6. UNITARY METHOD

Unitary method is the basic area of arithmetic.

Direct Proportion

Two quantities are said to be directly proportional, if on the increase in one the other increases proportionally or on the decrease in one the other decreases proportionally,

e.g., More the numbers of articles, More is the cost.

More the number of workers, More is the work done.

Less the number of articles, Less is the cost.

Less the number of workers, Less is the work done.

Indirect Proportion

Two quantities are said to be indirectly proportional, if on the increase in one the other decreases proportionally or on the decrease in one the other increases proportionally.

e.g., More the number of workers, less is the number of days required to finish a work. More the speed, less is the time taken to cover a certain distance.

Less the number of workers, more is the number of days required to finish a work. Less the speed, more is the time taken to cover a certain distance.

Chain Rule

When a series of variables are connected with one another, that we know how much of the first kind is equivalent to a given quantity of second, how much of the second is equivalent to a given quantity of the third and so on. The rule by which we can find how much of the last kind is equivalent to a given quantity of the first kind is called the Chain Rule.

Example 1: If 12 apples cost Rs.216, what is the cost of 3 dozen apples ?

Solution: Let the required cost be Rs. x. Also, 3 dozen apples = 36 apples

more apples- more cost (Direct Proportion);

Apples	Cost
12	216
36	X

$12\times x = 36\times 216 \Rightarrow x = \frac{36\times 216}{12}$ = Rs.648

Example 2: A man completes $\frac{3}{5}$ of a job in 18 days. At this rate, how many more days will it take him to finish the job?

Solution: Let the number of days still required to finish the job be x days. Remaining Work = $(1-\frac{3}{5})$ = $\frac{2}{5}$

Less work- Less hours (Direct Proportion).

Work	Time in days
$\frac{3}{5}$	18
$\frac{2}{5}$	x

$\Rightarrow \quad x\times\frac{3}{5} = \frac{2}{5}\times 18 \Rightarrow x = \frac{2\times 18\times 5}{3\times 5}$ = 12 days

Example 3: A wheel that has 5 cogs is meshed with a larger wheel of 15 cogs. When the smaller wheel has made 27 revolutions, find the number of revolution made by the larger wheel.

Solution:: Let the required number of revolutions made by larger wheel be x.

More cogs-Less revolutions (Indirect Proportion)

Cogs	Revolutions made
5	27
15	x

$\Rightarrow 15\times x = 5\times 27 \Rightarrow x = \frac{5\times 27}{15}$ = 9 revolutions

Example 4: If the wages for 8 men for 24 days be Rs.3040, then find the wages of 6 men for 18 days.

Solution: . Let the required wages be Rs. *x*.

Less men, Less wages (Direct Proportion)

Less days, Less wages (Direct Proportion)

Men	Days	Wages in Rs.
8	24	3040
6	18	x

$\Rightarrow x = \frac{6}{8} \times \frac{18}{24} \times 3040 = Rs.1710$

Example 5: If a man walks a certain distance in 20 days when he rests 10 h each day, how long will it take him to walk three times as far, if he walks twice as fast and rests 12 h each day?

Solution: In the first case the man walks (24- 10)hr = 14h each day. Let the distance travelled be d and the speed be s.

In the second case the man walks (24-12) hr = 12 hr each day. The distance travelled is 3*d* and the speed is 2s. Let the required number of days be x.

More distance-More days (Direct Proportion)

More speed-Less days (Indirect Proportion)

Less hours-More days (Indirect Proportion)

Distance	**Speed**	**Hours**	**Days**
d	s	14	20
3d	2s	12	x

$X = \frac{3d}{d} \times \frac{s}{2s} \times \frac{14}{12} \times \mathbf{20} = 35$ days

Example 6: A contractor undertakes to complete a road 420 m long in 140 days and employ 28 men for the work. After 70 days he finds that only 140 m of the road is made. How many men should the contractor employ more so that the work may be completed in time?

Solution: In the second case in (140-70) days i.e., 70 days the length of the road to be construct (420-140) m i.e., 280 m.

Let the number of men employed be *x*.

More length of road-More men (Direct Proportion)

Days	**Length of road in meters**	**Men**
70	140	28
70	280	x

$X = \frac{280}{140} \times \mathbf{28} = 56$ men

Additional men required= 56 - 28 = 28 men

EXERCISE

1. Cost of 24 pens is *Rs.* 96. Find the cost of 16 such pens,
(a) Rs. 66 (b) Rs. 64
(c) Rs. 62 (d) Rs. 68

2. A bus travels 240 km in 3 h. How long will it take to travel 360 km?
(a) 5 h (b) 4 h
(c) $4\frac{1}{2}$ *h* (d) $5\frac{1}{2}$ *h*

3. The temperature dropped 18°C in the last 24 days. If the rate of temperature drop remains constant, then how many degrees will the temperature drop in the next 32 days?
(a) $24\frac{1^0}{2}$C (b) 22^0C
(c) $22\frac{1^0}{2}$C (d) 24^0C

4. Cost of 8 dozen bananas is Rs.180. How many bananas can be purchased for *Rs.* 30?
(a) 16 bananas (b) 24 bananas
(c) 14 bananas (d) 22 bananas

5. 20 men can reap a field in 20 days. When should 5 men leave the work, if the whole field is to be reaped in 24 days after they leave the work?
(a) 2 days (b) 4 days

(c) 3 days (d) 5 days

6. A rope makes 125 rounds of a cylinder with base radius 15 cm. How many times can it go round a cylinder with base radius 25 cm?
(a) 100 (b) 75 (c) 80 (d) 65

7. 6 men finish one-fourth work in 2 days. The number of additional men required for finishing the same work in 2 days is
(a) 18 men (b) 24 men
(c) 28 men (d) 14 men

8. A certain number of men complete a piece of work in 45 days. If there were 5 men more, the work could be finished in 9 days less. How many men were originally there?
(a) 30 (b) 15
(c) 25 (d) 20

9. 10 workers can make 15 boxes in 6 days, how many boxes will 12 workers make in 3 days.
(a) 10 (b) 9
(c) 6 (d) 8

10. If 25 binders bind 25 books in 25 days. How many binders can bind 10 books in 10 days?
(a) 25 (b) 10
(c) 15 (d) 20

11. If 8 men working 9 h a day can reap a field in 24 days, in how many days will 12 men reap the field, working 6 h a day?
(a) 24 days (b)20 days
(c) 28 days (d) 16 days

12. If 5 men take 21 days of 8 h each to do a piece of work. How many days of 6 h each would 14 women take, if 2 women do as much work as a man?
(a) 20 days (b) 16 days
(c) 18 days (d) 22 days

13. If the cost of 'm' articles is - n the cost of P articles is
(a) Rs. $\frac{pn}{m}$ (b) Rs. $\frac{pm}{n}$
(c) Rs. pmn (d) Rs. $\frac{mn}{p}$

14. The work done by (m + 3) men in *(m* - 2) days and work done by (m - 2) men in (m + 5) days are in the ratio 4 :5 . Find the value of *m?*
(a) 5 (b) 6 (c) 4 (d)8

15. If 36 men take 9 days to earn rs 9000. How many men will earn rs 6000 in 6 days?
(a) 42 (b) 36 (c) 45 (d) 39

16. A contractor undertakes to complete the repairing of a rail track 480 m long in 60 days and employs 60 men for the work. After 30 days he finds that only 160 m of the rail track is repaired. How many more men Should he employ to complete the work in time?
(a) 60 men (b) 64 men
(c) 68 men (d) 62 men

17. If 8 men or 12 women can do a piece of work in 52 days. In how many days can 12 men and 8 women do the same piece of work?
(a) 28 days (b) 24 days
(c) 25 days (d) 30 days

18. A camp of 3000 soldiers has provision for 60 days. After 15 days how many soldiers must leave so that the provision may last for 75 days?
(a) 1200 (b) 1400
(c) 1300 (d) 1500

ANSWER KEY									
1	b	**5**	**a**	**9**	**b**	**13**	**a**	**17**	**b**
2	**c**	**6**	**b**	**10**	**a**	**14**	**a**	**18**	**a**
3	**d**	**7**	**a**	**11**	**a**	**15**	**b**		
4	**a**	**8**	**d**	**12**	**a**	**16**	**a**		

SOLUTIONS

1. Let the required cost be Rs. x. Then,
Less pens, Less cost (Direct Proportion)

Pens	Cost in Rs.
24	96
16	x

$$x = \frac{16}{24} \times 96 = Rs.64$$

2. Let the required number of hours be x.
More distance, More hours (Direct Proportion)

Distance (in km)	Hours
240	3

360 x

$\Rightarrow x = \frac{360}{240} \times 3 = \frac{9}{2} = 4\frac{1}{2}\ h$

3. Let the required drop in temperature be *x*.

More days, More drop in temperature (Direct Proportion)

Days	Drop in temperature
24	18
32	x

$\Rightarrow x = \frac{32}{24} \times 18 = 24°C$

4. 8 dozens = 8×12 = 96 bananas

Let the required number of bananas that can be bought be *x*.

Less price, Less bananas (Direct proportion)

Cost in Rs.	Bananas
180	96
30	x

$\Rightarrow x = \frac{30}{180} \times 96 = 16\ bananas$

5. 20 men can reap a field in 20 days.

⇒ 1 man can reap that field in (20 × 20) days = 400 days

Let 5 men leave the field after *x* days, so that the remaining 15 men can complete the work field

in 24 days.

$20x + 15\times24 = 400$

$\Rightarrow x = 2\ days$

∴ 5 men must leave the work after 2 days.

6. Let the required number of rounds be x.

More radius, Less rounds(Inverse Proportion)

Radius in cm	Round
15	125
25	x

$\Rightarrow x = \frac{15 \times 125}{25} = 75\ rounds$

7. Time taken by 6 men to finish the whole work = 8 days

Let the number of men required be x.

Less days, More men (Inverse Proportion)

Days	Men
8	6
2	x

$\Rightarrow x = \frac{8\times6}{2} = 24\ men$

The additional men required = 24-6 men= 18 men

8. Let there be originally x men.

Then, $(x + 5)$ men can finish the work in (45 - 9) days ie, 36 days

More days, Less men (Inverse Proportion)

Days	Men
36	$(x+5)$
45	x

$\Rightarrow x = \frac{36(x+5)}{45} \Rightarrow x = 20\ men$

9. Let the number of boxes made be x.

More workers, More boxes (Direct Proportion)

Less days, Less boxes (Direct Proportion)

Workers	Days	Boxes
10	6	15
12	3	x

$\Rightarrow x = \frac{12}{10} \times \frac{3}{6} \times 15 = 9\ boxes$

10. Let the number of binders required be x.

Less books, Less binders (Direct Variation)

Less days, More binders (Indirect Variation)

Books	Days	Binders
25	25	25
10	10	x

$\Rightarrow x = \frac{10}{25} \times \frac{25}{10} \times 25 =$

$25\ binders$

11. Let the required number of days be x.

More men, Less days (Indirect Proportion)

Less working hours, More days (Indirect Proportion)

Men	Hours	Days
8	9	24
12	6	*x*

$\Rightarrow x = \frac{8}{12} \times \frac{9}{6} \times 24 = 24 days$

12. 2 women = 1 man

14 women = 7 men

More men, Less days (Indirect Proportion)

Less working hours, More days (Indirect Proportion)

Men	Hours	Days
5	8	21
7	6	x

$\Rightarrow x = \frac{5}{7} \times \frac{8}{6} \times 21 = 20\ days$

13. Let the required cost be rs x.

More articles, More cost (Direct Proportion)

Articles	Cost in Rs.
m	*n*
p	*x*

$\Rightarrow x = \frac{pn}{m}$

14. Work done by (m+2) men in (m-2) days
= (m+3)(m-2)
Work done by (m-2) men in (m+5) days
= (m- 2)(m+5)
$\Rightarrow \frac{(m+3)(m-2)}{(m-2)(m+5)} = \frac{4}{5}$ => m =5

15. Let the required number of men be x.
Less days, More men (Indirect Proportion)
Less earnings, Less men (Direct Proportion)

Days	Earnings in Rs.	Men
9	9000	36
6	6000	x

$\Rightarrow x = \frac{9}{6} \times \frac{6000}{9000} \times 36 = 36\ men$

16. In the second case in (60 - 30) days ie, 30 days the length of the rail track to be repaired (480 - 160) m, i.e. 320 m. More length of rail track, More men (Direct Proportion)

Men	Days	Length of rail track in meter
60	30	160
x	30	320

$\Rightarrow x = \frac{320}{160} \times 60 = 120\ men$

Additional men required= (120 - 60) men
= 60 men

17. 8men = 12women$\Rightarrow$ 1 man = $\frac{3w}{2}$
12 men + 8 women = 12 ($\frac{3w}{2}$)+8w = 26women
Let the required number of days be *x*.
More women, Less days (indirect Proportion)

Women	Days
12	52
26	x

$\Rightarrow x = \frac{12 \times 52}{26} = 24\ days$

18. After 15 days, 3000 soldiers have provision for 45 days.
Let the number of soldiers be *x*.
More days, Less soldiers (Indirect Proportion)

Days	Soldiers
45	3000
75	x

$\Rightarrow x = \frac{45 \times 3000}{75} = 1800\ soldiers$

Required Soldiers = 3000- 1800 = 1200