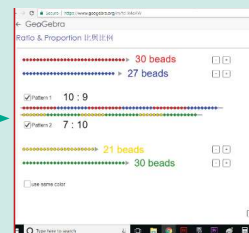
**Try these**

Write the ratios in the simplest form and fill in the table.

| Sl. No. | Quantity                               | Ratio Form                | Fraction Form     | Dividing by a common number                 | Simplest form of Ratio |
|---------|----------------------------------------|---------------------------|-------------------|---------------------------------------------|------------------------|
| 1       | Ratio of 15 girls to 10 boys           | 15 : 10                   | $\frac{15}{10}$   | $\frac{15 \div 5}{10 \div 5} = \frac{3}{2}$ | 3 : 2                  |
| 2       | Ratio of 1m 25 cm to 2 m<br>(1m=100cm) | 125 : 200<br>(1m=100cm)   | $\frac{125}{200}$ |                                             |                        |
| 3       | Ratio of 3 Kg to 750 g<br>(1Kg=1000g)  | 3000 : 750<br>(1Kg=1000g) |                   |                                             |                        |
| 4       | Ratio of 70 minutes to 30 minutes      |                           |                   |                                             |                        |

## RATIO AND PROPORTION

Expected Result is shown in this picture



### Step – 1

Open the Browser and copy and paste the Link given below (or) by typing the URL given (or) Scan the QR Code.

### Step - 2

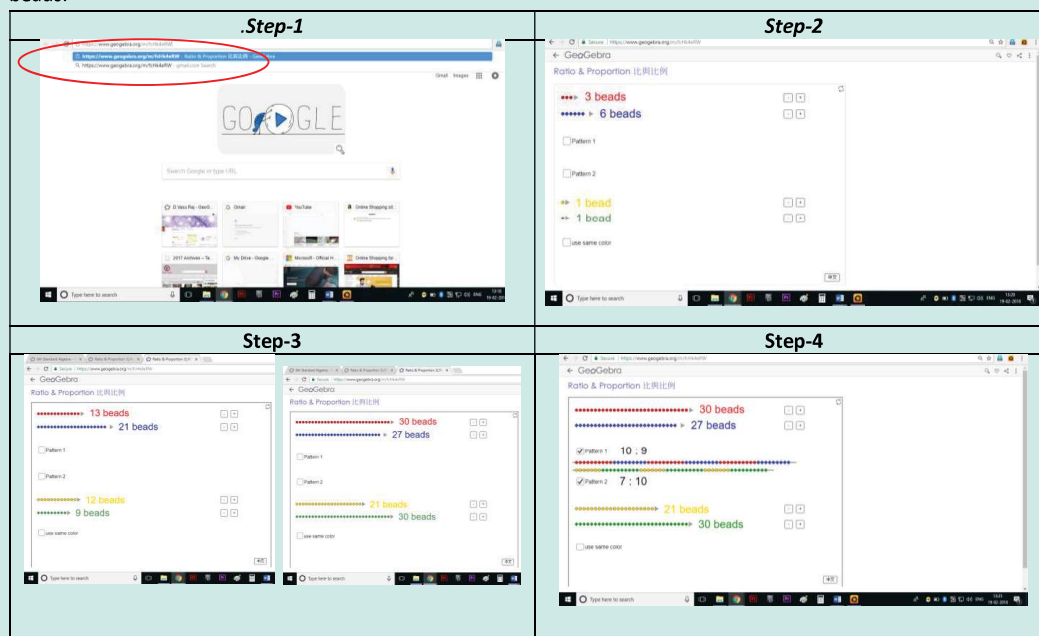
GeoGebra worksheet named “Ratio and Proportion” will open. Two sets of Coloured beads will appear.

### Step-3

Find the ratio of coloured beads for each pair. You can Increase or decrease the no’s by pressing “+” and “-” button appearing on the right side of the page.

### Step-4

To check your answer Press on “Pattern 1” and “Pattern 2” button. Repeat the test by increasing and decreasing the beads.



Browse in the link

Ratio and Proportion - <https://www.geogebra.org/m/fcHk4eRW>





### Exercise 3.1



1. Fill in the blanks.
  - (i) Ratio of ₹ 3 to ₹ 5 = \_\_\_\_\_.
  - (ii) Ratio of 3m to 200cm = \_\_\_\_\_.
  - (iii) Ratio of 5 km 400 m to 6 km = \_\_\_\_\_.
  - (iv) Ratio of 75 paise to ₹ 2 = \_\_\_\_\_.
2. Say whether the following statements are True or False.
  - (i) The ratio of 130 cm to 1 m is 13 : 10.
  - (ii) One of the terms in a ratio cannot be 1.
3. Find the simplified form of the following ratios.
  - (i) 15 : 20      (ii) 32 : 24      (iii) 7 : 15      (iv) 12 : 27      (v) 75 : 100
4. Akilan walks 10 km in an hour while Selvi walks 6 km in an hour. Find the simplest ratio of the distance covered by Akilan to that of Selvi.
5. The cost of parking a bicycle is ₹ 5 and the cost of parking a scooter is ₹ 15. Find the simplest ratio of the parking cost of a bicycle to that of a scooter.
6. Out of 50 students in a class, 30 are boys. Find the ratio of
  - (i) number of boys to the number of girls.
  - (ii) number of girls to the total number of students.
  - (iii) number of boys to the total number of students.

### Objective Type Questions

7. The ratio of ₹ 1 to 20 paise is \_\_\_\_\_.
  - (a) 1 : 5                      (b) 1 : 2                      (c) 2 : 1                      (d) 5 : 1
8. The ratio of 1 m to 50 cm is \_\_\_\_\_.
  - (a) 1 : 50                      (b) 50 : 1                      (c) 2 : 1                      (d) 1 : 2

9. The length and breadth of a window are in 1m and 70 cm respectively. The ratio of the length to the breadth is \_\_\_\_\_.
- (a) 1 : 7                      (b) 7 : 1                      (c) 7 : 10                      (d) 10 : 7
10. The ratio of the number of sides of a triangle to the number of sides of a rectangle is
- (a) 4 : 3                      (b) 3 : 4                      (c) 3 : 5                      (d) 3 : 2
11. If Azhagan is 50 years old and his son is 10 years old then the simplest ratio between the age of Azhagan to his son is
- (a) 10 : 50                      (b) 50 : 10                      (c) 5 : 1                      (d) 1 : 5

### 3.2.5 Equivalent Ratios

We can get **equivalent ratios** by multiplying or dividing the numerator and denominator by a common number. This is clear from the following example. Let us find the ratio between breadth and length of the following rectangles given in the Figure 3.3

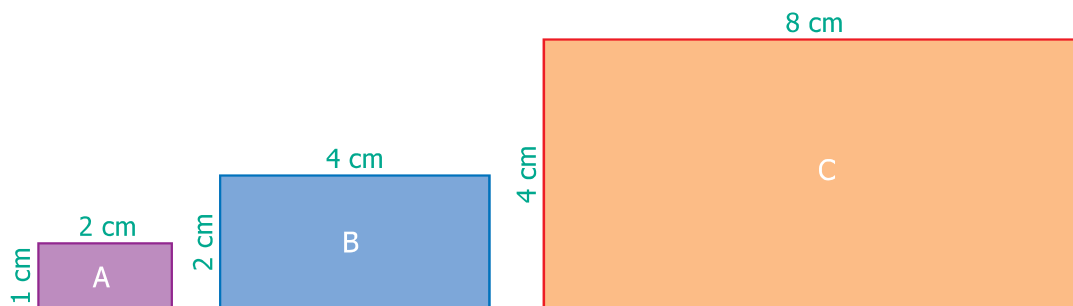


Fig. 3.3

- Ratio of breadth to length of **rectangle A** is **1 : 2** (already in simplest form)
- Ratio of breadth to length of **rectangle B** is **2 : 4** (simplest form is 1 : 2)
- Ratio of breadth to length of **rectangle C** is **4 : 8** (simplest form is 1 : 2)
- Thus, the ratios of breadth and length of rectangles **A**, **B** and **C** are said to be **equivalent ratios**.
- That is, the ratios **1 : 2 = 2 : 4 = 4 : 8** are **equivalent**. (See Fig. 3.3)



### Try these

1. For the given ratios, find two equivalent ratios and complete the table.

|       | Ratio | Fraction Form | Equivalent ratio                                                                                              |
|-------|-------|---------------|---------------------------------------------------------------------------------------------------------------|
| (i)   | 1 : 3 | $\frac{1}{3}$ | $\frac{1}{3} \times \frac{2}{2} = \frac{2}{6} = 2:6$ and $\frac{1}{3} \times \frac{3}{3} = \frac{3}{9} = 3:9$ |
| (ii)  | 3 : 7 | $\frac{3}{7}$ |                                                                                                               |
| (iii) | 5 : 8 | $\frac{5}{8}$ |                                                                                                               |

2. Write three equivalent ratios and fill in the boxes.

|       | Ratio | Equivalent Ratios         |                           |                           |
|-------|-------|---------------------------|---------------------------|---------------------------|
| (i)   | 4 : 5 | 8 : <input type="text"/>  | <input type="text"/> : 50 | 12 : <input type="text"/> |
| (ii)  | 7 : 2 | <input type="text"/> : 10 | 14 : <input type="text"/> | 49 : <input type="text"/> |
| (iii) | 8 : 5 | 32 : <input type="text"/> | <input type="text"/> : 50 | 4 : <input type="text"/>  |

3. For the given ratios, find their simplest form and complete the table.

|       | Ratio       | Fraction Form       | Simplest form                                      |
|-------|-------------|---------------------|----------------------------------------------------|
| (i)   | 5 : 60      | $\frac{5}{60}$      | $\frac{5 \div 5}{60 \div 5} = \frac{1}{12} = 1:12$ |
| (ii)  | 4000 : 6000 | $\frac{4000}{6000}$ |                                                    |
| (iii) | 1100 : 5500 |                     |                                                    |

### 3.2.6 Comparison of Ratios

Consider the following situations.

#### Situation 1

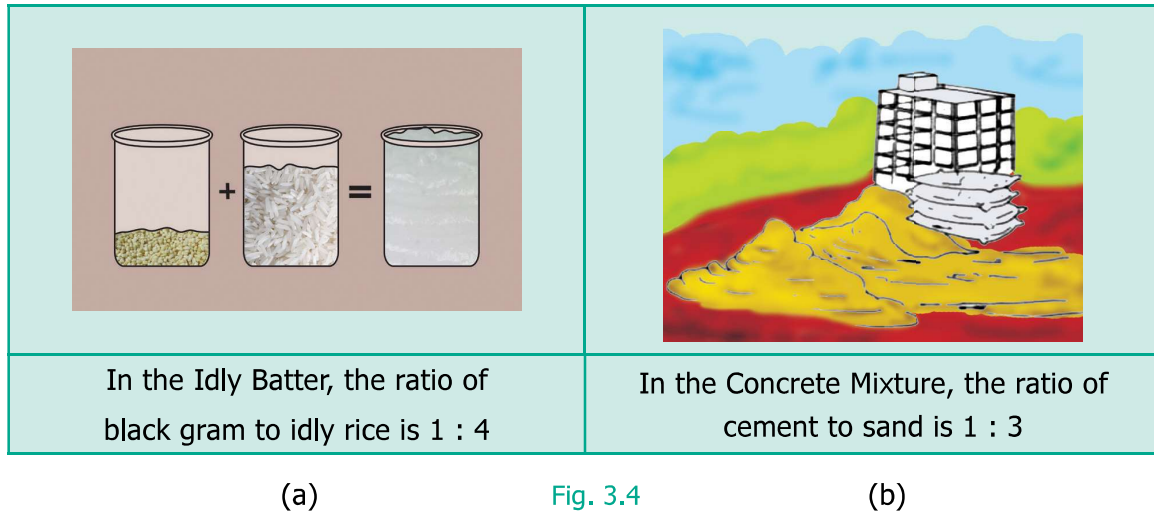


Fig. 3.4

Can you find which ratio is greater in Fig. 3.4?

Express ratios as a fraction and then find the equivalent fractions, until the denominators are the same, and compare the fractions with common denominators. This is done as follows :

| Idly Batter Ratio                               | Concrete Mixture Ratio                          |
|-------------------------------------------------|-------------------------------------------------|
| $\frac{1}{4} \times \frac{2}{2} = \frac{2}{8}$  | $\frac{1}{3} \times \frac{2}{2} = \frac{2}{6}$  |
| $\frac{1}{4} \times \frac{3}{3} = \frac{3}{12}$ | $\frac{1}{3} \times \frac{3}{3} = \frac{3}{9}$  |
| $\frac{1}{4} \times \frac{4}{4} = \frac{4}{16}$ | $\frac{1}{3} \times \frac{4}{4} = \frac{4}{12}$ |

Comparing the equivalent ratios,  $\frac{4}{12}$  &  $\frac{3}{12}$ , we can conclude that 1 : 3 is greater than 1 : 4

#### Situation 2

Let us consider another situation. For example, if a thread of 5 m is cut at 3 m, then the length of two pieces are 3 m and 2 m and the ratio of the two pieces is 3 : 2. From this we say that, a ratio ' $a : b$ ' is said to have a total of ' $a+b$ ' parts in it.

### Example 3.5

Kumaran has ₹ 600 and wants to divide it between Vimala and Yazhini in the ratio 2 : 3. Who will get more and how much?

### Solution

Divide the whole money into  $2 + 3 = 5$  equal parts then, Vimala gets 2 parts out of 5 parts and Yazhini gets 3 parts out of 5 parts.

$$\text{Amount Vimala gets} = ₹ 600 \times \frac{2}{5} = ₹ 240$$

$$\text{Amount Yazhini gets} = ₹ 600 \times \frac{3}{5} = ₹ 360$$

Vimala received ₹ 240 and Yazhini gets ₹ 360, which is ₹ 120 more than that of Vimala.



### Exercise 3.2

1. Fill in the blanks of the given equivalent ratios.

(i)  $3 : 5 = 9 : \underline{\hspace{1cm}}$

(ii)  $4 : 5 = \underline{\hspace{1cm}} : 10$

(iii)  $6 : \underline{\hspace{1cm}} = 1 : 2$

2. Complete the table.

(i)

|             |    |    |   |    |
|-------------|----|----|---|----|
| <b>Feet</b> | 1  | 2  | 3 | ?  |
| <b>Inch</b> | 12 | 24 | ? | 72 |

(ii)

|              |    |    |   |    |
|--------------|----|----|---|----|
| <b>Days</b>  | 28 | 21 | ? | 63 |
| <b>Weeks</b> | 4  | 3  | 2 | ?  |

3. Say True or False.

(i) 5 : 7 is equivalent to 21 : 15

(ii) If 40 is divided in the ratio 3 : 2, then the larger part is 24.

4. Give two equivalent ratios for each of the following.

(i) 3 : 2

(ii) 1 : 6

(iii) 5 : 4

5. Which of the two ratios is larger?
- (i) 4 : 5 or 8 : 15                      (ii) 3 : 4 or 7 : 8                      (iii) 1 : 2 or 2 : 1
6. Divide the numbers given below in the required ratio.
- (i) 20 in the ratio 3 : 2              (ii) 27 in the ratio 4 : 5              (iii) 40 in the ratio 6 : 14
7. In a family, the amount spent in a month for buying Provisions and Vegetables are in the ratio 3 : 2. If the allotted amount is ₹4000, then what will be the amount spent for (i) Provisions and (ii) Vegetables?
8. A line segment 63 cm long is to be divided into two parts in the ratio 3 : 4. Find the length of each part.

### Objective Type Questions

9. If 2 : 3 and 4 : \_\_\_\_ are equivalent ratios, then the missing term is
- (a) 6                      (b) 2                      (c) 4                      (d) 3
10. An equivalent ratio of 4 : 7 is
- (a) 1 : 3                      (b) 8 : 15                      (c) 14 : 8                      (d) 12 : 21
11. Which is not an equivalent ratio of  $\frac{16}{24}$  ?
- (a)  $\frac{6}{9}$                       (b)  $\frac{12}{18}$                       (c)  $\frac{10}{15}$                       (d)  $\frac{20}{28}$
12. If ₹1600 is divided among A and B in the ratio 3 : 5 then, B's share is
- (a) ₹ 480                      (b) ₹ 800                      (c) ₹ 1000                      (d) ₹ 200

### 3.3 Proportion

When two ratios are equal  $\left(\frac{a}{b} = \frac{c}{d}\right)$ , we say that the ratios are in **Proportion**. This is denoted as  $a : b :: c : d$  and it is read as ' $a$  is to  $b$  as  $c$  is to  $d$ '. The following situations explain about proportion.

#### Situation 1

The Teacher said to the students, "You can do a maximum of 4 projects in Mathematics. You will get 5 as internal marks for each project that you do". Kamala asked, "Teacher, What if I do 2 or 3 or 4 projects?" The teacher replied, "For 2 projects you will get 10 marks, for 3 projects you will get 15 marks and for 4 projects you will get 20 marks".



Here “1 project carries 5 marks” is equivalent to saying “2 projects carry 10 marks” and so on and hence the ratios,  $1 : 5 = 2 : 10 = 3 : 15 = 4 : 20$  are said to be in Proportion. Thus  $1 : 5$  is in proportion to  $2 : 10$ ,  $3 : 15$ ,  $4 : 20$  and so on. This is denoted by  $1 : 5 :: 2 : 10$  and it is read as ‘1 is to 5 as 2 is to 10’ and so on.

## Situation 2



Fig. 3.5(a)

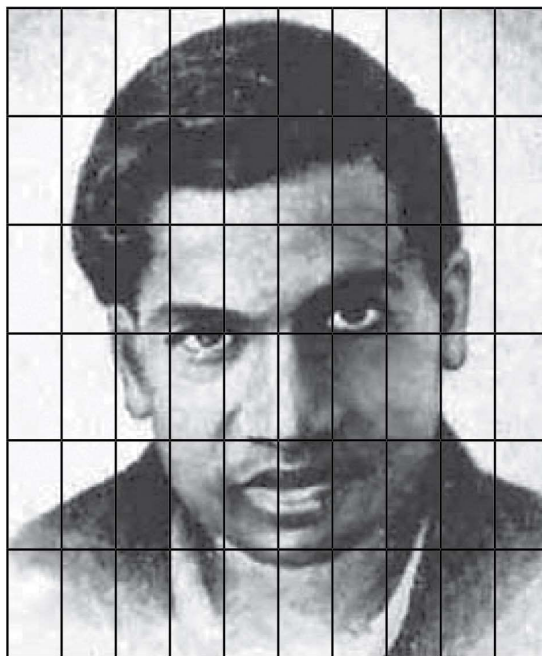


Fig. 3.5(b)

The size of the photograph of Srinivasa Ramanujan as shown in Figure 3.5(a) is of length 5 grids and width 3 grids. Figure 3.5(b) shows the enlarged size of the photograph of length 10 grids and width 6 grids. Here,

|                   |   |                            |   |                   |     |                  |   |                           |   |                  |
|-------------------|---|----------------------------|---|-------------------|-----|------------------|---|---------------------------|---|------------------|
| Photo grid length | : | Enlarged Photo grid length | = | 5 : 10<br>(1 : 2) | and | Photo grid width | : | Enlarged Photo grid width | = | 3 : 6<br>(1 : 2) |
|-------------------|---|----------------------------|---|-------------------|-----|------------------|---|---------------------------|---|------------------|

As the two ratios are equal, the given figures are in proportion. This is represented as  $5 : 10 :: 3 : 6$  or  $5 : 10 = 3 : 6$  and it is read as ‘5 is to 10 as 3 is to 6’

### 3.3.1 Proportionality law

If two ratios are in proportion ie.,  $a : b :: c : d$  then the product of the extremes is equal to the product of the means. This is called the proportionality law. Here,  $a$  and  $d$  are the extremes and  $b$  and  $c$  are the means. Also, if two ratios are equal ie.,  $\frac{a}{b} = \frac{c}{d} \rightarrow ad = bc$  is called the cross product of proportions.

### Example 3.6

By proportionality law, check whether  $3 : 2$  and  $30 : 20$  are in proportion.

#### Solution

Here the extremes are 3 and 20 and the means are 2 and 30.

Product of extremes,  $ad = 3 \times 20 = 60$ .

Product of means,  $bc = 2 \times 30 = 60$ .

Thus by proportionality law, we find  $ad = bc$  and hence  $3 : 2$  and  $30 : 20$  are in proportion.

### Example 3.7

A picture is resized in a computer as shown below.

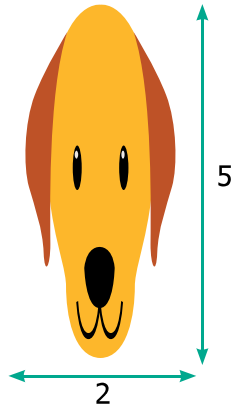


Fig. 3.6 (a)

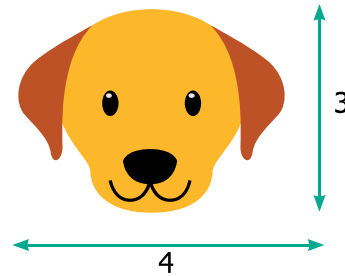


Fig. 3.6 (b)

Do you observe any change in the shape and size of the picture? Check whether the ratios formed by its length and breadth are in proportion by cross product method.

#### Solution

The given pictures are in the ratio  $2 : 5$  and  $4 : 3$  respectively.

Here the extremes are 2 and 3 and the means are 5 and 4.

Product of extremes,  $ad = 2 \times 3 = 6$ .

Product of means,  $bc = 5 \times 4 = 20$ .

Thus, we find  $ad \neq bc$  and hence  $2 : 5$  and  $4 : 3$  are not in proportion.



**Try this**

1. Fill the box by using cross product rule of two ratios  $\frac{1}{8} = \frac{5}{\square}$
2. Use the digits 1 to 9 only once and write as many ratios that are in proportion as possible. (For example :  $\frac{2}{4} = \frac{3}{6}$ )

### Exercise 3.3

1. Fill in the boxes.

(i)  $3 : 5 :: \square : 20$

(ii)  $\square : 24 :: 3 : 8$

(iii)  $5 : \square :: 10 : 8 :: 15 : \square$

(iv)  $12 : \square = \square : 4 = 8 : 16$

2. Say True or False.

(i)  $2 : 7 :: 14 : 4$

(ii) 7 Persons is to 49 Persons as 11 kg is to 88 kg

(iii) 10 books is to 15 books as 3 books is to 15 books

3. Using the numbers 3, 9, 4, 12 write two ratios that are in proportion.
4. Find whether 12, 24, 18, 36 in that order can be expressed as two ratios that are in proportion.
5. Write the mean and extreme terms in the following ratios and check whether they are in proportion.
  - (i) 78 litres is to 130 litre and 12 bottles is to 20 bottles
  - (ii) 400 gm is to 50 gm and 25 rupees is to 625 rupees

6. The America's famous Golden Gate bridge is 6480 ft long with 756 ft tall towers. A model of this bridge exhibited in a fair is 60 ft long with 7 ft tall towers. Is the model in proportion to the original bridge?





## Objective Type Questions

7. Which of the following ratios are in proportion?
- (a)  $3 : 5$ ,  $6 : 11$                       (b)  $2 : 3$ ,  $9 : 6$
- (c)  $2 : 5$ ,  $10 : 25$                       (d)  $3 : 1$ ,  $1 : 3$
8. If the ratios formed using the numbers 2, 5,  $x$ , 20 in the same order are in proportion, then ' $x$ ' is
- (a) 50                      (b) 4                      (c) 10                      (d) 8
9. If  $7 : 5$  is in proportion to  $x : 25$ , then ' $x$ ' is
- (a) 27                      (b) 49                      (c) 35                      (d) 14

## 3.4 Unitary Method

Finding the value of **one unit** and then using it to find the value of the required number of units is known as **unitary method**.

### Steps involved in Unitary Method

- Express the given problem in Mathematical statement.
- Find the value of one unit of the given item using division.
- Find the value of the required number of the same items using multiplication.

### Example 3.8

Pari wants to buy 5 tennis balls from a sports shop. If a dozen balls cost ₹180, how much should Pari pay to buy 5 balls?

By unitary method, we can solve this as follows :

Cost of a dozen balls = ₹ 180

⇒ Cost of 12 balls = ₹ 180

Cost of 1 ball =  $\frac{180}{12}$  = ₹ 15

Cost of 5 balls =  $5 \times 15$  = ₹ 75

Hence, Pari has to pay ₹ 75 for 5 balls.

### Example 3.9

A heater uses 3 units of electricity in 40 minutes. How many units does it consume in 2 hours?

### Solution

In 40 minutes, electricity used = 3 units.

In 1 minute, electricity used =  $\frac{3}{40}$  units.

In 120 minutes (2 hours), electricity used =  $\frac{3}{40} \times 120 = 9$  units

Thus, the heater consumed 9 units of electricity in 2 hours.

### Exercise 3.4

1. Fill in the blanks.

(i) If the cost of 3 pens is ₹ 18, then the cost of 5 pens is \_\_\_\_\_.

(ii) If Karkuzhali earns ₹ 1800 in 15 days, then she earns ₹ 3000 in \_\_\_\_\_ days.

2. Say True or False.

(i) If the weight of 40 books is 8 kg, then the weight of 15 books is 3kg.

(ii) A car travels 90 km in 3 hours with constant speed. It will travel 140 km in 5 hours at the same speed.

3. If a person reads 20 pages of a book in 2 hours, how many pages will he read in 8 hours at the same speed?

4. The cost of 15 chairs is ₹ 7500. Find the number of such chairs that can be purchased for ₹ 12,000?

5. A car covers a distance of 125 km in 5 kg of LP Gas. How much distance will it cover in 3 kg of LP Gas?

6. Cholan walks 6 km in 1 hour at constant speed. Find the distance covered by him in 20 minutes at the same speed.

7. The number of correct answers given by Kaarmugilan and Kavitha in a quiz competition are in the ratio 10 : 11. If they had scored a total of 84 points in the competition, then how many points did Kavitha get?



8. Karmegan made 54 runs in 9 overs and Asif made 77 runs in 11 overs. Whose run rate is better? (run rate = ratio of runs to overs)
9. You purchase 6 apples for ₹ 90 and your friend purchases 5 apples for ₹ 70. Whose purchase is better?

### Objective Type Questions

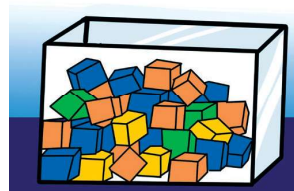
10. If a barbie doll costs ₹ 90, then the cost of 3 such dolls is ₹ \_\_\_\_\_.  
(a) 260      (b) 270      (c) 30      (d) 93
11. If 8 oranges cost ₹ 56, then the cost of 5 oranges is ₹ \_\_\_\_\_.  
(a) 42      (b) 48      (c) 35      (d) 24
12. If a man walks 2 km in 15 minutes, then he will walk \_\_\_\_\_ km in 45 minutes.  
(a) 10      (b) 8      (c) 6      (d) 12

### Exercise 3.5

#### Miscellaneous Practice Problems



1. The maximum speed of some of the animals are given below :  
the Elephant=20 km/h; the Lion=80 km/h; the Cheetah=100 km/h  
Find the following ratios of their speeds in simplified form and find which ratio is the least?.
- (i) the Elephant and the Lion      (ii) the Lion and the Cheetah  
(iii) the Elephant and the Cheetah
2. A particular high school has 1500 students 50 teachers and 5 administrators. If the school grows to 1800 students and the ratios are maintained, then find the number of teachers and administrators.
3. I have a box which has 3 green, 9 blue, 4 yellow, 8 orange coloured cubes in it.
- (a) What is the ratio of orange to yellow cubes?  
(b) What is the ratio of green to blue cubes?  
(c) How many different ratios can be formed, when you compare each colour to anyone of the other colours?



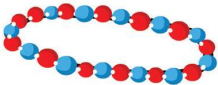


4. A gets double of what B gets and B gets double of what C gets. Find A : B and B : C and verify whether the result is in proportion or not.
5. The ingredients required for the preparation of **Ragi Kali**, a healthy dish of Tamilnadu is given below.

| Ingredients     | Quantity |
|-----------------|----------|
| Ragi flour      | 4 cups   |
| Raw rice broken | 1 cup    |
| Water           | 8 cups   |
| Sesame oil      | 15 ml    |
| Salt            | 10 mg    |

- (a) If one cup of ragi flour is used then, what would be the amount of raw rice required?
- (b) If 16 cups of water is used, then how much of ragi flour should be used?
- (c) Which of these ingredients cannot be expressed as a ratio? Why?

### Challenging Problems

6. Antony brushes his teeth in the morning and night on all days in a week. Shabeen brushes her teeth only in the morning. What is the ratio of the number of times they brush their teeth in a week?
7. Thirumagal's mother wears a bracelet made of 35 red beads and 30 blue beads. Thirumagal wants to make smaller bracelets using the same two coloured beads in the same ratio. In how many different ways can she make the bracelets? 
8. Team A wins 26 matches out of 52 matches. Team B wins three-fourth of 52 matches played. Which team has a better winning record?
9. In a school excursion, 6 teachers and 12 students from 6th standard and 9 teachers and 27 students from 7th standard, 4 teachers and 16 students from 8th standard took part. Which class has the least teacher to student ratio?
10. Fill the boxes using any set of suitable numbers 6 :  : :  : 15.
11. From your school diary, write the ratio of the number of holidays to the number of working days in the current academic year.

12. If the ratio of Green, Yellow and Black balls in a bag is 4 : 3 : 5, then
- (a) Which is the most likely ball that you can choose from the bag?
  - (b) How many balls in total are there in the bag if you have 40 black balls in it?
  - (c) Find the number of green and yellow balls in the bag.

### Summary

- A ratio is a comparison of two quantities by division.
- Ratios are often expressed as fractions in the simplest form.
- A ratio has no unit.
- The two quantities of a ratio should be in the same unit.
- Order of the terms in a ratio cannot be reversed.
- To get an equivalent ratio, multiply or divide the numerator and denominator by the same number.
- When two ratios are equal, they are said to be in proportion.
- The proportionality law states that the product of the extremes is equal to the product of the means.
- Finding the value of required number of units by knowing the value of one unit is known as unitary method.