

## 7

## RATIO

**LEARNING OBJECTIVES**

In this topic, we will learn to:

- compare two or more quantities by ratio
- simplify ratios (in integer, rational and decimal format)
- solve word problems relating to ratio

**7.1 SIMPLIFY THE RATIO**
**WORKED EXAMPLE 1**

Simplify the following ratios.

(a)  $5 : 15$

(b)  $0.4 : 1.4$

(c)  $\frac{2}{3} : \frac{6}{7}$

(d)  $12 : 6 : 18$

(e)  $\frac{3}{5} : 0.2 : 1.6$

*Worked Solution:*

(a)  $5 : 15 = 1 : 3$

(b)  $0.4 : 1.4 = 4 : 14$   
 $= 2 : 7$

(c)  $\frac{2}{3} : \frac{6}{7} = \frac{2 \times 7}{3 \times 7} : \frac{6 \times 3}{7 \times 3}$   
 $= \frac{14}{21} : \frac{18}{21}$   
 $= 14 : 18$   
 $= 7 : 9$

(d)  $12 : 6 : 18 = 2 : 1 : 3$

(e)  $\frac{3}{5} : 0.2 : 1.6 = \frac{3}{5} : \frac{2}{10} : 1\frac{6}{10}$   
 $= \frac{3 \times 2}{5 \times 2} : \frac{2}{10} : \frac{16}{10}$   
 $= \frac{6}{10} : \frac{2}{10} : \frac{16}{10}$   
 $= 6 : 2 : 16$   
 $= 3 : 1 : 8$

**Note:**

To express decimals as ratios, change all decimals into whole numbers.

To express fractions as ratios, ensure all denominators are the same.

**WORKED EXAMPLE 2**

 Find the value of  $x$  in the following equivalent ratios.

(a)  $3 : 4 = x : 64$

(b)  $\frac{1}{2} : \frac{1}{3} = 5 : x$

(c)  $1.2 : 0.04 = x : 1.6$

(d)  $\frac{4}{5} : 1.6 : 3 = 4 : x : 15$

**Worked Solution:**

(a)  $3 : 4 = x : 64$

$4 \text{ units} \rightarrow 64$

$1 \text{ unit} \rightarrow 16$

$3 \text{ units} \rightarrow 3 \times 16 = 48$

$x = 48$

(b)  $\frac{1}{2} : \frac{1}{3} = 5 : x$

$\frac{1 \times 3}{2 \times 3} : \frac{1 \times 2}{3 \times 2} = 5 : x$

$\frac{3}{6} : \frac{2}{6} = 5 : x$

$3 : 2 = 5 : x$

$3 \text{ units} \rightarrow 5$

$1 \text{ unit} \rightarrow \frac{5}{3}$

$2 \text{ units} \rightarrow \frac{5}{3} \times 2 = \frac{10}{3}$

$x = \frac{10}{3}$

(c)  $1.2 : 0.04 = x : 1.6$

$1.2 \times 100 : 0.04 \times 100 = x : 1.6$

$120 : 4 = x : 1.6$

$4 \text{ units} \rightarrow 1.6$

$1 \text{ unit} \rightarrow 1.6 \div 4 = 0.4$

$120 \text{ units} \rightarrow 0.4 \times 120 = 48$

$x = 48$

(d)  $\frac{4}{5} : 1.6 : 3 = 4 : x : 15$

$3 \text{ units} \rightarrow 15$

$1 \text{ unit} \rightarrow 5$

$1.6 \text{ units} \rightarrow 5 \times 1.6 = 8$

$x = 8$

**WORKED EXAMPLE 3**

If  $a : b = 4 : 3$  and  $b : c = 8 : 7$ , find  $a : b : c$ .

*Worked Solution:*

$$\begin{aligned} a : b &= 4 : 3 \\ &= 32 : 24 \\ b : c &= 8 : 7 \\ &= 24 : 21 \end{aligned}$$

Hence  $a : b : c = 32 : 24 : 21$ .

*Note:*

Since the value of  $b$  in the two given ratios are different, convert each ratio to an equivalent ratio where the new value of  $b$  is the L.C.M of the original values of  $b$ .

## 7.2 PROBLEMS INVOLVING RATIOS

**WORKED EXAMPLE 4**

\$4500 is shared among three siblings in the ratio  $4 : 5 : 7$ . The eldest sibling gets the highest share and the youngest sibling gets the lowest share. Find the difference in the amount received by the eldest and the youngest siblings.

*Worked Solution:*

$$\begin{aligned} \text{Total number of units} &= 4 + 5 + 7 \\ &= 16 \end{aligned}$$

$$16 \text{ units} \rightarrow \$4500$$

$$1 \text{ unit} \rightarrow \$4500 \div 16 = \$281.25$$

$$\begin{aligned} \text{Difference between eldest and youngest siblings} &= 7 - 4 \\ &= 3 \text{ units} \end{aligned}$$

$$3 \text{ units} \rightarrow 3 \times \$281.25 = \mathbf{\$843.75}$$

**PRACTICE QUESTIONS**

1. Simplify the following ratios.

(a) 15 : 10

(c) 7 : 21

(e) 20 : 14

(g) 24 : 21

(i) 36 : 18

(k) 42 : 14

(b) 9 : 12

(d) 12 : 18

(f) 15 : 25

(h) 16 : 26

(j) 30 : 6

(l) 81 : 108

2. Simplify the following ratios.

(a) 0.2 : 0.3

(c) 0.03 : 0.2

(e) 1.5 : 0.9

(g) 0.5 : 3

(i) 4.8 : 0.24

(k) 0.02 : 1.4

(b) 0.5 : 0.7

(d) 1.3 : 0.5

(f) 1.2 : 0.04

(h) 0.08 : 0.2

(j) 0.64 : 0.08

(l) 1.08 : 2.4

3. Simplify the following ratios.

(a)  $\frac{2}{3} : \frac{1}{3}$

(c)  $\frac{1}{3} : \frac{1}{4}$

(e)  $\frac{3}{4} : \frac{2}{5}$

(g)  $1\frac{5}{6} : \frac{2}{3}$

(i)  $3\frac{1}{3} : \frac{5}{9}$

(k)  $2\frac{3}{4} : \frac{7}{8}$

(b)  $\frac{1}{5} : \frac{4}{5}$

(d)  $\frac{1}{5} : \frac{3}{7}$

(f)  $\frac{9}{10} : \frac{2}{5}$

(h)  $\frac{6}{7} : 1\frac{3}{14}$

(j)  $\frac{17}{5} : 1\frac{1}{2}$

(l)  $1\frac{3}{4} : 5\frac{3}{5}$

4. Simplify the following ratios.

(a)  $4 : 16 : 8$

(c)  $10 : 5 : 25$

(e)  $0.4 : 0.3 : 1.2$

(g)  $0.08 : 1.6 : 3.2$

(i)  $6 : 0.2 : 4.8$

(k)  $2.4 : 0.32 : 1.6$

(b)  $12 : 6 : 18$

(d)  $8 : 2 : 26$

(f)  $1.2 : 0.9 : 1.5$

(h)  $4.0 : 2.4 : 0.8$

(j)  $0.9 : 0.15 : 3.0$

(l)  $2 : 2.4 : 0.48$

5. Simplify the following ratios.

(a)  $\frac{1}{2} : 0.3 : 1.2$

(c)  $\frac{3}{4} : \frac{1}{2} : 0.8$

(e)  $\frac{1}{3} : 1.5 : 2.4$

(g)  $\frac{1}{5} : 0.4 : \frac{7}{3}$

(i)  $0.9 : 1.5 : \frac{3}{10}$

(k)  $0.15 : 2.4 : \frac{3}{5}$

(b)  $0.6 : \frac{11}{15} : \frac{2}{3}$

(d)  $\frac{1}{4} : 4.0 : 1.8$

(f)  $0.8 : \frac{5}{4} : 1.6$

(h)  $1\frac{1}{2} : \frac{7}{4} : 0.6$

(j)  $\frac{6}{5} : 0.4 : 2.5$

(l)  $0.7 : \frac{8}{5} : 1.2$

6. Find the value of  $x$  in the following equivalent ratios.

(a)  $4 : 8 = 1 : x$

(c)  $9 : x = 27 : 12$

(e)  $15 : 45 = x : 9$

(g)  $x : 16 = 1 : 2$

(i)  $\frac{1}{2} : \frac{4}{5} = 15 : x$

(k)  $0.07 : 0.42 = x : 30$

(b)  $10 : 25 = x : 5$

(d)  $14 : x = 7 : 12$

(f)  $21 : 18 = x : 6$

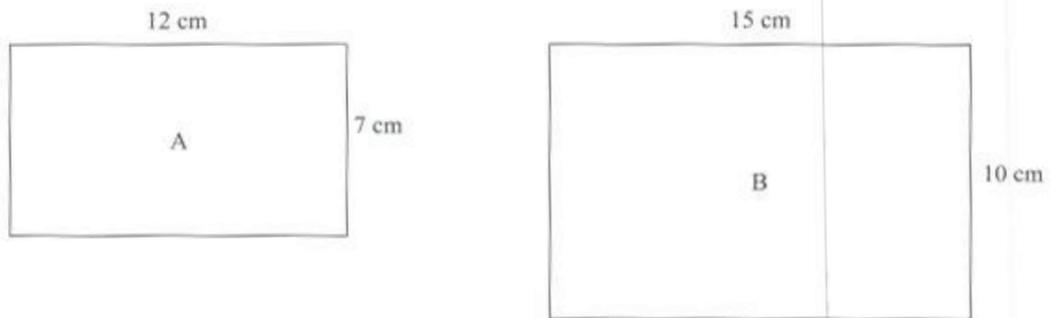
(h)  $x : 8 = 56 : 64$

(j)  $\frac{3}{4} : x = 30 : 45$

(l)  $x : 1.08 = 11 : 12$

7. The ratio of  $A$  to  $B$  is  $3 : 4$ . The ratio of  $B$  to  $C$  is  $3 : 5$ . Find the ratio of  $A : B : C$ .
8. The ratio of  $P$  to  $Q$  is  $5 : 9$ . The ratio of  $P$  to  $R$  is  $2 : 7$ . Find the ratio of  $P : Q : R$ .
9. The ratio of  $K$  to  $M$  is  $3 : 11$ . The ratio of  $K$  to  $L$  is  $3 : 5$ . Find the ratio of  $K$  to the sum of  $L$  and  $M$ .
10. A sum of money is shared among three boys in the ratio  $4 : 3 : 5$ . If the one with the smallest share receives \$33, find the total sum of money shared by the three boys.
11. \$2025 is shared among three girls in the ratio  $7 : 6 : 2$ . Find
  - (a) the amount of money the girl with the greatest share had, and
  - (b) the difference between the girl with the greatest share and the one with the smallest share.
12. Eugene, Ivan and George shared \$3200 in the ratio  $9 : 4 : 3$ . Find
  - (a) the total amount Ivan and George received, and
  - (b) the difference between the amount received by Eugene and George.
13. Raymond, Simon and Julian share a packet of sweets in the ratio  $3 : 8 : 5$ . If Raymond gets 24 fewer sweets than Julian, how many sweets are there in total?
14. Lisa, Monica and Betty share a box of red ribbons in the ratio  $10 : 7 : 5$ . If Lisa gets 80 red ribbons, how many ribbons are there in the box?
15. The ratio of the length of a rectangle to its breadth is  $5 : 3$ . Find the length of the rectangle if the perimeter is 48 cm.

16. The ratio of the length of a rectangle to its perimeter is 7 : 20. Find the breadth of the rectangle if its perimeter is 120 cm.
17. The area of a rectangle is  $42 \text{ cm}^2$  and the area of a triangle is  $60 \text{ cm}^2$ . Find the ratio of the area of the triangle to the area of the rectangle.
18. The length of square A to the breadth of square B is 4 : 9. If the area of square A is  $36 \text{ cm}^2$ , find the perimeter of square B.
19. The length of square P to the length of square Q is 16 : 9. Find the perimeter of square P if the perimeter of square Q is 36 cm.
20. The dimensions of the two rectangles are as shown in the diagram below:



Find the ratio of

- (a) the length of rectangle A to the breadth of rectangle B,
- (b) the area of rectangle A to the area of rectangle B,
- (c) the perimeter of rectangle B to the perimeter of rectangle A.

21. To make fruit punch from concentrated syrup, 5 litres of concentrated syrup is needed to mix with 12 litres of water. Find
- (a) the ratio of water to concentrated syrup, and
  - (b) the amount of concentrated syrup needed to mix with 35 litres of water.
22. To bake a cake, 3 kg of flour were needed to mix with 500 g of beaten eggs.
- (a) Find the ratio of the flour to the beaten eggs.
  - (b) How many kilograms of flour were needed if 1.2 kg of beaten eggs were used?