MATHEMATICS

Class-VIII

Topic-13

DIRECT AND INVERSE VARIATION

INDEX

CH-13

DIRECT AND INVERSE VARIATION

TERMINOLOGIES

Direct variation, inverse variation, inlet, outlet, average speed, directly, inversely, work done, efficient, pipes & cisterns , time , distance & speed.

INTRODUCTION

In previous classes, we have learnt about ratio and proportion 'Ratio' is a concept of comparision by division of two numbers.
If two ratios are equal, then they are in proportion.
In this chapter, we will study about variation. There are 2 types of variation.
(1) Direct **(2)** Inverse.

13.1 DIRECT VARIATION & INVERSE VARIATION

(a) Direct variation

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

Some Examples :

(i) The cost of articles varies directly as the number of articles (More articles, More cost).

(ii) The distance covered by a moving object varies directly as its speed (More speed, more distance covered in the same time).

(iii) The work done varies directly as the number of men at work (More men at work, more is the work done in the same time).

(iv) The work done varies directly as the working time (More is the working time, more is the work done).

Illustration 13.1

If a car covers 75 km in 3 hours, how much it travel in 5 hours.

Sol. In 3 hr, car cover a distance of 75 km.

In 1 hr, car cover a distance of $\frac{75}{3}$ km. [Less time, Less distance]

In 5 hr, car cover a distance of $\frac{75}{3} \times 5$ km = 125 km. [More time, More distance]

Illustration 13.2

If the wages of 15 workers for 6 days are Rs. 9450, find the wages of 19 workers for 5 days.

Sol. Wages of 15 workers for 6 days = Rs. 9450

Wages of 1 workers for 6 days = Rs. $\frac{9450}{15}$ [Less workers, Less wages]

Wages of 1 workers for 1 day = Rs. $\frac{9450}{6\times 15}$ [Less days, Less wages]

Wages of 19 workers for 1 day = Rs. $\frac{9450}{15\times 6}\times 19$ [More workers, More wages]

Wages of 19 workers for 5 days = Rs. $\frac{9450}{15\times 6}\times 19\times 5$ = Rs. 9975 [More days, More wages]

(b) Inverse variation

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

Examples

(i) The time taken to finish a piece of work varies inversely as the number of men at work (More men at work, less is the time to finish it).

(ii) The speed varies inversely as the time taken to cover a distance (More is the speed, less is the time taken to cover a distance).

Illustration 13.3

A fort had provision for food for 300 men for 90 days. After 20 days, 50 men left the fort. How long would the food last at the same rate ?

Sol. Remaining number of men = (300 – 50) = 250.

Remaining number of days = (90 – 20) days = 70 days.

300 men had provision for 70 days.

1 men had provision for 300 × 70 days. [Less men, More days]

250 men had provision for $\frac{300\times 70}{250}$ days. [More men , Less days]

= 84 days

Hence, the remaining food will last for 84 days.

Illustration 13.4

6 oxen or 8 cows can graze the field in 28 days. How would 9 oxen and 2 cows take to graze the same field?

Sol. 6 oxen $\cong$ 8 cows 1 ox $\cong \frac{8}{6}$ cows 9 oxen $\cong \left(\frac{8}{6}\times 9\right)$ cows = 12 cows.

(9 oxen + 2 cows) $\cong$ (12 cows + 2 cows) = 14 cows

Now, 8 cows can graze the field in 28 days.

1 cow can graze the field in 28 × 8 days.

14 cows can graze the field in $\frac{28\times 8}{14}$ days = 16 days.

Hence, 9 oxen and 2 cows can graze the field in 16 days.

(c) Applications

(i) Time and work :

(A) Suppose A can finish a work in n days.

Then, work done by A in 1 day is $\frac{1}{n}$.

(B) Suppose that the work done by A in 1 day is $\frac{1}{n}$.

Then, time taken by A to finish the whole work = n days.

Illustration 13.5

If a man can complete a piece of work in 10 days. Then, calculate the amount of work done by him in 7 days.

Sol. Amount of work done by him in 1 day = $\frac{1}{10}$ part of work

$\therefore$ In 7 days the part of work completed = $\frac{7}{10}$ part of work.

Illustration 13.6

Ram alone can do a piece of work in 5 days and Shyam alone can do it in 7 days. How long it would take for Ram and Shyam to finish the work, when they work together ?

Sol. Ram alone can do the work in 5 days.

Ram's one day work = $\frac{1}{5}$

Shyam alone can do the work in 7 days.

Shyam's one day work = $\frac{1}{7}$

If they both will work together, their work in one day $= \frac{1}{5} + \frac{1}{7} = \frac{7+5}{35} = \frac{12}{35}$

No. of days to finish the work $= \frac{1}{\text{One day's work}} = \frac{1}{12/35} = \frac{35}{12} = 2\frac{11}{12}$ days.

Illustration 13.7

A and B can do a piece of work in 10 days, B alone can do it in 15 days. In how many days 'A' alone can complete the same work ?

Sol. Let A complete the work in x days.

So, work done by A in 1 day = $\frac{1}{x}$.

B alone can do the work in 15 days.

B's one day work = $\frac{1}{15}$

If A and B both will work together, their work in one day = $\frac{1}{x} + \frac{1}{15}$

But, it is given that A and B complete the work in 10 days.

So, in one day they can do $\frac{1}{10}$ part of work

$\therefore$ $\frac{1}{x} = \frac{1}{10} - \frac{1}{15}$

$\frac{1}{x} = \frac{3-2}{30} \Rightarrow x = 30$

So, A complete the work in 30 days.

Illustration 13.8

A and B can complete a work in 15 days and 10 days respectively. They started doing the work together but after 2 days B had to leave and A alone completed the remaining work. In how many days will A finish the remaining work?

Sol. A alone can do the work in 15 days.

A's 1 day work = $\frac{1}{15}$

B alone can do the work in 10 days.

B's 1 day work = $\frac{1}{10}$

(A + B)'s 1 day work = $\left(\frac{1}{15}+\frac{1}{10}\right)=\frac{1}{6}$

(A + B)'s 2 days work = $2\times\frac{1}{6}=\frac{1}{3}$.

So, remaining work = $1-\frac{1}{3}=\frac{2}{3}$ part.

$\therefore$ Remaining work will be finished by A in $\frac{2/3}{1/15}$ = 10 days.

Illustration 13.9

A and B can do a piece of work in 30 days, while B and C can do the same work in 24 days and C and A in 20 days. In how many days will A, B, C finish it, working together ? In how many days will each one of them finish it, working alone?

Sol. Time taken by (A + B) to finish the work = 30 days
Time taken by (B + C) to finish the work = 24 days
Time taken by (C + A) to finish the work = 20 days

(A + B)'s 1 day work = $\frac{1}{30}$

(B + C)'s 1 day work = $\frac{1}{24}$

(A + C)'s 1 day work = $\frac{1}{20}$

Adding we get :

2 (A + B + C)' s 1 day work $=\left(\frac{1}{30}+\frac{1}{24}+\frac{1}{20}\right)=\frac{4+5+6}{120}=\frac{15}{120}=\frac{1}{8}$

So, (A + B + C)'s 1 day work $=\frac{1}{2}\times\frac{1}{8}=\frac{1}{16}$

A, B, C together can finish the work in 16 days.
Now, A's one day work = (A + B + C)'s one day work – (B + C)'s one day work

$=\frac{1}{16}-\frac{1}{24}=\frac{3-2}{48}=\frac{1}{48}$.

Hence, A alone can finish the work in 48 days.
Now, B's one day work = (A + B + C)'s one day work – (A + C)'s one day work

$=\frac{1}{16}-\frac{1}{20}=\frac{5-4}{80}=\frac{1}{80}$

Hence, B alone can finish the work in 80 days.
Now, C's one day work = (A + B + C)'s one day work – (A + B)'s one day work

$=\frac{1}{16}-\frac{1}{30}=\frac{15-8}{240}=\frac{7}{240}$

Hence, C alone can finish the work in $\frac{240}{7}$ days $=34\frac{2}{7}$ days.

(ii) Problem of pipes and cistern

A cistern or a water tank is connected with two types of pipes.

(A) Inlet : The pipe which fills the tank is called an **inlet**.

(B) Outlet : The pipe which empties the tank is called **outlet**.

Rule.1 Suppose a pipe fill tank in n hours.

Then, part of tank filled in 1 hour $= \frac{1}{n}$.

i.e Work done by the inlet in 1 hour $= \frac{1}{n}$.

Rule.2 Suppose an outlet empties a full tank in m hours.

Then, part of tank emptied in 1 hour $= \frac{1}{m}$. i.e. Work done by the outlet in 1 hour $= \left(-\frac{1}{m}\right)$.

Illustration 13.10

A tank is filled by 2 pipes and emptied by a third. If the first two can fill the tank in 2 hrs. and 3 hrs. respectively and third can empty it in 4 hours. How much time will it take to fill the empty tank when all three are open.

Sol. Time taken by first pipe to fill the tank= 2 hours
Time taken by second pipe to fill the tank= 3 hours
Time taken by third pipe to empty the tank= 4 hours

First pipe 1 hour's work $= \frac{1}{2}$

Second pipe 1 hour's work $= \frac{1}{3}$

Third pipe 1 hour's work = $(-\frac{1}{4})$

Let x hrs the time to fill the tank completely.

$\frac{1}{x} = \frac{1}{2} + \frac{1}{3} + \left(-\frac{1}{4}\right) \quad \Rightarrow \quad \frac{1}{x} = \frac{7}{12} \quad \Rightarrow \quad x = \frac{12}{7}$ hrs.

Complete tank will be filled in $\frac{12}{7}$ hrs $= 1\frac{5}{7}$ hrs.

Illustration 13.11

Two pipes M & N can fill a cistern in 12 hrs. & 16 hrs. respectively. If both the pipes are opened together, then after how many minutes N should be closed so that the tank is full in 9 hrs.

Sol. Let N be closed after x hrs. Then it means M and N work together for x hrs. and for (9 – x) hrs, M work alone.

$$x\left(\frac{1}{12} + \frac{1}{16}\right) + (9 - x)\,\frac{1}{12} = 1 \quad \Rightarrow \quad x\left(\frac{4+3}{48}\right) + \frac{9}{12} - \frac{x}{12} = 1$$

$$\Rightarrow \quad x\left(\frac{7}{48}\right) - \frac{x}{12} = 1 - \frac{3}{4} \quad \Rightarrow \quad \frac{7x - 4x}{48} = \frac{1}{4}$$

$$\Rightarrow \quad \frac{3x}{48} = \frac{1}{4} \quad \Rightarrow \quad x = \frac{1}{4} \times \frac{48}{3} = 4 \qquad x = 4 \text{ hrs.}$$

(iii) Time, Speed and Distance

(A) Speed $= \frac{\text{Distance}}{\text{time}}$

(B) time $= \frac{\text{Distance}}{\text{speed}}$

(C) Distance = Speed × Time

(D) If a certain distance (from A to B) is covered at **u km/hr** and the same distance (from B to A) is covered at **v km/hr**. then the average speed during the whole journey is $= \frac{2uv}{u+v}$ km/hr.

(E) If a body travels d_1, d_2, d_3,.....,d_n distances with speeds S_1,S_2,...,S_n,..... respectively, then the average speed of the body through the total distance is given by:

$$\text{Average speed} = \frac{\text{Total distance covered}}{\text{Total time taken}} = \frac{d_1 + d_2 + d_3 + ... + d_n}{t_1 + t_2 + t_3 + ... + t_n}$$

Where, $t_1 = \frac{d_1}{s_1}$, $t_2 = \frac{d_2}{s_2}$ ...

Illustration 13.12

An athlete ran 100 metres in 10 seconds. Then find his speed in Km/hr.

Sol. Speed $= \frac{\text{distance}}{\text{time}} = \frac{100}{10}$ m/sec $= 10$ m/sec $= 10 \times \frac{18}{5}$ km/hr $= 36$ km/hr

Illustration 13.13

A car travels 120 km from A to B at 30 km per hour but returns the same distance at 40 km per hour. Find the average speed for the round trip.

Sol. Average speed $= \frac{2 \times 30 \times 40}{30 + 40}$ km/hr $= \frac{240}{7}$ km/hr $= 34\frac{2}{7}$ km/hr

Illustration 13.14

A man travels Ist 50 km at 25 km/hr, next 40 km with 20 km/hr. and then 90 km at 15 km/hr. Then find his average speed for the whole journey (in km/hr).

Sol. Avg. Speed $= \frac{50 + 40 + 90}{\frac{50}{25} + \frac{40}{20} + \frac{90}{15}} = 18$ km/hr.

(iv) Problem on Trains

(a) Time taken by a train of length **'a'** metres to pass a pole or a standing man or a signal post is equal to the time taken by the train to cover **'a'** metres.

(b) Time taken by a train of length **'a'** metres to pass a stationary object of length **'b'** metres is the time taken by the train to cover **(a + b)** metres.

(c) Suppose two trains or two bodies are moving in the same direction at **u m/s** and **v m/s**, where **u > v**, then their relatives speed = **(u – v) m/s**.

(d) Suppose two trains or two bodies are moving in opposite direction at **u m/s** and **v m/s**, where **u > v**, then their relative speed = **(u + v) m/s**.

(e) If two trains of length **'a'** metres and **'b'** metres are moving in opposite directions at **u m/s** and **v m/s**, then time taken by the trains to cross each other $= \left(\frac{a+b}{u+v}\right)$ sec.

(f) It two trains of length **'a'** metres and **'b'** metres are moving in the same direction at **u m/s** and **v m/s** then the time taken by the faster train to cross the slower train $= \left(\frac{a+b}{u+v}\right)$ sec.

Illustration 13.15

A 400 m long train is running at the speed of 60 km per hour. Find the time taken by train to crosses a bridge of length 800 m.

Sol. When a train has to cross a stationary object which has some length, it has to cover the sum of its own length and the length of the stationary object.
In this case the distance covered = (400 + 800) m = 1200 m

Speed of train = 60 kmph = $60 \times \frac{5}{18}$ m/s = $\frac{50}{3}$ m/s

Time taken = $\frac{\text{distance}}{\text{speed}} = \frac{1200}{50/3} = \frac{1200 \times 3}{50}$ = 72 sec. = 1 min 12 sec

Illustration 13.16

Two trains running in the same direction at 40 km/hr and 22 km/hr completely pass one another in 1 minute. If the length of the Ist train is 125 m., then what will be the length of IInd train.

Sol. Here the speed will be taken as the difference of their speeds and the distance covered will be the sum of the lengths of the train. Now in this case
Speed per hour = 40 – 22 = 18 km/hr.
$\therefore$ 18 km/hr. = 5 m/sec.
Let the length of second train = L m.
Distance covered = (125 + L) m

Time taken to cross each other = $\frac{\text{distance}}{\text{speed}} \Rightarrow 60 = \frac{L+125}{5}$

$60 \times 5 = L + 125 \Rightarrow 300 = L + 125 \Rightarrow L = 300 - 125 \Rightarrow L = 175$ m.

Ask yourself

1. The cost of 45 metres of cloth is Rs. 877.50. What length of this cloth can be purchased for Rs. 12285 ?

2. A worker gets Rs. 400 for 10 days' work. If he works for 18 days, how much will he get ?

3. 20 pumps can empty a reservoir in 12 hours. In how many hours can 45 such pumps do the same work?

4. A, B and C together can finish a piece of work in 4 days. A alone can do it in 9 days and B alone in 18 days. How many days will be taken by C to do it alone.

5. A, B and C can do a piece of work 6, 8 and 12 days respectively. B and C work together for 2 days, then A takes C's place. How long will it take to finish the work.

6. A tank is emptied by 2 pipes and filled by a third. If the 1st two can empty the tank in 2 and 3 hrs. respectively and third can fill it in 4 hours. How much time will it take to empty the full tank ,when all three are open.

Answers

1. 630 m **2.** Rs. 720 **3.** $\frac{16}{3}$ hrs. **4.** 12 days

5. 2 days **6.** $\frac{12}{7}$ hrs.

Add your knowledge

MIXTURE AND ALLIGATION

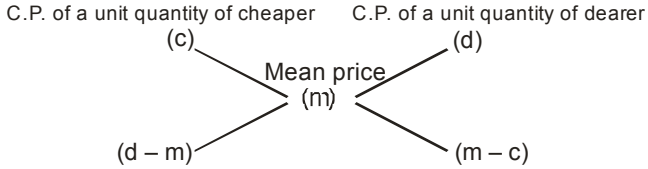
Alligation : It is the rule that enables us to find the ratio in which two or more ingredients at the given price must be mixed to produce a mixture of a desired price.

Mean Price : The cost price of a unit quantity of mixture is called the **mean price**.

Rule of Alligation : If two ingredients are mixed, then,

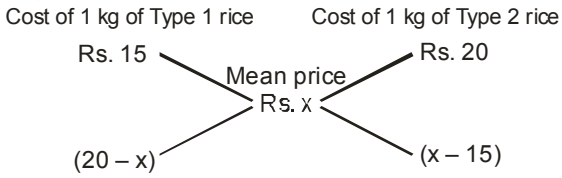
$$\frac{\text{Quantity of cheaper}}{\text{Quantity of dearer}} = \frac{(\text{C.P. of dearer}) - (\text{Mean price})}{(\text{Mean price}) - (\text{C.P. of cheaper})}$$

We can also represent this thing as under



1. The cost of Type 1 rice is Rs.15 per kg and Type 2 rice is Rs.20 per kg. If both type-1 and type-2 are mixed in ratio of 2 : 3 , then find the price per kg of the mixed variety of rice.

Sol. Let the price of the mixed variety be Rs. x per kg.
By the rule of alligation, we have :



$\therefore \quad \frac{(20-x)}{(x-15)} = \frac{2}{3}$

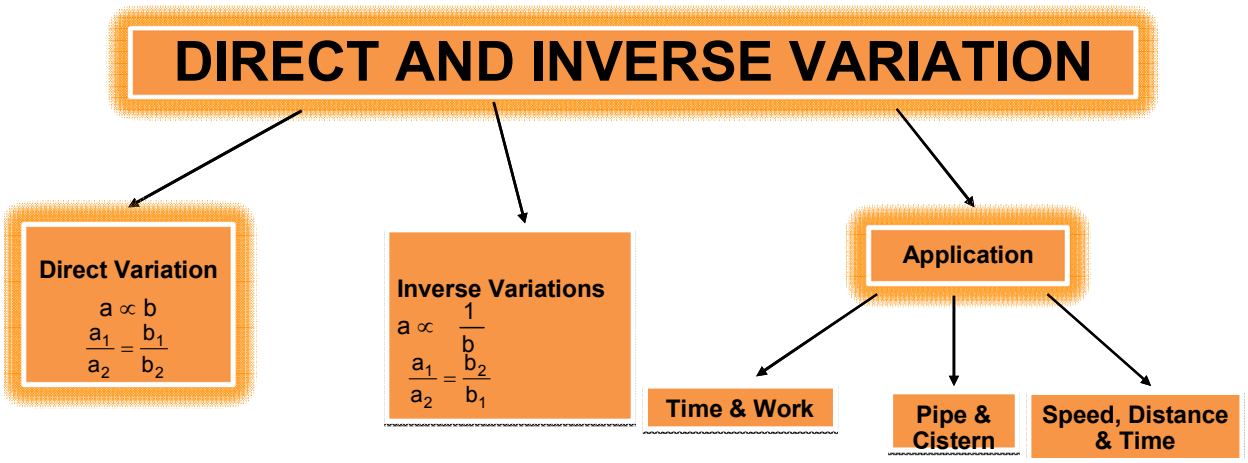
$\Rightarrow \quad 60 - 3x = 2x - 30$

$\Rightarrow \quad 5x = 90$

$\Rightarrow \quad x = 18.$

So, price of the mixture is Rs.18 per kg.

Concept Map


DIRECT AND INVERSE VARIATION
Direct Variation
$a \propto b$
$\frac{a_1}{a_2} = \frac{b_1}{b_2}$
Inverse Variations
$a \propto \frac{1}{b}$
$\frac{a_1}{a_2} = \frac{b_2}{b_1}$
Application
Time & Work
Pipe & Cistern
Speed, Distance & Time

Summary

PROBLEM OF PIPES AND CISTERN

A cistern or a water tank is connected with two types of pipes.

(i) **Inlet :** The pipe which fills the tank is called an **inlet**.

(ii) **Outlet :** The pipe which empties the tank is called **outlet**.

Rule.1 Suppose a pipe fill tank in n hours.

Then, part of tank filled in 1 hour = $\frac{1}{n}$. i.e Work done by the inlet in 1 hour = $\frac{1}{n}$.

Rule.2 Suppose an outlet empties a full tank m hours.

Then, part of tank emptied in 1 hour = $\frac{1}{m}$. i.e. Work done by the outlet in 1 hour = $\left(-\frac{1}{m}\right)$.

PROBLEM ON TRAINS

(i) Time taken by a train of length **'a'** metres to pass a pole or a standing man or a signal post is equal to the time taken by the train to cover **'a'** metres.

(ii) Time taken by a train of length **'a'** metres to pass a stationary object of length **'b'** metres is the time taken by the train to cover **(a + b)** metres.

(iii) Suppose two trains or two bodies are moving in the same direction at **u m/s** and **v m/s**, where **u > v**, then their relatives speed = **(u – v) m/s**.

(iv) Suppose two trains or two bodies are moving in opposite direction at **u m/s** and **v m/s**, where
u > v, then their relative speed = **(u + v) m/s**.

DIRECT VARIATION :

Two quantities are said to vary directly if an increase or decrease in one quantity leads to corresponding increase or decrease in the other quantity and vice-versa.

INVERSE VARIATION :

Two quantities are said to vary inversely if an increase or decrease in one quantity leads to corresponding decrease or increase in the other quantity and vice-versa.

TIME AND WORK :

(i) If a person completes the work in x days, then he will do 1/xth part of the work in one day.

(ii) If a person does 1/xth part of the work in one day, then he will complete the work in x days.

SPEED :

(i) Speed = $\frac{\text{Distance}}{\text{Time}}$ **(ii)** Distance = Speed × Time

(iii) Time = $\frac{\text{Distance}}{\text{Speed}}$.

Exercise-1

SECTION -A (FIXED RESPONSE TYPE)

MULTIPLE CHOICE QUESTIONS

1. If 36 men can do a piece of work in 25 days, in how many days will 15 men do it ?
(A) 50 days (B) 56 days (C) 60 days (D) 72 days

2. 120 men had food provisions for 200 days . After 5 days, 30 men died due to epidemic. The remaining food will last for :
(A) $146\frac{1}{4}$ days (B) 150 days (C) $225\frac{1}{2}$ days (D) 260 days

3. 39 persons can repair a road in 12 days working 5 hours a day. In how many day will 30 persons, working 6 hours a day, complete the work ?
(A) 10 days (B) 13 days (C) 14 days (D) 15 days

4. If 5 men or 9 women can do a piece of work in 19 days then in how many days will 3 men and 6 women do the same work ?
(A) 12 days (B) 15 days (C) 18 days (D) 21 days

5. A alone can do a piece of work in 10 days and B can do it in 15 days. In how many days will A and B together do the same work ?
(A) 5 days (B) 6 days (C) 8 days (D) 9 days

6. A can do a work in 15 days and B in 20 days. If they work on it together for 4 days then the fraction of the work that is left is :
(A) $\frac{1}{4}$ (B) $\frac{7}{15}$ (C) $\frac{1}{10}$ (D) $\frac{8}{15}$

7. A can do $\frac{1}{3}$ of a work in 5 days and B can do $\frac{2}{5}$ of the work in 10 days. In how many days can both A and B together do the work?
(A) $7\frac{3}{4}$ days (B) $8\frac{4}{5}$ days (C) $9\frac{3}{8}$ days (D) 10 days

8. A man can do a piece of work in 5 days, but with the help of his son, he can do it 3 days. In what time can the son do it alone ?
(A) $6\frac{1}{2}$ days (B) 7 days (C) $7\frac{1}{2}$ days (D) 8 days

9. A tap can fill a tank in 6 hours. After half of the tank is filled, two more similar taps are opened. What is the total time taken to fill the tank completely ?
(A) 3 hrs 15 min (B) 3 hrs 45 min (C) 4 hrs (D) 4 hrs 15 min

10. A train traveling at 90 km/hr is able to pass a telegraph post in 10 seconds . The length of the train is :
(A) 250 metres (B) 240 metres (C) 242 metres (D) 245 metres

11. A train passes a station platform in 36 seconds and a man standing on the platform in 20 seconds. If the speed of the train is 54 km/hr, what is the length of the platform ?
(A) 120 m (B) 240 m (C) 300 m (D) None of these

FILL IN THE BLANKS

1. If speed is constant, then less time required for _____ distance.
2. More men at work, _____ is the time to finish it.
3. A can finish a work in n days, then A can finish twice work in _____
4. Pipe which fills the tank is called _____
5. Pipe which empties the tank is called _____
6. Suppose two trains or two bodies are moving in opposite direction at u m/s and v m/s, where u > v, then relative speed is _____
7. Suppose two trains or two bodies are moving in the same direction at u m/s and v m/s, where u > v, then relative speed is _____.
8. If two quantities are very inversely then decrease in one quantity cause _____ in other quantity.
9. An athlete ran 100 m in 10 seconds. Then, his speed in km/hr _____

TRUE / FALSE

1. Work done varies directly as the working time.
2. As the no. of workers reduces, working time decreases
3. Speed is inversely varies with time.
4. If total time taken by man to complete certain work is D, then his 1 day work is $\frac{1}{D}$.
5. More is the working time, less is work done.

MATCH THE COLUMN

1.

Column – I		Column – II	
(A)	In a specified time, speed of a car varies	(p)	inversely with the number of pens
(B)	If the amount of money to be spent is fixed, the cost per pen varies	(q)	directly with the number
(C)	The money spent to pens varies	(r)	directly with the distance covered by it.
(D)	Amount of work done by workers varies	(s)	directly with the number of workers
(E)	Time taken by the workers to complete a certain work varies	(t)	inversely with the number of workers

2.

	Column–I		**Column–II**
(A)	Cost of articles varies with number of articles	(p)	Half
(B)	Time taken to finish a piece of work varies with number of men	(q)	$\frac{1}{n}$
(C)	1 day work of 'A' if he finish work in n days	(r)	directly
(D)	If 'A' take twice time to complete a work as compared to 'B' then 'A' efficiency as compared to B is	(s)	inversely

SECTION -B (FREE RESPONSE TYPE)

VERY SHORT ANSWER TYPE

1. If 32 men can reap a field in 15 days, in how many days can 20 men reap the same field ?

2. 70 patients in a hospital consume 1350 litres of milk in 30 days. At the same rate, how many patients will consume 1710 litres in 28 days ?

3. If 20 men can build a 112 m long wall in 6 days, what will be the length of a similar wall that can be built by 25 men in 3 days ?

4. 6 men, working 8 hours a day earn Rs 8400 per week. What will be the earning per week of 9 men who work for 6 hours a day ?

5. 500 soldiers in a fort had enough food for 30 days. After 6 days, some soldiers were sent to another fort and thus the food lasted for next 32 days. How many soldiers left the fort ?

SHORT ANSWER TYPE

6. If 270 kg of corn would feed 42 horses for 21 days, for how many days would 360 kg of it feed 21 horses?

7. Ravi can do a piece of work in 15 hours while Raman can do it in 12 hours. How long will both take to do it, working together ?

8. A, B and C can do a piece of work in 15, 12 and 20 days respectively. They started the work together, but C left after 2 days. In how many days will the remaining work be completed by A and B ?

9. Three taps A, B and C can fill an overhead tank in 6 hours, 8 hours and 12 hours respectively. How long would the three taps take to fill the empty tank, if all of them are opened together ?

10. A pipe can fill a cistern in 9 hours. Due to a leak in its bottom, the cistern fills in 10 hours. If the cistern is full, in how much time will it be emptied by the leak ?

LONG ANSWER TYPE

11. A can do a piece of work in 4 hours; B and C together can do it in 3 hours, while A and C together can do it in 2 hours. How long will B alone take to do it

12. Pipe A can fill a cistern 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 remaining part of the cistern ?

13. Three pipes A, B & C can fill a cistern in 8 hours. After working at it together for 2 hours, A is closed and B and C can fill it in 9 hours. The number of hours taken by A alone to fill the cistern ?

14. A train 100 m long traveling with speed of 60 km/hr passes of another train 150 m long moving in the opposite direction in 9 sec. What was the speed of second train ?

15. Two goods train each 500 m long, are running in opposite directions on parallel tracks. Their speeds are 45 km/hr and 30 km/hr respectively. Find the time taken by the train to cross each other.

Exercise-2

SECTION -A (COMPETITIVE EXAMINATION QUESTION)

MULTIPLE CHOICE QUESTIONS

1. The cost of 25 metres of cloth is Rs. 637.50. The cost of 15 metres of cloth is

(A) Rs. 395.50 (B) Rs. 382.50 (C) Rs. 287.50 (D) Rs. 526

2. A fort has enough food for 400 soldiers for 12 days. If 80 more soldiers join them, the food will last for

(A) 8 days (B) 10 days (C) 9 days (D) 11 days

3. A man can complete a piece of work in 20 days. The amount of work done in 8 days will be

(A) $\frac{2}{3}$ rd (B) $\frac{2}{5}$th (C) $\frac{3}{5}$th (D) $\frac{1}{2}$nd

4. Amit drives his car at 60 kmph. The time taken to cover 150 km is

(A) 3 hrs (B) 2 hrs (C) $2\frac{1}{2}$ hrs (D) $3\frac{1}{2}$ hrs.

5. Ram and Mohan can do a piece of work in 6 days and 4 days respectively. Ram starts the work and works for 2 days alone. Then Mohan joins him. How long will it take them to finish the remaining work ?

(A) 8/5 day (B) 2 days (C) 12/5 days (D) 14/3 days

6. A, B and C can do a work in 6, 8 and 12 days respectively, each working alone. B and C work together for 2 days and then A replaces C. In how much time will the total work finish ?
(A) 4 day (B) 3 days (C) 5 days (D) 6 days

7. Two pipes A and B can fill an empty tank in 12 and 16 hours respectively. Pipe C can empty the full tank in 8 hours. If all the three pipes are opened together together, how long will the tank to get filled up ?
(A) 45 hrs. (B) 48 hrs. (C) 50 hrs. (D) 52 hrs.

8. 20 boys earn Rs. 1680 in 7 days, how much will 15 boys earn in 5 days?
(A) Rs. 750 (B) Rs. 800 (C) Rs. 850 (D) Rs. 900

9. A pipe can fill a tank in 6 hours. Due to leak in the bottom it is filled in 7 hours. When the tank is full, in how much time will it be emptied ?
(A) 42 hrs. (B) 63 hrs. (C) 54 hrs. (D) 62 hrs.

10. 10 men and 15 women together can complete a work in 6 days. It takes 100 days for one man alone to complete the same work . How many days will be required for one woman alone to complete the same work?
(A) 90 (B) 125 (C) 145 (D) none of these

SECTION -B (TECHIE STUFF)

11. Tea worth Rs.126 per kg and Rs.135 per kg are mixed with a third variety in the ratio 1 : 1 : 2. If the mixture is worth Rs. 153 per kg, then find the price of the third variety per kg.
(A) 175.5 kg (B) 172 kg (C) 171 kg (D) 177.5 kg

12. A jar full of whisky contains 40% alcohol . A part of this whisky is replaced by another whisky containing 19% alcohol and now the percentage of alcohol was found to be 26%. Find the quantity of whisky replaced.
(A) 1/3 (B) 2/3 (C) 5/4 (D) 4/3

Exercise-3

(PREVIOUS YEAR EXAMINATION QUESTIONS)

1. A train 150 m long is moving at a speed of 30 km/hr. It will cross a cyclist coming at a speed of 10 km/hr in the opposite direction in **[Aryabhatta - 2009]**
(A) 11.5 seconds (B) 13.5 seconds (C) 14.25 seconds (D) 15.75 seconds.

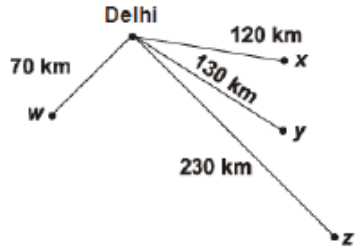
2. P alone can complete a work in 12 days, while P and Q together can complete the same work in 8 days. The number of days that Q will take to complete the work alone is **[NSTSE - 2010]**
(A) 10 (B) 24 (C) 20 (D) 9

3. Pipes A and B can fill a tank in 10 hours & 15 hours respectively. Find the time in which both together can fill it **[Aryabhatta - 2010]**
(A) 6 hours (B) 5 hours (C) 8 hours (D) 12 hours

4. A train 150 m long is moving at a speed of 30 km/hr. It will cross a cyclist coming at a speed of 20 km/hr in the opposite direction in
(A) 11.5 seconds (B) 13.5 seconds (C) 14.25 seconds (D) 10.80 seconds

5. A 2 cm long grasshopper can jump 160 cm. If 1 metre tall animal had the same height an jump ratio, how far could be jump? **[IMO - 2010]**
(A) 48 m (B) 480 m (C) 80 m (D) 8000 m

6. Dhruv plans on leaving his home in Delhi at 8 : 00 A.M. He will drive at an average speed of 40 km per hour and plans to arrive at his destination at 11:00 A.M. If the makes no stops along the way, which of the four places is his destination? **[IMO - 2010]**



(A) W (B) X (C) Y (D) Z

7. A machine takes 12 minutes to fill 200 bottles of soda. At this rate, how many minutes will it take the machine to fill 500 bottles of soda? **[IMO - 2010]**
(A) 25 minutes (B) 28 minutes (C) 30 minutes (D) 40 minutes

8. Jiah is building birdhouses. It takes her 3 hours to build 4 birdhouses. Which of the following is an equivalent rate ? **[IMO - 2010]**
(A) 14 hours to build 18 birdhouses (B) 28 hours to build 35 birdhouses
(C) 7 hours to build 8 birdhouses (D) 21 hours to build 28 birdhouses

9. 9 men visited a hotel, 8 of them spent Rs. 4 each over their meal and the 9^{th} spent Rs. 2 more than the average of all the nine. The total money spent by them on the meal is **[Aryabhatta - 2011]**
(A) 28.25 (B) 18.30 (C) 38.25 (D) 8.28

10. A can do a piece of work in 10 days, B can do it in 15 days. If they both work together they can finish the work in. _____. **[IMO - 2011]**
(A) 9 days (B) 8 days (C) 10 days (D) 6 days

11. Mr. Gupta drives at a speed of 60 km/hr for 6 hours from Chandigarh to Delhi. Mr. Verma drives his car at an average speed of 45 km/hr for the same journey. How much time does Mr. Verma take to complete the journey? **[IMO - 2011]**
(A) 7 hrs (B) 8 hrs (C) 9 hrs (D) 11 hrs

12. A train 108 m long moving at a speed of 50 km/hr crosses a train 112 m long coming from opposite direction in 6 seconds. Find the speed of the second train.**[Aryabhatta - 2012]**
(A) 22 km/hr (B) 52 km/hr (C) 102 km/hr (D) 82 km/hr

13. If x : y = 2 : 3 and 2 :x = 1 :2, then the value of y is . **[IMO - 2012]**
(A) 4 (B) 6 (C) $\frac{1}{3}$ (D) $\frac{3}{2}$

14. A boat goes downstream and covers the distance between two ports in 4 hours, while it covers the same distance upstream in 5 hours. If the speed of the stream is 2 km/hr, find the speed of boat in still water. **[IMO - 2012]**

(A) 16 km/hr (B) 18 km/hr (C) 20 km/hr (D) 15 km/hr

15. There are 12 pipes that are connected to a tank. Some of them are fill pipes and the others are drain pipes. Each of the fill pipes can fill the tank in 8 hours and each of the drain pipes can drain the tank completely in 6 hours. If all the fill pipes and the drain pipes are kept open, an empty tank gets filled in 24 hours. How many from the 12 pipes are fill pipes ? **[Aryabhatta - 2013]**

(A) 8 (B) 7 (C) 10 (D) 9

16. A takes 3 min 45 seconds to complete a kilometer. B takes 4 minutes to complete the same 1 km track. If A and B were to participate in a race of 2 kms. How much start can A give B in terms of distance ? **[Aryabhatta - 2013]**

(A) 125 m (B) 250 m (C) 500 m (D) 625 m

Answer Key

Exercise-1

SECTION -A (FIXED RESPONSE TYPE)

MULTIPLE CHOICE QUESTIONS

Ques.	1	2	3	4	5	6	7	8	9	10	11
Ans.	C	D	B	B	B	D	C	C	C	A	B

FILL IN THE BLANKS

1. Less **2.** Less **3.** 2n **4.** inlet pipe

5. outlet pipe **6.** U + V **7.** U – V **8.** increase

9. 36

TRUE / FALSE

1. True **2.** False **3.** True **4.** True

5. False

MATCH THE COLUMNS

1. (A) – r, (B) – p, (C) – q, (D) – s, (E) – t **2.** (A) – r, (B) – s, (C) – q, (D) – p

SECTION -B (FREE RESPONSE TYPE)

1. 24 Days **2.** 95 patients **3.** 70 meters **4.** Rs. 9450

5. 125 soldiers **6.** 56 **7.** $6\frac{2}{3}$ Hrs. **8.** 4 days

9. $2\frac{2}{3}$ Hrs. **10.** 90 Hrs. **11.** 12 Hrs. **12.** $3\frac{1}{3}$ hrs.

13. 24 hrs. **14.** 40 km/hr **15.** 48 sec.

Exercise-2

SECTION -A (COMPETITIVE EXAMINATION QUESTION)

Ques.	1	2	3	4	5	6	7	8	9	10	11	12
Ans.	B	B	B	C	A	A	B	D	A	D	A	B

Exercise-3

(PREVIOUS YEAR EXAMINATION QUESTIONS)

Ques.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Ans.	B	B	A	D	C	B	C	D	C	D	B	D	B	B	B	A