11
Chapter

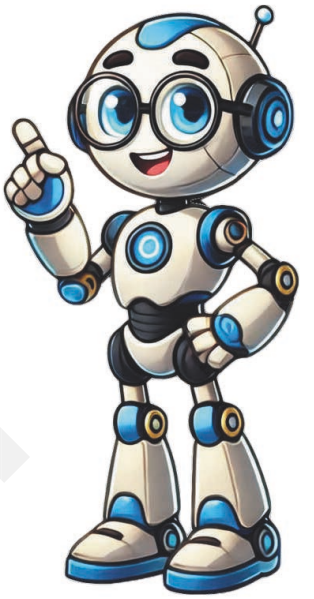
Direct and Inverse Proportions

We'll cover the following key points:

→ Direct variation

→ Inverse variation

→ Time and work



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Learning Outcomes

By the end of this chapter, students will be able to:

- Understand the concept of direct proportion and its real-life applications.
- Identify and solve problems related to direct proportion.
- Understand the concept of inverse proportion and its real-life applications.
- Identify and solve problems related to inverse proportion.
- Establish the relationship between two quantities in direct and inverse proportions.
- Solve word problems involving direct and inverse proportions.
- Use mathematical formulas to express and calculate direct and inverse proportions.
- Demonstrate the ability to use graphical representation to show direct and inverse proportional relationships.
- Apply the concept of proportion in everyday situations, such as speed, distance, time, cost, etc.
- Recognize the difference between direct and inverse proportions through examples.
- Solve problems involving the variation of quantities in different situations, such as work and time, price and quantity, etc.
- Understand and apply the cross-multiplication method to solve problems involving direct and inverse proportions.

Mind Map

DIRECT AND INVERSE PROPORTIONS

Direct Proportion

Two quantities x and y are said to be in **direct proportion** if they increase (decrease) together in such a manner that the ratio of their corresponding values remains constant. That is if $\frac{x}{y} = k$ [k is a positive number], then x and y are said to vary directly. In such a case if y_1 , y_2 are the values of y corresponding to the values x_1 , x_2 of x respectively then $\frac{x_1}{y_2} = \frac{x_2}{y_2}$.

Inverse Proportion

Two quantities x and y are said to be in **inverse proportion** if an increase in x causes a proportional decrease in y (and vice-versa) in such a manner that the product of their corresponding values remains constant. That is, if xy = k, then x and y are said to vary inversely. In this case if y_1 , y_2 are the values of y corresponding to the values x_1 , x_2 of x respectively then $x_1 y_1 = x_2 y_2$ or $\frac{x_1}{x_2} = \frac{y_2}{y_1}$.

Based on NCERT*

Introduction

The two quantities may be related to each other in two ways. First, both the quantities increase or decrease together and second, one quantity increases, other decreases and vice versa. So, there are two types of variations possible (*i*) Direct variation (*ii*) Inverse variation.

Direct Variation

When we purchase some articles from the shop, as the number of articles increases/decreases, the expenditure also increases/decreases. Here, important point to note is that increasing/decreasing happens in the same ratio.

Let us, understand this with the help of an example.

Suppose, the cost of a pen be ₹12. Then, the cost of 3 pens of the same kind will be ₹36, the cost of 4 such pens will be ₹48 and so on.

We can represent this in the form of a table as given below:

Take a Task

Watch Remedial

Number of pens (x)	1	2	3	6	10
Cost in rupees (y)	12	24	36	72	120
Ratio ($x : y$)	1:12	1:12	1:12	1:12	1:12

Notice that as x increases, y also increases but the ratio $x : y$ always remains constant.

These statement can be represented as below:

$\frac{x}{y} = k$ (some constant)

$\therefore \quad x = ky$ (k is called the *constant of proportionality*)

We can also observe that k always remains constant and does not change. That is why both x and y increase (or decrease) together. Thus, direct variation can be defined as follows:

When two quantities x and y are related so that if one quantity 'x' changes (increase/decrease) in such a way that the ratio remains constant, then the two quantities are said to be in a direct variation.

Example 1 : Find the values of *a* and *b* in the following table, if *x* and *y* vary directly.

x	8	6	b
y	24	a	42

Solution: Given that x and y vary directly. So, the ratio $\frac{x}{y}$ will be constant and positive.

Now, $\frac{8}{24}$, $\frac{6}{a}$, $\frac{b}{42}$ should have the same value.

Thus, $\frac{8}{24} = \frac{6}{a} = \frac{b}{42}$ or $a = 18$ and $b = 14$.

Example 2: In which of these tables, *x* and *y* vary directly? Also, find the constants of variation, if *x* and *y* are in direct variation.

(*i*)

x	2	5	5	6
y	5	3	15	18

(*ii*)

x	1	2	3	5	9
y	4	8	12	20	36

Solution : (*i*) It is obvious from the table that the ratios of the corresponding values of x and y are not constant.

So, x and y are not in direct variation, *i.e.*, they do not vary directly.

(*ii*) We have: $\frac{1}{4} = \frac{2}{8} = \frac{3}{12} = \frac{5}{20} = \frac{9}{36} = \frac{1}{4}$

Thus, the ratio of the corresponding values of x and y is constant and equal to $\frac{1}{4}$.

Hence, x and y are in direct variation with the constant of variation equal to $\frac{1}{4}$.

Example 3 : A machine in a mineral water factory fills 960 bottles in 8 hours. How many bottles will it fill in 6 hours?

Solution : Let the number of bottles filled in 8 hours be x.

Hours	8	6
Number of bottles	960	x

Since two quantities vary directly,

the ratio of hours = ratio of number of bottles

$$8 : 6 = 960 : x$$

$$\Rightarrow \quad 8 \times x = 6 \times 960 \quad \Rightarrow \quad x = \frac{6 \times 960}{8} = 720$$

Hence, machine will fill 720 bottles in 6 hours.

Example 4 : **In a model of a ship, the mast is 15 cm high while the mast of the actual ship is 30 m high. If the length of the ship is 60 m, how long is the model ship?**

Solution: Let the length of the model ship be x.

Length of actual ship (in m)	30 m	60 m
Length of model ship (in cm)	15 cm	x

$$\frac{30}{15} = \frac{60}{x} \qquad \left(\frac{x}{y} = k\right)$$

$$\Rightarrow \quad 30 \times x = 15 \times 60 \quad \Rightarrow \quad x = \frac{15 \times 60}{30} \quad \Rightarrow \quad x = 30 \text{ cm.}$$

Check Your Progress

Experiential Learning

Choose the correct option from the given four options:

1. x and y vary directly with each other. When x is 8, y is 12. Which of the following is not a possible pair of corresponding values of x and y ?

   (a) 12 : 18 (b) 16 : 24 (b) 3 : 4 (c) 4 : 6

2. If 25 men can do a piece of work in 36 days, in how many days will 50 men do it ?

   (a) 56 days (b) 72 days (b) 20 days (c) 18 days

Exercise 11.1

1. In which of the following tables, x and y vary directly ? Also, find the constant of variation, if x and y are in direct variation.

(*i*)

x	8	15	12	14	25
y	16	30	33	42	63

(*ii*)

x	5	8	12	15	18
y	15	24	36	60	72

2. Find the values of unknown terms, if x and y vary directly.

(*i*)

x	2	4	b	c	12
y	3	a	12	15	d

(*ii*)

x	1	2	$2\frac{1}{2}$	c	d
y	a	2	b	$4\frac{1}{2}$	$\frac{1}{2}$

3. The cost of 2 dozen of bananas is ₹48. What is the cost of 180 bananas?
4. A laborer can pack 275 boxes in 25 cartons. How many boxes can he pack in 16 cartons?
5. A car can travel 60 km in 3 litres of petrol. How far would it travel in 12 litres of petrol ?
6. Aneesh has a road map with a scale of 1 cm representing 6 km. He drives car on a road for 72 km. What would be his distance covered in the map?
7. In a model of a ship, the mast is 9 m high, while the mast of the actual ship is 12 m high. If the length of ship is 27 m, how long is the model ship?
8. A car takes 3 hours to reach a destination by travelling at the speed of 45 km/hr. How long will it take when the car travels at the speed of 90 km/hr?
9. Romani reaches school in 40 minutes when she travels by foot at the speed of 12 km/hr. How much time will she take to reach school if she cycles at the speed of 30 km/hr.
10. A worker is paid ` 720 for 6 days. How much will be paid for 15 days, 21 days and 39 days?

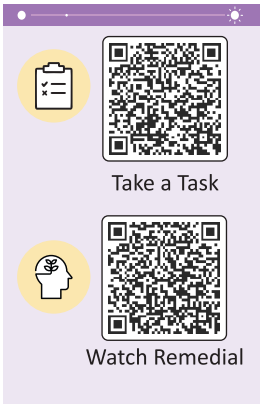
Skills covered: Evaluation skills, analytical skills, problem solving skills, numeracy skills

Inverse Variation

The quantity may change in such a way that by the increase of one quantity, the other quantity decreases. Let us take a routine example.

A job can be completed by a person in 30 days. Clearly, 3 persons can complete the same job in 10 days. The number of days required to complete the same job when 5, 10, or 30 person are working is given in a table as under:

Number of person (x)	1	3	5	10	30
Number of days (y)	30	10	6	3	1
$x \times y$	30	30	30	30	30



From the above table, we can observe the following:

(i) When the number of persons (x) engaged to complete the job increases, the number of days (y) required to complete the job decreases.

(ii) When the product of number of persons (x) engaged to complete the job decreases, the number of days (y) required to complete the job increases.

(iii) When the product of number of persons (x) and number of days is always 30, *i.e.*, $x \times y$ = constant.

If one quantity increases, the other decreases and if one quantity decreases, the other increases. Such variations are called **inverse variations**.

Thus, **when two quantities x and y vary in such a way that $x \times y$ is constant, then x and y are said to vary inversely**. The product $a \times b$ is called the **constant of variation**.

If x_1 and y_1 and x_2 and y_2 are in inverse proportion, then

$$x_1 \times y_1 = x_2 \times y_2 = k$$

$$\Rightarrow \quad \frac{x_1}{x_2} = \frac{y_2}{y_1} \quad \Rightarrow \quad x_1 : x_2 \quad :: \quad y_2 : y_1.$$

Example 5 : **Check whether *x* and *y* vary inversely in each of the following tables:**

(*i*)

x	3	2	1
y	10	15	30

(*ii*)

x	10	20	30	40
y	60	40	30	15

Solution : We know that, if x and y vary inversely, then the product xy remains same for all values of x and y.

(*i*) Here, $3 \times 10 = 30$, $2 \times 15 = 30$ and $1 \times 30 = 30$.

Clearly, the products of the values of x and the corresponding values of y are fixed. So, x and y vary inversely.

(*ii*) We have, $10 \times 60 = 600$, $20 \times 40 = 800$, $30 \times 30 = 900$, $40 \times 15 = 600$.

Since, the products of the values of x and the corresponding values of y are not fixed. So, x and y do not vary inversely.

Example 6 : **Find the values of *m, n, p* and *q*, if *x* and *y* vary inversely.**

x	2	3	p	6	q
y	m	n	18	15	10

Solution : Since x and y vary inversely, then the product xy remains constant and it is equal to

$$6 \times 15 = 90.$$

$$\therefore \quad m \times 2 = 90 \quad \Rightarrow \quad m = 45$$

$$3 \times n = 90 \quad \Rightarrow \quad n = 30$$

$$p \times 18 = 90 \quad \Rightarrow \quad p = 5$$

$$q \times 10 = 90 \quad \Rightarrow \quad q = 9$$

Thus, $m = 45$, $n = 30$, $p = 5$ and $q = 9$.

Example 7 : **A farmer has enough food to feed 30 animals in his shed for 5 days. How long would the food last, if there were 20 more animals in his shed ?**

Solution : Let the number of days be x. Total number of animals $= 30 + 20 = 50$.

Animals	30	50
Days	5	x

If the number of animals increases, the number of days decreases.

Therefore, it is a case of inverse proportion.

$$30 \times 5 = 50 \times x$$

$$\text{or,} \quad x = \frac{30 \times 5}{50} \quad \text{or,} \quad x = 3 \text{ days}$$

Hence, the food will last for 3 days.

Example 8 : 56 men can do some work in 42 days. How many men will do the same work in 14 days?

Solution : Let, x men finish the work in 14 days.

Since it is an inverse variation, *i.e.*,

$56 \times 42 = x \times 14$

Hence, 168 men will finish the given piece of work in 14 days.

$\Rightarrow \quad x = \frac{56 \times 42}{14} = 168$

Exercise 11.2

1. Check whether x and y vary inversely in each of following table :

(*i*)

x	3	6	13
y	12	24	39

(*ii*)

x	4	6	8
y	20	30	40

(*iii*)

x	6	2	3	5
y	10	30	20	12

2. x and y vary inversely. Complete the following table by finding the value of l, m and n:

6	2	m	5
l	30	20	n

3. Reshma takes 20 minutes to reach her school at an average speed of 6 km/hr. If she is required to reach the school in 24 minutes, what should be her speed?
4. 6 taps of equal capacity can fill a tub in 30 minutes. How many taps can fill it in 20 minutes?
5. 10 laburers can dig a well in 6 days. How many extra laburers should be employed so as to finish the work in 4 days?
6. 45 goats can graze a field in 13 days. How many goats will graze the same field in 9 days ?
7. 45 men can do a piece of work in 20 days. How many men will be required to complete the same work in 75 days?
8. In a military camp, there is food for 30 days for 50 soldiers. Assuming that average meal of every soldier is same, if 25 more soldiers join then how many days this food will last?
9. Rakesh buys 50 kg of rice for ₹ 15 per kg. How much rice should he buy at the rate of ₹ 25 per kg, so that he spends the same amount?

Skills covered: Evaluation skills, analytical skills, problem solving skills, numeracy skills

Time and Work

Direct and inverse variations are very helpful in solving problems related to time and work. When the rate of work is constant, time is directly proportional to work. Also, the number of labourers are directly proportional to work. But for a given quantity of work, the number of workmen is inversely proportional to time.

When there are more men, then time required to complete the job is less.

REMEMBER

- A complete job or work is taken to be one.
- Time taken to complete a work $= \frac{\text{Total work to be done}}{\text{Part of the work done in one day}}$.

The problems on "time and work" are divided in two categories:

(i) To find the work done in a given period of time.

(ii) To find the time required to complete a given work.

Example 9: **Mohan can read a book containing 480 pages in 12 days. How many pages will he read in 6 days?**

Solution : Number of pages read in 12 days = 480

Number of pages read in 1 day $= \frac{480}{12}$

$\therefore$ No. of pages read in 6 days $= \frac{480}{12} \times 6 = 240$ pages.

Example 10 : **Meena can do a piece of work in 24 days and Seema can do the same work in 12 days. They worked together for 6 days and then Seema leaves. In how many days, will Meena alone finish the remaining work?**

Solution : Since, Meena completes the work in 24 days.

$\therefore$ Meena's 1 day work $= \frac{1}{24}$

Similarly, Seema's 1 day work $= \frac{1}{12}$

$\therefore$ Their combined work for 1 day $= \frac{1}{24} + \frac{1}{12} = \frac{1+2}{24}$

$= \frac{3}{24} = \frac{1}{8}$

$\therefore$ Their combined work for 6 days $= 6 \times \frac{1}{8} = \frac{6}{8}$

Remaining work = Complete work – Work done in 6 days

$= 1 - \frac{6}{8} = \frac{8-6}{8} = \frac{2}{8}$

$= \frac{1}{4}$

Now, the remaining work is to be completed by Meena alone.

Meena can complete the whole work in 24 days so she will complete $\frac{1}{4}$ work in $\frac{1}{4} \times 24$ days, *i.e.*, 6 days.

Example 11 : **A tap 'A' can fill a cistern in 4 hours and the tap 'B' can empty the full cistern in 6 hours. If both the tapes are opened together in the empty cistern, in how much time will the cistern be filled up?**

Solution : Time taken by tap A to fill the cistern = 4 hours

Time taken by tap B to empty the full cistern = 6 hours

Work done by tap A in 1 hour $= \frac{1}{4}$

Work done by tap B in 1 hour $= \frac{1}{6}$ (Note: Tap B empties the cistern)

Work done by (A – B) in 1 hour $= \frac{1}{4} - \frac{1}{6} = \frac{3-2}{12} = \frac{1}{12}$

$\therefore$ Time taken by tap (A – B) to fill the cistern = 12 hours.

Example 12 : Ojas and Shreyas can do a piece of work in 8 days, Shreyas and Shyam in 6 days, Shayam, and Ojas in 4 days. In how many days can Ojas, Shreyas and Shayam finish it together? Also find the number of days in which Shreyas alone can do the work.

Solution: (Ojas + Shreyas)'s 1 day's work $= \frac{1}{8}$ ... (*i*)

(Shreyas + Shayam)'s 1 day's work $= \frac{1}{6}$ ... (*ii*)

(Shayam + Ojas)'s 1 day's work $= \frac{1}{4}$ ... (*iii*)

Adding (*i*), (*ii*) and (*iii*), we get

2 (Ojas + Shreyas + Shayam)'s 1 day's work $= \frac{1}{8} + \frac{1}{6} + \frac{1}{4}$

$= \frac{3+4+6}{24} = \frac{13}{24}$

$\therefore$ (Ojas + Shreyas + Shyam)'s 1 day's work $= \frac{1}{2} \times \frac{13}{24} = \frac{13}{48}$ ... (*iv*)

Thus, Ojas, Shreyas and Shyam together can finish the work in $\frac{48}{13}$ days or $3\frac{9}{13}$ days.

Subtracting (iii) from (iv), we get

Shreyas's 1 day's work $= \frac{13}{48} - \frac{1}{4} = \frac{13-12}{48} = \frac{1}{48}$

Thus, Shreyas's can finish the work in 48 days.

Example 13: A pipe can fill a Cistern in 9 hours. Due to a leak in its bottom, the Cistern fills up in 10 hours. if the Cistern is full, in how much time will it be emptied by leak?

Solution : Work done by a pipe in 1 hour $= \frac{1}{9}$

Total work done by Cistern in 1 hour $= \frac{1}{10}$

$\Rightarrow$ Work done by leak in 1 hour $= \frac{1}{9} - \frac{1}{10} = \frac{10-9}{90} = \frac{1}{90}$

Hence, the Cistern will be emptied in 90 hours

Example 14: Pipe A can fill a tank in 6 hours and pipe B can fill it in 8 hours. Both the pipes are opened and after two hours pipe A is closed. how much time will B take to fill the remaning part of the tank?

Solution : Work done by a pipe A in 1 hour $= \frac{1}{6}$

Work done by pipe B in 1 hour $= \frac{1}{6} + \frac{1}{8} = \frac{4-3}{24} = \frac{7}{24}$

$\Rightarrow$ Work done by (A+B) in 1 hour $= \frac{7}{24} \times 2 = \frac{7}{12}$

Work done by (A+B) in 2 hour $= 1 - \frac{7}{12} = \frac{5}{12}$

Now, B's 1 hour work $= \frac{1}{8}$

$\Rightarrow$ B will take $8 \times \frac{5}{12} = \frac{10}{3}$ hours

Hence, B will complete the remaining part of the work in $3\frac{1}{3}$ hours.

Exercise 11.3

1. Johri can do a piece of work in 10 days and Aman can do it in 15 days. How long will they take if both work together?
2. One tap can fill a cistern in 5 hours and another in 6 hours. If both the taps start, filling the cistern simultaneously then in how much time the cistern will be filled?
3. Pappu can do three times as much work as Ramu. They together finish a work in 14 days. In how many days can Pappu alone finish the work ?
4. A can do a piece of work in 25 days and B can finish it in 20 days. They work together for 5 days and then A leaves. In how many days will B finish the remaining work?
5. Reshma can do a work in 10 days and Roni can do the same work in 16 days. With the help of Sohna, they do the work in 4 days only. In how many days Sohna can do the work alone?
6. A and B can do a piece of work in 12 days. B and C can do it in 15 days while C and A can finish it in 20 days. In how many days A, B and C finish it, working together. In how many days will each one of them finish it working alone?
7. A carpenter can do a piece of work in 5 days, but with the help of his son, he can do it in 3 days. In what time can the son do the work alone?
8. Rajesh can do a piece of work in 24 days and Vinay can do the same work in 15 days. They work together for 6 days and then Vinay leaves. In how many days will Rajesh alone finish the remaining work?
9. Three pipes A, B and C together can fill a cistern in 6 hours. After watering at it together for 2 hours, C is closed and A and B fill it in 7 hours more. How many hours will C alone take to fill the cistern?

Skills covered: Evaluation skills, analytical skills, problem solving skills, numeracy skills

HOTS (Higher Order Thinking Skills)

Experiential Learning

1. Pipe 'A' can fill an empty tank in 10 hours while pipe 'B' can empty the fill tank in 12 hours. If both are opened at the same time in the empty tank, how much time will they take to fill it up completely?

2. Rohit can do $\frac{1}{5}$ of a work in 5 days and Mohit can do $\frac{2}{3}$ of the work in 8 days. In how many days can both Rohit and Mohit together do the work?
3. A and B together can do a piece of work in 12 days while B alone can finish it in 30 days. In how many day can A alone finish the work?

Check Your Progress

Experiential Learning

Choose the correct option from the given four options:

1. A car travelling at a speed of 54 km/h can cover a distance in 2.5 hours. It can cover the same distance at a speed of 45 km/h in :
   (*a*) 2 hours (*b*) 3.5 hours (*c*) 3 hours (*d*) none of these
2. If 20 men can build a road 56 metres long in 6 days, what length of a similar road can be built by 40 men in 3 days ?
   (*a*) 49 metres (*b*) 36 metres (*c*) 42 metres (*d*) 56 metres

Revision Exercise

Conceptual Learning

1. Tick (✓) the correct option:

(*i*) The weight of 12 sheets of a thick paper is 40 grams. How many sheets would weigh 1 kg?
(*a*) 360 (*b*) 300 (*c*) 480 (*d*) none of these

(*ii*) If 14 kg of pulses cost Rs. 441,what is the cost of 22 kg of pulses?
(*a*) ₹ 627 (*b*) ₹ 649 (*c*) ₹ 671 (*d*) ₹ 693

(*iii*) If *a* varies inversely as $b + 2$ and if $a = 8$ when $b = 1.5$, find *a* when $b = 5$.
(*a*) 4 (*b*) $4\frac{2}{5}$ (*c*) $5\frac{3}{5}$ (*d*) $2\frac{2}{5}$

(*iv*) The equation for *y* varies directly as *z* and $y = 19$ when $z = 152$ is:
(*a*) $y = 18z$ (*b*) $y = -12z$ (*c*) $y = 8z$ (*d*) $y = -2z$

(*v*) If 5 persons can build a wall in 12 days, how many persons can build it in 10 days?
(*a*) 6 (*b*) 7 (*c*) 4 (*d*) 8

2. Answer the following questions:

(*i*) A can complete a work in 12 days and B can complete the same work in 8 days. What part of the work will they all together complete in 1 day.

(*ii*) A and B together can do a piece of work in 6 days and A alone can do in 8 days. In how many days can B alone do it.

(*iii*) A and B together can do piece work in 10 days. A alone can finish the work in 30 days. In how many days will B alone finish the work?

(*iv*) A can complete a work in 6 days and B can complete it in 5 days. How long will both together take to complete the work.

(*v*) A train of length 450 m crosses a pole with a speed of 72 km/h. How long will it take to cross the pole?

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Mental Maths

Experiential Learning

1. When 20 labourers finish building a hall in 20 days, then how many days will 25 labourers take to finish the work?
2. A mini van is travelling from Delhi to Agra with a speed of 54 km/hr in 2.5 hours. How much time will it take to cover the same distance at an decreased speed of 45 km/hr?
3. If 20 men can built a wall 56 m long in 6 days. What length of a similar wall can be built by 35 men in 3 days?
4. If 25 cows can eat 5 bags of feed in 12 days, how much 10 cows eat in 18 days?

Scan to Create Your Own Learning Path

Custom Learning Path

Assertion and Reason

Critical Thinking

In each of the following questions, an Assertion (A) and a corresponding Reason (R) supporting it is given.

Study both the statements and state which of the following is correct.

(*a*) Both A and R are true and R is the correct explanation of A.

(*b*) Both A and R are true but R is not the correct explanation of A.

(*c*) A is true but R is false.

(*d*) A is false but R is true.

1. **Assertion (A) :** If a car covers 82.5 km in 5.5 litres of petrol, then the car covers distance in 13.2 litres of petrol is 198 km.
   Reason (R) : If two quantities are related such that a change in one causes a corresponding change in the other, then we say that one varies with the other.
2. **Assertion (A) :** If the wage of 15 workers for 6 days is ₹9450, the wage of 19 workers for 5 days is ₹9665.
   Reason (R) : x varies inversely as the square of y. If $x = 6$ when $y = 2$, then the value of x when $y = 8$ will be
3. **Assertion (A) :** x caries inversely as y and $x = 30$, when $y = 400$. When $x = 600$, then the value of y is 20.
   Reason (R) : If the speed of a train increases, the time taken to complete a journey increases in the same ratio.
4. **Assertion (A) :** If speed increases then the time decreases.
   Reason (R) : The time taken to finish a work is inversely proportional to the number of persons working on it.

Thinking Skills

1. A farmer has a field and can plant 120 trees in 6 hours. How many trees will the farmer be able to plant in 10 hours, assuming the rate of planting remains constant?
2. A cylindrical tank can hold 240 liters of water. If the height of the tank is 6 meters and the radius of its base is 2 meters, how much water can the tank hold if its height is increased to 12 meters while keeping the radius the same?
3. A rectangular box has a length of 4 meters, a width of 3 meters, and a height of 2 meters. It is completely filled with liquid. If the height of the box is increased to 5 meters while keeping the length and width the same, how much more liquid will the box be able to hold?
4. A factory can produce 600 units of a product in 10 hours. If the factory increases its production rate by 50%, how many units can the factory produce in 12 hours?

Skills covered: Creativity, Observation, Critical Thinking, Logical Reasoning, Reflective Thinking

Case Study

A school bus travels from a town to a school located 120 kilometers away. The speed of the bus is directly proportional to the time it takes to reach the school. When the bus travels at a speed of 60 km/h, it takes 2 hours to reach the school.

However, when the speed of the bus is increased to 80 km/h, it takes less time to reach the school. The bus driver is trying to decide on the optimal speed for the trip to reduce travel time while maintaining a safe journey.

Based on this information answer the following questions:

Direct Proportion Analysis

1. If the speed of the bus is doubled to 120 km/h, how much time will it take to reach the school? (Assume that the relationship between speed and time is directly proportional.)
2. How would the travel time change if the speed is reduced to 40 km/h?

Inverse Proportion Analysis

1. The bus is carrying a group of students on a trip. The number of students is inversely proportional to the number of buses required. If 3 buses are required to transport 240 students, how many buses would be needed to transport 180 students?

Skills covered: Research, Logical Reasoning, Problem-Solving, Practical Application