UNIT 8

RATIO AND PROPORTION

(A) Main Concepts and Results

- Ratio, Proportion and Unitary Method.
- The comparison of two numbers or quantities by division is known as the **ratio**. Symbol ':' is used to denote ratio.
- For a ratio, the two quantities must be in the same unit. If they are not, they should be expressed in the same unit before the ratio is taken.
- A ratio may be treated as a fraction.
- Two ratios are **equivalent,** if the fractions corresponding to them are equivalent.
- Four quantities are said to be in **proportion**, if the ratio of the first and the second quantities is equal to the ratio of the third and the fourth quantities. The symbol '**::**' or '=' is used to equate the two ratios.
- The order of terms in a proportion is important. For example 3, 8, 24, 64 are in proportion but 3, 8, 64, 24 are not in proportion.
- The method in which first we find the value of one unit and then the value of the required number of units is known as **unitary method**.

(B) Solved Examples

In examples 1 and 2, write the correct answer from the given four options:

Example 1. The ratio of Rs 8 to 80 paise is

(A) 1 : 10 (B) 10 : 1 (C) 1: 1 (D) 100 : 1

Solution: Correct answer is (B)

(**Hint:** 1 Rupee = 100 paise)

Example 2. The length and breadth of a steel tape are 10m and 2.4cm, respectively. The ratio of the length to the breadth is

(A) 5 : 1.2 (B) 25: 6 (C) 625: 6 (D) 1250: 3

Solution: Correct answer is (D)

(**Hint:** 10m = 10 × 100cm)

Example 3. Find the missing number in the box in the following proportion:

□ : 8 :: 12 : 32

Solution: $12:32 = \frac{12}{32} = \frac{3\times4}{8\times4} = \frac{3}{8} = 3:8$

We have, □ : 8 = 3 : 8 (Given)

So, the missing number in □ is 3.

Example 4. State whether the given statements are true or false:

(a) 12 : 18 = 28 : 56

(b) 25 persons : 130 persons = 15kg : 78kg

Solution: (a) False, Because

$12:18 = \frac{12}{18} = \frac{2}{3} = 2:3$

and $28:56 = \frac{28}{56} = \frac{1}{2} = 1:2$

These are not equal.

(b) True, Because

25 persons : 130 persons = 5: 26

and 15kg : 78kg = 5: 26

These are equal.

Example 5. Fill in the blanks:

If two ratios are _____, then they are in proportion.

Solution: Equal/same.

Example 6. Find the ratio of the shaded portion to the unshaded portion in Fig. 8.1

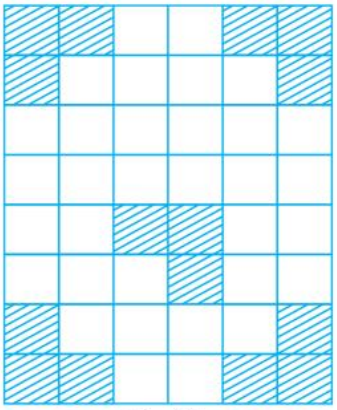


Fig. 8.1

Solution: Number of squares in the shaded portion = 15

Number of squares in the unshaded portion = 33

So, the ratio of the shaded portion to the unshaded portion = 15 : 33

$$=\frac{15}{33}=\frac{5\times3}{11\times3}=\frac{5}{11}=5:11$$

Example 7. Income of Rahim is Rs 12000 per month and that of Ami is Rs 191520 per annum. If the monthly expenditure of each of them is Rs 9960 per month find the ratio of their savings.

Solution: Savings of Rahim per month = Rs (12000 – 9960)

= Rs 2040

Monthly income of Ami = Rs $\frac{191520}{12}$ = Rs 15960

Savings of Ami per month = Rs (15960 – 9960)

= Rs 6000

Therefore, ratio of savings of Rahim and Ami

= 2040 : 6000 = 17:50

Example 8. 20 tons of iron costs Rs 600000. Find the cost of 560kg of iron.

Solution: 1 ton = 1000kg

Therefore, 20 tons = 20000kg

Now, cost of 20000kg iron = Rs 600000

Therefore, cost of 1kg iron = Rs $\frac{600000}{20000}$ = Rs 30

Therefore, cost of 560kg iron = Rs 30 × 560 = Rs 16800

(C) Exercise

In questions 1 to 10, only one of the four options is correct. Write the correct one.

1. The ratio of 8 books to 20 books is

(A) 2 : 5 (B) 5 : 2 (C) 4 : 5 (D) 5 : 4

2. The ratio of the number of sides of a square to the number of edges of a cube is

(A) 1 : 2 (B) 3 : 2 (C) 4 : 1 (D) 1 : 3

3. A picture is 60cm wide and 1.8m long. The ratio of its width to its perimeter in lowest form is

(A) 1 : 2 (B) 1 : 3 (C) 1 : 4 (D) 1 : 8

4. Neelam's annual income is Rs. 288000. Her annual savings amount to Rs. 36000. The ratio of her savings to her expenditure is

(A) 1 : 8 (B) 1 : 7 (C) 1 : 6 (D) 1 : 5

5. Mathematics textbook for Class VI has 320 pages. The chapter 'symmetry' runs from page 261 to page 272. The ratio of the number of pages of this chapter to the total number of pages of the book is

(A) 11 : 320 (B) 3 : 40 (C) 3 : 80 (D) 272 : 320

6. In a box, the ratio of red marbles to blue marbles is 7:4. Which of the following could be the total number of marbles in the box?

(A) 18 (B) 19 (C) 21 (D) 22

7. On a shelf, books with green cover and that with brown cover are in the ratio 2:3. If there are 18 books with green cover, then the number of books with brown cover is

(A) 12 (B) 24 (C) 27 (D) 36

8. The greatest ratio among the ratios 2 : 3, 5 : 8, 75 : 121 and 40 : 25 is

(A) 2 : 3 (B) 5 : 8 (C) 75 : 121 (D) 40 : 25

9. There are 'b' boys and 'g' girls in a class. The ratio of the number of boys to the total number of students in the class is:

(A) $\frac{b}{b+g}$ (B) $\frac{g}{b+g}$ (C) $\frac{b}{g}$ (D) $\frac{b+g}{b}$

10. If a bus travels 160 km in 4 hours and a train travels 320km in 5 hours at uniform speeds, then the ratio of the distances travelled by them in one hour is

(A) 1 : 2 (B) 4 : 5 (C) 5 : 8 (D) 8 : 5

In questions 11 to 15, find the missing number in the box $\square$ in each of the proportions:

11. $\frac{3}{5}=\frac{\square}{20}$

12. $\frac{\square}{18}=\frac{2}{9}$

13. $\frac{8}{\square}=\frac{3.2}{4}$

14. $\frac{\square}{45}=\frac{16}{40}=\frac{24}{\square}$

15. $\frac{16}{36}=\frac{\square}{63}=\frac{36}{\square}=\frac{\square}{117}$

In questions 16 to 34, state whether the given statements are true (T) or false (F).

16. $\frac{3}{8}=\frac{15}{40}$

17. 4 : 7 = 20 : 35

18. 0.2 : 5 = 2 : 0.5

19. 3 : 33 = 33 : 333

20. 15m : 40m = 35m : 65m

21. $27cm^2 : 57cm^2 = 18cm : 38cm$

22. 5kg : 7.5kg = Rs 7.50 : Rs 5

23. 20g : 100g = 1metre : 500cm

24. 12 hours : 30 hours = 8km : 20km

25. The ratio of 10kg to 100kg is 1:10

26. The ratio of 150cm to 1metre is 1:1.5.

27. 25kg : 20g = 50kg : 40g

28. The ratio of 1 hour to one day is 1:1.

29. The ratio 4 :16 is in its lowest form.

30. The ratio 5 : 4 is different from the ratio 4 : 5.

31. A ratio will always be more than 1.

32. A ratio can be equal to 1.

33. If $b : a = c : d$, then a, b, c, d are in proportion.

34. The two terms of a ratio can be in two different units.

In questions 35 to 46, fill in the blanks to make the statements true.

35. A ratio is a form of comparison by _____.

36. 20m : 70m = Rs 8 : Rs _____.

37. There is a number in the box ☐ such that ☐, 24, 9, 12 are in proportion. The number in the box is _____.

38. If two ratios are equal, then they are in _____.

Use Fig. 8.2 (In which each square is of unit length) for questions 39 and 40:

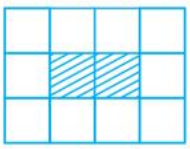


Fig. 8.2

39. The ratio of the perimeter of the boundary of the shaded portion to the perimeter of the whole figure is _____.

40. The ratio of the area of the shaded portion to that of the whole figure is _____.

41. Sleeping time of a python in a 24 hour clock is represented by the shaded portion in Fig. 8.3.

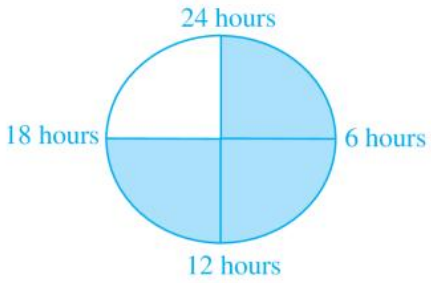


Fig. 8.3

The ratio of sleeping time to awaking time is _____.

42. A ratio expressed in lowest form has no common factor other than _____ in its terms.

43. To find the ratio of two quantities, they must be expressed in _____units.

44. Ratio of 5 paise to 25 paise is the same as the ratio of 20 paise to _____

45. Saturn and Jupiter take 9 hours 56 minutes and 10 hours 40 minutes, respectively for one spin on their axes. The ratio of the time taken by Saturn and Jupiter in lowest form is _____.

46. 10g of caustic soda dissolved in 100mL of water makes a solution of caustic soda. Amount of caustic soda needed for 1 litre of water to make the same type of solution is _____.

47. The marked price of a table is Rs 625 and its sale price is Rs 500. What is the ratio of the sale price to the marked price?

48. Which pair of ratios are equal? And why?

(i) $\frac{2}{3}, \frac{4}{6}$ (ii) $\frac{8}{4}, \frac{2}{1}$ (iii) $\frac{4}{5}, \frac{12}{20}$

49. Which ratio is larger 10 : 21 or 21 : 93?

50. Reshma prepared 18kg of *Burfi* by mixing *Khoya* with sugar in the ratio of 7 : 2. How much *Khoya* did she use?

51. A line segment 56cm long is to be divided into two parts in the ratio of 2 : 5. Find the length of each part.

52. The number of milk teeth in human beings is 20 and the number of permanent teeth is 32. Find the ratio of the number of milk teeth to the number of permanent teeth.

53. Sex ratio is defined as the number of females per 1000 males in the population. Find the sex ratio if there are 3732 females per 4000 males in a town.

54. In a year, Ravi earns Rs 360000 and paid Rs 24000 as income tax. Find the ratio of his

(a) income to income tax.

(b) income tax to income after paying income tax.

55. Ramesh earns Rs 28000 per month. His wife Rama earns Rs 36000 per month. Find the ratio of

(a) Ramesh's earnings to their total earnings

(b) Rama's earnings to their total earnings.

56. Of the 288 persons working in a company, 112 are men and the remaining are women. Find the ratio of the number of

(a) men to that of women.

(b) men to the total number of persons.

(c) women to the total number of persons.

57. A rectangular sheet of paper is of length 1.2m and width 21cm. Find the ratio of width of the paper to its length.

58. A scooter travels 120km in 3 hours and a train travels 120km in 2 hours.

Find the ratio of their speeds.

(**Hint :** Speed = $\frac{\text{distance travelled}}{\text{time taken}}$)

59. An office opens at 9 a.m. and closes at 5.30 p.m. with a lunch break of 30 minutes. What is the ratio of lunch break to the total period in the office?

60. The shadow of a 3m long stick is 4m long. At the same time of the day, if the shadow of a flagstaff is 24m long, how tall is the flagstaff?

61. A recipe calls for 1 cup of milk for every $2\frac{1}{2}$ cups of flour to make a cake that would feed 6 persons. How many cups of both flour and milk will be needed to make a similar cake for 8 people?

62. In a school, the ratio of the number of large classrooms to small classrooms is 3:4. If the number of small rooms is 20, then find the number of large rooms.

63. Samira sells newspapers at Janpath crossing daily. On a particular day, she had 312 newspapers out of which 216 are in English and remaining in Hindi. Find the ratio of

(a) the number of English newspapers to the number of Hindi newspapers.

(b) the number of Hindi newspapers to the total number of newspapers.

64. The students of a school belong to different religious backgrounds. The number of Hindu students is 288, the number of Muslim students is 252, the number of Sikh students is 144 and the number of Christian students is 72. Find the ratio of

(a) the number of Hindu students to the number of Christian students.

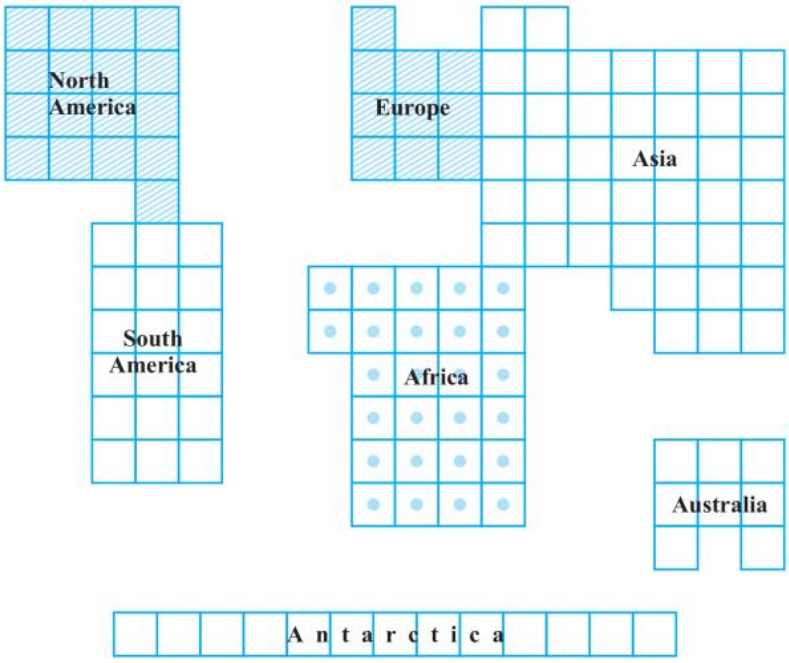
(b) the number of Muslim students to the total number of students.

65. When Chinmay visted chowpati at Mumbai on a holiday, he observed that the ratio of North Indian food stalls to South Indian food stalls is 5:4. If the total number of food stalls is 117, find the number of each type of food stalls.

66. At the parking stand of Ramleela ground, Kartik counted that there are 115 cycles, 75 scooters and 45 bikes. Find the ratio of the number of cycles to the total number of vehicles.

67. A train takes 2 hours to travel from Ajmer to Jaipur, which are 130km apart. How much time will it take to travel from Delhi to Bhopal which are 780km apart if the train is travelling at the uniform speed?

68. The length and breadth of a school ground are 150m and 90m respectively, while the length and breadth of a mela ground are 210m and 126m, respectively. Are these measurements in proportion?



(Comparative areas of the continents)

Fig. 8.4

69. In Fig. 8.4, the comparative areas of the continents are given: What is the ratio of the areas of

(a) Africa to Europe

(b) Australia to Asia

(c) Antarctica to Combined area of North America and South America.

70. A tea merchant blends two varieties of tea costing her Rs 234 and Rs 130 per kg in the ratio of their costs. If the weight of the mixture is 84kg, then find the weight of each variety of tea.

71. An alloy contains only zinc and copper and they are in the ratio of 7:9. If the weight of the alloy is 8kg, then find the weight of copper in the alloy.

72. In the following figure, each division represents 1cm:



Fig. 8.5

Express numerically the ratios of the following distances:

(i) AC : AF (ii) AG : AD (iii) BF : AI (iv) CE : DI

73. Find two numbers whose sum is 100 and whose ratio is 9 :16.

74. In Fig. 8.6 (i) and Fig. 8.6 (ii), find the ratio of the area of the shaded portion to that of the whole figure:

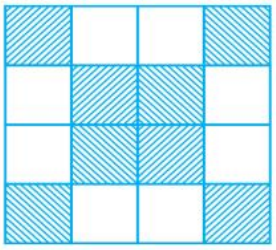


Fig. 8.6 (i)

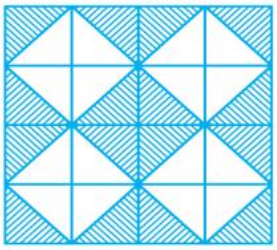


Fig. 8.6 (ii)

75. A typist has to type a manuscript of 40 pages. She has typed 30 pages of the manuscript. What is the ratio of the number of pages typed to the number of pages left?

76. In a floral design made from tiles each of dimensions 40cm by 60cm (See Fig. 8.7), find the ratios of:

(a) the perimeter of shaded portion to the perimeter of the whole design.

(b) the area of the shaded portion to the area of the unshaded portion.

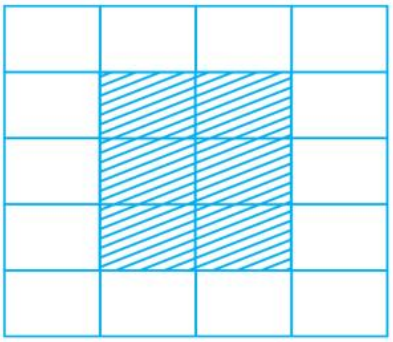


Fig. 8.7

77. In Fig. 8.8, what is the ratio of the areas of

(a) shaded portion I to shaded portion II ?

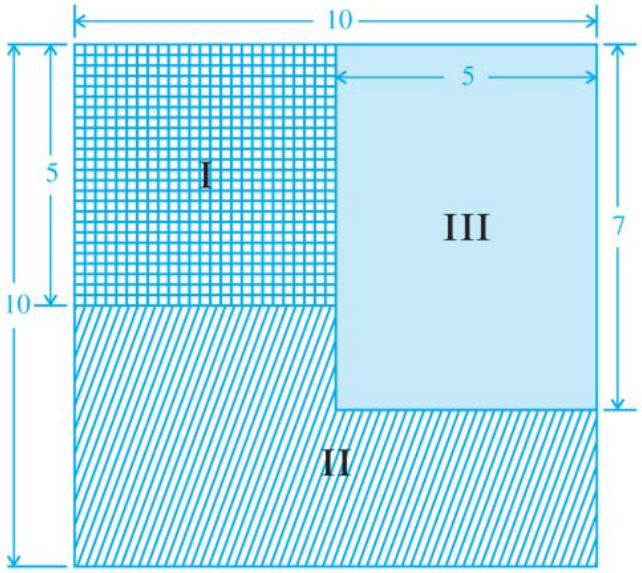


Fig. 8.8

(b) shaded portion II to shaded portion III?

(c) shaded portions I and II taken together and shaded portion III?

78. A car can travel 240km in 15 litres of petrol. How much distance will it travel in 25 litres of petrol?

79. Bachhu Manjhi earns Rs 24000 in 8 months. At this rate,

(a) how much does he earn in one year?

(b) in how many months does he earn Rs 42000?

80. The yield of wheat from 8 hectares of land is 360 quintals. Find the number of hectares of land required for a yield of 540 quintals?

81. The earth rotates 360° about its axis in about 24 hours. By how much degree will it rotate in 2 hours?

82. Shivangi is suffering from anaemia as haemoglobin level in her blood is lower than the normal range. Doctor advised her to take one iron tablet two times a day. If the cost of 10 tablets is Rs 17, then what amount will she be required to pay for her medical bill for 15 days?

83. The quarterly school fee in Kendriya Vidyalaya for Class VI is Rs 540. What will be the fee for seven months?

84. In an election, the votes cast for two of the candidates were in the ratio 5 : 7. If the successful candidate received 20734 votes, how many votes did his opponent receive?

85. A metal pipe 3 metre long was found to weigh 7.6kg. What would be the weight of the same kind of 7.8m long pipe?

86. A recipe for raspberry jelly calls for 5 cups of raspberry juice and $2\frac{1}{2}$ cups of sugar. Find the amount of sugar needed for 6 cups of the juice?

87. A farmer planted 1890 tomato plants in a field in rows each having 63 plants. A certain type of worm destroyed 18 plants in each row. How many plants did the worm destroy in the whole field?

88. Length and breadth of the floor of a room are 5m and 3m, respectively. forty tiles, each with area $\frac{1}{16}$ m^2 are used to cover the floor partially. Find the ratio of the tiled and the non tiled portion of the floor.

89. A carpenter had a board which measured 3m × 2m. She cut out a rectangular piece of 250cm × 90cm. What is the ratio of the area of cut out piece and the remaining piece?

Rough Work

Rough Work

11.4.2018