



Government of Tamilnadu

Department of Employment and Training

Course : TNPSC Group I Mains Material
Subject : General Aptitude & Mental Ability
Topic : **Ratio and Proportion**

© Copyright

The Department of Employment and Training has prepared the TNPSC Group-I Preliminary and Main Exam study material in the form of e-content for the benefit of Competitive Exam aspirants and it is being uploaded in this Virtual Learning Portal. This e-content study material is the sole property of the Department of Employment and Training. No one (either an individual or an institution) is allowed to make copy or reproduce the matter in any form. The trespassers will be prosecuted under the Indian Copyright Act.

It is a cost-free service provided to the job seekers who are preparing for the Competitive Exams.

Commissioner,
Department of Employment and Training.

Ratio and Proportion

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'.
- 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 $1/2$ or 1 to 2 .

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 $2 \text{ km} : 1 \text{ km}$.
- 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.

Proportion

When two ratios are equal $a/b = c/d$, 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

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.

Proportionality law

If two ratios are in proportion i.e., $a : b :: c : d$ 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 i.e., $a/b = c/d \rightarrow ad - bc$ is called the cross product of proportions.

Ratio - comparison of sizes of two quantities of same unit

Proportion - equality of two ratios

Proportionality law

If two ratios are in proportion $a : b :: c : d$ then product of extremes is equal to the product of means a, d - extremes ; b, c - means $a \times d = b \times c$

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

Solution:

$$3 : 2 :: 30 : 20$$

$$a : b :: c : d$$

$$a \times d = b \times c$$

$$3 \times 20 = 2 \times 30$$

$$60 = 60$$

$3 : 2, 30 : 20$ are in proportion.

2. 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?

Solution:

Cost of dozen balls, 12 balls = ₹ 180

$$1 \text{ ball} = \frac{180}{12}$$

Cost of 1 ball = ₹ 15

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

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

Solution:

In 40 minutes = 3 units electricity used

Electricity usage in 1 minute = $\frac{3}{40}$ units

2 hours (120 mins) = $\frac{3}{40} \times 120$

= 9 units.

9 units of electricity used in 2 hours.

4. Cost of 3 pens is ₹ 18, cost of 5 pens is

Solution:

Cost of 3 Pens = ₹ 18

Cost of 1 Pen = $\frac{18}{3} = ₹ 6$

∴ Cost of 5 Pens = ₹ 30.

5. A person read 20 pages of book in 2 hours, how many pages will read in 8 hours at same speed.

Solution:

In two hours, no. of pages read = 20 pages

In 1 hour, no. of page read = 10 pages

∴ 8 hours, no. of page read = 80 pages.

6. Cost of 15 chairs is ₹ 7500. Find the number of such chairs purchased for ₹ 12000?

Solution:

Cost of 15 chairs = ₹ 7,500

Cost of 1 chair = $\frac{7500}{15} = ₹ 500$

No. of chair purchased for ₹ 12,000 = $\frac{12000}{500}$

= 24 chairs.

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

Solution:

5 kg of LP Gas covers = 125 km

$$1 \text{ kg of LP Gas covers} = \frac{125}{5} = 25 \text{ km}$$

$$\therefore 3 \text{ kg of LP Gas covers} = 25 \times 3 = 75 \text{ km}$$

8. If Cholan walks 6 km in 1 hour at constant speed find the distance covered by him in 20 minutes?

Solution:

In 1 hour, Cholan walks = 6 km

$$1 \text{ min Cholan walks} = \frac{54}{9} = \frac{54}{9} \text{ km}$$

$$\therefore \text{In 20 minutes Cholan walks} = \frac{54}{9} \times 20 = 2 \text{ km.}$$

9. Number of correct answers given by kaarmugilan and Kavitha in a quiz competition are in the ratio of 10 : 11. If they had scored a total of 84 points in the competition, then how many points did Kavitha get.

Solution:

Number of correct answers = $10x : 11x$

$$\text{Given, } 10x + 11x = 84$$

$$21x = 84$$

$$x = \frac{84}{21} \Rightarrow x = 4$$

$$\therefore \text{Kavitha gets} = 11x \text{ Points}$$

$$= 11 \times 4 = 44 \text{ Points.}$$

10. Karmegam made 54 runs in 9 over Asif made 77 runs in 11 over Whose run rate is better? (run rate = ratio of run to overs)

Solution:

$$\text{Karmegam run rate} = \frac{54}{9} = 6$$

$$\text{Asif's run rate} = \frac{77}{11} = 7$$

Asif's run rate is better.

11. If 7 : 5 is in proportion to x : 25, then 'x' is

Solution:

$$7 : 5 :: x : 25$$

$$7 \times 25 = 5x \Rightarrow \frac{7 \times 25}{5} = x$$

$$x = 35.$$

12. 3 : 5 :: □ : 20

Solution:

$$a \times d = b \times c$$

$$3 \times 20 = 5 \times x$$

$$60 = 5x$$

$$x = 12$$

- 13 : 5 :: □ : 10 : 8 :: 15 : □

$$a : b :: c : d$$

Solution:

$$5 \times 8 = 10x$$

$$40 = 10x$$

$$x = 4$$

$$\text{Ans: } 5 : \boxed{4} :: 10 : 8 :: 15 : \boxed{12}$$

$$10 \times x = 8 \times 15$$

$$x = 12$$

13. If 6 children shared 24 pencils equally, then how many chart papers pencils are required for 18 children.

Solution:

$$6 \text{ children shared} = 24 \text{ pencils} \quad (6 \times 3 = 18)$$

$$18 \text{ children shared} = 24 \times 3 \text{ pencils} \quad (24 \times 3 = 72)$$

$$= 72 \text{ pencils.}$$

14. If 15 chart papers together weigh 50 grams, how many chart papers of the same type will be there in a pack of 2½ kg?

Solution:

$$\text{In 50 gms, No. of chart papers} = 15 \quad (50 \times 50 = 2500); (15 \times 50 = 750)$$

$$\text{In 2500 gms, No. of chart papers} = 15 \times 50$$

$$= 750 \text{ papers.}$$

15. Anbu bought 2 notebooks for ₹ 24. How much money will be needed to buy 9 of such books

Solution:

$$\text{Cost of 2 notebook} = ₹ 24$$

$$\text{Cost of 1 notebook} = ₹ 12$$

$$\text{Cost of 9 notebook} = 9 \times 12$$

$$= ₹ 108.$$

16. A car travels 90 km in 2 hours 30 minutes. How much time is required to cover 210 km.

Solution:

Time taken to cover 90 km = 5 hrs 30 mins

$$\text{Time taken to cover 1 km} = \frac{150}{90} = \frac{15}{9}$$

$$\begin{aligned}\text{Time taken to cover 210 km} &= \frac{15}{9} \times 210 = 350 \text{ mins} \\ &= \frac{350}{60} \text{ 5 hrs 50 mins} \\ &= \text{5 hrs 50 mins.}\end{aligned}$$

17. If the cost of 8 apples is ₹ 56 then cost of 12 apples is?

Solution:

Cost of 8 apples = ₹ 56

$$\text{Cost of 1 apples} = \frac{56}{8} = ₹ 7$$

$$\text{Cost of 12 apples} = 7 \times 12 = ₹ 84.$$

18. If the weight of one fruit box is $3\frac{1}{2}$ kg, then weight of 6 such boxes is?

Solution:

$$\text{weight of one fruit box} = \frac{7}{2} \text{ kg}$$

$$\begin{aligned}\text{weight of 6 box} &= \frac{7}{2} \times 6 \\ &= 21 \text{ kg.}\end{aligned}$$

19. A car can travels 60 km with 3 litres of petrol If the car has to cover the distance of 200 km. It requires how many litres of petrol?

Solution:

60 km travel = 3 lit petrol

$$10 \text{ km travel} = \frac{3}{6} = \frac{1}{2} \text{ litres}$$

$$\begin{aligned}200 \text{ km travel} &= \frac{1}{2} \times 20 \\ &= 10 \text{ litres.}\end{aligned}$$

20. If a machine in a cool drinks factory can fill 600 bottles in 5 hrs, then how many bottles it could fill in 3 hrs.

Solution:

In 5 hrs, It fill = 600 bottles

In 1 hr, It fill = 120 bottles

In 3 hrs, It fill = $120 \times 3 = 360$ bottles.

21. A birthday party arranged in 3rd floor of a hotel. 120 people takes 8 trips in a lift to go to the party hall. If 12 trips were made, how many people would have attended.

Solution:

8 trips = 120 people

people travelled per trip = $\frac{120}{8}$

12 trips, No. of people travelled = $\frac{120}{8} \times 12$
 = 180 people attended the party.

22. The shadow of a pole with the height of 8m is 6 m. If the shadow of another pole measured at same time is 30 m, Then find the height of the pole?

Solution:

	1 st pole	2 nd pole
height of the pole	= 8 m	height = ?
shadow of the pole	= 6 m	shadow = 30 m
	$8 : 6 :: x : 30$	
	$6x = 8 \times 30$	
	$6x = 240$	
	$x = 40$ m height.	

23. If a postman can sort out 738 letters in 6 hours, how many letters sorted in 9 hours?

Solution:

In 6 hours postman sorted = 738 letters

In 1 hour postman sorted = $\frac{738}{6} = 123$ letters

In 9 hours postman sorted = 123×9
 = 1107 letters.

24. If half a meter of cloth cost ₹ 15, Then find the cost of $8\frac{1}{3}$ meter of same cloth.

Solution:

Cost of half meter of cloth = ₹ 15

Cost of one meter of cloth = ₹ 30

$$\begin{aligned}\text{Cost of } \frac{25}{3} \text{ meter of cloth} &= 30 \times \frac{25}{3} \\ &= ₹ 250.\end{aligned}$$

25. Valli purchases 10 pens for ₹ 180 and Kamala buys 8 pens for ₹ 96. Can you say who bought the pen cheaper?

Solution:

Valli purchases 10 pens = ₹ 180

Cost of 1 pen = ₹ 18

Kamala purchases 8 pens = ₹ 96

Cost of 1 pens = ₹ 12

Kamala bought cheaper.

26. A motorbike requires 2 litres of petrol to cover 100 kilometres. How many litres of petrol will be required to cover 250 km?

Solution:

100 kilometer travel required = 2 litres of petrol

$$1 \text{ kilometer travel required} = \frac{2}{100}$$

$$250 \text{ kilometer travel required} = \frac{2}{100} \times 250$$

= 5 litres of petrol.

27. If an aircraft can accommodate 280 people in 2 trips. It can take how many trips to take 1400 people.

Solution:

$$280 : 2 :: 1400 : x$$

$$280x = 2 \times 1400$$

$$x = \frac{2 \times 1400}{280}$$

$x = 10$. (1400 people take 10 trips)

28. Suppose 3 kg of Sugar is used to prepare sweets for 50 members, then how many kg of sugar is required for 150 members.

Solution:

$$3 : 50 :: x : 150$$

$$50x = 3 \times 150$$

$$x = \frac{3 \times 150}{50}$$

$$x = 9. \text{ (9 kg sugar required for 150 members)}$$

29. Cost of 1 box of tomato is ₹ 200. Vendan had money to buy 13 boxes. If the cost of box is increased to ₹ 260, then how many boxes will buy with same amount.

Solution:

$$13 \times 200 = x \times 260$$

$$x = 10 \text{ boxes.}$$

He can buy 10 boxes for same amount.

30. If the cost of 7 kg of onions is ₹ 84 then find the weight of onions bought for ₹ 180, and cost of 3 kg of onions?

Solution:

$$\text{Cost of 7 kg of onions} = ₹ 84$$

$$\text{Cost of 1 kg of onions} = \frac{84}{7} = ₹ 12$$

$$\text{i) Weight of onions bought for ₹ 180} = \frac{180}{12}$$

$$= 15 \text{ kg bought for ₹ 180.}$$

$$\text{ii) Cost of 3 kg of onions} = 3 \times 12 = ₹ 36.$$

31. For every 3 months Tamilselvan deposits ₹ 5000 as savings in his Bank account. In how many years he could save ₹ 1,50,000

Solution:

$$\text{In every 3 month Tamilselvan deposit} = ₹ 5000$$

$$\text{He deposit} = \frac{5000}{3} \text{ month}$$

$$\text{No. of years to save 1,50,000} = \frac{150000 \times 3}{5000} = 90 \text{ months.}$$

32. If the cost of 6 cans of juice is ₹ 210, then what will be the cost of 4 cans of juice.

Solution:

$$\overbrace{6 : 210 :: 4 : x}$$

$$6x = 210 \times 4$$

$$x = \frac{210 \times 4}{6}$$

$$x = 140.$$

Cost of 4 cans of juice = ₹ 140.

33. A flood relief camp has food stock by which 80 people can be benefitted for 60 days. After 10 days 20 more people have joined the camp. Calculate the number of days of food shortage due to the addition of 20 more people

Solution:

$$\text{Total food stock} = 80 \times 60 = 4800$$

$$10 \text{ days } 80 \text{ people benefitted} = 10 \times 80 = 800$$

$$\text{Remaining food stock} = 4800 - 800 = 4000$$

$$\text{Remaining days } 100 \text{ people benefitted} = \frac{4000}{100} = 40 \text{ days}$$

$$\text{Total no. of days} = 40 + 10 = 50 \text{ days} \quad [60 - 50 = 10]$$

$$\text{No. of days food shortage due to the addition of food shortage} = 10 \text{ days}$$

Another Method:

20 more people added

$$80 \times 60 = (80 \times 10) + (100 \times x)$$

↓
days

↓
days

↓
days

$$4800 = 800 + 100x$$

$$100x = 4000$$

$$x = 40 \text{ days}$$

$$\text{Total} = 40 + 10 = 50 \text{ days.}$$

$$\text{Food shortage} = 60 - 50 = 10 \text{ days.}$$

34. Cost of 105 notebooks is ₹ 2415. How many notebooks can be bought for ₹ 1863.

Solution:

(Direct Proportion)

$$105 : 2415 :: x : 1863$$

$$105 \times 1863 = 2415x$$

$$x = \frac{105 \times 1863}{2415}$$

$$x = 81.$$

81 Notebooks bought for ₹ 1863.

35. 10 farmers can plough a field in 21 days find the number of days reduced if 14 farmers ploughed the same field.

Solution:

$$10 \times 21 = 14 \times x$$

$$x = \frac{10 \times 21}{14}$$

$$x = 15 \text{ days.}$$

$$= 21 - 15 = 6 \text{ days.}$$

6 days reduced of 14 farmers plough the same field.

