UNIT 6

UNITARY METHOD

6.1 Unitary Method

6.1.1 Describe the concept of unitary method.

Unitary means "of one". In unitary method the cost of several objects is given and then by finding the cost of one object we can calculate the cost of many objects.

6.1.2 Calculate the value of many objects of the same kind when the value of one of these objects is given.

If the value of one object is known we can find the value of many objects of the same kind by multiplication. Following example illustrates this process.

Example Cost of 1 book is Rs. 20. What is the cost of 10 such books?

Solution:

Cost of 1 book = Rs. 20

Cost of 10 books = 20 × 10

= Rs. 200

Cost of 10 books is Rs. 200.

Multiply the value of one object by the number of more objects.

6.1.3 Calculate the value of one object when the value of many objects of the same type is given

Let us explain this method with the help of a few examples.

Example 1 If 4 oranges cost Rs.12, how much do 9 oranges cost?

Solution

Cost of 4 oranges = Rs. 12

Cost of 1 orange $= \frac{12}{4}$ = Rs. 3

Cost of 9 oranges = 9 × 3 = Rs. 27

Cost of 9 oranges is Rs. 27

Example 2 Cost of 5 pens is Rs 125. What is the cost of 10 pens?

Solution Cost of 5 pens = Rs. 125

$$\text{Cost of 1 pen} = \frac{125}{5} = \text{Rs. } 25$$

Cost of 10 pens = 10×25 = Rs. 250

Cost of 10 pens is Rs. 250

Example 3 5 workers can complete a work in 22 days. In how many days same work will be completed if 11 workers are employed?

Solution 5 workers can complete a work in = 22 days

1 worker can complete the work in = $5 \times 22 = 110$ days

$$11 \text{ workers can complete the work in} = \frac{110}{11} = 10 \text{ days}$$

11 workers can complete the work in 10 days.

Exercise 6.1

1. If a carpet is sold for Rs.1,550 per square metre, how much will it cost to cover a room that measures 20 square metres?
2. If 4 litres of paint can cover 1,120 square metres, how many square metres will 7 litres of paint cover?
3. If the scale on a map reads 2 *cm* = 50 *km*, how many *km* are there between two cities whose distance on a map is 7.5 *cm*?
4. If a person burns 120 calories in 15 minutes of cycling, how many calories will the person burn in 75 minutes?
5. If a pizza delivery person drives 276 *km* in 3 days, how many *km* will the person drive in 5 days?

6. If an author writes 3 chapters in 10 days, how long will it take the author to write a 15 chapter book?
7. If it takes 12 metres cloth to make 3 dresses, how many metres of cloth will be needed to make 10 dresses?
8. If 4 *kg* of grass seed covers 1,250 square metres, how many *kg* of grass seed will be needed to cover 3,000 square metres?
9. Parvez earns Rs. 3,600 in 4 days. How many days will it take him to earn Rs. 4,500?

6.2 Direct and Inverse Proportion

6.2.1 Define ratio of two quantities.

A ratio is a relation between two quantities of the same kind. It can be expressed as a fraction. The symbol for ratio is a colon (:). Ratio shows how much of one quantity there is as compared to another quantity. Ratios are used to make comparisons between quantities. In general, the ratio of a to b is written as $a : b = \frac{a}{b}$.

Examples

i. The ratio of 4 to 10 is 4:10 or $\frac{4}{10}$ which reduces to 2:5 .

ii. If there is 1 boy and 3 girls, we can write the ration as:

$1 : 3 = \frac{1}{3}$

6.2.2 Define and identify direct and inverse proportion.

Direct Proportion: It is a relationship between two quantities such that if one increases, other also increases. If one decreases, the other also decreases.

Inverse Proportion: It is a relationship between two quantities such that if one increases, other decreases. If one decreases, the other increases.

Some situations of Direct Proportion:

- More articles, more money is required to purchase. Fewer articles, less money is required to purchase.
- More men at work, more work is done. Fewer men at work, lesser work is done.
- More money borrowed, more interest is to be paid. Less money borrowed, less interest is to be paid.
- More speed, more distance is covered in fixed time. Less speed, less distance is covered in fixed time.
- More working hours, more work will be done. Less working hours, less work will be done.

Some situations of Inverse Proportion.

- More men at work, less time is taken to finish the same work.
- More speed, less time is taken to cover the same distance.
- More men in the camp and less number of days for food stock to last.
- More is the cost less you could buy with the same amount of money.

6.2.3 Solve real life problems involving direct and inverse proportion (by unitary method).

Unitary method can be used to solve real life problems involving direct and inverse proportions. Following examples illustrate the process of solving problems.

(a) Direct Proportion by Unitary Method

Example 1 If 12 flowers cost Rs.156, what do 28 flowers cost?

Solution This is the situation of direct proportion as: More flowers result in more cost.

Cost of 12 flowers = Rs. 156

$$\text{Cost of 1 flower} = \frac{156}{12} = \text{Rs. } 13$$

Cost of 28 flowers = 13×28 = Rs. 364

Example 2 A car travels 240 *km* in 40 litres of petrol. How much distance will it cover in 9 litres of petrol?

Solution This is the situation of direct proportion as: Less quantity of petrol, less distance is to be covered.

In 40 litres of petrol, distance covered = 240 *km*

$$\text{In 1 litres of petrol, distance covered} = \frac{240}{40} = 6 \text{ } km$$

In 9 litres of petrol, distance covered = $6 \times 9 = 54$ *km*

Example 3 A labourer gets Rs.9800 for 14 days work. How many days should he work to get Rs.21,000?

Solution This is a situation of direct proportion as: more money will be received for working more days.

Number of days to earn Rs. 9,800 = 14 days

$$\text{Number of days to earn Rs. 1} = \frac{14}{9,800} \text{ days}$$

$$\text{Number of days to earn Rs. 21,000} = \frac{14}{9,800} \times 21,000$$

$$= 30 \text{ days.}$$

Therefore, Rs.21,000 can be earned by a labourer in 30 days.

(b) Inverse Proportion by Unitary Method

Real life problems involving inverse proportion can be solved using unitary method. This is illustrated by the following examples.

Example 1 16 men can build a wall in 56 hours. How many men will be required to do the same work in 32 hours?

Solution This is a situation of inverse proportion as: More the number of men, then faster they will build the wall i.e., less number of days needed.

Number of men who build the wall in 56 hours = 16 men

Number of men who build the wall in 1 hour = 16×56 men

Number of men who can build the wall in 32 hours = $\frac{16 \times 56}{32}$

= 28 men

Therefore, in 32 hours, wall is built by 28 men.

Example 2 12 typists can type a book in 18 days. In how many days 4 typists will type the same book?

Solution

This is a situation of indirect proportion as: Less number of typists will take more days.

Number of days in which 12 typists can type a book = 18 days

Number of days in which 1 typist can type a book = 18×12

Number of days in which 4 typists can type a book = $\frac{18 \times 12}{4}$

= 54 days

Therefore, 4 typists will type a book in 54 days.

Example 3 If 72 workers can do a piece of work in 40 days. How many more days are required to complete the same work if 8 workers left the job?

Solution This is a situation of indirect proportion as: Less workers will require more days to complete the work.

Number of workers left the job = 8

Number of remaining workers to complete work = $72 - 8 = 64$

Number of days to complete work by 72 workers = 40 days

Number of days to complete work by 1 worker = 72×40

Number of days to complete work by 64 workers = $\frac{72 \times 40}{64}$ = 45 days

More number of days = $45 - 40 = 5$ days

Therefore, 64 workers will require 5 more days to complete the same work.

Exercise 6.2

1. 12 farmers harvest the crops in 20 hours. How many farmers will be required to do the same work in 15 hours?
2. The weight of 56 books is 8 kg. What is the weight of 152 such books?
3. John types 450 words in half an hour. How many words would he type in 7 minutes?
4. A worker is paid Rs.7500 for 6 days' work. If he works for 23 days, how much will he get?
5. A water tank can be filled in 7 hours by 5 equal sized pumps working together. How much time will 7 pumps take to fill it up?
6. 15 masons can build the wall in 20 days. How many masons will build the wall in 12 days?
7. 76 persons can complete the job in 42 days. In how many days will 56 persons do the same job?
8. In a camp, there is food for 400 persons for 23 days. If 60 more persons join the camp, find the number of days the provision will last.
9. The freight for 75 quintals of goods is Rs. 375. Find the freight for 42 quintals.
10. A car travels 228 km in 3 hours.
    (a) How long will it take to travel 912 km?
    (b) How far will it travel in 7 hours?

11. The weight of 56 books is 7 kg.

(a) What is the weight of 90 such books?

(b) How many such books weigh 7.5 Kg?

Review Exercise 6

1. Four possible options have been given. Encircle the correct one.

i. If the cost of several objects is given and by finding the cost of one object the cost of many objects is calculated then this method is called:

(a) unitary method (b) direct proportion method

(c) inverse proportion method (d) ratio

ii. The cost of 15 pens is Rs. 105. What is the cost of one pen?

(a) Rs. 120 (b) Rs. 95

(c) Rs. 7 (d) Rs. 1

iii. A car travels 90 km in 10 litres of petrol. How many litres of petrol is needed to travel 180 km?

(a) 15 litres (b) 20 litres

(c) 25 litres (d) 30 litres

iv. If the value of many objects of the same kind is known we can find the value of one of these objects by:

(a) addition (b) subtraction

(c) multiplication (d) division

v. If the value of many objects of the same kind is known we can find the value of one of these objects by:

(a) multiplication (b) division

(c) ratio (d) unitary method

vi. A relation between two quantities of the same kind by division is called:

(a) ratio (b) proportion

(c) unitary method (d) all of the above

vii. A relationship between two quantities such that if one increases, other also increases. If one decreases, the other also decreases is called:

(a) unitary method (b) ratio

(c) direct proportion (d) inverse proportion

viii. A relationship between two quantities such that if one increases, other decreases is called:

(a) unitary method (b) ratio

(c) direct proportion (d) inverse proportion

ix. More working hours, more work will be done. Less working hours, less work will be done. What kind of relation it is?

(a) unitary method (b) ratio

(c) direct proportion (d) inverse proportion

x. More men at work, less time taken to finish the work. What is the kind of this relation?

(a) unitary method (b) ratio

(c) direct proportion (d) inverse proportion

2. Ashraf bought a dozen pens for Rs. 144. Find the cost of 15 such pens.

3. The cost of 2 kg of onions is Rs.24. What will the cost of 12 kg of onions?

4. 12 tailors can stitch 15 shirts in a day. How many shirts will be stitched by 28 tailors in a day?

5. A train is moving at a uniform speed of 68 km per hour. How far will it go in 15 minutes?

6. A man is paid Rs.7700 for 7 days. If he works for 21 days, how much will he get?

7. In 8 hours, workers fill 960 bottles of cold drinks. How many bottles will be filled in 6 hours?

8. Ahmad reads 21 pages of a book every day and finishes the book in 30 days. If he reads 18 pages in a day, in how many days will he finish the book?

9. 6 pipes are required to fill the tank in 64 minutes. How many pipes are required to fill the tank in 96 minutes?

10. If 17 men can complete the work in 42 hours. How many men will be required to do the same work in 34 hours?

11. A school has 8 periods in a day such that each period is of 35 minutes. If the number of periods is reduced to 7, then how long would each period be?

12. 500 soldiers in a fort had enough food for 30 days but 125 soldiers were transferred to another fort. For how many days did the food last then?

13. 5 pumps working together can empty the tank in 36 minutes. How long will it take to empty the tank if 9 such pumps are working together?

Summary

- In unitary method the cost of several objects is given and then by finding the cost of one object we can calculate the cost of many objects.
- If we know the cost of one object, then to know the cost of many objects we will do multiplication.
- If we know the cost of many objects, then to know the cost of one object we will do division.
- If the value of one object is known, we can find the value of many of these objects by multiplication.
- If the value of many objects of the same kind is known, we can find the value of one of these objects by unitary method.
- A ratio is a relation between two quantities of the same kind. It can be expressed as a fraction. The symbol for ration is a colon (:).
- Ratio shows how much of one quantity is compared to another quantity. Ratios are used to make comparisons between quantities.
- In general, the ratio of a to b is written as $a:b=\frac{a}{b}$.
- Direct Proportion is a relationship between two quantities such that if one increases, other also increases. If one decreases, the other also decreases.
- Inverse Proportion is a relationship between two quantities such that if one increases, other decreases. If one decreases, the other increases.