15 Chain Rule

IMPORTANT FACTS

I. Direct Proportion: *Two quantities are said to be directly proportional, if on the increase (or decrease) of the one, the other increases (or decreases) to the same extent.*

Ex. 1. ***Cost is directly proportional to the number of articles.*** (*More Articles, More Cost*)

Ex. 2. ***Work done is directly proportional to the number of men working on it.*** (*More Men, More Work*)

II. Indirect Proportion: *Two quantities are said to be indirectly proportional, if on the increase of the one, the other decreases to the same extent and vice-versa.*

Ex. 1. ***The time taken by a car in covering a certain distance is inversely proportional to the speed of the car.*** (*More speed, Less is the time taken to cover a distance*)

Ex. 2. ***Time taken to finish a work is inversely proportional to the number of persons working at it.*** (*More persons, Less is the time taken to finish a job*)

Remark: In solving questions by chain rule, we compare every item with the term to be found out.

SOLVED EXAMPLES

Ex. 1. ***A canteen requires 105 kgs of wheat for a week. How many kgs of wheat will it require for 58 days?*** **(L.I.C.A.D.O., 2007)**

Sol. Let the required quantity be x kg. Then,

More days, More cost *(Direct Proportion)*

$\therefore \quad 7 : 58 :: 105 : x \Leftrightarrow 7 \times x = 58 \times 105 \Leftrightarrow x = \left(\frac{58 \times 105}{7}\right) = 870.$

Hence, the canteen will require 870 kg of wheat for 58 days.

Ex. 2. ***If 36 men can do a piece of work in 25 hours, in how many hours will 15 men do it?***

Sol. Let the required number of hours be x. Then,

Less men, More hours *(Indirect Proportion)*

$\therefore \quad 15 : 36 :: 25 : x \quad \Leftrightarrow \quad (15 \times x) = (36 \times 25) \Leftrightarrow x = \frac{36 \times 25}{15} = 60.$

Hence, 15 men can do it in 60 hours.

Ex. 3. ***35 women can do a piece of work in 15 days. How many women would be required to do the same work in 25 days?*** **(Bank P.O., 2008)**

Sol. Let the required number of women be x. Then,

More days, Less women *(Indirect Proportion)*

$\therefore \; 25 : 15 :: 35 : x \Leftrightarrow (25 \times x) = (15 \times 35) \Leftrightarrow x = \left(\frac{15 \times 35}{25}\right) = 21.$

Hence, 21 women can do the work in 25 days.

Ex. 4. ***A certain number of people were supposed to complete a work in 24 days. The work, however, took 32 days since 9 people were absent throughout. How many people were supposed to be working originally?*** **(MA.T., 2004)**

Sol. Originally, let there be x people.

Less people, More days *(Indirect Proportion)*

$\therefore (x - 9) : x :: 24 : 32 \Leftrightarrow (x - 9) \times 32 = x \times 24 \Leftrightarrow 8x = 288 \Leftrightarrow x = 36.$

Hence, 36 people were supposed to be working originally.

Ex. 5. *If 5 students utilize 18 pencils in 9 days, how long, at the same rate, will 66 pencils last for 15 students?* **(M.A.T., 2010)**

Sol. Let the required number of days be x.

More students, Less days *(Indirect Proportion)*

More pencils, More days *(Direct Proportion)*

$$\left.\begin{matrix}\text{Students} & 15:5\\ \text{Pencils} & 18:66\end{matrix}\right\} :: 9 : x$$

$\therefore$ $(15 \times 18 \times x) = (5 \times 66 \times 9) \Leftrightarrow x = \left(\dfrac{5\times 66\times 9}{15\times 18}\right) = 11.$

Hence, the required number of days is 11.

Ex. 6. *If 20 men can build a wall 56 metres long in 6 days, what length of a similar wall can be built by 35 men in 3 days?*

Sol. Let the required length be x metres.

More men, More length built **(Direct Proportion)**

Less days, Less length built **(Direct Proportion)**

$$\left.\begin{matrix}\text{Men} & 20:35\\ \text{Days} & 6:3\end{matrix}\right\} :: 56 : x$$

$\therefore$ $(20 \times 6 \times x) = (35 \times 3 \times 56) \Leftrightarrow x = \dfrac{(35\times 3\times 56)}{120} = 49.$

Hence, the required length is 49 m.

Ex. 7. *8 men working for 9 hours a day complete a piece of work in 20 days. In how many days can 7 men working for 10 hours a day complete the same piece of work?* **(Bank P.O., 2006)**

Sol. Let the required number of days be x.

Less men, More days *(Indirect Proportion)*

More hours per day, Less days *(Indirect Proportion)*

$$\left.\begin{matrix}\text{Men} & 7:8\\ \text{Hours per day} & 10:9\end{matrix}\right\} :: 20 : x$$

$\therefore$ $(7 \times 10 \times x) = (8 \times 9 \times 20) \Leftrightarrow x = \left(\dfrac{8\times 9\times 20}{7\times 10}\right) = \dfrac{144}{7} = 20\dfrac{4}{7}.$

Hence, required number of days = $20\dfrac{4}{7}$.

Ex. 8. *If 12 men or 18 women can do a work in 14 days, then in how many days will 8 men and 16 women do the same work?* **(R.R.B., 2007)**

Sol. Let the required number of days be x.

12 men $\equiv$ 18 women $\Rightarrow$ 8 men $\equiv \left(\dfrac{18}{12}\times 8\right)$ women = 12 women.

More women, Less days *(Indirect Proportion)*

$\therefore$ 28 : 18 : : 14 : $x \Leftrightarrow (28 \times x) = (18 \times 14) \Leftrightarrow x = \left(\dfrac{18\times 14}{28}\right) = 9.$

Hence, required number of days = 9.

Ex. 9. *5 press compositors can set 625 pages of a manuscript in 16 days of* $10\dfrac{1}{2}$ *hours each. Each page has 60 lines and each line has 40 letters. In how many days of 8 hours each, will 10 compositors set 1000 pages of a manuscript, each page having 45 lines with 50 letters in each line?*

Sol. Let the required number of days be x.

More compositors, Less days	*(Indirect Proportion)*
More pages, More days	*(Direct Proportion)*
Less hours per day, More days	*(Indirect Proportion)*
Less lines per page, Less days	*(Direct Proportion)*
More letters per line, More days	*(Direct Proportion)*

$$\left.\begin{array}{ll} \text{Compositors} & 10:5 \\ \text{Pages} & 625:1000 \\ \text{Hours per day} & 8:\frac{21}{2} \\ \text{Lines per page} & 60:45 \\ \text{Letters per line} & 40:50 \end{array}\right\} :: 16 : x$$

$\therefore \quad 10 \times 625 \times 8 \times 60 \times 40 \times x = 5 \times 1000 \times \frac{21}{2} \times 45 \times 50 \times 16$

$$\Rightarrow x = \frac{5\times1000\times21\times45\times50\times16}{2\times10\times625\times8\times60\times40} = \frac{63}{4} = 15\frac{3}{4}.$$

Hence, required number of days $= 15\frac{3}{4}$.

Ex. 10. ***Rocky can walk a certain distance in 40 days when he rests 9 hours a day. How long will he take to walk twice the distance, twice as fast and rest twice as long each day?***

Sol. Let the distance in the two cases be y and $2y$ respectively and the speed be z and $2z$ respectively. Let the required number of days be x.

More distance, More days	*(Direct Proportion)*
More speed, Less days	*(Indirect Proportion)*
More resting time, More days	*(Direct Proportion)*

$$\left.\begin{array}{ll} \text{Distance} & y:2y \\ \text{Speed} & 2z:z \\ \text{Resting time} & 9:18 \end{array}\right\} :: 40 : x$$

$\therefore \quad y \times 2z \times 9 \times x = 2y \times z \times 18 \times 40 \Rightarrow x = \frac{2y\times z\times18\times40}{y\times2z\times9} = 80.$

Hence, required number of days = 80.

Ex. 11. ***15 persons working 8 hours a day can complete a work in 21 days. How many days will 14 persons take to complete a work $1\frac{1}{2}$ times as great, if they work 6 hours a day?*** **(S.S.C., 2006)**

Sol. Let the required number of days be x.

Less persons, More days	*(Indirect Proportion)*
Less hours per day, More days	*(Indirect Proportion)*
More work, More days	*Direct Proportion)*

$$\left.\begin{array}{ll} \text{Persons} & 14:15 \\ \text{Hours per day} & 6:8 \\ \text{Work} & y:\frac{3}{2}y \end{array}\right\} :: 21 : x$$

$\therefore \quad 14 \times 6 \times y \times x = 15 \times 8 \times \frac{3}{2}y \times 21 \Leftrightarrow x = \frac{15\times8\times3y\times21}{2\times14\times6\times y} = 45.$

Hence, required number of days = 45.

Ex. 12. ***A contract is to be completed in 50 days and 105 men were set to work, each working 8 hours a day. After 25 days, $\frac{2}{5}$ of the work is finished. How many additional men be employed so that the work may be completed on time, each man now working 9 hours a day?*** **(SNAP., 2010)**

Sol. Let the required number of additional men be x.

Remaining work = $\left(1-\frac{2}{5}\right)=\frac{3}{5}$.

More days, less men *(Indirect Proportion)*
More working hours per day, Less men *(Indirect Proportion)*
More work, More men *(Direct Proportion)*

$$\left.\begin{matrix}\text{Days} & 25:25\\ \text{Working hours} & 9:8\\ \text{Work} & \frac{2}{5}:\frac{3}{5}\end{matrix}\right\} :: 105:(105+x)$$

$\therefore \quad 25 \times 9 \times \frac{2}{5} \times (105 + x) = 25 \times 8 \times \frac{3}{5} \times 105$

$\Leftrightarrow (105 + x) = 8\times\frac{3}{5}\times 105\times\frac{5}{2}\times\frac{1}{9} = 140 \Leftrightarrow x = 35.$

Hence, additional number of men required = 35.

Ex. 13. ***If 9 engines consume 24 metric tonnes of coal, when each is working 8 hours a day; how much coal will be required for 8 engines, each running 13 hours a day, it being given that 3 engines of former type consume as much as 4 engines of latter type?***

Sol. Let 3 engines of former type consume 1 unit in 1 hour.
Then, 4 engines of latter type consume 1 unit in 1 hour.

$\therefore$ 1 engine of former type consumes $\frac{1}{3}$ unit in 1 hour.

1 engine of latter type consumes $\frac{1}{4}$ unit in 1 hour.

Let the required consumption of coal be x units.

Less engines, Less coal consumed **(*Direct Proportion*)**
More working hours, More coal consumed **(*Direct Proportion*)**
Less rate of consumption, Less coal consumed **(*Direct Proportion*)**

$$\left.\begin{matrix}\text{Number of engines} & 9:8\\ \text{Working hours} & 8:13\\ \text{Rate of consumption} & \frac{1}{3}:\frac{1}{4}\end{matrix}\right\} :: 24:x$$

$\therefore \quad \left(9\times 8\times\frac{1}{3}\times x\right)=\left(8\times 13\times\frac{1}{4}\times 24\right) \Leftrightarrow 24x = 624 \Leftrightarrow x = 26.$

Hence, the required consumption of coal = 26 metric tonnes.

Ex. 14. ***A garrison of 3300 men had provisions for 32 days, when given at the rate of 850 gms per head. At the end of 7 days, a reinforcement arrives and it was found that the provisions will last 17 days more, when given at the rate of 825 gms per head. What is the strength of the reinforcement?***

Sol. ***The problem becomes :***
3300 men taking 850 gms per head have provisions for (32 – 7) or 25 days. How many men taking 825 gms each have provisions for 17 days?

Less ration per head, More men **(*Indirect Proportion*)**
Less days, More men **(*Indirect Proportion*)**

$$\left.\begin{matrix}\text{Ration} & 825:850\\ \text{Days} & 17:25\end{matrix}\right\} :: 3300:x$$

$\therefore \quad 825 \times 17 \times x = 850 \times 25 \times 3300$ or $x = \frac{850\times 25\times 3300}{825\times 17} = 5000.$

$\therefore$ Strength of reinforcement = (5000 – 3300) = 1700.

Ex. 15. ***Two coal loading machines each working 12 hours per day for 8 days handle 9000 tonnes of coal with an efficiency of 90% while 3 other coal loading machines at an efficiency of 80% are set to handle 12000 tonnes of coal in 6 days. Find how many hours per day each should work.*** **(M.A.T., 2008)**

Sol. Let the number of working hours per day be x.

More machines, Less working hours per day *(Indirect Proportion)*
Less days, More working hours per day *(Indirect Proportion)*
More coal, More working hours per day *(Direct Proportion)*
Less efficiency, More working hours per day *(Indirect Proportion)*

$$\left.\begin{array}{ll} \text{Machines} & 3:2 \\ \text{Days} & 6:8 \\ \text{Coal} & 9000:12000 \\ \text{Efficiency} & 80:90 \end{array}\right\} :: 12 : x$$

$\therefore \quad 3 \times 6 \times 9000 \times 80 \times x = 2 \times 8 \times 12000 \times 90 \times 12 \Leftrightarrow x = \dfrac{2\times 8\times 12000\times 90\times 12}{3\times 6\times 9000\times 80} = 16.$

Hence, each machine should work for 16 hours per day.

EXERCISE
(OBJECTIVE TYPE QUESTIONS)

Directions: ***Mark (✓) against the correct answer:***

1. If the cost of x metres of wire is d rupees, then what is the cost of y metres of wire at the same rate? **(M.B.A., 2002)**

(*a*) ₹ $\left(\dfrac{xy}{d}\right)$ (*b*) ₹ (xd)
(*c*) ₹ (yd) (*d*) ₹ $\left(\dfrac{yd}{x}\right)$

2. The price of 5.5 dozen pens is ₹ 1287. What is the price of 16 such pens?
(*a*) ₹ 212 (*b*) ₹ 296
(*c*) ₹ 312 (*d*) ₹ 412
(*e*) None of these

3. The price of 357 mangoes is ₹ 1517.25. What will be the approximate price of 49 dozens of such mangoes?
(*a*) ₹ 3000 (*b*) ₹ 3500
(*c*) ₹ 4000 (*d*) ₹ 2500

4. If a quarter kg of potato costs 60 paise, how many paise will 200 gm cost?
(*a*) 48 paise (*b*) 54 paise
(*c*) 56 paise (*d*) 72 paise

5. If 11.25 m of a uniform iron rod weighs 42.75 kg, what will be the weight of 6 m of the same rod?
(*a*) 22.8 kg (*b*) 25.6 kg
(*c*) 28 kg (*d*) 26.5 kg

6. On a scale of map, 0.6 cm represents 6.6 km. If the distance between the points on the map is 80.5 cm, the actual distance between these points is
(*a*) 9 km (*b*) 72.5 km
(*c*) 190.75 km (*d*) 885.5 km

7. An industrial loom weaves 0.128 metres of cloth every second. Approximately, how many seconds will it take for the loom to weave 25 metres of cloth? **(M.B.A., 2003)**
(*a*) 178 (*b*) 195
(*c*) 204 (*d*) 488

8. A recipe for stew that feeds 4 people calls for $1\dfrac{1}{2}$ teaspoons of salt. If 3 teaspoons = 1 tablespoon, then how many tablespoons of salt will be needed to make enough stew for 18 people?
(*a*) 2.25 (*b*) 3.25
(*c*) 4.5 (*d*) 6

9. A snapshot $1\dfrac{7}{8}'' \times 2\dfrac{1}{2}''$ is to be enlarged so that the longer dimension is 4″. What will be the dimension of the shorter side? **(DMRC, 2003)**
(*a*) $2\dfrac{3}{8}''$ (*b*) $2\dfrac{1}{2}''$
(*c*) 3″ (*d*) $3\dfrac{3}{8}''$

10. A canteen requires 651 bananas for a week. Totally, how many bananas will it require for the months of April, May and June? **(Bank Recruitment, 2009)**
(*a*) 8463 (*b*) 8547
(*c*) 9086 (*d*) 9284
(*e*) None of these

11. If $\frac{4}{9}$th of a bucket is filled in 1 minute, the rest of it will be filled in **(Hotel Management, 2010)**

(*a*) 1 min (*b*) $\frac{9}{4}$ min

(*c*) $\frac{5}{4}$ min (*d*) $\frac{4}{5}$ min

12. On a certain map of India the actual distance of 1450 km between two cities Delhi and Kolkata is shown as 5 cm. What scale is used to draw the map? **(A.T.M.A., 2004)**

(*a*) $1 : 15 \times 10^6$ (*b*) $1 : 20 \times 10^6$

(*c*) $1 : 25 \times 10^6$ (*d*) $1 : 29 \times 10^6$

13. A flagstaff 17.5 m high casts a shadow of length 40.25 m. The height of the building, which casts a shadow of length 28.75 m under similar conditions will be **(M.B.A., 2002)**

(*a*) 10 m (*b*) 12.5 m

(*c*) 17.5 m (*d*) 21.25 m

14. A TV tower 36 metres high casts a shadow of 24 metres at a particular time of a day. What is the height of a minar with a three metre high flagstaff atop it, if both of these together cast a shadow of 50 metres at the same time of the day?

(*a*) 64 m (*b* 72 m

(*c*) 75 m (*d*) None of these

15. A man completes $\frac{5}{8}$ of a job in 10 days. At this rate, how many more days will it take him to finish the job? **(M.B.A., 2003)**

(*a*) 5 (*b*) 6

(*c*) 7 (*d*) $7\frac{1}{2}$

16. 56 men can complete a piece of work in 24 days. In how many days can 42 men complete the same piece of work? **(Bank P.O., 2008)**

(*a*) 18 (*b*) 32

(*c*) 48 (*d*) 98

(*e*) None of these

17. 30 men can do a piece of work in 16 days. How many men would be required to do the same work in 20 days? **(Bank P.O., 2008)**

(*a*) 12 (*b*) 24

(*c*) 36 (*d*) 48

(*e*) None of these

18. A group of workers promise to complete a piece of work in 10 days, but five of them do not report for work. If it took the remaining workers 12 days to complete the work, then the number of workers originally hired was

(*a*) 15 (*b*) 25

(*c*) 30 (*d*) 45

19. A wheel that has 6 cogs is meshed with a larger wheel of 14 cogs. When the smaller wheel has made 21 revolutions, then the number of revolutions made by the larger wheel is

(*a*) 4 (*b*) 9

(*c*) 12 (*d*) 49

20. In a camp, there is a meal for 120 men or 200 children. If 150 children have taken the meal, how many men will be catered to with the remaining meal?

(*a*) 20 (*b*) 30

(*c*) 40 (*d*) 50

21. The cost of 16 packets of salt, each weighing 900 grams is ₹ 28. What will be the cost of 27 packets, if each packet weighs 1 kg?

(*a*) ₹ 52.50 (*b*) ₹ 56

(*c*) ₹ 58.50 (*d*) ₹ 64.75

22. 4 mat-weavers can weave 4 mats in 4 days. At the same rate, how many mats would be woven by 8 mat-weavers in 8 days? **(S.S.C., 2004)**

(*a*) 4 (*b*) 8

(*c*) 12 (*d*) 16

23. If 7 maids with 7 mops cleaned 7 floors in 7 hours, how long would it take 3 maids to mop 3 floors with 3 mops? **(M.A.T., 2005)**

(*a*) $\frac{7}{3}$ hours (*b*) 3 hours

(*c*) $\frac{49}{3}$ hours (*d*) 7 hours

24. Four gardeners with four grass mowers mow 400 sq. m of ground in 4 hours. How long would it take for eight gardeners with eight grass mowers to mow 800 sq. m of ground? **(CLAT, 2010)**

(*a*) 4 hours (*b*) 6 hours

(*c*) 8 hours (*d*) 12 hours

25. Runnning at the same constant rate, 6 identical machines can produce a total of 180 bottles per hour. How many bottles could 15 such machines produce in 30 minutes? **(SNAP, 2010)**

(*a*) 225 (*b*) 250

(*c*) 300 (*d*) 350

26. If 6 persons working 8 hours a day earn ₹ 8400 per week, then 9 persons working 6 hours a day will earn per week **(S.S.C., 2003)**

(*a*) ₹ 8400 (*b*) ₹ 9450

(*c*) ₹ 16200 (*d*) ₹ 16800

27. If 5 workers can collect 60 kg wheat in 3 days, how many kilograms of wheat will 8 workers collect in 5 days? **(Bank P.O., 2007)**

(*a*) 80 kg (*b*) 100 kg

(*c*) 120 kg (*d*) 160 kg

28. 50 people consume 350 kg of rice in 30 days. In how many days will 35 people consume 50 kg of rice? **(NABARD, 2008)**

(*a*) 2 days (*b*) 3 days
(*c*) 5 days (*d*) 7 days
(*e*) None of these

29. In a dairy farm, 40 cows eat 40 bags of husk in 40 days. In how many days one cow will eat one bag of husk?

(*a*) 1 (*b*) $\frac{1}{40}$
(*c*) 40 (*d*) 80

30. Working 8 hours a day, 12 men can do a work in 30 days. Working 4 hours a day, 18 men can do the work in **(P.C.S., 2006)**

(*a*) 30 days (*b*) 40 days
(*c*) 45 days (*d*) 50 days

31. 12 men working 8 hours per day complete a piece of work in 10 days. To complete the same work in 8 days, working 15 hours a day, the number of men required, is:

(*a*) 4 (*b*) 5
(*c*) 6 (*d*) 8

32. 5 persons can prepare an admission list in 8 days working 7 hours a day. If 2 persons join them so as to complete the work in 4 days, they need to work per day for **(S.S.C., 2004)**

(*a*) 8 hours (*b*) 9 hours
(*c*) 10 hours (*d*) 12 hours

33. 3 pumps, working 8 hours a day, can empty a tank in 2 days. How many hours a day must 4 pumps work to empty the tank in 1 day?

(*a*) 9 (*b*) 10
(*c*) 11 (*d*) 12

34. If 8 men can reap 80 hectares in 24 days, then how many hectares can 36 men reap in 30 days?

(*a*) 350 (*b*) 400
(*c*) 425 (*d*) 450

35. A certain number of persons can dig a trench 100 m long, 50 m broad and 10 m deep in 10 days. The same number of persons can dig another trench 20 m broad and 15 m deep in 30 days. The length of the second trench is

(*a*) 400 m (*b*) 500 m
(*c*) 800 m (*d*) 900 m

36. If 5 men or 7 women can earn ₹ 5250 per day, how much would 7 men and 13 women earn per day? **(S.S.C., 2010)**

(*a*) ₹ 11600 (*b*) ₹ 11700
(*c*) ₹ 16100 (*d*) ₹ 17100

37. 3 men or 6 women can do a piece of work in 20 days. In how many days will 12 men and 8 women do the same work? **(P.C.S., 2008)**

(*a*) $3\frac{1}{2}$ days (*b*) $3\frac{3}{4}$ days
(*c*) 4 days (*d*) 5 days

38. 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 (*b*) 15
(*c*) 18 (*d*) 21

39. 49 pumps can empty a reservoir in $6\frac{1}{2}$ days, working 8 hours a day. If 196 pumps are used for 5 hours each day, then the same work will be completed in

(*a*) 2 days (*b*) $2\frac{1}{2}$ days
(*c*) $2\frac{3}{5}$ days (*d*) 3 days

40. 30 labourers, working 7 hours a day can finish a piece of work in 18 days. If the labourers work 6 hours a day, then the number of labourers to finish the same piece of work in 30 days, will be:

(*a*) 15 (*b*) 21
(*c*) 22 (*d*) 25

41. If 18 pumps can raise 2170 tonnes of water in 10 days, working 7 hours a day; in how many days will 16 pumps raise 1736 tonnes of water, working 9 hours a day?

(*a*) 6 (*b*) 7
(*c*) 8 (*d*) 9

42. If 80 lamps can be lighted, 5 hours per day for 10 days for ₹ 21.25, then the number of lamps, which can be lighted 4 hours daily for 30 days, for ₹ 76.50, is

(*a*) 100 (*b*) 120
(*c*) 150 (*d*) 160

43. If 12 carpenters, working 6 hours a day, can make 460 chairs in 24 days, how many chairs will 18 carpenters make in 36 days, each working 8 hours a day?

(*a*) 1260 (*b*) 1320
(*c*) 920 (*d*) 1380

44. If 5 spiders can catch five flies in five minutes, how many flies can hundred spiders catch in 100 minutes? **(SNAP, 2005)**

(*a*) 100 (*b*) 500
(*c*) 1000 (*d*) 2000

45. 2 persons working 2 hours a day assemble 2 machines in 2 days. The number of machines assembled by 6 persons working 6 hours a day in 6 days is **(A.A.O., 2009)**

(*a*) 6 (*b*) 18
(*c*) 27 (*d*) 54

46. The work done by a man is double the work done by a woman in the same time. If 10 men can do a piece of work in 8 days, then in how many days that work can be done by 3 men and 4 women?

(*a*) 4 (*b*) $7\frac{3}{11}$
(*c*) 8 (*d*) 16

47. A wall of 100 metres can be built by 7 men or 10 women in 10 days. How many days will 14 men and 20 women take to build a wall of 600 metres?

(*a*) 15 (*b*) 20
(*c*) 25 (*d*) 30

48. If 10 men or 20 boys can make 260 mats in 20 days, then how many mats will be made by 8 men and 4 boys in 20 days? **(C.P.O., 2007)**

(*a*) 240 (*b*) 260
(*c*) 280 (*d*) 520

49. If 600 men dig a 5.5 m wide, 4 m deep and 405 m long canal in half an hour, then how long a canal will 2500 men, working for 6 hours, dig if it is 10 m wide and 8 m deep?

(*a*) $2694\frac{1}{3}$ m (*b*) 4082 m
(*c*) $5568\frac{3}{4}$ m (*d*) 6452 m

50. 64 persons can dig a trench 50 m long, 2 m wide and 2 m deep in 5 days, working 12 hours daily. In how many days, working 8 hours daily, will 80 persons dig another trench 75 m long, 4 m wide and 3 m deep?

(*a*) 18 (*b*) 27
(*c*) 36 (*d*) 45

51. 21 binders can bind 1400 books in 15 days. How many binders will be required to bind 800 books in 20 days? **(Bank P.O., 2009)**

(*a*) 7 (*b*) 9
(*c*) 12 (*d*) 14
(*e*) None of these

52. A certain number of artisans can complete a shoe fabrication consignment in 16 days. 8 additional artisans had to be deployed for the same consignment and together they completed it in 4 days less than the earlier estimate. The number of artisans initially employed was

(*a*) 18 (*b*) 20
(*c*) 24 (*d*) None of these

53. If 9 examiners can examine a certain number of answer books in 12 days, working 5 hours a day; for how many hours a day would 4 examiners have to work in order to examine twice the number of answer books in 30 days?

(*a*) 6 (*b*) 8
(*c*) 9 (*d*) 10

54. If 17 labourers can dig a ditch 20 m long in 18 days, working 8 hours a day; how many more labourers should be engaged to dig a similar ditch 39 m long in 6 days, each labourer working 9 hours a day?

(*a*) 34 (*b*) 51
(*c*) 68 (*d*) 85

55. 20 men complete one-third of a piece of work in 20 days. How many more men should be employed to finish the rest of the work in 25 more days? **(G.B.O., 2007)**

(*a*) 10 (*b*) 12
(*c*) 15 (*d*) 20

56. A rope makes 70 rounds of the circumference of a cylinder whose radius of the base is 14 cm. How many times can it go round a cylinder with radius 20 cm?

(*a*) 40 (*b*) 49
(*c*) 100 (*d*) None of these

57. If x men, working x hours per day, can do x units of work in x days, then y men, working y hours per day would be able to complete how many units of work in y days?

(*a*) $\frac{x^2}{y^3}$ (*b*) $\frac{x^3}{y^2}$
(*c*) $\frac{y^2}{x^3}$ (*d*) $\frac{y^3}{x^2}$

58. A contract is to be completed in 46 days and 117 men were set to work, each working 8 hours a day. After 33 days, $\frac{4}{7}$ of the work is completed. How many additional men may be employed so that the work may be completed in time, each man now working 9 hours a day? **(M.A.T., 2005)**

(*a*) 80 (*b*) 81
(*c*) 82 (*d*) 83

59. The normal dosage of a particular medicine is t tablets per day for each patient. A hospital's current supply of these tablets will last p patients for d days. If the recommended dosage increases by 20% and the number of patients decreases by one-third, then for how many days will the hospital's supply last?

(*a*) $\frac{5d}{4}$ (*b*) $\frac{4d}{5}$
(*c*) $\frac{4pt}{5}$ (*d*) Cannot be determined

60. Some persons can do a piece of work in 12 days. Two times the number of such persons will do half of that work in :
(*a*) 6 days (*b*) 4 days
(*c*) 3 days (*d*) 12 days

61. 12 persons can do a piece of work in 4 days. How many persons are required to complete 8 times the work in half the time? **(S.S.C., 2004)**
(*a*) 144 (*b*) 180
(*c*) 190 (*d*) 192

62. If 5 engines consume 6 metric tonnes of coal when each is running 9 hours a day, how many metric tonnes of coal will be needed for 8 engines, each running 10 hours a day, it being given that 3 engines of the former type consume as much as 4 engines of the latter type? **(M.A.T., 2008)**
(*a*) $3\frac{1}{8}$ (*b*) 8
(*c*) $8\frac{8}{9}$ (*d*) $6\frac{12}{25}$

63. If 9 men working $7\frac{1}{2}$ hours a day can finish a piece of work in 20 days, then how many days will be taken by 12 men, working 6 hours a day to finish the work? It is being given that 2 men of latter type work as much as 3 men of the former type. **(L.I.C.A.A.O., 2007)**
(*a*) $9\frac{1}{2}$ (*b*) 11
(*c*) $12\frac{1}{2}$ (*d*) 13

64. If a certain number of workmen can do a piece of work in 25 hours, in how many hours will another set of an equal number of men, do a piece of work, twice as great, supposing that 2 men of the first set can do as much work in an hour, as 3 men of the second set do in an hour?
(*a*) 60 (*b*) 75
(*c*) 90 (*d*) 105

65. 15 men take 21 days of 8 hours each to do a piece of work. How many days of 6 hours each would 21 women take, if 3 women do as much work as 2 men?
(*a*) 18 (*b*) 20
(*c*) 25 (*d*) 30

66. A contractor employed 30 men to do a piece of work in 38 days. After 25 days, he employed 5 men more and the work was finished one day earlier. How many days he would have been behind, if he had not employed additional men?
(*a*) 1 (*b*) $1\frac{1}{4}$
(*c*) $1\frac{3}{4}$ (*d*) $1\frac{1}{2}$

67. In a barrack of soldiers there was stock of food for 190 days for 4000 soldiers. After 30 days 800 soldiers left the barrack. For how many days shall the left over food last for the remaining soldiers? **(P.C.S., 2006)**
(*a*) 175 days (*b*) 200 days
(*c*) 225 days (*d*) 250 days

68. A garrison of 500 men had provisions for 27 days. After 3 days a reinforcement of 300 men arrived. For how many more days will the remaining food last now? **(M.B.A., 2006)**
(*a*) 15 (*b*) 16
(*c*) $17\frac{1}{2}$ (*d*) 18

69. A garrison had provisions for a certain number of days. After 10 days, $\frac{1}{5}$ of the men desert and it is found that the provisions will now last just as long as before. How long was that? **(M.B.A., 2003)**
(*a*) 15 days (*b*) 25 days
(*c*) 35 days (*d*) 50 days

70. A fort has provisions for 50 days. If after 10 days they are strengthened by 500 men and the food lasts for 35 days longer, the number of men originally in the fort were
(*a*) 2500 (*b*) 3000
(*c*) 3500 (*d*) 4000

71. A garrison of 2000 men has provision of ration for 66 days. At the end of a fortnight, reinforcement arrives and it is found that ration will last only for 20 days more. The strength of the reinforcement is
(*a*) 2000 (*b*) 2200
(*c*) 2600 (*d*) 3200

72. A team of workers was employed by a contractor who undertook to finish 360 pieces of an article in a certain number of days. Making four more pieces per day than was planned, they could complete the job a day ahead of schedule. How many days did they take to complete the job? **(M.A.T., 2007)**
(*a*) 8 days (*b*) 9 days
(*c*) 10 days (*d*) 12 days

73. The work done by a woman in 8 hours is equal to the work done by a man in 6 hours and by a boy in 12 hours. If working 6 hours per day 9 men can complete a work in 6 days, then in how many days can 12 men, 12 women and 12 boys together finish the same work, working 8 hours per day? **(M.A.T., 2007)**
(*a*) $1\frac{1}{2}$ days (*b*) 3 days
(*c*) $3\frac{2}{3}$ days (*d*) $4\frac{1}{2}$ days

74. 12 men and 18 boys, working $7\frac{1}{2}$ hours a day, can do a piece of work in 60 days. If a man works equal to 2 boys, then how many boys will be required to help 21 men to do twice the work in 50 days, working 9 hours a day?

(*a*) 30 (*b*) 42
(*c*) 48 (*d*) 90

75. If 3 men or 6 boys can do a piece of work in 10 days, working 7 hours a day; how many days will it take to complete a piece of work twice as large with 6 men and 2 boys working together for 8 hours a day?

(*a*) 6 (*b*) $7\frac{1}{2}$
(*c*) $8\frac{1}{2}$ (*d*) 9

76. 2 men and 7 boys can do a piece of work in 14 days; 3 men and 8 boys can do the same in 11 days. Then, 8 men and 6 boys can do three times the amount of this work in :

(*a*) 18 days (*b*) 21 days
(*c*) 24 days (*d*) 30 days

77. Large, medium and small ships are used to bring water. 4 large ships carry as much water as 7 small ships, 3 medium ships carry the same amount of water as 2 large ships and 1 small ship. 15 large, 7 medium and 14 small ships, each made 36 journeys and brought a certain quantity of water. In how many journeys would 12 large, 14 medium and 21 small ships bring the same quantity? **(M.A.T., 2007)**

(*a*) 25 (*b*) 29
(*c*) 32 (*d*) 49

78. If 2 m. 60 cm cloth is required for one shirt, then the cloth required for 7 shirts is ……..

[APTET, 2011]

(*a*) 14 m 80 cm (*b*) 18 m 20 cm
(*c*) 15 m 20 cm (*d*) 16 m 80 cm

79. The cost of 4 dozen papers is ₹ 24. The cost of 1 score of papers (in rupees) is …….

[APTET, 2011]

(*a*) 40 (*b*) 20
(*c*) 10 (*d*) 42

80. The cost of 8 fans and 14 ovens is ₹ 36.520. What is the cost of 12 fans and 21 ovens?

[SBI—Clerk Level, 2012]

(*a*) ₹ 56.800 (*b*) ₹ 54.780
(*c*) ₹ 57.950 (*d*) Cannot be determined

81. The cost of 5 kgs of apples is ₹ 450. The cost of 12 dozen mangoes is ₹ 4,320 and the cost of 4 kgs of oranges is ₹ 240. What is the total cost of 8 kg of apples, 8 dozens of mangoes and 8 kg of oranges?

[MAT—2012]

(*a*) ₹ 4,020 (*b*) ₹ 4,080
(*c*) ₹ 4,050
(*d*) Other than those given as options

82. The cost of 21 pencils and 9 clippers is ₹ 819. The cost price of 7 pencils and 3 clippers is

[DMRC—Train Operator (Station Controller), 2012]

(*a*) ₹ 204 (*b*) ₹ 409
(*c*) ₹ 273 (*d*) ₹ 208

ANSWERS

1. (*d*)	**2.** (*c*)	**3.** (*d*)	**4.** (*a*)	**5.** (*a*)	**6.** (*d*)	**7.** (*b*)	**8.** (*a*)	**9.** (*c*)	**10.** (*a*)
11. (*c*)	**12.** (*d*)	**13.** (*b*)	**14.** (*b*)	**15.** (*b*)	**16.** (*b*)	**17.** (*b*)	**18.** (*c*)	**19.** (*b*)	**20.** (*b*)
21. (*a*)	**22.** (*d*)	**23.** (*d*)	**24.** (*a*)	**25.** (*a*)	**26.** (*b*)	**27.** (*d*)	**28.** (*e*)	**29.** (*c*)	**30.** (*b*)
31. (*d*)	**32.** (*c*)	**33.** (*d*)	**34.** (*d*)	**35.** (*b*)	**36.** (*d*)	**37.** (*b*)	**38.** (*b*)	**39.** (*c*)	**40.** (*b*)
41. (*b*)	**42.** (*b*)	**43.** (*d*)	**44.** (*d*)	**45.** (*d*)	**46.** (*d*)	**47.** (*a*)	**48.** (*b*)	**49.** (*c*)	**50.** (*b*)
51. (*b*)	**52.** (*c*)	**53.** (*c*)	**54.** (*b*)	**55.** (*b*)	**56.** (*b*)	**57.** (*d*)	**58.** (*b*)	**59.** (*a*)	**60.** (*c*)
61. (*d*)	**62.** (*b*)	**63.** (*c*)	**64.** (*b*)	**65.** (*d*)	**66.** (*a*)	**67.** (*b*)	**68.** (*a*)	**69.** (*d*)	**70.** (*c*)
71. (*d*)	**72.** (*c*)	**73.** (*a*)	**74.** (*b*)	**75.** (*b*)	**76.** (*b*)	**77.** (*b*)	**78.** (*b*)	**79.** (*c*)	**80.** (*b*)
81. (*b*)	**82.** (*c*)								

SOLUTIONS

1. Cost of x metres = ₹ d. Cost of 1 metre = ₹ $\left(\frac{d}{x}\right)$.

Cost of y metres = ₹ $\left(\frac{d}{x}\times y\right)$ = ₹ $\left(\frac{yd}{x}\right)$.

2. 5.5 dozen pens = (5.5 × 12) pens = 66 pens. Let the cost of 16 pens be ₹ x.

Less pens, Less cost ***(Direct Proportion)***

$\therefore$ 66 : 16 : : 1287 : x $\Leftrightarrow$ 66x = 16 × 1287

$\Leftrightarrow x = \left(\frac{16\times 1287}{66}\right)$ = ₹ 312.

3. Let the required price be ₹ x.

Then,

More mangoes, More price ***(Direct Proportion)***

$\therefore$ 357 : (49 × 12) : : 1517.25 : x

$\Leftrightarrow$ 357x = (49 × 12 × 1517.25)

$\Leftrightarrow x = \dfrac{(49\times12\times1517.25)}{357} \Leftrightarrow x = 2499.$

Hence, the approximate price is ₹ 2500.

4. Let the required cost be x paise.

Less weight, Less cost **(*Direct Proportion*)**

$\therefore$ 250 : 200 : : 60 : x

$\Leftrightarrow$ 250 × x = (200 × 60)

$\Leftrightarrow x = \dfrac{(200\times60)}{250} \Leftrightarrow x = 48.$

5. Let the required weight be x kg. Then,

Less length, Less weight **(*Direct Proportion*)**

$\therefore$ 11.25 : 6 : : 42.75 : x

$\Leftrightarrow$ 11.25 × x = 6 × 42.75

$\Leftrightarrow x = \dfrac{(6\times42.75)}{11.25}$

$\Leftrightarrow x = 22.8.$

6. Let the actual distance be x km. Then,

More distance on the map, More is the actual distance

(*Direct Proportion*)

$\therefore$ 0.6 : 80.5 : : 6.6 : x

$\Leftrightarrow$ 0.6 x = 80.5 × 6.6

$\Leftrightarrow x = \dfrac{80.5\times6.6}{0.6} \Leftrightarrow x = 885.5.$

7. Let the required time be x seconds.

Then,

More metres, More time **(*Direct Proportion*)**

$\therefore$ 0.128 : 25 : : 1 : x

$\Leftrightarrow$ 0.128 × x = 25 × 1

$\Leftrightarrow x = \dfrac{25}{0.128} = \dfrac{25\times1000}{128} \Leftrightarrow x = 195.31.$

$\therefore$ Required time = 195 sec (approximately).

8. 3 teaspoons = 1 tablespoon

$\Rightarrow 1\dfrac{1}{2}$ teaspoons = $\dfrac{1}{2}$ tablespoon.

Let the number of tablespoons required be x.

More people, More salt required **(*Direct Proportion*)**

$\therefore 4 : 18 : : \dfrac{1}{2} : x \Leftrightarrow 4x = 18\times\dfrac{1}{2} = 9 \Leftrightarrow x = \dfrac{9}{4} = 2.25.$

9. Let the dimension of the shorter side be x.

More is the longer side, More is the shorter side

(*Direct Proportion*)

$\therefore 2\dfrac{1}{2} : 4 : : 1\dfrac{7}{8} : x \Leftrightarrow \dfrac{5}{2}x = 4\times\dfrac{15}{8} \Leftrightarrow x = \left(\dfrac{15}{2}\times\dfrac{2}{5}\right) = 3.$

10. Total number of days = $(\overset{\text{Apr}}{30} + \overset{\text{May}}{31} + \overset{\text{Jun}}{30}) = 91.$

Let the number of bananas be x.

More days, More bananas **(*Direct Proportion*)**

$\therefore$ 7 : 91 : : 651 : $x \Leftrightarrow 7x = 91 \times 651$

$\Leftrightarrow x = \left(\dfrac{91\times651}{7}\right) = 8463.$

11. Remaining part = $\left(1-\dfrac{4}{9}\right) = \dfrac{5}{9}.$

Let the required time be x minutes.

More volume to be filled, More time taken

(*Direct Proportion*)

$\therefore \dfrac{4}{9} : \dfrac{5}{9} : : 1 : x \Leftrightarrow \dfrac{4}{9}x = \dfrac{5}{9} \Leftrightarrow x = \left(\dfrac{5}{9}\times\dfrac{9}{4}\right) = \dfrac{5}{4}.$

12. 5 cm on the map represents 1450 km.

$\therefore$ 1 cm on the map represents $\left(\dfrac{1450}{5}\right)$km = 290 km.

Hence, the scale is 1 cm : 290 km *i.e.*, 1 : 29 × 10^6.

[$\because$ 290 km = (29 × 10^6) cm]

13. Let the height of the building be x metres.

Less lengthy shadow, Less is the height

(*Direct Proportion*)

$\therefore$ 40.25 : 28.75 : : 17.5 : x

$\Leftrightarrow$ 40.25 × x = 28.75 × 17.5

$\Leftrightarrow x = \dfrac{(28.75\times17.5)}{40.25} \Leftrightarrow x = 12.5.$

14. Let the height of the minar with flagstaff be x metres.

More lengthy shadow, More is the height

(*Direct Proportion*)

$\therefore$ 24 : 50 : : 36 : $x \Leftrightarrow 24x = 50 \times 36$

$\Leftrightarrow x = \left(\dfrac{50\times36}{24}\right) = 75.$

Hence, height of the minar = (75 − 3) m = 72 m.

15. Work done = $\dfrac{5}{8}$. Balance work = $\left(1-\dfrac{5}{8}\right) = \dfrac{3}{8}.$

Less work, Less days **(*Direct Proportion*)**

Let the required number of days be x.

Then,

$\dfrac{5}{8} : \dfrac{3}{8} :: 10 : x \Leftrightarrow \dfrac{5}{8}\times x = \dfrac{3}{8}\times10 \Leftrightarrow x = \left(\dfrac{3}{8}\times10\times\dfrac{8}{5}\right) = 6.$

16. Let the required number of days be x.

Less men, More days **(*Indirect Proportion*)**

$\therefore$ 42 : 56 : : 24 : x

$\Leftrightarrow 42\ x = 56 \times 24 \Leftrightarrow x = \left(\dfrac{56\times24}{42}\right) = 32.$

17. Let the required number of men be x.

More days, Less men **(*Indirect Proportion*)**

$\therefore$ 20 : 16 : : 30 : $x \Leftrightarrow 20x = 16 \times 30$

$\Leftrightarrow x = \left(\dfrac{16\times30}{20}\right) = 24.$

18. Let the number of workers originally hired be x.

Less workers, More days **(*Indirect Proportion*)**

$(x - 5) : x : : 10 : 12$

$\Leftrightarrow 12\ (x - 5) = 10\ x \Leftrightarrow 2x = 60 \Leftrightarrow x = 30.$

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

Then, ***More cogs, Less revolutions***

(*Indirect Proportion*)

$\therefore$ 14 : 6 :: 21 : x

$\Leftrightarrow$ 14 × x = 6 × 21 $\Leftrightarrow x = \left(\dfrac{6\times21}{14}\right) = 9.$

20. There is a meal for 200 children. 150 children have taken the meal.

Remaining meal is to be catered to 50 children.

Now, 200 children ≡ 120 men

$$50 \text{ children} \equiv \left(\frac{120}{200}\times 50\right)\text{men} = 30 \text{ men}.$$

21. Let the required cost be ₹ x. Then,

More packets, More cost **(*Direct Proportion*)**

More weight, More cost **(*Direct Proportion*)**

$$\left.\begin{matrix}\text{Packets} & 16:27\\ \text{Weight} & 900:1000\end{matrix}\right\}::28:x$$

$\therefore \quad (16 \times 900 \times x) = (27 \times 1000 \times 28)$

$$\Leftrightarrow \quad x = \frac{(27\times 1000\times 28)}{16\times 900} = \frac{105}{2} = 52.50.$$

22. Let the required number of mats be x.

More weavers, More mats **(*Direct Proportion*)**

More days, More mats **(*Direct Proportion*)**

$$\left.\begin{matrix}\text{Weavers} & 4:8\\ \text{Days} & 4:8\end{matrix}\right\}::4:x$$

$$\therefore\ 4\times 4\times x = 8\times 8\times 4 \Leftrightarrow x = \frac{(8\times 8\times 4)}{(4\times 4)} = 16.$$

23. Since each maid would work with one mop, so we shall consider 1 maid and 1 mop as 1 unit. Let the required time be x hours.

Less maids and mops, More time **(*Indirect Proportion*)**

Less floors, Less time **(*Direct Proportion*)**

$$\left.\begin{matrix}\text{Maids \& Mops} & 3:7\\ \text{Floors} & 7:3\end{matrix}\right\}::7::x$$

$$\therefore\ 3\times 7\times x = 7\times 3\times 7 \Leftrightarrow x = \frac{7\times 3\times 7}{3\times 7} = 7.$$

24. Since each gardener would work with one grass mower, so we shall consider 1 gardener and 1 grass mower as one unit. Let the required time be x hours.

More gardeners and grass mowers, Less time **(*Indirect Proportion*)**

More area, More time **(*Direct Proportion*)**

$$\left.\begin{matrix}\text{Gardeners \& grass mowers} & 8:4\\ \text{Area} & 400:800\end{matrix}\right\}::4:x$$

$\therefore\ 8\times 400\times x = 4\times 800\times 4$

$$\Leftrightarrow x = \left(\frac{4\times 800\times 4}{8\times 400}\right) = 4.$$

25. Let the required number of bottles be x.

More machines, More bottles produced **(*Direct Proportion*)**

Less time, Less bottles produced **(*Direct Proportion*)**

$$\left.\begin{matrix}\text{Machines} & 6:15\\ \text{Time} & 60:30\end{matrix}\right\}::180:x$$

$\therefore\ 6\times 60\times x = 15\times 30\times 180$

$$\Leftrightarrow x = \left(\frac{15\times 30\times 180}{6\times 60}\right) = 225.$$

26. Let the weekly earning be ₹ x.

More persons, More earning **(*Direct Proportion*)**

Less working hours, Less earning **(*Direct Proportion*)**

$$\left.\begin{matrix}\text{Persons} & 6:9\\ \text{Working hours} & 8:6\end{matrix}\right\}::8400:x$$

$\therefore\ 6\times 8\times x = 9\times 6\times 8400$

$$\Leftrightarrow x = \left(\frac{9\times 6\times 8400}{6\times 8}\right) = 9450.$$

27. Let the required quantity be x kg.

More workers, More quantity **(*Direct Proportion*)**

More days, More quantity **(*Direct Proportion*)**

$$\left.\begin{matrix}\text{Workers} & 5:8\\ \text{Days} & 3:5\end{matrix}\right\}::60:x$$

$\therefore\ 5\times 3\times x = 8\times 5\times 60$

$$\Leftrightarrow x = \left(\frac{8\times 5\times 60}{5\times 3}\right) = 160.$$

28. Let the required number of days be x.

Less people, More days **(*Indirect Proportion*)**

Less quantity, Less days **(*Direct Proportion*)**

$$\left.\begin{matrix}\text{People} & 35:50\\ \text{Quantity} & 350:50\end{matrix}\right\}::30:x$$

$\therefore\ 35\times 350\times x = 50\times 50\times 30$

$$\Leftrightarrow x = \left(\frac{50\times 50\times 30}{35\times 350}\right) = \frac{300}{49} = 6\frac{6}{49}.$$

29. Let the required number of days be x.

Less cows, More days **(*Indirect Proportion*)**

Less bags, Less days **(*Direct Proportion*)**

$$\left.\begin{matrix}\text{Cows} & 1:40\\ \text{Bags} & 40:1\end{matrix}\right\}::40:x$$

$\therefore\ 1\times 40\times x = 40\times 1\times 40 \Leftrightarrow x = 40.$

30. Let the required number of days be x.

Less working hours, More days **(*Indirect Proportion*)**

More men, Less days **(*Indirect Proportion*)**

$$\left.\begin{matrix}\text{Working hours} & 4:8\\ \text{Men} & 18:12\end{matrix}\right\}::30:x$$

$\therefore\ 4\times 18\times x = 8\times 12\times 30$

$$\Leftrightarrow x = \left(\frac{8\times 12\times 30}{4\times 18}\right) = 40.$$

31. Let the required number of men be x.

Less days, More men **(*Indirect Proportion*)**

More working hrs per day, Less men **(*Indirect Proportion*)**

$$\left.\begin{matrix}\text{Days} & 8:10\\ \text{Working Hrs} & 15:8\end{matrix}\right\}::12:x$$

$\therefore\ 8\times 15\times x = 10\times 8\times 12$

$$\Leftrightarrow x = \frac{10\times 8\times 12}{8\times 15} \Leftrightarrow x = 8.$$

32. Let the number of working hours per day be x.

More persons, Less working hours **(Indirect Proportion)**
Less days, More working hours **(Indirect Proportion)**

$$\left.\begin{matrix}\text{Persons} & 7:5\\ \text{Days} & 4:8\end{matrix}\right\}::7:x$$

$\therefore\ 7\times4\times x=5\times8\times7 \Leftrightarrow x=\left(\dfrac{5\times8\times7}{7\times4}\right)=10.$

33. Let the required number of working hours per day be x.
More pumps,
Less working hours per day **(Indirect Proportion)**
Less days,
More working hours per day **(Indirect Proportion)**

$$\left.\begin{matrix}\text{Pumps} & 4:3\\ \text{Days} & 1:2\end{matrix}\right\}::8:x$$

$\therefore\ 4\times1\times x=3\times2\times8$

$\Leftrightarrow x=\dfrac{3\times2\times8}{4} \Leftrightarrow x=12.$

34. Let the required number of hectares be x. Then,
More men, More hectares **(Direct Proportion)**
More days, More hectares **(Direct Proportion)**

$$\left.\begin{matrix}\text{Men} & 8:36\\ \text{Days} & 24:30\end{matrix}\right\}::80:x$$

$\therefore\ 8\times24\times x=36\times30\times80$

$\Leftrightarrow x=\dfrac{(36\times30\times80)}{(8\times24)} \Leftrightarrow x=450.$

35. Let the required length be x metres.
Less breadth, More length **(Indirect Proportion)**
More depth, Less length **(Indirect Proportion)**
More days, More length **(Direct Proportion)**

$$\left.\begin{matrix}\text{Breadth} & 20:50\\ \text{Depth} & 15:10\\ \text{Days} & 10:30\end{matrix}\right\}::100:x$$

$\therefore\ \ 20\times15\times10\times x=50\times10\times30\times100$

$\Leftrightarrow\ x=\dfrac{(50\times10\times30\times100)}{(20\times15\times10)} \Leftrightarrow x=500.$

36. Let the required earning be ₹ x.

$5\text{ men}\equiv7\text{ women}\Leftrightarrow7\text{ men}\equiv\left(\dfrac{7}{5}\times7\right)\text{women}=\dfrac{49}{5}\text{ women}.$

$\therefore(7\text{ men and }13\text{ women})\equiv\left(\dfrac{49}{5}+13\right)\text{women}=\dfrac{114}{5}\text{ women}.$

Now, *More women, More earning* **(Direct Proportion)**

$\therefore\ 7:\dfrac{114}{5}::5250:x\Leftrightarrow7x=\left(\dfrac{114}{5}\times5250\right)=119700$

$\Leftrightarrow x=\dfrac{119700}{7}=17100.$

37. Let the required number of days be x.

3 men ≡ 6 women ⇔ 12 men ≡ (2 × 12) women
= 24 women.

$\therefore$ (12 men and 8 women) ≡ (24 + 8) women = 32 women.

Now, *More women, Less days* **(Indirect Proportion)**

$\therefore\ 32:6::20:x\Leftrightarrow32x=6\times20$

$\Leftrightarrow x=\left(\dfrac{6\times20}{32}\right)=\dfrac{15}{4}=3\dfrac{3}{4}.$

38. Let the required number of days be x.

$5\text{ men}\equiv9\text{ women}\Leftrightarrow3\text{ men}\equiv\left(\dfrac{9}{5}\times3\right)\text{women}=\dfrac{27}{5}\text{ women}.$

$\therefore(3\text{ men and }6\text{ women})\equiv\left(\dfrac{27}{5}+6\right)\text{women}=\dfrac{57}{5}\text{ women}.$

Now,
More women, Less days **(Indirect Proportion)**

$\therefore\ \ \dfrac{57}{5}:9::19:x\ \Leftrightarrow\ \dfrac{57}{5}\times x=9\times19$

$\Leftrightarrow\ x=\left(9\times19\times\dfrac{5}{57}\right)=15.$

39. Let the required number of days be x. Then,
More pumps, Less days **(Indirect Proportion)**
Less working hrs/day, More days **(Indirect Proportion)**

$$\left.\begin{matrix}\text{Pumps} & 196:49\\ \text{Working Hrs/Day} & 5:8\end{matrix}\right\}::\frac{13}{2}:x$$

$\therefore\ \ 196\times5\times x=49\times8\times\dfrac{13}{2}\ \Leftrightarrow x=\left(49\times8\times\dfrac{13}{2}\times\dfrac{1}{196\times5}\right)$

$\Leftrightarrow\ x=\dfrac{13}{5}=2\dfrac{3}{5}.$

40. Let the required number of labourers be x. Then,
Less working hrs/day, More labourers
(Indirect Proportion)
More days, Less labourers **(Indirect Proportion)**

$$\left.\begin{matrix}\text{Working Hrs/Day} & 6:7\\ \text{Days} & 30:18\end{matrix}\right\}::30:x$$

$\therefore\ 6\times30\times x=7\times18\times30\Leftrightarrow6x=126\Leftrightarrow x=21.$

41. Let the required number of days be x. Then,
Less pumps, More days **(Indirect Proportion)**
Less weight, Less days **(Direct Proportion)**
More hours/day, Less days **(Indirect Proportion)**

$$\left.\begin{matrix}\text{Pumps} & 16:18\\ \text{Weight} & 2170:1736\\ \text{Hours/Day} & 9:7\end{matrix}\right\}::10:x$$

$\therefore\ \ (16\times2170\times9\times x)=(18\times1736\times7\times10)$

$\Leftrightarrow\ x=\dfrac{18\times1736\times7\times10}{16\times2170\times9}=7.$

42. Let the required number of lamps be x.
Less hours per day, More lamps **(Indirect Proportion)**
More money, More lamps **(Direct Proportion)**
More days, Less lamps **(Indirect Proportion)**

$$\left.\begin{matrix}\text{Hours per day} & 4:5\\ \text{Money} & 21.25:76.50\\ \text{Number of days} & 30:10\end{matrix}\right\}::80:x$$

$\therefore\ \ 4\times21.25\times30\times x=5\times76.50\times10\times80$

$\Leftrightarrow x=\dfrac{5\times76.50\times10\times80}{4\times21.25\times30}\ \Leftrightarrow\ x=120.$

43. Let the required number of chairs be x. Then,

More carpenters, More chairs **(Direct Proportion)**

More hours per day, More chairs **(Direct Proportion)**

More days, More chairs **(Direct Proportion)**

$$\left.\begin{array}{ll}\text{Carpenters} & 12:18\\ \text{Hours per day} & 6:8\\ \text{Days} & 24:36\end{array}\right\}::460:x$$

$\therefore \quad (12 \times 6 \times 24 \times x) = (18 \times 8 \times 36 \times 460)$

$$\Leftrightarrow \quad x = \frac{(18\times 8\times 36\times 460)}{(12\times 6\times 24)} = 1380.$$

$\therefore$ Required number of chairs = 1380.

44. Let the required number of flies be x.

More spiders, More flies **(Direct Proportion)**

More time, More flies **(Direct Proportion)**

$$\left.\begin{array}{ll}\text{Spiders} & 5:100\\ \text{Minutes} & 5:100\end{array}\right\}::5:x$$

$\therefore 5 \times 5 \times x = 100 \times 100 \times 5$

$$\Leftrightarrow x = \left(\frac{100\times 100\times 5}{5\times 5}\right) = 2000.$$

45. Let the required number of machines be x.

More persons, More machines **(Direct Proportion)**

More working hours, More machines **(Direct Proportion)**

More days, More machines **(Direct Proportion)**

$$\left.\begin{array}{ll}\text{Persons} & 2:6\\ \text{Working hours} & 2:6\\ \text{Days} & 2:6\end{array}\right\}::2:x \quad \therefore 2 \times 2 \times 2 \times x$$

$$= 6 \times 6 \times 6 \times 2$$

$$\Leftrightarrow x = \left(\frac{6\times 6\times 6\times 2}{2\times 2\times 2}\right) = 54.$$

46. 2 women ≡ 1 man $\Leftrightarrow$ 4 women ≡ 2 men.

$\therefore$ (3 men and 4 women) ≡ (3 + 2) men = 5 men.

Let the required number of days be x.

Less Men, More days **(Indirect Proportion)**

$\therefore 5 : 10 :: 8 : x \Leftrightarrow 5x = 10 \times 8 \Leftrightarrow x = 16.$

47. Let the required number of days be x.

7 men ≡ 10 women

$\Rightarrow$ 14 men ≡ 20 women

$\therefore$ (14 men and 20 women)

≡ (20 + 20) women = 40 women.

More length, More days **(Direct Proportion)**

More women, Less days **(Indirect Proportion)**

$$\left.\begin{array}{ll}\text{Length} & 100:600\\ \text{Women} & 40:10\end{array}\right\}::10:x$$

$\therefore 100 \times 40 \times x = 600 \times 10 \times 10$

$$\Leftrightarrow x = \left(\frac{600\times 10\times 10}{100\times 40}\right) = 15.$$

48. Let the required number of mats be x.

10 men ≡ 20 boys $\Rightarrow$ 1 man ≡ 2 boys

$\Rightarrow$ 8 men ≡ 16 boys

$\Rightarrow$ (8 men + 4 boys) ≡ (16 + 4) boys = 20 boys.

$\therefore$ 8 men and 4 boys can make as many mats as 20 boys i.e., 260 mats.

49. Let the required length be x metres.

More men, More length **(Direct Proportion)**

More width, Less length **(Indirect Proportion)**

More depth, Less length **(Indirect Proportion)**

More time, More length **(Direct Proportion)**

$$\left.\begin{array}{ll}\text{Men} & 600:2500\\ \text{Width} & 10:5.5\\ \text{Depth} & 8:4\\ \text{Hours} & \frac{1}{2}:6\end{array}\right\}::405:x$$

$$\therefore 600 \times 10 \times 8 \times \frac{1}{2} \times x = 2500 \times 5.5 \times 4 \times 6 \times 405$$

$$\Leftrightarrow x = \left(\frac{2500\times 5.5\times 4\times 6\times 405\times 2}{600\times 10\times 8}\right) = \frac{22275}{4} = 5568\frac{3}{4}.$$

50. Let the required number of days be x.

More persons, Less days **(Indirect Proportion)**

More length, More days **(Direct Proportion)**

More width, More days **(Direct Proportion)**

More depth, More days **(Direct Proportion)**

Less working hrs, More days **(Indirect Proportion)**

$$\left.\begin{array}{ll}\text{Persons} & 80:64\\ \text{Length} & 50:75\\ \text{Width} & 2:4\\ \text{Depth} & 2:3\\ \text{Working hrs} & 8:12\end{array}\right\}::5:x$$

$$\therefore 80\times 50\times 2\times 2\times 8\times x = 64\times 75\times 4\times 3\times 12\times 5$$

$$\Leftrightarrow x = \left(\frac{64\times 75\times 4\times 3\times 12\times 5}{80\times 50\times 2\times 2\times 8}\right) = 27.$$

51. Let the required number of binders be x.

Less books, Less binders **(Direct Proportion)**

More days, Less binders **(Indirect Proportion)**

$$\left.\begin{array}{ll}\text{Books} & 1400:800\\ \text{Days} & 20:15\end{array}\right\}::21:x$$

$\therefore 1400 \times 20 \times x = 800 \times 15 \times 21$

$$\Leftrightarrow x = \left(\frac{800\times 15\times 21}{1400\times 20}\right) = 9.$$

52. Let the original number of artisans be x.

More artisans, Less days **(Indirect Proportion)**

$\therefore (x + 8) : x :: 16 : 12 \Leftrightarrow 12(x + 8) = 16x$

$\Leftrightarrow 4x = 96 \Leftrightarrow x = 24.$

53. Let the required number of working hours per day be x.

Less examiners, More working hours per day **(Indirect Proportion)**

More days, Less working hours per day **(Indirect Proportion)**

More answer books,

More working hours per day **(Direct Proportion)**

Examiners 4 : 9
Days 30 : 12 } : : 5 : x
Answer books 1 : 2

$\therefore$ $(4 \times 30 \times 1 \times x) = (9 \times 12 \times 2 \times 5)$

$\Leftrightarrow 120x = 1080 \Leftrightarrow x = 9.$

54. Let the total number of men to be engaged be x.

More length, More labourers **(Direct Proportion)**

Less days, More labourers **(Indirect Proportion)**

More hours per day, Less labourers **(Indirect Proportion)**

Length 26 : 39
Days 6 : 18 } :: 17 : x
Hours per day 9 : 8

$\therefore$ $(26 \times 6 \times 9 \times x) = (39 \times 18 \times 8 \times 17)$

$\Leftrightarrow x = \dfrac{(39 \times 18 \times 8 \times 17)}{(26 \times 6 \times 9)} = 68.$

$\therefore$ Number of more labourers = (68 − 17) = 51.

55. Let the total number of men be x.

Work done $= \dfrac{1}{3}$, Remaining work $= \left(1 - \dfrac{1}{3}\right) = \dfrac{2}{3}.$

More work, More men **(Direct Proportion)**

More days, Less men **(Indirect Proportion)**

Work $\frac{1}{3} : \frac{2}{3}$
Days 25 : 20 } : : 20 : x

$\therefore$ $\left(\dfrac{1}{3} \times 25 \times x\right) = \left(\dfrac{2}{3} \times 20 \times 20\right) \Leftrightarrow x = \dfrac{800}{25} = 32.$

$\therefore$ More men to be employed = (32 − 20) = 12.

56. Let the required number of rounds be x.

More radius, Less rounds **(Indirect Proportion)**

$\therefore$ 20 : 14 : : 70 : $x \Leftrightarrow (20 \times x) = (14 \times 70)$

$\Leftrightarrow x = \dfrac{14 \times 70}{20} \Leftrightarrow x = 49.$

Hence, the required number of rounds = 49.

57. Let the required number of units of work be z.

More men, More work **(Direct Proportion)**

More working hours, More work **(Direct Proportion)**

More days, More work **(Direct Proportion)**

Men $x : y$
Hours per day $x : y$ } : : $x : z$
Days $x : y$

$\therefore$ $(x \times x \times x \times z) = (y \times y \times y \times x) \Leftrightarrow z = \dfrac{y^3}{x^2}.$

58. Remaining work $= \left(1 - \dfrac{4}{7}\right) = \dfrac{3}{7}.$ Remaining period = (46 − 33) days = 13 days.

Let the total men working at it be x.

Less work, Less men **(Direct Proportion)**

Less days, More men **(Indirect Proportion)**

More Hrs/Day, Less men **(Indirect Proportion)**

Work $\frac{4}{7} : \frac{3}{7}$
Days 13 : 33 } : : 117 : x
Hrs/Day 9 : 8

$\therefore$ $\dfrac{4}{7} \times 13 \times 9 \times x = \dfrac{3}{7} \times 33 \times 8 \times 117$ or x

$= \left(\dfrac{3 \times 33 \times 8 \times 117}{4 \times 13 \times 9}\right) = 198.$

$\therefore$ Additional men to be employed = (198 − 117) = 81.

59. New dosage = 120% of $t = \dfrac{6}{5}t$. Number of patients $= \dfrac{2}{3}p.$

Let the required number of days be x.

More dosage, Less days **(Indirect Proportion)**

Less patients, More days **(Indirect Proportion)**

Dosage $\frac{6}{5}t : t$
Patients $\frac{2}{3}p : p$ } : : $d : x$

$\therefore$ $\dfrac{6}{5}t \times \dfrac{2}{3}p \times x = t \times p \times d \Leftrightarrow x = \left(\dfrac{3}{2} \times \dfrac{5}{6} \times d\right) = \dfrac{5d}{4}.$

60. Let x men can do the work in 12 days and the required number of days be z.

More men, Less days **(Indirect Proportion)**

Less work, Less days **(Direct Proportion)**

Men $2x : x$
Work $1 : \frac{1}{2}$ } : : 12 : z

$\therefore$ $(2x \times 1 \times z) = \left(x \times \dfrac{1}{2} \times 12\right)$

$\Leftrightarrow 2xz = 6x \Leftrightarrow z = 3.$

61. Let the required number of persons be x.

Less days, More persons **(Indirect Proportion)**

More work, More persons **(Direct Proportion)**

Days 2 : 4
Work 1 : 8 } :: 12 : x

$\therefore$ $2 \times 1 \times x = 4 \times 8 \times 12$

$\Leftrightarrow x = \left(\dfrac{4 \times 8 \times 12}{2}\right) = 192.$

62. Let the required quantity of coal be x metric tonnes.

More engines, More coal **(Direct Proportion)**

More hours per day, More coal **(Direct Proportion)**

More rate, More coal **(Direct Proportion)**

Engines 5 : 8
Hours per day 9 : 10
Rate $\frac{1}{3} : \frac{1}{4}$ } : : 6 : x

$\therefore$ $\left(5 \times 9 \times \dfrac{1}{3} \times x\right) = \left(8 \times 10 \times \dfrac{1}{4} \times 6\right) \Leftrightarrow 15x = 120 \Leftrightarrow x = 8.$

63. Let the required number of days be x.

2 men of latter type

≡ 3 men of former type

$\Rightarrow$ 12 men of latter type ≡ $\left(\frac{3}{2}\times 12\right)$

= 18 men of former type

More men, Less days *(Indirect Proportion)*
Less working hrs, More days *(Indirect Proportion)*

$$\left.\begin{matrix}\text{Men} & 18:9\\ \text{Working hrs} & 6:\frac{15}{2}\end{matrix}\right\}::20:x$$

$\therefore 18\times 6\times x = 9\times\frac{15}{2}\times 20 \Leftrightarrow 108x = 1350 \Leftrightarrow x = \frac{25}{2} = 12\frac{1}{2}.$

64. Let the required number of hours be x.
Speeds of working of first and second type of men are $\frac{1}{2}$ and $\frac{1}{3}$.

More work, More time *(Direct Proportion)*
Less speed, More time *(Indirect Proportion)*

$$\left.\begin{matrix}\text{Work} & 1:2\\ \text{Speed} & \frac{1}{3}:\frac{1}{2}\end{matrix}\right\}::25:x$$

$\therefore \left(1\times\frac{1}{3}\times x\right) = \left(2\times\frac{1}{2}\times 25\right) \Leftrightarrow x = 75.$

65. 3 women ≡ 2 men.
So, 21 women ≡ 14 men.

Less men, More days *(Indirect Proportion)*
Less hours per day, More days *(Indirect Proportion)*

$$\left.\begin{matrix}\text{Men} & 14:15\\ \text{Hours per day} & 6:8\end{matrix}\right\}::21:x$$

$\therefore (14\times 6\times x) = (15\times 8\times 21)$

$\Leftrightarrow x = \frac{(15\times 8\times 21)}{(14\times 6)} = 30.$

$\therefore$ Required number of days = 30.

66. After 25 days, 35 men complete the work in 12 days.
Thus, 35 men can finish the remaining work in 12 days.

$\therefore$ 30 men can do it in $\frac{(12\times 35)}{30} = 14$ days,

which is 1 day behind.

67. Let the remaining food last for x days.
4000 soldiers had provisions for 160 days. 3200 soldiers had provisions for x days.

Less men, More days *(Indirect Proportion)*
$\therefore$ 3200 : 4000 : : 160 : x
$\Leftrightarrow 3200x = 4000\times 160$
$\Leftrightarrow x = \left(\frac{4000\times 160}{3200}\right) = 200.$

68. Let the remaining food last for x days.
500 men had provisions for (27 – 3) = 24 days.
(500 + 300) men had provisions for x days.

More men, Less days *(Indirect Proportion)*
$\therefore$ 800 : 500 : : 24 : x
$\Leftrightarrow (800\times x) = (500\times 24)$
$\Leftrightarrow x = \left(\frac{500\times 24}{800}\right) = 15.$

69. Initially, let there be x men having food for y days.
After 10 days, x men had food for $(y - 10)$ days. Also, $\left(x-\frac{x}{5}\right)$ men had food for y days.

$\therefore x(y-10) = \frac{4x}{5}\times y$

$\Leftrightarrow 5xy - 50x = 4xy \Leftrightarrow xy - 50x = 0$
$\Leftrightarrow x(y - 50) = 0 \Leftrightarrow y - 50 = 0 \Leftrightarrow y = 50.$

70. Let there be x men originally.
So, x men had provisions for 40 days whereas $(x + 500)$ men consumed it in 35 days.

More men, Less days *(Indirect Proportion)*
$\therefore (x + 500) : x : : 40 : 35$
$\Leftrightarrow 35(x + 500) = 40x \Leftrightarrow 5x = 35\times 500$
$\Leftrightarrow x = \left(\frac{35\times 500}{5}\right) = 3500.$

71. Let the strength of the reinforcement be x men.
Then, 2000 men had provisions for (66 – 14) = 52 days while $(2000 + x)$ men consumed it in 20 days.

More men, Less days *(Indirect Proportion)*
$\therefore (2000 + x) : 2000 : : 52 : 20$
$\Leftrightarrow 20(2000 + x) = 2000\times 52$
$\Leftrightarrow (2000 + x) = \left(\frac{2000\times 52}{20}\right) = 5200 \Leftrightarrow x = 3200.$

72. Let the team take x days to finish 360 pieces.
Then, number of pieces made each day = $\frac{360}{x}$.

More number of pieces per day, Less days *(Indirect Proportion)*

$\therefore \left(\frac{360}{x} + 4\right) : \frac{360}{x} : : x : (x - 1)$

$\Leftrightarrow \left(\frac{360}{x} + 4\right)(x-1) = \frac{360}{x}\times x = 360$

$\Leftrightarrow 360 - \frac{360}{x} + 4x - 4 = 360$

$\Leftrightarrow 4x - \frac{360}{x} - 4 = 0 \Leftrightarrow x - \frac{90}{x} - 1 = 0$

$\Leftrightarrow x^2 - x - 90 = 0 \Leftrightarrow (x - 10)(x + 9) = 0 \Leftrightarrow x = 10.$

73. Ratio of time taken by a woman, a man and a boy
= 8 : 6 : 12 = 4 : 3 : 6.

So, 4 women ≡ 3 men ≡ 6 boys.
(12 men + 12 women + 12 boys)

$$= \left[12 + \left(\frac{3}{4}\times 12\right) + \left(\frac{3}{6}\times 12\right)\right] \text{men}$$

= (12 + 9 + 6) men = 27 men.

Let the required number of days be x.

More men, Less days *(Indirect Proportion)*
More working hours, Less days *(Indirect Proportion)*

$$\left.\begin{matrix}\text{Men} & 27:9\\ \text{Working hrs} & 8:6\end{matrix}\right\}::6:x$$

$\therefore 27\times 8\times x = 9\times 6\times 6$

$\Leftrightarrow x = \left(\frac{9\times 6\times 6}{27\times 8}\right) = \frac{3}{2} = 1\frac{1}{2}.$

74. 1 man ≡ 2 boys ⇔ (12 men + 18 boys)
≡ (12 × 2 + 18) boys = 42 boys.
Let required number of boys = x.
21 men + x boys ≡ (21 × 2 + x) boys = (42 + x) boys.
Less days, More boys **(*Indirect Proportion*)**
More hrs per day, Less boys **(*Indirect Proportion*)**
More work, More boys **(*Direct Proportion*)**

$$\left.\begin{array}{ll}\text{Days} & 50:60\\ \text{Hours per day} & 9:\frac{15}{2}\\ \text{Work} & 1:2\end{array}\right\}::42:(42+x)$$

$\therefore\ [50 \times 9 \times 1 \times (42 + x)] = \left(60\times\frac{15}{2}\times 2\times 42\right)$

$\Leftrightarrow\ (42+x)=\frac{37800}{450} \Leftrightarrow\ 42+x=84 \Leftrightarrow\ x=42.$

75. 3 men ≡ 6 boys ⇔ (6 men + 2 boys) ≡ 14 boys.
More work, More days **(*Direct Proportion*)**
More boys, Less days **(*Indirect Proportion*)**
More hours per day, Less days **(*Indirect Proportion*)**

$$\left.\begin{array}{ll}\text{Work} & 1:2\\ \text{Boys} & 14:6\\ \text{Hours per day} & 8:7\end{array}\right\}::10:x$$

$\therefore$ (1 × 14 × 8 × x) = (2 × 6 × 7 × 10)

$\Leftrightarrow x = \frac{840}{112}=7\frac{1}{2}.$

76. (2 × 14) men + (7 × 14) boys
≡ (3 × 11) men + (8 × 11) boys
⇔ 5 men ≡ 10 boys ⇔ 1 man ≡ 2 boys.
$\therefore$ (2 men + 7 boys) ≡ (2 × 2 + 7) boys = 11 boys.
(8 men + 6 boys) ≡ (8 × 2 + 6) boys = 22 boys.
Let the required number of days be x.
Now, ***More boys, Less days*** **(*Indirect Proportion*)**
More work, More days **(*Direct Proportion*)**

$$\left.\begin{array}{ll}\text{Boys} & 22:11\\ \text{Work} & 1:3\end{array}\right\}::14:x$$

$\therefore$ (22 × 1 × x) = (11 × 3 × 14)

$\therefore\ x = \frac{462}{22}=21.$

77. 4 large ships ≡ 7 small ships

$\Leftrightarrow$ 15 large ships $= \left(\frac{7}{4}\times 15\right)$small ships $=\frac{105}{4}$ small ships.

Also, 2 large ships $= \left(\frac{7}{4}\times 2\right)$small ships $=\frac{7}{2}$ small ships.

3 medium ships ≡ 2 large ships + 1 small ship

$$\equiv \left(\frac{7}{2}+1\right)\text{small ships}=\frac{9}{2}\text{ small ships.}$$

$\Leftrightarrow$ 7 medium ships

$$= \left(\frac{9}{2}\times\frac{1}{3}\times 7\right)\text{small ships}=\frac{21}{2}\text{ small ships.}$$

$\therefore$ (15 large + 7 medium + 14 small) ships

$$\equiv \left(\frac{105}{4}+\frac{21}{2}+14\right)\text{small ships}=\frac{203}{4}\text{ small ships.}$$

(12 large + 14 medium + 21 small) ships

$$\equiv \left[\left(\frac{7}{4}\times 12\right)+\left(\frac{21}{2}\times 2\right)+21\right]\text{small ships}$$

= (21 + 21 + 21) small ships = 63 small ships.

Let the required number of journeys be x.
More ships, Less journeys **(*Indirect Proportion*)**

$\therefore\ 63:\frac{203}{4}::36:x \Leftrightarrow 63x=\frac{203}{4}\times 36=1827 \Leftrightarrow x=\frac{1827}{63}=29.$

78. Cloth is required for 1 shirt = 2m, 60cm or 260cm
Cloth is required for 7 shirts = 260 × 7 = 1,820 cm
Or 18m 20cm.

79. 1 score of papers = 20 papers.
Cost of 4 dozen papers = ₹ 24
Cost of 20 papers = $\frac{24}{4\times 12}\times 20 =$ ₹ 10

80. Cost of 8 fans and 14 oven's is ₹ 36.520
Cost of 4 fans and 7 oven's is = $\frac{36.520}{2}$ = ₹ 18.260
Cost of 12 fans and 21 oven's = 18.260 × 3 = ₹ 54.780.

81. Cost of 5 apples = ₹ 450
Cost of 1kg apples = $\frac{450}{5}$
Cost of 8 kg apples = $\frac{450}{5}\times 8 =$ ₹ 720
Cost of 12 dozen mangoes = ₹ 4,320
Cost of 1 dozen mangoes = $\frac{4320}{12}$
Cost of 8 dozen mangoes = $\frac{4320}{12}\times 8 =$ ₹ 2880
Cost of 4kg oranges = ₹ 240
Cost of 1kg orange = $\frac{240}{4}$
Cost of 8 kg orange = $\frac{240}{4}\times 8 =$ ₹ 480
Total cost = 720 + 2880 + 480 = ₹ 4080

82. Cost of 21 pencils and 9 clippers = ₹ 819
Cost of 7 pencils and 3 clippers = $\frac{819}{3}=$ ₹ 273