Chapter 5

UNITARY METHOD AND ITS APPLICATIONS

In the previous class, you learnt how to solve some real life simple problems using unitary method and also by using multiplying ratio method. We also solved problems on time and work. In this chapter, we shall refresh that knowledge and add a few tougher problems. We will also solve problems involving more than two different types of quantities.

UNITARY METHOD

A method in which the value of a unit quantity is first obtained to find the value of any required quantity, is called ***unitary method***.

In solving problems based on unitary method, we come across two types of variations:

(*i*) ***Direct variation*** (*ii*) ***Inverse variation***

Direct variation

Two quantities are said to ***vary directly*** *if the increase (or decrease) in one quantity causes the increase (or decrease) in the other quantity.*

For example :

(*i*) The cost of articles varies directly to the number of articles.
More articles, more cost.
Less articles, less cost.

(*ii*) The work done varies directly to the number of men at work.
More men at work, more work done.
Less men at work, less work done.

(*iii*) The work done varies directly to the working time.
More work done in more time.
Less work done in less time.

(*iv*) The distance covered by a moving object varies directly to its speed.
More speed, more distance covered in same time.
Less speed, less distance covered in same time.

In direct variation, the ratio of one kind of like terms is equal to the ratio of second kind of like terms.

Inverse variation

Two quantities are said to ***vary inversely*** *if the increase (or decrease) in one quantity causes the decrease (or increase) in the other quantity.*

For example :

(*i*) The time taken to finish a work varies inversely to the number of men at work.

More men at work, less time taken to finish the work.

Less men at work, more time taken to finish the work.

(*ii*) The speed of a moving object varies inversely to the time taken to cover a certain distance.

More speed, less time taken to cover the same distance.

Less speed, more time taken to cover the same distance.

> ***In inverse variation, the ratio of one kind of like terms is equal to the inverse ratio of second kind of like terms.***

Sometimes, neither the idea of direct variation nor the idea of inverse variation applies.

For example :

(*i*) If the weight of a girl is 3 kg when she is 1 day old, we cannot say that her weight will be 15 kg when she is 5 days old.

(*ii*) If the height of a plant is 5 cm when it is 2 weeks old, we cannot say that its height will be 20 cm when it is 8 weeks old.

(*iii*) If your mother alone can cook an omellete in 10 minutes, we cannot say that your mother and father cooking together can do it in 5 minutes. Probably, it will still take 10 minutes to cook the omellete.

Thus, when using unitary method, we have to use common sense to see whether the direct variation applies or the inverse variation applies or there is no such variation.

A unitary method involving two different types of quantities is called a **single unitary method** and a unitary method involving more than two different types of quantities is called a **compound unitary method.**

Example 1. If 7 kg sugar costs ₹ 115·50, what is the cost of 12 kg sugar?

Solution. Cost of 7 kg sugar is ₹ 115·50

Less sugar, less cost

$\therefore$ cost of 1 kg sugar = ₹ $\frac{115 \cdot 50}{7}$ = ₹ 16·50

More sugar, more cost

$\therefore$ cost of 12 kg sugar = ₹ (16·50 × 12) = ₹ 198.

Using multiplying ratio method

More sugar, more cost Direct variation

As the quantity of sugar increases in the ratio 7 : 12, the cost of sugar also increases in the ratio 7 : 12.

Multiplying ₹ 115·50 by the ratio $\frac{12}{7}$,

the cost of 12 kg sugar = $\frac{12}{7}$ of ₹ 115·50 = ₹ $\left(\frac{12}{7} \times 115 \cdot 50\right)$

= ₹ (12 × 16·50) = ₹ 198.

Example 2. If one score eggs cost ₹ 35, how many eggs can be bought for ₹ 63?

Solution. Since for ₹ 35, the number of eggs bought is one score *i.e.* 20.

$\therefore$ for ₹ 1, the number of eggs bought = $\frac{20}{35}$

$\therefore$ for ₹63, the number of eggs bought = $\frac{20}{35} \times 63 = 36$.

Multiplying ratio method

As the money increases in the ratio 35 : 63 *i.e.* 5 : 9, the number of eggs also increases in the ratio 5 : 9

More money, more eggs
Direct variation

Multiplying one score *i.e.* 20 by $\frac{9}{5}$, the number of eggs bought

$= \frac{9}{5} \times 20 = 36$.

Example 3. Sheetal has enough money to buy 5 kg mangoes at the rate of ₹18 per kg. How much quantity of mangoes she can buy in the same money if the price is increased to ₹20 per kg?

Solution. The price of 5 kg mangoes at the rate of ₹18 per kg = ₹(5 × 18)= ₹90. Thus, Sheetal has ₹90.

Now for ₹20, the quantity of mangoes available = 1 kg

$\therefore$ for ₹1, the quantity of mangoes available $= \frac{1}{20}$ kg

$\therefore$ for ₹90, the quantity of mangoes available $= \left(90 \times \frac{1}{20}\right)$ kg

$= \frac{9}{2}$ kg = 4·5 kg.

Multiplying ratio method

As the price of mangoes increases in the ratio 18 : 20 *i.e.* 9 : 10, the quantity of mangoes decreases in the ratio 10 : 9

Price increases, quantity decreases
Inverse variation

Multiplying 5 kg by the ratio $\frac{9}{10}$, the quantity of mangoes that can be bought in the same money

$= \frac{9}{10}$ of 5 kg $= \left(\frac{9}{10} \times 5\right)$ kg $= \frac{9}{2}$ kg = 4·5 kg.

Example 4. 20 labourers can dig a pond in 12 days. How many days will it take 16 labourers to dig the same pond?

Solution. 20 labourers can dig a pond in 12 days

Less labourers, more days

$\therefore$ 1 labourer will dig the pond in (20 × 12) days

$\therefore$ 16 labourers will dig the pond in $\frac{20 \times 12}{16}$ days

= 15 days.

More labourers, less days

Multiplying ratio method

As the number of labourers decrease in the ratio 20 : 16 *i.e.* 5 : 4, the number of days to dig the pond will increase in the ratio 4 : 5.

Less labourers, more days
Inverse variation

Multiplying 12 days by the ratio $\frac{5}{4}$, the number of days required to dig the pond

$= \frac{5}{4}$ of 12 days $= \left(\frac{5}{4} \times 12\right)$ days = 15 days.

Example 5. A hostel had rations for 150 students for 60 days. After 12 days, 30 more students join the hostel. How long will the remaining ration last?

Solution. After 12 days, the ration is sufficient for 150 students for (60 – 12) days *i.e.* 48 days.

After 12 days, 30 more students join the hostel. So number of students in the hostel = 150 + 30 = 180

Less students, more days

Since for 150 students, the ration is sufficient for 48 days

∴ for 1 student, the ration is sufficient for (150 × 48) days

∴ for 180 students, the ration is sufficient for $\frac{150 \times 48}{180}$ days = 40 days.

Multiplying ratio method

After 12 days, the ration is sufficient for 150 students for 48 days. As 30 more students join the hostel, number of students in the hostel

= 150 + 30 = 180

More students, ration lasts for less days Inverse variation

As the number of students increases in the ratio 150 : 180 *i.e.* 5 : 6, the number of days for which the ration lasts decreases in the ratio 6 : 5.

Multiplying 48 days by $\frac{5}{6}$, the number of days for which the remaining ration lasts = $\frac{5}{6}$ of 48 days = $\left(\frac{5}{6} \times 48\right)$ days = 40 days.

Example 6. If 3 men or 4 women can earn ₹480 in a day, find how much will 7 men and 11 women earn in a day?

Solution. Since in a day, 3 men can earn ₹480

∴ in a day, 1 man will earn ₹ $\frac{480}{3}$ = ₹160

∴ in a day, 7 men will earn ₹(160 × 7) = ₹1120.

Since in a day, 4 women can earn ₹480

∴ in a day, 1 woman will earn ₹ $\frac{480}{4}$ = ₹120

∴ in a day, 11 women will earn ₹(120 × 11) = ₹1320

∴ Total earning of 7 men and 11 women in a day

= ₹(1120 + 1320) = ₹2440.

Example 7. If the wages of 15 labourers for 6 days are ₹7200, find the wages of 23 labourers for 5 days.

Solution. Since wages of 15 labourers for 6 days are ₹7200.

∴ wages of 1 labourer for 6 days = ₹ $\frac{7200}{15}$ = ₹480

∴ wages of 1 labourer for 1 day = ₹ $\frac{480}{6}$ = ₹80

∴ wages of 23 labourers for 1 day = ₹(80 × 23) = ₹1840

∴ wages of 23 labourers for 5 days = ₹(1840 × 5) = ₹9200.

Example 8. If 7 typists typing 6 hours a day (at equal speeds) take 12 days to type the manuscript of a book, then how many days will 3 typists working 8 hours a day take to do the same job?

Solution. Since 7 typists working 6 hours a day take 12 days to do the job.

$\therefore$ 1 typist working 6 hours a day takes (12 × 7) days = 84 days

$\therefore$ 1 typist working 1 hour a day takes (84 × 6) days = 504 days

$\therefore$ 3 typists working 1 hour a day take $\frac{504}{3}$ days = 168 days

$\therefore$ 3 typists working 8 hours a day take $\frac{168}{8}$ days = 21 days.

Note. (*i*) Less number of typists, more number of days required to complete the job. So, we have inverse variation.

As the number of typists decreases in the ratio 7 : 3, the number of days will increase in the ratio 3 : 7.

(*ii*) More number of working hours, less number of days required to complete the job. So, we have inverse variation.

As the number of working hours increases in the ratio 6 : 8 *i.e.* 3 : 4, the number of days required to complete the job will decrease in the ratio 4 : 3

Hence, the number of days required to complete the job

$$= \frac{7}{3} \times \frac{3}{4} \times 12 = 21.$$

Example 9. A contractor undertook to build a road in 180 days. He employed 150 men for the construction of road. After 60 days, he found that only one-fourth of the road could be built. How many additional men should be employed to complete the work in time?

Solution. Portion of the road built = $\frac{1}{4}$,

$\therefore$ the portion of the road left = $1 - \frac{1}{4} = \frac{3}{4}$.

The number of days left for the completion of work = 180 – 60 = 120.

According to the given condition,

$\frac{1}{4}$ of the road can be built in 60 days by 150 men,

$\therefore$ $\frac{1}{4}$ of the road can be built in one day by (150 × 60) men = 9000 men

$\therefore$ complete road can be built in one day by (9000 × 4) men = 36000 men

$\therefore$ complete road can be built in 120 days by $\frac{36000}{120}$ men = 300 men

$\therefore$ $\frac{3}{4}$ of the road can be built in 120 days by $(300 \times \frac{3}{4})$ men = 225 men.

$\therefore$ Number of additional men to be employed to complete the work in time

= 225 – 150 = 75.

Exercise 5.1

1. If 8 metres cloth costs ₹ 250, find the cost of 5·8 metres of the same cloth.
2. If one dozen pencils cost ₹ 21, find the cost of one score pencils.
3. If 18 dolls cost ₹ 450, how many dolls can be purchased for ₹ 325?
4. If a labourer earns ₹ 672 per week, how much will he earn in 18 days?

5. If 175 dollars cost ₹ 7350, how many dollars can be purchased in ₹ 24024?
6. If a car travels 67·5 km in 4·5 litres of petrol, how many kilometres will it travel in 26·4 litres of petrol?
7. Pooja has enough money to buy 36 oranges at the rate of ₹ 4·50 per orange. How many oranges she can buy if the price of each orange is increased by 90 paise?
8. Four men working together take 3 hours to paint a wall. How much time would 6 men take to do the same job?
9. It takes 8 days for 12 men to construct a wall. How many men should be put on the job if it is required to be constructed in 6 days?
10. Eight taps through which water flows at the same rate can fill a tank in 27 minutes. If two taps go out of order, how long will the remaining taps take to fill the tank?
11. A hostel has enough food for 250 students for 12 days. How long will the food last if 50 more students join them?
12. A fort is provided with food for 80 soldiers to last for 60 days. Find how long would the food last if 20 additional soldiers join after 15 days?
13. 1200 soldiers in a fort had enough food for 28 days. After 4 days, some soldiers were sent to another fort and thus, the food lasted for 32 more days. How many soldiers left the fort?
14. If 5 men or 7 women can earn ₹ 525 per day, how much would 7 men and 13 women will earn per day?
15. If 8 labourers can earn ₹ 9000 in 15 days, how many labourers can earn ₹ 6300 in 7 days?
16. Three typists working 8 hours a day type a document in 10 days. If only 2 typists are working, how many hours a day should they work to finish the job in 12 days?

TIME AND WORK

In solving problems on time and work, remember that :

- One day's work = $\frac{1}{\text{number of days to complete the work}}$
- Number of days needed to complete the work = $\frac{1}{\text{one day's work}}$
- Time required to do a certain work = $\frac{\text{work to be done}}{\text{one day's work}}$
- Remuneration is in proportion of work done.

Example 1. Jyoti alone can knit a sweater in 4 hours and Meera alone can knit a sweater in 6 hours. How much time would they take working together to knit

(*i*) one sweater (*ii*) 15 sweaters?

Solution. (*i*) Jyoti alone can knit a sweater in 4 hours

Her one hour's work = $\frac{1}{4}$ sweater

Meera alone can knit a sweater in 6 hours

Her one hour's work = $\frac{1}{6}$ sweater

Working together, their one hour's work

$= \left(\frac{1}{4} + \frac{1}{6}\right)$ sweater $= \frac{3+2}{12}$ sweater $= \frac{5}{12}$ sweater

∴ Working together, they can knit one sweater in $\frac{12}{5}$ hours *i.e.* 2 hours 24 minutes.

(*ii*) Working together, they will knit 15 sweaters in $\left(15 \times \frac{12}{5}\right)$ hours $= 36$ hours.

Example 2. Baban and Ramsukh together erect a shed in 12 days. Baban alone can do it in 20 days. How much time would Ramsukh take working alone to erect the shed?

Solution. Baban and Ramsukh together take 12 days to erect a shed,

∴ one day's work of Baban and Ramsukh together $= \frac{1}{12}$.

Now Baban alone can erect the shed in 20 days,

∴ Baban's one day work $= \frac{1}{20}$.

∴ Ramsukh's one day work $= \frac{1}{12} - \frac{1}{20} = \frac{5-3}{60} = \frac{2}{60} = \frac{1}{30}$

∴ Ramsukh alone can erect the shed in 30 days.

Example 3. A can complete $\frac{1}{5}$ of a piece of work in 12 hours and B can complete $\frac{1}{6}$ of the same work in 15 hours. In how many hours both working together can complete the work?

Solution. Since A can complete $\frac{1}{5}$ of the work in 12 hours,

∴ A's one hour work $= \frac{1}{12}$ of $\frac{1}{5} = \frac{1}{12} \times \frac{1}{5} = \frac{1}{60}$.

Since B can complete $\frac{1}{6}$ of the same work in 15 hours,

∴ B's one hour work $= \frac{1}{15}$ of $\frac{1}{6} = \frac{1}{15} \times \frac{1}{6} = \frac{1}{90}$.

∴ One hour's work of A and B together

$= \frac{1}{60} + \frac{1}{90} = \frac{3+2}{180} = \frac{5}{180} = \frac{1}{36}$

∴ A and B working together can complete the work in 36 hours.

Example 4. A and B together can dig a pond in 20 days. They worked together for 8 days and then B leaves the work. How long will A take to finish the work if A alone can dig the pond in 30 days?

Solution. Since A and B together can dig the pond in 20 days,

∴ one day's work of A and B together $= \frac{1}{20}$

∴ 8 day's work of A and B together $= 8 \times \frac{1}{20} = \frac{2}{5}$

∴ Remaining work $= 1 - \frac{2}{5} = \frac{3}{5}$

Since A alone can dig the pond in 30 days,

∴ A's one day work $= \frac{1}{30}$

∴ The number of days taken by A to complete the remaining work

$$= \frac{\text{work to be done}}{\text{A's one day work}} = \frac{\frac{3}{5}}{\frac{1}{30}} = \frac{3}{5} \times \frac{30}{1} = 18.$$

Hence, A will finish the remaining work in 18 days.

Example 5. A can do a work in 10 days and B can do it in 15 days. They worked together for 4 days and then A left the work. In how many days can B finish the remaining work? If the remuneration for the work is one thousand rupees, how much amount would each get?

Solution. A's one day work = $\frac{1}{10}$ and B's one day work = $\frac{1}{15}$,

∴ one day's work of A and B together

$$= \frac{1}{10} + \frac{1}{15} = \frac{3+2}{30} = \frac{5}{30} = \frac{1}{6}$$

∴ 4 days' work of A and B together $= 4 \times \frac{1}{6} = \frac{2}{3}$

∴ Remaining work $= 1 - \frac{2}{3} = \frac{1}{3}$

∴ The number of days taken by B to finish the remaining work

$$= \frac{\text{work to be done}}{\text{B's one day work}} = \frac{\frac{1}{3}}{\frac{1}{15}} = \frac{1}{3} \times \frac{15}{1} = 5$$

Hence, B will complete the remaining work in 5 days.

To calculate the remuneration of each, it is easier to find how much work A did.

A did work for 4 days, so A's one day work = $\frac{1}{10}$

∴ A's 4 days work $= \frac{1}{10} \times 4 = \frac{2}{5}$

∴ A's share of money $= \frac{2}{5}$ of ₹ 1000 = ₹ $\left(\frac{2}{5} \times 1000\right)$ = ₹ 400

∴ B's share of money = total money – A's share

= ₹ 1000 – ₹ 400 = ₹ 600.

Example 6. If 2 men or 3 boys take 40 hours to do a certain piece of work, how long will 4 men and 9 boys working together take to complete the work?

Solution. Since 2 men's work = 3 boy's work,

∴ 1 man's work = $\frac{3}{2}$ boys' work

∴ 4 mens' work = $\frac{3}{2} \times 4$ *i.e.* 6 boys' work

∴ 4 men and 9 boys work = 6 + 9 *i.e.* 15 boys' work

Since 3 boys can do the work in 40 hours,

∴ 1 boy can do the work in 3 × 40 *i.e.* 120 hours

∴ 15 boys can do the work in $\frac{120}{15}$ hours = 8 hours

Hence, 4 men and 9 boys working together will complete the work in 8 hours.

Example 7. A and B together can built a wall in 30 days. If A is twice as good a workman as B, in how many days will A alone finish the work?

Solution. Since A is twice as good a workman as B,

A's one day work = B's 2 days work

$\Rightarrow$ B's one day work = A's $\frac{1}{2}$ day work ...(*i*)

Since A and B together can built a wall in 30 days,

$\therefore$ A's one day work + B's one day work = $\frac{1}{30}$

$\Rightarrow$ A's one day work + A's $\frac{1}{2}$ day work = $\frac{1}{30}$ [using (*i*)]

$\Rightarrow$ A's $1 + \frac{1}{2}$ *i.e.* $\frac{3}{2}$ days work = $\frac{1}{30}$

$\Rightarrow$ A's one day work = $\frac{2}{3} \times \frac{1}{30} = \frac{1}{45}$

$\therefore$ A alone can complete the work in 45 days.

Example 8. A, B and C working separately can do a work in 2, 3 and 4 days respectively. If they all work together and earn ₹ 3900 for the whole work, how should they divide the money?

Solution. A's one day work = $\frac{1}{2}$,

B's one day work = $\frac{1}{3}$ and

C's one day work = $\frac{1}{4}$.

So they should divide the money in the ratio $\frac{1}{2} : \frac{1}{3} : \frac{1}{4}$

i.e. $\frac{1}{2} \times 12 : \frac{1}{3} \times 12 : \frac{1}{4} \times 12$ *i.e.* 6 : 4 : 3.

Sum of the terms of the ratio = 6 + 4 + 3 = 13.

$\therefore$ A's share = $\frac{6}{13}$ of ₹ 3900 = ₹ $\left(\frac{6}{13} \times 3900\right)$ = ₹ 1800,

B's share = $\frac{4}{13}$ of ₹ 3900 = ₹ $\left(\frac{4}{13} \times 3900\right)$ = ₹ 1200 and

C's share = $\frac{3}{13}$ of ₹ 3900 = ₹ $\left(\frac{3}{13} \times 3900\right)$ = ₹ 900.

Example 9. A and B together can do a piece of work in 20 days; B and C together can do it in 15 days, C and A together can do it in 12 days. How long will they take to finish the work, working all together? How long would each take to do the same work?

Solution. A's one day work + B's one day work = $\frac{1}{20}$ ...(*i*)

B's one day work + C's one day work = $\frac{1}{15}$ ...(*ii*)

C's one day work + A's one day work = $\frac{1}{12}$ ...(*iii*)

Adding these three equations, we get

2 (A's one day work + B's one day work + C's one day work)

$$= \frac{1}{20} + \frac{1}{15} + \frac{1}{12} = \frac{3+4+5}{60} = \frac{12}{60} = \frac{1}{5}$$

$\therefore$ one day's work of A, B and C all together $= \frac{1}{2} \times \frac{1}{5} = \frac{1}{10}$ ...(*iv*)

$\therefore$ A, B and C working all together can finish the work in 10 days.

Subtracting (*i*) from (*iv*), we get

C's one day work $= \frac{1}{10} - \frac{1}{20} = \frac{2-1}{20} = \frac{1}{20}$

$\therefore$ C alone can do the work in 20 days.

Subtracting (*ii*) from (*iv*), we get

A's one day work $= \frac{1}{10} - \frac{1}{15} = \frac{3-2}{30} = \frac{1}{30}$

$\therefore$ A alone can do the work in 30 days

Subtracting (*iii*) from (*iv*), we get

B's one day work $= \frac{1}{10} - \frac{1}{12} = \frac{5-4}{60} = \frac{1}{60}$

$\therefore$ B alone can do the work in 60 days.

Example 10. Taps A and B can fill a tank in 4 hours and 6 hours respectively and tap C (at the bottom) can empty it in 12 hours. If all the three taps are opened together when the tank is empty, find after how many hours the tank will be full.

Solution. In one hour, tap A fills $\frac{1}{4}$ of the tank.

In one hour, tap B fills $\frac{1}{6}$ of the tank.

In one hour, tap C empties $\frac{1}{12}$ of the tank.

$\therefore$ In one hour, the portion of the tank filled by the taps A, B and C all together $= \frac{1}{4} + \frac{1}{6} - \frac{1}{12}$

$$= \frac{3+2-1}{12} = \frac{4}{12} = \frac{1}{3}$$

$\therefore$ All the three taps A, B and C together will fill the tank in 3 hours.

Exercise 5.2

1. Ramdin can reap a field in 30 days. What part of the field would he have reaped in 25 days?
2. A farmer can reap a field in 10 days while his wife can do it in 8 days (she does not waste time in smoking). If they work together, in how much time can they reap the field?
3. A can do a job in 10 days while B can do it in 15 days. If they work together and earn ₹ 3500, how should they share the money?
4. A and B together can paint a room in 2 days. A alone can do it in 3 days. How many days would B require working alone to paint the room?

5. A can do $\frac{1}{5}$th of a certain work in 2 days and B can do $\frac{2}{3}$rd of it in 8 days. In how much time can they together complete the work?
6. One tap fills a tank in 20 minutes and another tap fills it in 12 minutes. The tank being empty and if both taps are opened together, in how many minutes the tank will be full?
7. A can do a work in 6 days and B can do it in 8 days. They worked together for 2 days and then B left the work. How many days will A require to finish the work?
8. A can do a piece of work in 40 days. He works at it for 8 days and then B finishes the remaining work in 16 days. How long will they take to complete the work if they do it together?
9. A and B separately do a work in 10 and 15 days respectively. They worked together for some days and then A completed the remaining work in 5 days. For how many days had A and B worked together?
10. If 3 women or 5 girls take 17 days to complete a piece of work, how long will 7 women and 11 girls working together take to complete the work?
11. A, B and C can separately do a work in 2, 6 and 3 days respectively. Working together, how much time would they require to do it? If the work earns them ₹ 960, how should they divide the money?
12. A, B and C together can do a piece of work in 15 days, B alone can do it in 30 days and C alone can do it in 40 days. In how many days will A alone do the work?
13. A, B and C working together can plough a field in $4\frac{4}{5}$ days. A and C together can do it in 8 days. How long would B working alone take to plough the field?
14. A and B together can build a wall in 10 days; B and C working together can do it in 15 days; C and A together can do it in 12 days. How long will they take to finish the work, working all together? Also find the number of days taken by each to do the same work, working alone.
15. A pipe can fill a tank in 12 hours. By mistake, a waste pipe at the bottom is left opened and the tank is filled in 16 hours. If the tank is full, how much time will the waste pipe take to empty it?

[**Hint.** Portion of the tank emptied by the waste pipe in one hour = $\frac{1}{12} - \frac{1}{16} = \frac{1}{48}$.]

Summary

- A method in which the value of a unit quantity is first obtained to find the value of any quantity is called unitary method.
- Two quantities are said to vary directly if the increase (or decrease) in one quantity causes the increase (or decrease) in the other quantity.
- In direct variation, the ratio of one kind of like terms is equal to the ratio of second kind of like terms.
- Two quantities are said to vary inversely if the increase (or decrease) in one quantity causes the decrease (or increase) in the other quantity.
- In inverse variation, the ratio of one kind of like terms is equal to the inverse ratio of second kind of like terms.
- A unitary method involving two different types of quantities is called a single unitary method, and a unitary method involving more than two different types of quantities is called a compound unitary method.

fill in the blanks

➡ In solving problems on time and work remember that

- More persons will do more work in a certain time.
- More persons will require less time to do the same work.
- More work will be done in more time.
- One day's work = $\frac{1}{\text{number of days to complete the work}}$
- Number of days to complete the work = $\frac{1}{\text{one day's work}}$
- Time required to do a certain work = $\frac{\text{work to be done}}{\text{one day's work}}$

Check Your Progress

1. Bananas are selling at ₹ 30 a dozen. How many bananas would you get for ₹ 20?
2. It rained 80 mm in first 20 days of April. What would be the total rainfall in April?
3. Mamta earns ₹ 540 for a working week of 48 hours. If she was absent for 6 hours, how much did she earn?
4. Navjot can do a piece of work in 6 days working 10 hours per day. In how many days can he do the same work if he increases his working hours by 2 hours per day?
5. Sharmila has enough money to buy 24 bananas at the rate of ₹ 1·50 per banana. How many bananas she can buy if the price of each banana is decreased by 30 paise?
6. A fort has rations for 180 soldiers for 40 days. After 10 days, 30 soldiers leave the fort. Find the total number of days for which the food will last.
7. If 10 men can build 2 boats in 4 days, how many men are needed to build 5 boats in 2 days?
8. If 12 men working 8 hours a day can construct a shed in 5 days, then in how many days will 8 men working 10 hours a day complete the same job?
9. If 4 goats or 6 sheep can graze a field in 40 days, how many days will 4 goats and 14 sheep take to graze the same field?
10. A tap can fill a tank in 20 hours, while the other can empty it in 30 hours. The tank being empty and if both taps are opened together, how long will it take for the tank to be half full?
11. A can complete $\frac{1}{3}$ of a piece of work in 6 days and B can complete $\frac{1}{4}$ of the same piece of work in 6 days. Find
    (*i*) in how many days both working together can complete the work.
    (*ii*) the portion of the work done by each.
    (*iii*) the share of B if both started working together and after completing the work A receives ₹ 2800.
12. Three ants separately can gobble a grasshopper in 3, 4 and 6 days respectively. How many days will they take together to finish off the poor chap? If the grasshopper weighs 63 gram, find the share of each.
13. A and B together can do a piece of work in 12 days; B and C together can do it in 15 days. If A is twice as good a workman as C, in how many days A alone will do the same work?