



ST. LAWRENCE HIGH SCHOOL



A JESUIT CHRISTIAN MINORITY INSTITUTION

Sub: Arithmetic

Class: 7

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STUDY MATERIAL: UNITARY METHOD

Important Formulae and Concepts

In simple terms, the unitary method is used to find the value of a single unit from a given multiple.

What is Unitary Method?

The unitary method is a method in which you find the value of a unit and then the value of a required number of units. What can units and values be?

Suppose you go to the market to purchase 6 apples. The shopkeeper tells you that he is selling 10 apples for Rs 100. In this case, the apples are the units and the cost of the apples is the value. While solving a problem using the unitary method, it is important that you recognize the units and values.

For simplification, always write the things to be found on the right-hand side and things known on the left-hand side. In the above problem, we know the amount of the number of apples and the value of the apples is unknown. It should be noted that the concept of ratio and proportion is used for problems related to this method.

Example of Unitary Method

Consider another example, a car runs 150 km on 15 litres of fuel, how many kilometre will it run on 10 litres of fuel?

In the above question, try and identify units (known) and values (unknown).

Kilometre = Unknown (Right Hand Side)

No of litres of fuel = Known (Left Hand Side)

Now we will try and solve this problem.

15 litres = 150 km

1 litre = $150/15 = 10$ km

10 litres = $10 \times 10 = 100$ km

The car will run 100 kilometres on 10 litres of fuel.

Applications of Unitary Method

The unitary method finds its practical application everywhere ranging from problems of speed, distance, time to problems related to calculating the cost of materials. Let us take unitary method problems for speed distance time and for time and work.

Solved Numericals

1. The cost of 3 kg of sugar is \$ 60. What will the cost of 8 kg of sugar be?

Solution:

This is a situation of direct variation, now we solve using unitary method.

Cost of 3 kg of sugar = \$ 60

Cost of 1 kg of sugar = \$ $60/3$ = \$ 20

Cost of 8 kg of sugar = \$ 20×8

Therefore, cost of 8 kg of sugar = \$ 160

2. If 13 books cost 169, what do 30 books cost?

Solution:

This is a situation of direct variation, now we solve using unitary method.

Cost of 13 books = \$ 169.

Cost of 1 book = \$ $169/13$ = \$ 13.

Cost of 30 books = \$ 13×30 .

Therefore, cost of 30 books = \$ 390.

3. A labourer gets \$ 684 for 9 days. How many days should he work to get \$ 912?

Solution:

This is also a situation of direct variation, now we solve using unitary method.

For \$ 684, the labourer works 9 days.

For \$ 1, the labourer works $9/684$ days.

For \$ 912, the labourer works $9/684 \times 912$ days.

Therefore, for \$ 912, the labourer works 12 days.

4. A car travelling at a speed of 140 kmph covers 420 km. How much time will it take to cover 280 km?

Solution: First we need to find the time required to cover 420 km.

Speed = Distance/Time

$$140 = 420/T$$

$$T = 3 \text{ hours}$$

Applying the unitary method,

$$420 \text{ km} = 3 \text{ hours}$$

$$1 \text{ km} = 3/420 \text{ hour}$$

$$280 \text{ km} = (3/420) \times 280 = 2 \text{ hours}$$

5: A finishes his work in 15 days while B takes 10 days. How many days will the same work be done if they work together?

Solution:

If A takes 15 days to finish his work then,

$$\text{A's 1 day of work} = 1/15$$

$$\text{Similarly, B's 1 day of work} = 1/10$$

$$\text{Now, total work done by A and B in 1 day} = 1/15 + 1/10$$

Taking LCM (15, 30) we have,

$$1 \text{ day's work of A and B} = (2+3)/30$$

$$1 \text{ day's work of (A + B)} = 1/6$$

Thus, A and B can finish the work in 6 days if they work together.

6. If 24 painters working for 7 hours a day, for painting a house in 16 days. How many painters are required working for 8 hours a day will finish painting the same house in 12 days?

Solution:

24 painters working for 7 hours paint a house in 16 days.

1 painter working for 7 hours paints a house in 16×24 days.

1 painter working for 1 hour paints a house in $16 \times 24 \times 7$ days.

Let the required number of painters be x , then;

x painters working for 1 hour a day paint the house in $(16 \times 24 \times 7)/x$ days

x painters working for 8 hours a day paint the house in $(16 \times 24 \times 7)/(x \times 8)$ days

But the number of days given = 12

According to the problem;

$$(16 \times 24 \times 7)/(x \times 8) = 12$$

$$2688/8x = 12$$

$$8x \times 12 = 2688$$

$$96x = 2688$$

$$x = 2688/96$$

$$x = 28$$

Therefore, 28 painters working for 8 hours a day will finish the same work in 12 days.

7. 11 potters can make 143 pots in 8 days. How many potters will be required to make 169 pots in 4 days?

Solution:

11 potters can make 143 pots in 8 days.

1 potter can make 143 pots in 8×11 days.

1 potter can make 1 pot in $(8 \times 11)/143$ days.

Let the number of potters required be x , then;

x potters can make 1 pot in $(8 \times 11)/(143 \times x)$ days

x potters can make 169 pots in $(8 \times 11 \times 169)/(143 \times x)$ days

But the number of days given = 4

According to the problem;

$$(8 \times 11 \times 169)/(143 \times x) = 4$$

$$14872/143x = 4$$

$$572x = 14872$$

$$x = 14872/572$$

$$x = 26$$

Therefore, 26 potters are required to make 169 pots in 4 days.

8. 12 typists working for 4 hours to type a book in 18 days. In how many days 4 typists will work for 8 hours to type same book?

Solution:

This is a situation of indirect variation.

12 typists working for 4 hours type a book in 18 days

1 typist working for 4 hours types a book in 18×12 days.

1 typist working for 1 hour types a book in $18 \times 12 \times 4$ days.

4 typists working for 1 hour type a book in $(18 \times 12 \times 4)/4$

4 typists working for 8 hours type a book in $(18 \times 12 \times 4)/(4 \times 8)$ days.

Therefore, 4 typists working for 8 hours type a book in 27 days.

9. 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 variation

More the number of men, the faster will they build the wall.

In 56 hours, the wall is built by 16 men.

In 1 hour, the wall is built by 16×56 men.

In 32 hours, the wall is built by $(16 \times 56)/32$ men

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

10. If 72 workers can do a piece of work in 40 days, in how many days will 64 workers complete the same work?

Solution:

This is a situation of indirect variation.

Less workers will require more days to complete the work.

72 workers can do the work in 40 days

1 worker can do the same work in 72×40 days

64 workers can do the same work in $(72 \times 40)/64$

Therefore, 64 workers can do the same work in 45 days.

11. If 52 men can do a piece of work in 35 days, then 28 men will complete the same work in how many days?

Solution:

This is a situation of inverse variation, now we solve using unitary method.

52 men can do the work in 35 days.

1 man can do the work in (35×52) days.

28 men can do the work in days. $(35 \times 52)/28$ days

Therefore, 28 men can do the work in 65 days.

12. In a camp there is enough food for 500 soldiers for 35 days. If 200 more soldiers join the camp, how many days will the food last?

Solution:

This is a situation of inverse variation, now we solve using unitary method.

For 500 soldiers, food lasts for 35 days.

For 1 soldier, food lasts for (35×500) days.

Since 200 more join. So, now the number of soldiers is $(500 + 200) = 700$.

For 700 soldiers, food lasts for $(35 \times 500)/700$ days

Therefore, for 700 soldiers, food lasts for = 25 days.

13. Sara starts at 8:00 AM by bicycle to reach school. She cycles at the speed of 18 km/hour and reaches the school at 8:22 AM. By how much should she increase the speed so that she can reach the school at 8:12 AM?

Solution:

This is a situation of inverse variation, now we solve using unitary method.

In 22 minutes the same distance is covered at the speed of 18 km/hr.

In 1 minute the same distance is covered at the speed of (18×22) km/hr.

In 12 minutes the same distance is covered at the speed of $(18 \times 22)/12$ km/hr.

Therefore, in 12 minutes the same distance is covered at the speed of 16 km/hr.

14. 32 workers can complete a work in 84 days. How many workers will complete the same work in 48 days?

Solution:

This is a situation of inverse variation, now we solve using unitary method.

To complete the work in 84 days, workers required = 32

To complete the work in 1 day, worker required = (32×84)

To complete the work in 48 days workers required = $(32 \times 84)/48$

Therefore, to complete the work in 48 days, 56 workers are required.

Solution of Previous Years' Question Papers

2019

1st term

- 6) If 20 workers consume a certain quantity of flour in 14 days, in how many days will 8 workers consume the same quantity of flour?

Workers	Days
↓ 20	14 ↑
8	x

∴ By the problem,

$$\frac{20}{8} = \frac{x}{14}$$
$$\text{or, } x = \frac{20 \times 14}{8} = 35 \text{ days}$$

- 3) 28 pumps can empty a reservoir in 18 hours. In how many hours can 42 such pumps do the same work?

No. of pumps	No. of hours
↓ 28	18 ↑
42	x

∴ By the problem,

$$\frac{28}{42} = \frac{x}{18}$$
$$\text{or, } x = \frac{28 \times 18}{42} = 12 \text{ hours}$$

- 4) A and B together can do a piece of work in 5 days, but A alone can do it in 10 days. How many days would B alone take to do the same work?

$$\text{In 1 day part of the work done by B} = \frac{1}{5} - \frac{1}{10} = \frac{2-1}{10} = \frac{1}{10}$$

∴ No. of days required by B alone to complete the work = 10 days

- 5) A cistern can be filled by one tap in 6 hours and another tap in 8 hours. How long will it take to fill the cistern, if both the taps are opened together?

$$\text{Part of the cistern filled when two taps are opened together} = \frac{1}{6} + \frac{1}{8} = \frac{4+3}{24} = \frac{7}{24}$$

$$\text{∴ Required time} = \frac{24}{7} \text{ hours} = 3\frac{3}{7} \text{ hours}$$

2nd Term

- 5) If 5 men can finish a piece of work in 4 days, how many men could be required to finish in 1 day? (c) 20
- 5) If it would take 15 hours for cleaning the tress from some land by 4 people, then how many people will be needed to complete the job in 6 hours.

Ans:

Time	People
15	4
06	x

Here it is inversely related. Therefore $x = \frac{15 \times 4}{6} = 10$

6) A farmer has enough hay to feed 5 horses for 6 days. How long would the hay last for 3 horses?
 Ans: The length of time for which the horses can be fed is inversely proportional to the number of horses to be fed. So 5 horses : 3 horses :: x : 6
 Solving we get x = 10. So 3 horses can be fed for 10 days.

7) A water tank can be filled by a tap in 12 hours and emptied by an outlet pipe in 18 hours. How long will it take to fill the cistern if both the tap and the pipe are opened together?
 Ans : The work done by the tap in 1 hour = $\frac{1}{12}$ and the work done by the outlet pipe in 1 hour = $\frac{1}{18}$
 So, the work done by the tap and the outlet pipe = $\frac{1}{12} + (-\frac{1}{18}) = \frac{1}{36}$
 So, when both opened the tank can be filled in 36 hours.

3rd Term

i) What is the cost of 30 books if the cost of 16 books is Rs 72 ? Ans-Rs135

4. 28 pumps can empty a reservoir in 18 hrs. In how many hours can 42 such pumps do the same work.

ii) A fort had provisions for 150 men for 55 days. After 15 days, 25 men left the fort. How long will the food last at the same rate?

Ans- For 150 men food for 40 days. Therefore for 125 men food for $(40 \times 150) / 125 = 48$ days.

Or

A and B together can do a piece of work in 5 days, but A alone can do it in 10 days. How many days would B alone take to do the same work?

Ans-A+B can do $\frac{1}{5}$ of work. A can do $\frac{1}{10}$ of the work in 1 day. Therefore B can do $(\frac{1}{5} - \frac{1}{10}) = \frac{1}{10}$ of the work in 1 day. Hence B can do the work in 10 days.

2018

2nd Term

(i) If cost of 16 products is Rs. 72, then the cost of 30 products will be _____.

(i) 135

(i) If 20 workers consume a certain quantity of flour in 14 days, in how many days will 8 workers consume the same quantity of flour?

(i) 20 workers consume a certain quantity in 14 days
 1 " " " " in 14×20 days
 8 " " " " in $\frac{14 \times 20}{8}$ days = 35 days.

vi) A cistern can be filled by one tap in $2\frac{1}{2}$ hrs and by another $3\frac{3}{4}$ hrs. How long will the cistern take to fill if they are opened together.

vi) A cistern can be filled by one tap in $2\frac{1}{2}$ hrs and by another $3\frac{3}{4}$ hrs. How long will the cistern take to fill if they are opened together.

Ans: 1st tap fills in 1 hr $\frac{2}{5}$ part

2nd tap fills in 1 hr $\frac{4}{15}$ part

Therefore both the taps can fill in 1 hr $(\frac{2}{5} + \frac{4}{15}) = \frac{10}{15}$ part = $\frac{2}{3}$ part

$\frac{2}{3}$ part can be filled in 1 hr

1 part can be filled in $\frac{1}{\frac{2}{3}}$ hrs = $\frac{3}{2}$ hrs = $1\frac{1}{2}$ hrs.

3rd Term

(iv) The weight of 45 books is 9 kg. What is the weight of 80 books.

45 books weight 9 kg
1 book weight $\frac{9}{45}$ kg
80 books weight $\frac{9}{45} \times 80 = 16$ kg.

(vii) The distance around the field is 540 m. Vijay runs around the field 8 times in half an hour. What is the average speed in m/s?

Distance covered by Vijay = (540×8) m = 4320 m; Time = (30×60) sec.s = 1800 sec.s

In 1800 seconds he covers 4320 m
In 1 second he covers $\frac{4320}{1800} = 2.4$ m/second.

(iii) A and B together can do a piece of a work in 5 days, but A alone can do it in 10 days. How many days would B alone take to do the same work?

In 1 day A and B together can do $\frac{1}{5}$ th of the work.

In 1 day A alone can do $\frac{1}{10}$ th of the total work

\therefore In 1 day B alone can do $(\frac{1}{5} - \frac{1}{10})$ of the work i.e. $\frac{1}{10}$ th of the total work.

So, B alone can do the work in $(1 \div \frac{1}{10})$ i.e. 10 days.

Exercise Problems

- 12 workers finish a job in 20 hours. How many workers will be required to finish the same work in 15 hours?
- If the annual rent of a flat is Rs. 3600, calculate the rent of 7 months.
- If 56 books weigh 8 Kg, calculate the weight of 152 books.
- If 5 cars can carry 325 people, find out the total number of people which 8 cars can carry.
- Rakesh completes $\frac{5}{8}$ of a job in 20 days. How many more days will he take to finish the job at his current rate?
- 12 farmers harvest the crops in the field in 20 hours. How many workers will be required to do the same work in 15 hours?
- 2 men or 3 women can earn \$192 in a day. Find how much 5 men and 7 women will earn in a day?
- The weight of 56 books is 8 kg. What is the weight of 152 such books? How many such books weigh 5 kg?
- John types 450 words in half an hour. How words would he type in 7 minutes?
- A worker is paid Rs.750 for 6 days' work. If he works for 23 days, how much will he get?
- 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?
- 15 masons can build the wall in 20 days. How many masons will build the wall in 12 days?
- 76 persons can complete the job in 42 days. In how many days will 56 persons do the same job?
- In a camp, there are provisions for 400 persons for 23 days. If 60 more persons join the camp, find the number of days the provision will last?
- If 10 workers, working for 4 hours complete the work in 12 days, in how many days will 8 workers working for 6 hours complete the same work?
- The freight for 75 quintals of goods is Rs. 375. Find the freight for 42 quintals.
- 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?