
ANSWERS

1. (b) 2. (d) 3. (a) 4. (e) 5. (e) 6. (e) 7. (d) 8. (b)
9. (a) 10. (e) 11. (c) 12. (d) 13. (d) 14. (d) 15. (e) 16. (b)
17. (d) 18. (a) 19. (e) 20. (e) 21. (b) 22. (b)

SOLUTIONS

1. S.P. = Rs. 250 each. To find gain percent, we must know the C.P. of each.
 \therefore Correct answer is (b).

2. Gain = 25% of C.P.
 In order to find gain, we must know the sale price of each article and the number of articles sold.
 \therefore Correct answer is (d).

3. Gain = 20%
 I. Profit = (S.P.) - (C.P.) = Rs. 40.
 Thus, I gives the answer. But, II does not give the answer.
 \therefore Correct answer is (a).

4. I. Gain = $\frac{1}{3}$ (C.P.).
 II. S.P. = Rs. 400.
 $\text{Gain} = (\text{S.P.}) - (\text{C.P.}) \Rightarrow \frac{1}{3} (\text{C.P.}) = (\text{Rs. } 400) - (\text{C.P.}) \Rightarrow \left(1 + \frac{1}{3}\right) (\text{C.P.}) = \text{Rs. } 400$
 $\Rightarrow \text{C.P.} = \text{Rs. } \left(400 \times \frac{3}{4}\right) = \text{Rs. } 300.$

Thus, I and II both are needed to get the answer.
 \therefore Correct answer is (e).

5. I. Total C.P. of 50 kg = Rs. $(3350 + 150)$ = Rs. 3500.
 \therefore C.P. of 1 kg = Rs. $\left(\frac{3500}{50}\right)$ = Rs. 70.
 II. Gain = 5%.
 \therefore S.P. of 1 kg = 105% of Rs. 70 = Rs. $\left(70 \times \frac{105}{100}\right)$ = Rs. 73.50.

Thus, both I and II are needed to get the answer.
 \therefore Correct answer is (e).

6. I. C.P. = Rs. 300. II. $\frac{x}{4}$ (d)
 II. Loss = 25% of S.P. III. $\frac{25}{100} \times 300$ (a)

Let S.P. be Rs. x . Then, loss = 25% of Rs. x = Rs. $\frac{x}{4}$.
 $\text{Loss} = (\text{C.P.}) - (\text{S.P.}) \Rightarrow \frac{x}{4} = 300 - x \Rightarrow \left(x + \frac{x}{4}\right) = 300$
 $\Rightarrow x = \left(300 \times \frac{4}{5}\right) = 240$.
 $\therefore \text{Loss} = 25\% \text{ of Rs. } 240 = \text{Rs. } \left(\frac{25}{100} \times 240\right) = \text{Rs. } 60$.

Thus, I and II are required to get the answer.

∴ Correct answer is (e).

7. (d) The ratio in which X and Y are mixed, is not given. (b). S. (d). I.

(d) So, both I and II together cannot give the answer. (f). (e). (a). (c).

∴ Correct answer is (d). (d). (e). (f). (g). (h). (b). (f). (g).

8. (f) II gives, S.P. = Rs. 310 and gain = Rs. 70. (b). S.

∴ C.P. = Rs. $(310 - 70) = \text{Rs. } 240$.

∴ Gain % = $\left(\frac{70}{240} \times 310\right)\%$.

Thus, II alone gives the answer.

Clearly, I alone does not give the answer.

∴ Correct answer is (b). (d). (e). (f). (g). (h). (i). (j). (k). (l). (m). (n). (o). (p). (q). (r). (s). (t). (u). (v). (w). (x). (y). (z).

9. Let the C.P. be Rs. x . Then,

$$\text{I. } \frac{(78-x)}{x} \times 100 = 2 \times \frac{(69-x)}{x} \times 100 \Leftrightarrow 78 - x = 138 - 2x \Leftrightarrow x = 60.$$

Thus, I only gives the answer.

II. Let the C.P. be Rs. x . Then, M.P. = Rs. $\left(\frac{120}{100} \times x\right) = \text{Rs. } \frac{6x}{5}$.

∴ S.P. = 90% of Rs. $\frac{6x}{5} = \text{Rs. } \left(\frac{6x}{5} \times \frac{90}{100}\right) = \text{Rs. } \frac{27x}{25}$.

Thus, 108% of $x = \frac{27x}{25}$. This does not give x .

∴ II does not give the answer.

∴ Correct answer is (a).

10. Let the labelled price be Rs. x .

I. C.P. = 80% of Rs. $x = \text{Rs. } \left(x \times \frac{80}{100}\right) = \text{Rs. } \frac{4x}{5}$.

II. S.P. = Rs. 2000, S.P. = 125% of Rs. $x = \text{Rs. } \left(\frac{125}{100} \times x\right) = \text{Rs. } \frac{5x}{4}$.

∴ $\frac{5x}{4} = 2000 \Rightarrow x = \frac{2000 \times 4}{5} = 1600$.

∴ C.P. = Rs. $\frac{4x}{5} = \text{Rs. } \left(\frac{4}{5} \times 1600\right) = \text{Rs. } 1280$.

Thus, I and II together give the answer.

∴ Correct answer is (e).

Profit and Loss

11. S.P. = Rs. 100.

I. When S.P. = Rs. 90, Gain = 20%.

$$\therefore \text{C.P.} = \text{Rs.} \left(\frac{100}{120} \times 90 \right) = \text{Rs.} 75.$$

Now, (C.P. = Rs. 75 and S.P. = Rs. 100) \Rightarrow Profit = Rs. 25.

Thus, I alone gives the answer.

II. Let the C.P. be Rs. x . Then, gain = Rs. $\frac{x}{3}$.

$$\therefore \text{S.P.} = \text{Rs.} \left(x + \frac{x}{3} \right) = \text{Rs.} \frac{4x}{3}.$$

$$\text{Thus, } \frac{4x}{3} = 100 \Rightarrow x = \left(\frac{3 \times 100}{4} \right) = 75 \text{ and so C.P.} = \text{Rs.} 75.$$

Thus, II alone gives the answer.

\therefore Correct answer is (c).

12. Let the price of a banana be Rs. x and that of an orange Rs. y .

$$\text{I. } 14x + 35y = 84 \Rightarrow 2x + 5y = 12 \quad \dots(i)$$

$$\text{II. } 4 \times \frac{x}{2} + 5y = 12 \Rightarrow 2x + 5y = 12 \quad \dots(ii)$$

Thus, even I and II together do not give the answer.

\therefore Correct answer is (d).

13. I. Let the labelled price be Rs. x .

$$\text{C.P.} = 60\% \text{ of Rs. } x = \text{Rs.} \left(x \times \frac{60}{100} \right) = \text{Rs.} \frac{3x}{5}.$$

$$\text{II. S.P.} = 120\% \text{ of Rs. } x = \text{Rs.} \left(x \times \frac{120}{100} \right) = \text{Rs.} \frac{6x}{5}.$$

$$\text{Profit} = \text{Rs.} \left(\frac{6x}{5} - \frac{3x}{5} \right) = \text{Rs.} \frac{3x}{5}.$$

Thus, even I and II together do not give the answer.

\therefore Correct answer is (d).

14. I. Total gain = Rs. 1596.

II. C.P. of each article = Rs. 632.

III. S.P. of each article = Rs. 765.

Let the number of articles be x .

$$\text{Then, } 765x - 632x = 1596 \Rightarrow x = \frac{1596}{133} = 12.$$

Thus, all I, II and III are needed to get the answer.

\therefore Correct answer is (d).

15. Let the M.P. be Rs. x .

$$\text{I. S.P.} = 90\% \text{ of Rs. } x = \text{Rs.} \left(x \times \frac{90}{100} \right) = \text{Rs.} \frac{9x}{10}.$$

II. If S.P. = Rs. x , then gain = 30%.

$$\therefore \text{C.P.} = \text{Rs.} \left(\frac{100}{130} \times x \right) = \text{Rs.} \frac{10x}{13}.$$

III. Gain = 20%.

Thus, I, II, III do not give the answer.

\therefore Correct answer is (e).

16. I. Let the C.P. be Rs. x .

$$\text{Then, M.P.} = 120\% \text{ of Rs. } x = \text{Rs.} \left(\frac{120}{100} \times x \right) = \text{Rs.} \frac{6x}{5}$$

$$\text{II. S.P.} = 85\% \text{ of M.P.} = \text{Rs.} \left(\frac{6x}{5} \times \frac{85}{100} \right) = \text{Rs.} \frac{51x}{50}$$

$$\therefore \frac{51x}{50} = 408 \Rightarrow x = \left(408 \times \frac{50}{51} \right) \Rightarrow x = 400.$$

Thus, I and II give the answer.

$$\text{III. When there is no discount, then S.P.} = \text{M.P.} = \text{Rs.} \frac{6x}{5} \quad [\text{From I}]$$

Thus, II and III give the same answer.

∴ Correct answer is (b).

17. Let the M.P. be Rs. x .

$$\text{I. C.P.} = 85\% \text{ of Rs. } x = \text{Rs.} \left(x \times \frac{85}{100} \right) = \text{Rs.} \frac{17x}{20}$$

$$\text{II. S.P.} = \text{Rs.} 3060.$$

$$\text{III. } 102\% \text{ of } x = 3060 \Rightarrow x = \left(3060 \times \frac{100}{102} \right) = 3000.$$

$$\therefore \text{C.P.} = \text{Rs.} \frac{17x}{20} = \text{Rs.} \left(\frac{17}{20} \times 3000 \right) = \text{Rs.} 2550.$$

$$\text{So, gain} = \text{Rs.} (3060 - 2550) = \text{Rs.} 510.$$

Thus all I, II and III give the answer.

∴ Correct answer is (d).

18. I. Let the list price be Rs. x .

$$\text{Then, S.P.} = 95\% \text{ of Rs. } x = \text{Rs.} \left(x \times \frac{95}{100} \right) = \text{Rs.} \frac{19x}{20}$$

- II. When S.P. = Rs. x and gain = 20%.

$$\text{Then, C.P.} = \text{Rs.} \left(\frac{100}{120} \times x \right) = \text{Rs.} \frac{5x}{6}.$$

$$\therefore \text{Gain} = \left(\frac{19x}{20} - \frac{5x}{6} \right) = \left(\frac{57x - 50x}{60} \right) = \frac{7x}{60}.$$

$$\therefore \text{Gain\%} = \left(\frac{7x}{60} \times \frac{6}{5x} \times 100 \right)\% = 14\%.$$

Thus, I and II only give the answer.

∴ Correct answer is (a).

19. C.P. = Rs. 3000. Let the rate of discount be $x\%$.

$$\text{I. S.P.} = 105\% \text{ of Rs. } 3000 = \text{Rs.} 3150.$$

$$\text{II. Let M.P.} = \text{Rs. } x. \text{ Then, } \frac{(x - 3150)}{(x - 85\% \text{ of } 3000)} = \frac{1}{2} \Rightarrow x = 3750.$$

$$\text{From I and II, discount} = \text{Rs.} (3750 - 3150) = \text{Rs.} 600.$$

$$\text{Discount\%} = \left(\frac{600}{3750} \times 100 \right)\% = 16\%.$$

Thus, I and II give the answer.

III. M.P. = 125% of Rs. 3000 = Rs. 3750.

From I and III, discount = (M.P.) - (S.P.) = Rs. 600.

Thus, Discount% can be calculated.

Thus, I and III give the answer.

From II and III, we get : discount = Rs. $\left(\frac{3750 - 85\% \text{ of } 3000}{2} \right)$ = Rs. 600.

Thus, II and III give the answer.

∴ Correct answer is (e).

20. I. S.P. = Rs. 12350, Gain = 23.5%.

$$\therefore C.P. = \text{Rs.} \left(\frac{100}{123.5} \times 12350 \right) = \text{Rs.} 10000.$$

II. M.P. = 130% of C.P. = 130% of Rs. 10000 = Rs. 13000.

From I and II, discount = Rs. (13000 - 12350) = Rs. 650.

$$\text{Discount\%} = \left(\frac{650}{13000} \times 100 \right)\% = 5\%.$$

Thus, I and II give the answer.

III gives C.P. = Rs. 10000.

So, II and III give the answer.

∴ Correct answer is (e).

21. I. Let C.P. be Rs. x . Then, M.P. = Rs. $\frac{13x}{10}$.

III. S.P. = 90% of M.P.

$$\text{Thus, I and III give, S.P.} = \text{Rs.} \left(\frac{90}{100} \times \frac{13x}{10} \right) = \text{Rs.} \frac{117x}{100}.$$

$$\text{Gain} = \text{Rs.} \left(\frac{117x}{100} - x \right) = \text{Rs.} \frac{17x}{100}.$$

Thus, from I and III, gain% can be obtained.

Clearly, II is redundant.

∴ Correct answer is (b).

22. II. C.P. = Rs. 1500.

I. Gain = 10.5%.

∴ From I and II, we get

$$\text{S.P.} = 110.5\% \text{ of C.P.} = \text{Rs.} \left(\frac{110.5}{100} \times 1500 \right) = \text{Rs.} 1657.50.$$

Discount = 15%.

$$\therefore M.P. = \text{Rs.} \left(\frac{100}{85} \times 1657.50 \right) = \text{Rs.} 1950.$$

Thus, I and II give the answer and so III is redundant.

III. M.P. = 130% of C.P.

$$\text{From II and III, we get : M.P.} = \text{Rs.} \left(\frac{130}{100} \times 1500 \right) = \text{Rs.} 1950.$$

∴ II and III give the answer and so I is redundant.

So, either I or III is redundant.

∴ Correct answer is (b).

12. RATIO AND PROPORTION

IMPORTANT FACTS AND FORMULAE

I. RATIO : The ratio of two quantities a and b in the same units, is the fraction $\frac{a}{b}$ and we write it as $a : b$.

In the ratio $a : b$, we call a as the **first term or antecedent** and b , the **second term or consequent**.

Ex. The ratio $5 : 9$ represents $\frac{5}{9}$ with antecedent = 5, consequent = 9.

Rule : The multiplication or division of each term of a ratio by the same non-zero number does not affect the ratio.

Ex. $4 : 5 = 8 : 10 = 12 : 15$ etc. Also, $4 : 6 = 2 : 3$.

2. PROPORTION : The equality of two ratios is called proportion.

If $a : b = c : d$, we write, $a : b :: c : d$ and we say that a, b, c, d are in proportion.

Here a and d are called **extremes**, while b and c are called **mean terms**.

Product of means = Product of extremes.

Thus, $a : b :: c : d \Leftrightarrow (b \times c) = (a \times d)$.

3. (i) Fourth Proportional : If $a : b = c : d$, then d is called the fourth proportional to a, b, c .

(ii) Third Proportional : If $a : b = b : c$, then c is called the third proportional to a and b .

(iii) Mean Proportional : Mean proportional between a and b is \sqrt{ab} .

4. (i) COMPARISON OF RATIOS :

We say that $(a : b) > (c : d) \Leftrightarrow \frac{a}{b} > \frac{c}{d}$.

(ii) COMPOUNDED RATIO :

The compounded ratio of the ratios $(a : b), (c : d), (e : f)$ is $(ace : bdf)$.

5. (i) Duplicate ratio of $(a : b)$ is $(a^2 : b^2)$.

(ii) Sub-duplicate ratio of $(a : b)$ is $(\sqrt{a} : \sqrt{b})$.

(iii) Triplicate ratio of $(a : b)$ is $(a^3 : b^3)$.

(iv) Sub-triplicate ratio of $(a : b)$ is $(\frac{1}{a^3} : \frac{1}{b^3})$.

(v) If $\frac{a}{b} = \frac{c}{d}$, then $\frac{a+b}{a-b} = \frac{c+d}{c-d}$. (componendo and dividendo)

6. VARIATION :

(i) We say that x is directly proportional to y , if $x = ky$ for some constant k and we write, $x \propto y$.

(ii) We say that x is inversely proportional to y , if $xy = k$ for some constant k and we write, $x \propto \frac{1}{y}$.

SOLVED PROBLEMS

Ex. 1. If $a : b = 5 : 9$ and $b : c = 4 : 7$, find $a : b : c$.

$$\begin{aligned} \text{Sol. } a : b &= 5 : 9 \text{ and } b : c = 4 : 7 = \left(4 \times \frac{9}{4}\right) : \left(7 \times \frac{9}{4}\right) = 9 : \frac{63}{4} = \frac{36}{4} : \frac{63}{4} \\ \Rightarrow a : b : c &= 5 : 9 : \frac{63}{4} = 20 : 36 : 63. \end{aligned}$$

Ex. 2. Find :

- (i) the fourth proportional to 4, 9, 12;
- (ii) the third proportional to 16 and 36;
- (iii) the mean proportional between 0.08 and 0.18.

Sol. (i) Let the fourth proportional to 4, 9, 12 be x .

$$\text{Then, } 4 : 9 :: 12 : x \Leftrightarrow 4 \times x = 9 \times 12 \Leftrightarrow x = \frac{9 \times 12}{4} = 27.$$

∴ Fourth proportional to 4, 9, 12 is 27.

(ii) Let the third proportional to 16 and 36 be x .

$$\text{Then, } 16 : 36 :: 36 : x \Leftrightarrow 16 \times x = 36 \times 36 \Leftrightarrow x = \frac{36 \times 36}{16} = 81.$$

∴ Third proportional to 16 and 36 is 81.

(iii) Mean proportional between 0.08 and 0.18

$$\sqrt{0.08 \times 0.18} = \sqrt{\frac{8}{100} \times \frac{18}{100}} = \sqrt{\frac{144}{10000}} = \frac{12}{100} = 0.12.$$

Ex. 3. If $x : y = 3 : 4$, find $(4x + 5y) : (5x - 2y)$.

$$\begin{aligned} \text{Sol. } \frac{x}{y} &= \frac{3}{4} \Rightarrow \frac{4x + 5y}{5x - 2y} = \frac{4\left(\frac{x}{y}\right) + 5}{5\left(\frac{x}{y}\right) - 2} = \frac{(3+5)}{\left(\frac{7}{4}\right)} = \frac{32}{7}. \end{aligned}$$

Ex. 4. Divide Rs. 672 in the ratio 5 : 3.

Sol. Sum of ratio terms = $(5 + 3) = 8$.

$$\therefore \text{First part} = \text{Rs. } \left(672 \times \frac{5}{8}\right) = \text{Rs. } 420; \text{ Second part} = \text{Rs. } \left(672 \times \frac{3}{8}\right) = \text{Rs. } 252.$$

Ex. 5. Divide Rs. 1162 among A, B, C in the ratio 35 : 28 : 20.

Sol. Sum of ratio terms = $(35 + 28 + 20) = 83$.

$$\text{A's share} = \text{Rs. } \left(1162 \times \frac{35}{83}\right) = \text{Rs. } 490; \text{ B's share} = \text{Rs. } \left(1162 \times \frac{28}{83}\right) = \text{Rs. } 392;$$

$$\text{C's share} = \text{Rs. } \left(1162 \times \frac{20}{83}\right) = \text{Rs. } 280.$$

Ex. 6. A bag contains 50 p, 25 p and 10 p coins in the ratio 5 : 9 : 4, amounting to Rs. 206. Find the number of coins of each type.

Sol. Let the number of 50 p, 25 p and 10 p coins be $5x$, $9x$ and $4x$ respectively.

$$\text{Then, } \frac{5x}{2} + \frac{9x}{4} + \frac{4x}{10} = 206$$

$$\Leftrightarrow 50x + 45x + 8x = 4120 \Leftrightarrow 103x = 4120 \Leftrightarrow x = 40.$$

∴ Number of 50 p coins = $(5 \times 40) = 200$; Number of 25 p coins = $(9 \times 40) = 360$;

Number of 10 p coins = $(4 \times 40) = 160$.

Ex. 7. A mixture contains alcohol and water in the ratio 4 : 3. If 5 litres of water is added to the mixture, the ratio becomes 4 : 5. Find the quantity of alcohol in the given mixture.

Sol. Let the quantity of alcohol and water be $4x$ litres and $3x$ litres respectively. Then,

$$\frac{4x}{3x+5} = \frac{4}{5} \Leftrightarrow 20x = 4(3x+5) \Leftrightarrow 8x = 20 \Leftrightarrow x = 2.5$$

∴ Quantity of alcohol = (4×2.5) litres = 10 litres.

EXERCISE 12

(OBJECTIVE TYPE QUESTIONS)

Directions : Mark (✓) against the correct answer:

1. If $A : B = 5 : 7$ and $B : C = 6 : 11$, then $A : B : C$ is :
 - (a) 55 : 77 : 66
 - (b) 30 : 42 : 77
 - (c) 35 : 49 : 42
 - (d) None of these
2. If $A : B = 3 : 4$ and $B : C = 8 : 9$, then $A : C$ is :
 - (a) 1 : 3
 - (b) 3 : 2
 - (c) 2 : 3
 - (d) 1 : 2
3. If $A : B = 8 : 15$, $B : C = 5 : 8$ and $C : D = 4 : 5$, then $A : D$ is equal to :
 - (a) 2 : 7
 - (b) 4 : 15
 - (c) 8 : 15
 - (d) 15 : 4
4. If $A : B : C = 2 : 3 : 4$, then $\frac{A}{B} : \frac{B}{C} : \frac{C}{A}$ is equal to : (S.S.C. 2002)
 - (a) 4 : 9 : 16
 - (b) 8 : 9 : 12
 - (c) 8 : 9 : 16
 - (d) 8 : 9 : 24
5. If $A : B = \frac{1}{2} : \frac{3}{8}$, $B : C = \frac{1}{3} : \frac{5}{9}$ and $C : D = \frac{5}{6} : \frac{3}{4}$, then the ratio $A : B : C : D$ is :
 - (a) 4 : 6 : 8 : 10
 - (b) 6 : 4 : 8 : 10
 - (c) 6 : 8 : 9 : 10
 - (d) 8 : 6 : 10 : 9
6. If $A : B = 2 : 3$, $B : C = 4 : 5$ and $C : D = 6 : 7$, then $A : B : C : D$ is :
 - (a) 16 : 22 : 30 : 35
 - (b) 16 : 24 : 15 : 35
 - (c) 16 : 24 : 30 : 35
 - (d) 18 : 24 : 30 : 35 (S.S.C. 2002)
7. If $2A = 3B = 4C$, then $A : B : C$ is :
 - (a) 2 : 3 : 4
 - (b) 4 : 3 : 2
 - (c) 6 : 4 : 3
 - (d) 20 : 15 : 2
8. If $\frac{A}{3} = \frac{B}{4} = \frac{C}{5}$, then $A : B : C$ is :
 - (a) 4 : 3 : 5
 - (b) 5 : 4 : 3
 - (c) 3 : 4 : 5
 - (d) 20 : 15 : 2
9. If $2A = 3B$ and $4B = 5C$, then $A : C$ is :
 - (a) 4 : 3
 - (b) 8 : 15
 - (c) 15 : 8
 - (d) 3 : 4
10. The ratio of $4^{3.5} : 2^5$ is same as :
 - (a) 2 : 1
 - (b) 4 : 1
 - (c) 7 : 5
 - (d) 7 : 10
11. If $\frac{1}{5} : \frac{1}{x} = \frac{1}{x} : \frac{1}{125}$, then the value of x is :
 - (a) 1.5
 - (b) 2
 - (c) 2.5
 - (d) 3.5
12. If $0.75 : x :: 5 : 8$, then x is equal to : (L.I.C. 2003)
 - (a) 1.12
 - (b) 1.20
 - (c) 1.25
 - (d) 1.30
13. If $x : y = 5 : 2$, then $(8x + 9y) : (8x + 2y)$ is :
 - (a) 22 : 29
 - (b) 26 : 61
 - (c) 29 : 22
 - (d) 61 : 26
14. If 15% of x = 20% of y , then $x : y$ is :
 - (a) 3 : 4
 - (b) 4 : 3
 - (c) 17 : 16
 - (d) 16 : 17

15. If $(x : y) = 2 : 1$, then $(x^2 - y^2) : (x^2 + y^2)$ is :
(a) 3 : 5 (b) 5 : 3 (c) 1 : 3 (d) 3 : 1
16. If $(4x^2 - 3y^2) : (2x^2 + 5y^2) = 12 : 19$, then $(x : y)$ is :
(a) 2 : 3 (b) 1 : 2 (c) 3 : 2 (d) 2 : 1
17. If $x^2 + 4y^2 = 4xy$, then $x : y$ is :
(a) 2 : 1 (b) 1 : 2 (c) 1 : 1 (d) 1 : 4
18. If $5x^2 - 13xy + 6y^2 = 0$, then $x : y$ is :
(a) (2 : 1) only (b) (3 : 5) only
(c) (5 : 3) or (1 : 2) (d) (3 : 5) or (2 : 1)
19. If $\frac{x}{5} = \frac{y}{8}$, then $(x+5) : (y+8)$ is equal to :
(a) 3 : 5 (b) 13 : 8 (c) 8 : 5 (d) 5 : 8
20. If $\frac{a}{3} = \frac{b}{4} = \frac{c}{7}$, then $\frac{a+b+c}{c}$ is equal to :
(a) 7 (b) 2 (c) $\frac{1}{2}$ (d) $\frac{1}{7}$
21. If $(a+b) : (b+c) : (c+a) = 6 : 7 : 8$ and $(a+b+c) = 14$, then the value of c is :
(a) 6 (b) 7 (c) 8 (d) 14
22. The salaries of A, B, C are in the ratio 2 : 3 : 5. If the increments of 15%, 10% and 20% are allowed respectively in their salaries, then what will be the new ratio of their salaries ?
(Bank P.O. 2002)
(a) 3 : 3 : 10 (b) 10 : 11 : 20
(c) 23 : 33 : 60 (d) Cannot be determined
23. If Rs. 782 be divided into three parts, proportional to $\frac{1}{2} : \frac{2}{3} : \frac{3}{4}$, then the first part is :
(C.B.I. 2003)
(a) Rs. 182 (b) Rs. 190 (c) Rs. 196 (d) Rs. 204
24. If 76 is divided into four parts proportional to 7, 5, 3, 4, then the smallest part is :
(a) 12 (b) 15 (c) 16 (d) 19
25. Two numbers are in the ratio 3 : 5. If 9 is subtracted from each, the new numbers are in the ratio 12 : 23. The smaller number is :
(S.S.C. 2003)
(a) 27 (b) 33 (c) 49 (d) 55
26. Two numbers are in the ratio 1 : 2. If 7 is added to both, their ratio changes to 3 : 5. The greatest number is :
(Hotel Management, 2003)
(a) 24 (b) 26 (c) 28 (d) 32
27. Rs. 1210 were divided among A, B, C so that $A : B = 5 : 4$ and $B : C = 9 : 10$. Then, C gets :
(a) Rs. 340 (b) Rs. 400 (c) Rs. 450 (d) Rs. 475
28. In a bag, there are coins of 25 p, 10 p and 5 p in the ratio of 1 : 2 : 3. If there are Rs. 30 in all, how many 5 p coins are there ?
(Hotel Management, 2003)
(a) 50 (b) 100 (c) 150 (d) 200
29. The ratio of three numbers is 3 : 4 : 5 and the sum of their squares is 1250. The sum of the numbers is :
(a) 30 (b) 50 (c) 60 (d) 90
30. The ratio of three numbers is 3 : 4 : 7 and their product is 18144. The numbers are :
(a) 9, 12, 21 (b) 15, 20, 25 (c) 18, 24, 42 (d) None of these
31. Salaries of Ravi and Sumit are in the ratio 2 : 3. If the salary of each is increased by Rs. 4000, the new ratio becomes 40 : 57. What is Sumit's present salary ?
(a) Rs. 17,000 (b) Rs. 20,000 (c) Rs. 25,500 (d) None of these
(Bank P.O. 2003)

32. If Rs. 510 be divided among A, B, C in such a way that A gets $\frac{2}{3}$ of what B gets and B gets $\frac{1}{4}$ of what C gets, then their shares are respectively : (I.M.T. 2002)
- (a) Rs. 120, Rs. 240, Rs. 150 (b) Rs. 60, Rs. 90, Rs. 360
 (c) Rs. 150, Rs. 300, Rs. 60 (d) None of these
33. The sum of three numbers is 98. If the ratio of the first to the second is 2 : 3 and that of the second to the third is 5 : 8, then the second number is : (S.S.C. 2001)
- (a) 20 (b) 30 (c) 48 (d) 58
34. A fraction which bears the same ratio to $\frac{1}{27}$ that $\frac{3}{11}$ does to $\frac{5}{9}$, is equal to : (S.S.C. 2001)
- (a) $\frac{1}{55}$ (b) $\frac{1}{11}$ (c) $\frac{3}{11}$ (d) 55
35. Rs. 366 are divided amongst A, B and C so that A may get $\frac{1}{2}$ as much as B and C together, B may get $\frac{2}{3}$ as much as A and C together, then the share of A is : (A.P.T.O. 2001)
- (a) Rs. 122 (b) Rs. 129.60 (c) Rs. 146.60 (d) Rs. 183
36. A sum of Rs. 1300 is divided amongst P, Q, R and S such that $\frac{P's\ share}{Q's\ share} = \frac{Q's\ share}{R's\ share} = \frac{R's\ share}{S's\ share} = \frac{2}{3}$. Then, P's share is : (L.I.C. 2003)
- (a) Rs. 140 (b) Rs. 160 (c) Rs. 240 (d) Rs. 320
37. A and B together have Rs. 1210. If $\frac{4}{15}$ of A's amount is equal to $\frac{2}{5}$ of B's amount, how much amount does B have ? (A.A.O. 2003)
- (a) Rs. 460 (b) Rs. 484 (c) Rs. 550 (d) Rs. 664
38. Two numbers are respectively 20% and 50% more than a third number. The ratio of the two numbers is : (S.S.C. 2003)
- (a) 2 : 5 (b) 3 : 5 (c) 4 : 5 (d) 6 : 7
39. Two whole numbers whose sum is 72 cannot be in the ratio : (2003)
- (a) 5 : 7 (b) 3 : 5 (c) 3 : 4 (d) 4 : 5
40. If a carton containing a dozen mirrors is dropped, which of the following cannot be the ratio of broken mirrors to unbroken mirrors ? (2003)
- (a) 2 : 1 (b) 3 : 1 (c) 3 : 2 (d) 7 : 5
41. Seats for Mathematics, Physics and Biology in a school are in the ratio 5 : 7 : 8. There is a proposal to increase these seats by 40%, 50% and 75% respectively. What will be the ratio of increased seats ? (Bank P.O. 2003)
- (a) 2 : 3 : 4 (b) 6 : 7 : 8 (c) 6 : 8 : 9 (d) None of these
42. The ratio of the number of boys and girls in a college is 7 : 8. If the percentage increase in the number of boys and girls be 20% and 10% respectively, what will be the new ratio ? (R.B.I. 2003)
- (a) 8 : 9 (b) 17 : 18 (c) 21 : 22 (d) Cannot be determined
43. A sum of money is to be distributed among A, B, C, D in the proportion of 5 : 2 : 4 : 3. If C gets Rs. 1000 more than D, what is B's share ? (R.B.I. 2003)
- (a) Rs. 500 (b) Rs. 1500 (c) Rs. 2000 (d) None of these
44. If 40% of a number is equal to two-third of another number, what is the ratio of first number to the second number ? (Bank P.O. 2002)
- (a) 2 : 5 (b) 3 : 7 (c) 5 : 3 (d) 7 : 3

45. Ratio of the earnings of A and B is 4 : 7. If the earnings of A increase by 50% and those of B decrease by 25%, the new ratio of their earnings becomes 8 : 7. What are A's earnings ?
(Bank P.O. 2002)
(a) Rs. 21,000 (b) Rs. 26,000 (c) Rs. 28,000 (d) Data inadequate
46. What least number must be subtracted from each of the numbers 14, 17, 34 and 42 so that the remainders may be proportional ?
(a) 0 (b) 1 (c) 2 (d) 7
47. In a mixture of 60 litres, the ratio of milk and water is 2 : 1. If this ratio is to be 1 : 2, then the quantity of water to be further added is :
(a) 20 litres (b) 30 litres (c) 40 litres (d) 60 litres
48. The fourth proportional to 5, 8, 15 is :
(R.R.B. 2002)
(a) 18 (b) 24 (c) 19 (d) 20 (e) 21
49. The mean proportional between 234 and 104 is :
(a) 12 (b) 39 (c) 54 (d) None of these
50. The third proportional to 0.36 and 0.48 is :
(a) 0.64 (b) 0.1728 (c) 0.423 (d) 0.94
51. The third proportional to $(x^2 - y^2)$ and $(x - y)$ is :
(a) $(x + y)$ (b) $(x - y)$ (c) $\frac{x+y}{x-y}$ (d) $\frac{x-y}{x+y}$
52. The ratio of third proportional to 12 and 30 and the mean proportional between 9 and 25 is :
(a) 2 : 1 (b) 5 : 1 (c) 7 : 15 (d) 9 : 14
53. In a ratio, which is equal to 3 : 4, if the antecedent is 12, then the consequent is :
(a) 9 (b) 16 (c) 20 (d) 24
54. The prices of a scooter and a TV. are in the ratio 7 : 5. If the scooter costs Rs. 8000 more than a T.V. set, then the price of a T.V. set is :
(a) Rs. 20,000 (b) Rs. 24,000 (c) Rs. 28,000 (d) Rs. 32,000
55. An amount of Rs. 735 was divided between A, B and C. If each of them had received Rs. 25 less, their shares would have been in the ratio of 1 : 3 : 2. The money received by C was :
(a) Rs. 195 (b) Rs. 200 (c) Rs. 225 (d) Rs. 245
56. An amount of Rs. 2430 is divided among A, B and C such that if their shares be reduced by Rs. 5, Rs. 10 and Rs. 15 respectively, the remainders shall be in the ratio of 3 : 4 : 5. Then, B's share was :
(a) Rs. 605 (b) Rs. 790 (c) Rs. 800 (d) Rs. 810
57. The ratio between two numbers is 3 : 4 and their L.C.M. is 180. The first number is :
(a) 60 (b) 45 (c) 20 (d) 15
58. An alloy is to contain copper and zinc in the ratio 9 : 4. The zinc required to be melted with 24 kg of copper is :
(a) $10\frac{2}{3}$ kg (b) $10\frac{1}{3}$ kg (c) $9\frac{2}{3}$ kg (d) 9 kg
59. 60 kg of an alloy A is mixed with 100 kg of alloy B. If alloy A has lead and tin in the ratio 3 : 2 and alloy B has tin and copper in the ratio 1 : 4, then the amount of tin in the new alloy is :
(a) 36 kg (b) 44 kg (c) 53 kg (d) 80 kg
60. Gold is 19 times as heavy as water and copper is 9 times as heavy as water. In what ratio should these be mixed to get an alloy 15 times as heavy as water ?
(a) 1 : 1 (b) 2 : 3 (c) 1 : 2 (d) 3 : 2

61. 15 litres of mixture contains 20% alcohol and the rest water. If 3 litres of water be mixed with it, the percentage of alcohol in the new mixture would be : (A.T.M. 2002)
- (a) 15% (b) $16\frac{2}{3}\%$ (c) 17% (d) $18\frac{1}{2}\%$
62. 20 litres of a mixture contains milk and water in the ratio 5 : 3. If 4 litres of this mixture be replaced by 4 litres of milk, the ratio of milk to water in the new mixture would be : (A.T.M. 2002)
- (a) 2 : 1 (b) 7 : 3 (c) 8 : 3 (d) 4 : 3
63. 85 kg of a mixture contains milk and water in the ratio 27 : 7. How much more water is to be added to get a new mixture containing milk and water in the ratio 3 : 1 ? (A.T.M. 2002)
- (a) 5 kg (b) 6.5 kg (c) 7.25 kg (d) 8 kg
64. The ages of A and B are in the ratio 3 : 1. Fifteen years hence, the ratio will be 2 : 1. Their present ages are : (A.T.M. 2002)
- (a) 30 years, 10 years (b) 45 years, 15 years (c) 21 years, 7 years (d) 60 years, 20 years
65. The average age of three boys is 25 years and their ages are in the proportion 3 : 5 : 7. The age of the youngest boy is : (A.T.M. 2002)
- (a) 21 years (b) 18 years (c) 15 years (d) 9 years
66. The speeds of three cars are in the ratio 5 : 4 : 6. The ratio between the time taken by them to travel the same distance is : (A.T.M. 2002)
- (a) 5 : 4 : 6 (b) 6 : 4 : 5 (c) 10 : 12 : 15 (d) 12 : 15 : 10
67. In a college, the ratio of the number of boys to girls is 8 : 5. If there are 160 girls, the total number of students in the college is : (A.T.M. 2002)
- (a) 100 (b) 250 (c) 260 (d) 416
68. The sides of a triangle are in the ratio $\frac{1}{2} : \frac{1}{3} : \frac{1}{4}$ and its perimeter is 104 cm. The length of the longest side is : (A.T.M. 2002)
- (a) 52 cm (b) 48 cm (c) 32 cm (d) 26 cm
69. The ratio of the number of boys and girls in a school is 3 : 2. If 20% of the boys and 25% of the girls are scholarship holders, what percentage of the students does not get the scholarship ? (A.T.M. 2002)
- (a) 56 (b) 70 (c) 78 (d) 80
70. In a school, 10% of the boys are same in number as $\frac{1}{4}$ th of the girls. What is the ratio of boys to girls in that school ? (A.T.M. 2002)
- (a) 3 : 2 (b) 5 : 2 (c) 2 : 1 (d) 4 : 3
71. Three containers have their volumes in the ratio 3 : 4 : 5. They are full of mixtures of milk and water. The mixtures contain milk and water in the ratio of (4 : 1), (3 : 1) and (5 : 2) respectively. The contents of all these three containers are poured into a fourth container. The ratio of milk and water in the fourth container is : (A.T.M. 2002)
- (a) 4 : 1 (b) 151 : 48 (c) 157 : 53 (d) 5 : 2
72. x varies inversely as square of y . Given that $y = 2$ for $x = 1$. The value of x for $y = 6$ will be equal to : (C.D.S. 2003)
- (a) 3 (b) 9 (c) $\frac{1}{3}$ (d) $\frac{1}{9}$
73. If 10% of x = 20% of y , then $x : y$ is equal to : (C.D.S. 2003)
- (a) 1 : 2 (b) 2 : 1 (c) 5 : 1 (d) 10 : 1

74. The electricity bill of a certain establishment is partly fixed and partly varies as the number of units of electricity consumed. When in a certain month 540 units are consumed, the bill is Rs. 1800. In another month 620 units are consumed and the bill is Rs. 2040. In yet another month 500 units are consumed. The bill for that month would be :
(a) Rs. 1560 (b) Rs. 1680 (c) Rs. 1840 (d) Rs. 1950
75. The ratio of the incomes of A and B is 5 : 4 and the ratio of their expenditures is 3 : 2. If at the end of the year, each saves Rs. 1600, then the income of A is :
(a) Rs. 3400 (b) Rs. 3600 (c) Rs. 4000 (d) Rs. 4400
76. Zinc and copper are melted together in the ratio 9 : 11. What is the weight of melted mixture, if 28.8 kg of zinc has been consumed in it ?
(a) 58 kg (b) 60 kg (c) 64 kg (d) 70 kg
77. The compounded ratio of (2 : 3), (6 : 11) and (11 : 2) is :
(a) 1 : 2 (b) 2 : 1 (c) 11 : 24 (d) 36 : 121
78. If 0.4 of a number is equal to 0.06 of another number, the ratio of the numbers is :
(a) 2 : 3 (b) 3 : 4 (c) 3 : 20 (d) 20 : 3
79. The least whole number which when subtracted from both the terms of the ratio 6 : 7 gives a ratio less than 16 : 21 is :
(a) 2 (b) 3 (c) 4 (d) 6
80. A and B are two alloys of gold and copper prepared by mixing metals in the ratio 7 : 2 and 7 : 11 respectively. If equal quantities of the alloys are melted to form a third alloy C, the ratio of gold and copper in C will be :
(a) 5 : 7 (b) 5 : 9 (c) 7 : 5 (d) 9 : 5
81. Which of the following ratios is greatest ?
(a) 7 : 15 (b) 15 : 23 (c) 17 : 25 (d) 21 : 29
82. A certain amount was divided between A and B in the ratio 4 : 3. If B's share was Rs. 4800, the total amount was :
(a) Rs. 11,200 (b) Rs. 6400 (c) Rs. 19,200 (d) Rs. 39,200
83. A sum of Rs. 53 is divided among A, B, C in such a way that A gets Rs. 7 more than what B gets and B gets Rs. 8 more than what C gets. The ratio of their shares is :
(a) 16 : 9 : 18 (b) 25 : 18 : 10 (c) 18 : 25 : 10 (d) 15 : 8 : 30
84. What is the ratio whose terms differ by 40 and the measure of which is $\frac{2}{7}$?
(a) 16 : 56 (b) 14 : 56 (c) 15 : 56 (d) 16 : 72

ANSWERS

1. (b) 2. (c) 3. (b) 4. (d) 5. (d) 6. (c) 7. (c) 8. (c)
9. (c) 10. (b) 11. (c) 12. (b) 13. (c) 14. (b) 15. (a) 16. (c)
17. (a) 18. (d) 19. (d) 20. (b) 21. (a) 22. (c) 23. (d) 24. (a)
25. (b) 26. (c) 27. (b) 28. (c) 29. (c) 30. (c) 31. (d) 32. (b)
33. (b) 34. (a) 35. (a) 36. (b) 37. (b) 38. (c) 39. (c) 40. (c)
41. (a) 42. (c) 43. (c) 44. (c) 45. (d) 46. (c) 47. (d) 48. (b)
49. (d) 50. (a) 51. (d) 52. (b) 53. (b) 54. (c) 55. (c) 56. (d)
57. (b) 58. (a) 59. (b) 60. (d) 61. (b) 62. (b) 63. (a) 64. (b)
65. (c) 66. (d) 67. (d) 68. (b) 69. (c) 70. (b) 71. (c) 72. (d)
73. (b) 74. (b) 75. (c) 76. (c) 77. (b) 78. (c) 79. (b) 80. (c)
81. (d) 82. (a) 83. (b) 84. (a)

SOLUTIONS

1. $A : B = 5 : 7, B : C = 6 : 11 \Rightarrow \left(6 \times \frac{7}{6}\right) : \left(11 \times \frac{7}{6}\right) = 7 : \frac{77}{6}$
 $\therefore A : B : C = 5 : 7 : \frac{77}{6} = 30 : 42 : 77.$
2. $\left(\frac{A}{B} = \frac{3}{4}, \frac{B}{C} = \frac{8}{9}\right) \Rightarrow \frac{A}{C} = \left(\frac{A}{B} \times \frac{B}{C}\right) = \left(\frac{3}{4} \times \frac{8}{9}\right) = \frac{2}{3} \Rightarrow A : C = 2 : 3.$
3. $\frac{A}{B} = \frac{8}{15}, \frac{B}{C} = \frac{5}{8} \text{ and } \frac{C}{D} = \frac{4}{5} \Rightarrow \frac{A}{D} = \left(\frac{A}{B} \times \frac{B}{C} \times \frac{C}{D}\right) = \left(\frac{8}{15} \times \frac{5}{8} \times \frac{4}{5}\right) = \frac{4}{15}$
 $\Rightarrow A : D = 4 : 15.$
4. Let $A = 2x, B = 3x$ and $C = 4x$. Then, $\frac{A}{B} = \frac{2x}{3x} = \frac{2}{3}, \frac{B}{C} = \frac{3x}{4x} = \frac{3}{4}$ and $\frac{C}{A} = \frac{4x}{2x} = \frac{2}{1}$
 $\Rightarrow \frac{A}{B} : \frac{B}{C} : \frac{C}{A} = \frac{2}{3} : \frac{3}{4} : \frac{2}{1} = 8 : 9 : 24.$
5. $A : B = \frac{1}{2} : \frac{3}{8} = 4 : 3, B : C = \frac{1}{3} : \frac{5}{9} = 3 : 5, C : D = \frac{5}{6} : \frac{3}{4} = 10 : 9$
 $\Rightarrow A : B = 4 : 3, B : C = 3 : 5 \text{ and } C : D = 5 : \frac{9}{2}$
 $\Rightarrow A : B : C : D = 4 : 3 : 5 : \frac{9}{2} = 8 : 6 : 10 : 9.$
6. $A : B = 2 : 3, B : C = 4 : 5 = \left(4 \times \frac{3}{4}\right) : \left(5 \times \frac{3}{4}\right) = 3 : \frac{15}{4}$
and $C : D = 6 : 7 = \left(6 \times \frac{15}{24}\right) : \left(7 \times \frac{15}{24}\right) = \frac{15}{4} : \frac{25}{8}$
 $\Rightarrow A : B : C : D = 2 : 3 : \frac{15}{4} : \frac{35}{8} = 16 : 24 : 30 : 35.$
7. Let $2A = 3B = 4C = k$. Then, $A = \frac{k}{2}, B = \frac{k}{3}$ and $C = \frac{k}{4}$
 $\Rightarrow A : B : C = \frac{k}{2} : \frac{k}{3} : \frac{k}{4} = 6 : 4 : 3.$
8. Let $\frac{A}{3} = \frac{B}{4} = \frac{C}{5} = k$. Then, $A = 3k, B = 4k$ and $C = 5k$
 $\Rightarrow A : B : C = 3k : 4k : 5k = 3 : 4 : 5.$
9. $2A = 3B$ and $4B = 5C \Rightarrow \frac{A}{B} = \frac{3}{2}$ and $\frac{B}{C} = \frac{5}{4}$
 $\Rightarrow \frac{A}{C} = \left(\frac{A}{B} \times \frac{B}{C}\right) = \left(\frac{3}{2} \times \frac{5}{4}\right) = \frac{15}{8} \Rightarrow A : C = 15 : 8.$
10. $\frac{4^{3.5}}{2^5} = \frac{(2^2)^{3.5}}{2^5} = \frac{2^{2 \times 3.5}}{2^5} = \frac{2^7}{2^5} = 2^2 = 4.$
 $\therefore \text{Required ratio is } 4 : 1.$
11. $\frac{1}{5} : \frac{1}{x} = \frac{1}{x} : \frac{100}{125} \Rightarrow \left(\frac{1}{x} \times \frac{1}{x}\right) = \left(\frac{1}{5} \times \frac{100}{125}\right) = \frac{4}{25}$
 $\Rightarrow \frac{1}{x^2} = \frac{4}{25} \Rightarrow x^2 = \frac{25}{4} \Rightarrow x = \frac{5}{2} = 2.5.$

12. $(x \times 5) = (0.75 \times 8) \Rightarrow x = \frac{6}{5} = 1.20$. $\frac{120}{100} = 60\%$ increase over 50%.
13. Let $x = 5k$ and $y = 2k$. Then, $\frac{8x+9y}{8x+2y} = \frac{(8 \times 5k) + (9 \times 2k)}{(8 \times 5k) + (2 \times 2k)} = \frac{58k}{44k} = \frac{29}{22}$.
 $\Rightarrow (8x+9y) : (8x+2y) = 29 : 22$.
14. 15% of $x = 20\%$ of $y \Rightarrow \frac{15x}{100} = \frac{20y}{100} \Rightarrow \frac{x}{y} = \left(\frac{20}{100} \times \frac{100}{15} \right) = \frac{4}{3}$
 $\Rightarrow x : y = 4 : 3$.
15. $\frac{x}{y} = \frac{2}{1} \Leftrightarrow \frac{x^2}{y^2} = \frac{4}{1} \Leftrightarrow \frac{x^2 + y^2}{x^2 - y^2} = \frac{4+1}{4-1}$ [By componendo and dividendo]
 $\Leftrightarrow \frac{x^2 - y^2}{x^2 + y^2} = \frac{3}{5} \Leftrightarrow (x^2 - y^2) : (x^2 + y^2) = 3 : 5$.
16. $\frac{4x^2 - 3y^2}{2x^2 + 5y^2} = \frac{12}{19} \Leftrightarrow 19(4x^2 - 3y^2) = 12(2x^2 + 5y^2)$
17. $x^2 + 4y^2 = 4xy \Leftrightarrow x^2 - 4xy + 4y^2 = 0 \Leftrightarrow (x - 2y)^2 = 0$
 $\Leftrightarrow (x - 2y) = 0 \Leftrightarrow x = 2y \Leftrightarrow \frac{x}{y} = \frac{2}{1}$.
 \therefore Required ratio is 3 : 2.
18. $5x^2 - 13xy + 6y^2 = 0 \Leftrightarrow 5x^2 - 10xy - 3xy + 6y^2 = 0$
 $\Leftrightarrow 5x(x - 2y) - 3y(x - 2y) = 0 \Leftrightarrow (x - 2y)(5x - 3y) = 0$
 $\Leftrightarrow x = 2y \text{ or } 5x = 3y \Leftrightarrow \frac{x}{y} = \frac{2}{1} \text{ or } \frac{x}{y} = \frac{3}{5}$
 $\therefore (x : y) = (2 : 1) \text{ or } (3 : 5)$.
19. Let $\frac{x}{5} = \frac{y}{8} = k$. Then, $x = 5k$ and $y = 8k$.
 $\therefore \frac{x+5}{y+8} = \frac{5k+5}{8k+8} = \frac{5(k+1)}{8(k+1)} = \frac{5}{8} \Rightarrow (x+5) : (y+8) = 5 : 8$.
20. Let $\frac{a}{3} = \frac{b}{4} = \frac{c}{7} = k$. Then, $a = 3k$, $b = 4k$, $c = 7k$.
 $\therefore \frac{a+b+c}{c} = \frac{3k+4k+7k}{7k} = \frac{14k}{7k} = 2$.
21. Let $(a+b) = 6k$, $(b+c) = 7k$ and $(c+a) = 8k$.
Then, $2(a+b+c) = 21k \Leftrightarrow 2 \times 14 = 21k \Leftrightarrow k = \frac{28}{21} = \frac{4}{3}$.
 $\therefore (a+b) = \left(6 \times \frac{4}{3}\right) = 8 \Rightarrow c = (a+b+c) - (a+b) = (14 - 8) = 6$.
22. Let $A = 2k$, $B = 3k$ and $C = 5k$.
A's new salary = $\frac{115}{100}$ of $2k = \left(\frac{115}{100} \times 2k\right) = \frac{23}{10}k$
B's new salary = $\frac{110}{100}$ of $3k = \left(\frac{110}{100} \times 3k\right) = \frac{33}{10}k$
 $\therefore B$'s new salary is $\frac{33}{10}k$ and A's new salary is $\frac{23}{10}k$.
 $\therefore B : A = \frac{33}{10}k : \frac{23}{10}k = 33 : 23$.

- C's new salary = $\frac{120}{100}$ of $5k = \left(\frac{120}{100} \times 5k\right) = 6k$. $\therefore (8 \times 6k) = (6 \times x) \Rightarrow 48k = 6x \Rightarrow x = 8k$
- \therefore New ratio = $\frac{23k}{10} : \frac{33k}{10} : 6k = 23 : 33 : 60$.
23. Given ratio = $\frac{1}{2} : \frac{2}{3} : \frac{3}{4} = 6 : 8 : 9$.
- \therefore 1st part = Rs. $\left(782 \times \frac{6}{23}\right) = \text{Rs. } 204$.
24. Given ratio = $7 : 5 : 3 : 4$, Sum of ratio terms = 19.
- \therefore Smallest part = $\left(76 \times \frac{3}{19}\right) = 12$.
25. Let the numbers be $3x$ and $5x$. Then, $\frac{3x - 9}{5x - 9} = \frac{12}{23} \Leftrightarrow 23(3x - 9) = 12(5x - 9)$
 $\Leftrightarrow 9x = 99 \Leftrightarrow x = 11$.
- \therefore The smaller number = $(3 \times 11) = 33$.
26. Let the numbers be x and $2x$. Then, $\frac{x+7}{2x+7} = \frac{3}{5} \Leftrightarrow 5(x+7) = 3(2x+7) \Leftrightarrow x = 14$.
- \therefore Greatest number = 28.
27. A : B = $5 : 4$, B : C = $9 : 10 = \left(9 \times \frac{4}{9}\right) : \left(10 \times \frac{4}{9}\right) = 4 : \frac{40}{9}$.
- \therefore A : B : C = $5 : 4 : \frac{40}{9} = 45 : 36 : 40$.
- Sum of ratio terms = $(45 + 36 + 40) = 121$.
- \therefore C's share = Rs. $\left(1210 \times \frac{40}{121}\right) = \text{Rs. } 400$.
28. Let the number of 25 p, 10 p and 5 p coins be x , $2x$ and $3x$ respectively.
- Then, sum of their values = Rs. $\left(\frac{25x}{100} + \frac{10 \times 2x}{100} + \frac{5 \times 3x}{100}\right) = \text{Rs. } \frac{60x}{100}$.
- $\therefore \frac{60x}{100} = 30 \Leftrightarrow x = \frac{30 \times 100}{60} = 50$.
- Hence, the number of 5 p coins = $(3 \times 50) = 150$.
29. Let the numbers be $3x$, $4x$ and $5x$. Then,
 $9x^2 + 16x^2 + 25x^2 = 1250 \Leftrightarrow 50x^2 = 1250 \Leftrightarrow x^2 = 25 \Leftrightarrow x = 5$.
- \therefore Sum of numbers = $(3x + 4x + 5x) = 12x = (12 \times 5) = 60$.
30. Let the numbers be $3x$, $4x$ and $7x$. Then,
 $3x \times 4x \times 7x = 18144 \Leftrightarrow x^3 = 216 \Leftrightarrow x^3 = 6^3 \Leftrightarrow x = 6$.
- \therefore The numbers are 18, 24 and 42.
31. Let the original salaries of Ravi and Sumit be Rs. $2x$ and Rs. $3x$ respectively. Then,
 $\frac{2x + 4000}{3x + 4000} = \frac{40}{57} \Leftrightarrow 57(2x + 4000) = 40(3x + 4000) \Leftrightarrow 6x = 68000 \Leftrightarrow x = 34000$.
- Sumit's present salary = $(3x + 4000) = \text{Rs. } (34000 + 4000) = \text{Rs. } 38,000$.
32. $\left(A = \frac{2}{3}B \text{ and } B = \frac{1}{4}C\right) \Leftrightarrow \frac{A}{B} = \frac{2}{3} \text{ and } \frac{B}{C} = \frac{1}{4}$
 $\Rightarrow A : B = 2 : 3 \text{ and } B : C = 1 : 4 = 3 : 12 \Rightarrow A : B : C = 2 : 3 : 12$.

\therefore A's share = Rs. $\left(510 \times \frac{2}{17}\right)$ = Rs. 60; B's share = Rs. $\left(510 \times \frac{3}{17}\right)$ = Rs. 90;

C's share = Rs. $\left(510 \times \frac{12}{17}\right)$ = Rs. 360.

33. Let the three parts be A, B, C. Then,

$$A : B = 2 : 3 \text{ and } B : C = 5 : 8 = \left(5 \times \frac{3}{5}\right) : \left(8 \times \frac{3}{5}\right) = 3 : \frac{24}{5}$$

$$\Rightarrow A : B : C = 2 : 3 : \frac{24}{5} = 10 : 15 : 24 \Rightarrow B = \left(98 \times \frac{15}{49}\right) = 30.$$

34. Let $x : \frac{1}{27} :: \frac{3}{11} : \frac{5}{9}$. Then, $x \times \frac{5}{9} = \frac{1}{27} \times \frac{3}{11} \Leftrightarrow x = \left(\frac{1}{27} \times \frac{3}{11} \times \frac{9}{5}\right) = \frac{1}{55}$.

35. $A : (B + C) = 1 : 2 \Rightarrow A$'s share = Rs. $\left(366 \times \frac{1}{3}\right)$ = Rs. 122.

36. Let $P = 2x$ and $Q = 3x$. Then, $\frac{Q}{R} = \frac{2}{3} \Rightarrow R = \frac{3}{2}Q = \left(\frac{3}{2} \times 3x\right) = \frac{9x}{2}$.

$$\text{Also, } \frac{R}{S} = \frac{2}{3} \Rightarrow S = \frac{3}{2}R = \left(\frac{3}{2} \times \frac{9x}{2}\right) = \frac{27x}{4}.$$

$$\text{Thus, } P = 2x, Q = 3x, R = \frac{9x}{2} \text{ and } S = \frac{27x}{4}.$$

$$\text{Now, } P + Q + R + S = 1300 \Leftrightarrow \left(2x + 3x + \frac{9x}{2} + \frac{27x}{4}\right) = 1300$$

$$\Leftrightarrow (8x + 12x + 18x + 27x) = 5200$$

$$\Leftrightarrow 65x = 5200 \Rightarrow x = \frac{5200}{65} = 80.$$

\therefore P's share = Rs. (2×80) = Rs. 160.

37. $\frac{4}{15}A = \frac{2}{5}B \Leftrightarrow A = \left(\frac{2}{5} \times \frac{15}{4}\right)B \Leftrightarrow A = \frac{3}{2}B \Leftrightarrow \frac{A}{B} = \frac{3}{2} \Leftrightarrow A : B = 3 : 2$

\therefore B's share = Rs. $\left(1210 \times \frac{2}{5}\right)$ = Rs. 484.

38. Let the third number be x .

Then, first number = 120% of $x = \frac{120x}{100} = \frac{6x}{5}$;

second number = 150% of $x = \frac{150x}{100} = \frac{3x}{2}$.

\therefore Ratio of first two numbers = $\frac{6x}{5} : \frac{3x}{2} = 12x : 15x = 4 : 5$.

39. The sum of the ratio terms must divide 72. So, the ratio cannot be 3 : 4.

40. For dividing 12 into two whole numbers, the sum of the ratio terms must be a factor of 12. So, they cannot be in the ratio 3 : 2.

41. Originally, let the number of seats for Mathematics, Physics and Biology be $5x$, $7x$ and $8x$ respectively.

Number of increased seats are (140% of $5x$), (150% of $7x$) and (175% of $8x$)

i.e. $\left(\frac{140}{100} \times 5x\right)$, $\left(\frac{150}{100} \times 7x\right)$ and $\left(\frac{175}{100} \times 8x\right)$ i.e. $7x$, $\frac{21x}{2}$ and $14x$.

\therefore Required ratio = $7x : \frac{21x}{2} : 14x = 14x : 21x : 28x = 2 : 3 : 4$.

42. Originally, let the number of boys and girls in the college be $7x$ and $8x$ respectively.
 Their increased number is (120% of $7x$) and (110% of $8x$)

i.e. $\left(\frac{120}{100} \times 7x\right)$ and $\left(\frac{110}{100} \times 8x\right)$ i.e. $\frac{42x}{5}$ and $\frac{44x}{5}$.

$$\therefore \text{Required ratio} = \frac{42x}{5} : \frac{44x}{5} = 21 : 22.$$

43. Let the shares of A, B, C and D be Rs. $5x$, Rs. $2x$, Rs. $4x$ and Rs. $3x$ respectively.
 Then, $4x - 3x = 1000 \Leftrightarrow x = 1000$.

$$\therefore \text{B's share} = \text{Rs. } 2x = \text{Rs. } (2 \times 1000) = \text{Rs. } 2000.$$

44. Let 40% of A = $\frac{2}{3}$ B. Then, $\frac{40A}{100} = \frac{2B}{3} \Leftrightarrow \frac{2A}{5} = \frac{2B}{3} \Leftrightarrow \frac{A}{B} = \left(\frac{2}{3} \times \frac{5}{2}\right) = \frac{5}{3}$.
 $\therefore A : B = 5 : 3$.

45. Let the original earnings of A and B be Rs. $4x$ and Rs. $7x$.

$$\text{New earnings of A} = 150\% \text{ of } \text{Rs. } 4x = \text{Rs. } \left(\frac{150}{100} \times 4x\right) = \text{Rs. } 6x.$$

$$\text{New earnings of B} = 75\% \text{ of } \text{Rs. } 7x = \text{Rs. } \left(\frac{75}{100} \times 7x\right) = \text{Rs. } \frac{21x}{4}.$$

$$\therefore 6x : \frac{21x}{4} = 8 : 7 \Leftrightarrow \frac{6x \times 4}{21x} = \frac{8}{7}.$$

This does not give x . So, the given data is inadequate.

46. Let the required number be x . Then, $(14 - x) : (17 - x) :: (34 - x) : (42 - x)$.

$$\therefore \frac{14 - x}{17 - x} = \frac{34 - x}{42 - x} \Leftrightarrow (14 - x)(42 - x) = (17 - x)(34 - x)$$

$$\Leftrightarrow x^2 - 56x + 588 = x^2 - 51x + 578 \Leftrightarrow 5x = 10 \Leftrightarrow x = 2.$$

$$\therefore \text{Required number} = 2.$$

47. Quantity of milk = $\left(60 \times \frac{2}{3}\right)$ litres = 40 litres.

$$\text{Quantity of water in it} = (60 - 40) \text{ litres} = 20 \text{ litres.}$$

$$\text{New Ratio required} = 1 : 2.$$

$$\text{Let quantity of water to be added further be } x \text{ litres. Then, milk : water} = \frac{40}{(20 + x)}.$$

$$\text{Now, } \frac{40}{(20 + x)} = \frac{1}{2} \Leftrightarrow 20 + x = 80 \Leftrightarrow x = 60.$$

$$\text{Quantity of water to be further added} = 60 \text{ litres.}$$

48. Let the fourth proportional to 5, 8, 15 be x .

$$\text{Then, } 5 : 8 :: 15 : x \Leftrightarrow 5x = (8 \times 15) \Leftrightarrow x = \frac{(8 \times 15)}{5} = 24.$$

49. Required mean proportional = $\sqrt{234 \times 104} = \sqrt{13 \times 9 \times 2 \times 13 \times 8} = (13 \times 3 \times 4) = 156$.

50. Let the third proportional to 0.36 and 0.48 be x .

$$\text{Then, } 0.36 : 0.48 :: 0.48 : x \Leftrightarrow x = \left(\frac{0.48 \times 0.48}{0.36}\right) = 0.64.$$

51. Let the third proportional to $(x^2 - y^2)$ and $(x - y)$ be z . Then,

$$(x^2 - y^2) : (x - y) :: (x - y) : z \Leftrightarrow (x^2 - y^2) \times z = (x - y)^2 \Leftrightarrow z = \frac{(x - y)^2}{(x^2 - y^2)} = \frac{(x - y)}{(x + y)}.$$

52. Let the third proportional to 12 and 30 be x .

$$\text{Then, } 12 : 30 :: 30 : x \Leftrightarrow 12x = 30 \times 30 \Leftrightarrow x = \frac{(30 \times 30)}{12} = 75.$$

∴ Third proportional to 12 and 30 = 75.

Mean proportional between 9 and 25 = $\sqrt{9 \times 25} = 15$.

∴ Required ratio = 75 : 15 = 5 : 1.

$$53. \text{We have } \frac{3}{4} = \frac{12}{x} \Leftrightarrow 3x = 48 \Leftrightarrow x = 16.$$

∴ Consequent = 16.

54. Let the prices of a scooter and a T.V. set be Rs. $7x$ and Rs. $5x$ respectively. Then,
 $7x - 5x = 8000 \Leftrightarrow 2x = 8000 \Leftrightarrow x = 4000$.

∴ Price of a T.V. set = Rs. (7×4000) = Rs. 28000.

$$55. \text{Remainder} = \text{Rs. } [735 - (25 \times 3)] = \text{Rs. } 660. \Leftrightarrow \frac{6}{1} = \frac{\left(\frac{660}{2}\right)}{\left(x + \frac{25}{2}\right)}$$

∴ Money received by C = Rs. $\left[\left(660 \times \frac{2}{6} \right) + 25 \right]$ = Rs. 225.

$$56. \text{Remainder} = \text{Rs. } [2430 - (5 + 10 + 15)] = \text{Rs. } 2400.$$

∴ B's share = Rs. $\left[\left(2400 \times \frac{4}{12} \right) + 10 \right]$ = Rs. 810.

57. Let the required numbers be $3x$ and $4x$. Then, their L.C.M. is $12x$.

∴ $12x = 180 \Leftrightarrow x = 15$. Hence, the first number is 45.

58. Let the required quantity of copper be x kg.

$$\text{Then, } 9 : 4 :: 24 : x \Leftrightarrow 9x = 4 \times 24 \Leftrightarrow x = \frac{4 \times 24}{9} = 10\frac{2}{3}.$$

Hence, the required quantity of copper is $10\frac{2}{3}$ kg.

$$59. \text{Quantity of tin in } 60 \text{ kg of A} = \left(60 \times \frac{2}{5} \right) \text{ kg} = 24 \text{ kg.}$$

$$\text{Quantity of tin in } 100 \text{ kg of B} = \left(100 \times \frac{1}{5} \right) \text{ kg} = 20 \text{ kg.}$$

Quantity of tin in the new alloy = $(24 + 20)$ kg = 44 kg.

60. G = 19W and C = 9W.

Let 1 gm of gold be mixed with x gm of copper to get $(1 + x)$ gm of the alloy.

(1 gm gold) + (x gm copper) = $(x + 1)$ gm of alloy

$$\Leftrightarrow 19W + 9Wx = (x + 1) \times 15W \Leftrightarrow 19 + 9x = 15(x + 1) \Leftrightarrow 6x = 4 \Leftrightarrow x = \frac{2}{3}.$$

∴ Ratio of gold with copper = $1 : \frac{2}{3} = 3 : 2$.

$$61. \text{Alcohol in } 15 \text{ litres of mix.} = 20\% \text{ of } 15 \text{ litres} = \left(\frac{20}{100} \times 15 \right) \text{ litres} = 3 \text{ litres.}$$

Water in it = $(15 - 3)$ litres = 12 litres.

New quantity of mix. = $(15 + 3)$ litres = 18 litres.

Quantity of alcohol in it = 3 litres.

$$\text{Percentage of alcohol in new mix.} = \left(\frac{3}{18} \times 100 \right)\% = 16\frac{2}{3}\%.$$

62. Quantity of milk in 16 litres of mix. = $\left(16 \times \frac{5}{8}\right)$ litres = 10 litres.

Quantity of milk in 20 litres of new mix. = (10 + 4) litres.

Quantity of water in it = (20 - 14) litres = 6 litres.

∴ Ratio of milk and water in the new mix. = 14 : 6 = 7 : 3.

63. Milk in 85 kg of mix. = $\left(85 \times \frac{27}{34}\right)$ kg = $\frac{135}{2}$ kg.

Water in it = $\left(85 - \frac{135}{2}\right)$ kg = $\frac{35}{2}$ kg.

Let x kg of water be added to it.

$$\text{Then, } \frac{\left(\frac{135}{2}\right)}{\left(\frac{35}{2} + x\right)} = \frac{3}{1} \Leftrightarrow \frac{135}{35 + 2x} = \frac{3}{1} \Leftrightarrow 105 + 6x = 135 \Leftrightarrow 6x = 30 \Leftrightarrow x = 5.$$

∴ Quantity of water to be added = 5 kg.

64. Let the ages of A and B be $3x$ years and x years respectively.

$$\text{Then, } \frac{3x + 15}{x + 15} = \frac{2}{1} \Leftrightarrow 2x + 30 = 3x + 15 \Leftrightarrow x = 15.$$

So, A's age = (3×15) years = 45 years and B's age = 15 years.

65. Total age of 3 boys = (25×3) years = 75 years. Ratio of their ages = 3 : 5 : 7.

Age of the youngest = $\left(75 \times \frac{3}{15}\right)$ years = 15 years.

66. Ratio of time taken = $\frac{1}{5} : \frac{1}{4} : \frac{1}{6} = 12 : 15 : 10$.

67. Let the number of boys and girls be $8x$ and $5x$ respectively. Then, $5x = 160 \Leftrightarrow x = 32$.

∴ Total number of students = $13x = (13 \times 32) = 416$.

68. Ratio of sides = $\frac{1}{2} : \frac{1}{3} : \frac{1}{4} = 6 : 4 : 3$.

Largest side = $\left(104 \times \frac{6}{13}\right)$ cm = 48 cm.

69. Let boys = $3x$ and girls = $2x$.

Number of those who do not get scholarship

$$= (80\% \text{ of } 3x) + (75\% \text{ of } 2x) = \left(\frac{80}{100} \times 3x\right) + \left(\frac{75}{100} \times 2x\right) = \frac{39x}{10}.$$

Required percentage = $\left(\frac{39x}{10} \times \frac{1}{5x} \times 100\right)\% = 78\%$.

70. $10\% \text{ of } B = \frac{1}{4} G \Leftrightarrow \frac{10B}{100} = \frac{1}{4} G \Leftrightarrow B = \frac{5}{2} G$

$$\therefore \frac{B}{G} = \frac{5}{2} \Leftrightarrow B : G = 5 : 2.$$

71. Let the three containers contain $3x$, $4x$ and $5x$ litres of mixtures respectively.

Milk in 1st mix. = $\left(3x \times \frac{4}{5}\right)$ litres = $\frac{12x}{5}$ litres.

$$\text{Water in 1st mix.} = \left(3x - \frac{12x}{5}\right) \text{ litres} = \frac{3x}{5} \text{ litres.}$$

$$\text{Milk in 2nd mix.} = \left(4x \times \frac{3}{4}\right) \text{ litres} = 3x \text{ litres.}$$

$$\text{Water in 2nd mix.} = (4x - 3x) \text{ litres} = x \text{ litres.}$$

$$\text{Milk in 3rd mix.} = \left(5x \times \frac{5}{7}\right) \text{ litres} = \frac{25x}{7} \text{ litres.}$$

$$\text{Water in 3rd mix.} = \left(5x - \frac{25x}{7}\right) \text{ litres} = \frac{10x}{7} \text{ litres.}$$

$$\text{Total milk in final mix.} = \left(\frac{12x}{5} + 3x + \frac{25x}{7}\right) \text{ litres} = \frac{314x}{35} \text{ litres.}$$

$$\text{Total water in final mix.} = \left(\frac{3x}{5} + x + \frac{10x}{7}\right) \text{ litres} = \frac{106x}{35} \text{ litres.}$$

$$\text{Required ratio of milk and water} = \frac{314x}{35} : \frac{106x}{35} = 157 : 53.$$

72. Given $x = \frac{k}{y^2}$, where k is a constant.

Now, $y = 2$ and $x = 1$ gives $k = 4$.

$$\therefore x = \frac{4}{y^2} \Rightarrow x = \frac{4}{6^2}, \text{ when } y = 6 \Rightarrow x = \frac{4}{36} = \frac{1}{9}.$$

$$73. 10\% \text{ of } x = 20\% \text{ of } y \Leftrightarrow \frac{10x}{100} = \frac{20y}{100} \Leftrightarrow \frac{x}{10} = \frac{y}{5} \Leftrightarrow \frac{x}{y} = \frac{10}{5} = \frac{2}{1}.$$

$$\therefore x : y = 2 : 1.$$

74. Let the fixed amount be Rs. x and the cost of each unit be Rs. y . Then,

$$540y + x = 1800 \quad \dots(i) \quad \text{and} \quad 620y + x = 2040 \quad \dots(ii)$$

On subtracting (i) from (ii), we get $80y = 240 \Leftrightarrow y = 3$.

Putting $y = 3$ in (i), we get :

$$540 \times 3 + x = 1800 \Leftrightarrow x = (1800 - 1620) = 180.$$

\therefore Fixed charges = Rs. 180, Charge per unit = Rs. 3.

Total charges for consuming 500 units = Rs. $(180 + 500 \times 3) =$ Rs. 1680.

75. Let the incomes of A and B be Rs. $5x$ and Rs. $4x$ respectively and let their expenditures be Rs. $3y$ and Rs. $2y$ respectively.

$$\text{Then, } 5x - 3y = 1600 \quad \dots(i) \quad \text{and} \quad 4x - 2y = 1600 \quad \dots(ii)$$

On multiplying (i) by 2, (ii) by 3 and subtracting, we get : $2x = 1600 \Leftrightarrow x = 800$.

\therefore A's income = Rs. $5x =$ Rs. $(5 \times 800) =$ Rs. 4000.

76. For 9 kg zinc, mixture melted = $(9 + 11)$ kg.

$$\text{For 28.8 kg zinc, mixture melted} = \left(\frac{20}{9} \times 28.8\right) \text{ kg} = 64 \text{ kg.}$$

$$77. \text{ Required ratio} = \left(\frac{2}{3} \times \frac{6}{11} \times \frac{11}{2}\right) = \frac{2}{1} = 2 : 1.$$

$$78. 0.4A = 0.06B \Leftrightarrow \frac{A}{B} = \frac{0.06}{0.40} = \frac{6}{40} = \frac{3}{20}.$$

$$\therefore A : B = 3 : 20.$$

79. Let x be subtracted. Then,

$$\frac{6-x}{7-x} < \frac{16}{21} \Leftrightarrow 21(6-x) < 16(7-x) \Leftrightarrow 5x > 14 \Leftrightarrow x > 2.8.$$

∴ Least such whole number is 3.

80. Gold in C = $\left(\frac{7}{9} + \frac{7}{18}\right)$ units = $\frac{7}{6}$ units. Copper in C = $\left(\frac{2}{9} + \frac{11}{18}\right)$ units = $\frac{5}{6}$ units.

$$\therefore \text{Gold : Copper} = \frac{7}{6} : \frac{5}{6} = 7 : 5.$$

$$81. \frac{7}{15} = 0.466, \frac{15}{23} = 0.652, \frac{17}{25} = 0.68 \text{ and } \frac{21}{29} = 0.724.$$

Clearly, 0.724 is greatest and therefore, 21 : 29 is greatest.

82. If B's share is Rs. 3, total amount = Rs. 7.

$$\text{If B's share is Rs. 4800, total amount} = \text{Rs.} \left(\frac{7}{3} \times 4800\right) = \text{Rs.} 11200.$$

83. Suppose C gets Rs. x . Then, B gets Rs. $(x+8)$ and A gets Rs. $(x+15)$.

$$\text{Then, } x + (x+8) + (x+15) = 53 \Leftrightarrow x = 10.$$

$$\therefore A : B : C = (10+15) : (10+8) : 10 = 25 : 18 : 10.$$

84. Let the ratio be $x : (x+40)$. Then,

$$\frac{x}{(x+40)} = \frac{2}{7} \Leftrightarrow 7x = 2x + 80 \Leftrightarrow 5x = 80 \Leftrightarrow x = 16.$$

$$\therefore \text{Required ratio} = 16 : 56.$$

13. PARTNERSHIP

IMPORTANT FACTS AND FORMULAE

1. **Partnership :** When two or more than two persons run a business jointly, they are called **partners** and the deal is known as **partnership**.
2. **Ratio of Division of Gains :**
 - (i) When investments of all the partners are for the same time, the gain or loss is distributed among the partners in the ratio of their investments.
Suppose A and B invest Rs. x and Rs. y respectively for a year in a business, then at the end of the year :
(A's share of profit) : (B's share of profit) = $x : y$.
 - (ii) When investments are for different time periods, then equivalent capitals are calculated for a unit of time by taking (capital \times number of units of time). Now, gain or loss is divided in the ratio of these capitals.
Suppose A invests Rs. x for p months and B invests Rs. y for q months, then
(A's share of profit) : (B's share of profit) = $xp : yq$.
3. **Working and Sleeping Partners :** A partner who manages the business is known as a **working partner** and the one who simply invests the money is a **sleeping partner**.

SOLVED EXAMPLES

Ex. 1. A, B and C started a business by investing Rs. 1,20,000, Rs. 1,35,000 and Rs. 1,50,000 respectively. Find the share of each, out of an annual profit of Rs. 56,700.

Sol. Ratio of shares of A, B and C = Ratio of their investments
 $= 120000 : 135000 : 150000 = 8 : 9 : 10.$

$$\text{A's share} = \text{Rs.} \left(56700 \times \frac{8}{27} \right) = \text{Rs.} 16800.$$

$$\text{B's share} = \text{Rs.} \left(56700 \times \frac{9}{27} \right) = \text{Rs.} 18900.$$

$$\text{C's share} = \text{Rs.} \left(56700 \times \frac{10}{27} \right) = \text{Rs.} 21000.$$

Ex. 2. Alfred started a business investing Rs. 45,000. After 3 months, Peter joined him with a capital of Rs. 60,000. After another 6 months, Ronald joined them with a capital of Rs. 90,000. At the end of the year, they made a profit of Rs. 16,500. Find the share of each.

Sol. Clearly, Alfred invested his capital for 12 months, Peter for 9 months and Ronald for 3 months.

$$\text{So, ratio of their capitals} = (45000 \times 12) : (60000 \times 9) : (90000 \times 3)$$
$$= 540000 : 540000 : 270000 = 2 : 2 : 1.$$

$$\therefore \text{Alfred's share} = \text{Rs.} \left(16500 \times \frac{2}{5} \right) = \text{Rs.} 6600;$$

$$\text{Peter's share} = \text{Rs. } \left(16500 \times \frac{2}{5} \right) = \text{Rs. } 6600;$$

$$\text{Ronald's share} = \text{Rs. } \left(16500 \times \frac{1}{5} \right) = \text{Rs. } 3300.$$

Ex. 3. A, B and C start a business each investing Rs. 20,000. After 5 months A withdrew Rs. 5000, B withdrew Rs. 4000 and C invests Rs. 6000 more. At the end of the year, a total profit of Rs. 69,900 was recorded. Find the share of each.

$$\text{Sol. Ratio of the capitals of A, B and C}$$

$$= 20000 \times 5 + 15000 \times 7 : 20000 \times 5 + 16000 \times 7 : 20000 \times 5 + 26000 \times 7$$

$$= 205000 : 212000 : 282000 = 205 : 212 : 282.$$

$$\therefore \text{A's share} = \text{Rs. } \left(69900 \times \frac{205}{699} \right) = \text{Rs. } 20500;$$

$$\text{B's share} = \text{Rs. } \left(69900 \times \frac{212}{699} \right) = \text{Rs. } 21200;$$

$$\text{C's share} = \text{Rs. } \left(69900 \times \frac{282}{699} \right) = \text{Rs. } 28200.$$

Ex. 4. A, B and C enter into partnership. A invests 3 times as much as B invests and B invests two-third of what C invests. At the end of the year, the profit earned is Rs. 6600. What is the share of B?

$$\text{Sol. Let C's capital} = \text{Rs. } x. \text{ Then, B's capital} = \text{Rs. } \frac{2}{3}x.$$

$$\text{A's capital} = \text{Rs. } \left(3 \times \frac{2}{3}x \right) = \text{Rs. } 2x.$$

$$\text{Ratio of their capitals} = 2x : \frac{2}{3}x : x = 6 : 2 : 3.$$

$$\therefore \text{Hence, B's share} = \text{Rs. } \left(6600 \times \frac{2}{11} \right) = \text{Rs. } 1200.$$

Ex. 5. Four milkmen rented a pasture. A grazed 24 cows for 3 months; B 10 cows for 5 months; C 35 cows for 4 months and D 21 cows for 3 months. If A's share of rent is Rs. 720, find the total rent of the field.

$$\text{Sol. Ratio of shares of A, B, C, D} = (24 \times 3) : (10 \times 5) : (35 \times 4) : (21 \times 3)$$

$$= 72 : 50 : 140 : 63.$$

$$\text{Let total rent be Rs. } x. \text{ Then, A's share} = \text{Rs. } \frac{72x}{325}.$$

$$\therefore \frac{72x}{325} = 720 \Leftrightarrow x = \frac{720 \times 325}{72} = 3250.$$

$$\therefore \text{Hence, total rent of the field is Rs. 3250.}$$

Ex. 6. A invested Rs. 76,000 in a business. After few months, B joined him with Rs. 57,000. At the end of the year, the total profit was divided between them in the ratio 2 : 1. After how many months did B join?

Sol. Suppose B joined after x months. Then, B's money was invested for $(12 - x)$ months.

$$\therefore \frac{76000 \times 12}{57000 \times (12 - x)} = \frac{2}{1} \Leftrightarrow 912000 = 114000 (12 - x)$$

$$\Leftrightarrow 114 (12 - x) = 912 \Leftrightarrow (12 - x) = 8 \Leftrightarrow x = 4.$$

Hence, B joined after 4 months.

Ex. 7. A, B and C enter into a partnership by investing in the ratio of 3 : 2 : 4. After one year, B invests another Rs. 2,70,000 and C, at the end of 2 years, also invests Rs. 2,70,000. At the end of three years, profits are shared in the ratio of 3 : 4 : 5. Find the initial investment of each.

Sol. Let the initial investments of A, B and C be Rs. 3x, Rs. 2x and Rs. 4x respectively. Then,

$$(3x \times 36) : [(2x \times 12) + (2x + 270000) \times 24] : [(4x \times 24) + (4x + 270000) \times 12] \\ = 3 : 4 : 5.$$

$$\Leftrightarrow 108x : (72x + 6480000) : (144x + 3240000) = 3 : 4 : 5 \\ \Leftrightarrow \frac{108x}{72x + 6480000} = \frac{3}{4} \Leftrightarrow 432x = 216x + 19440000$$

$$\Leftrightarrow 216x = 19440000 \Leftrightarrow x = 90000. \\ \text{Hence, A's initial investment} = 3x = \text{Rs. 2,70,000}; \\ \text{B's initial investment} = 2x = \text{Rs. 1,80,000}; \\ \text{C's initial investment} = 4x = \text{Rs. 3,60,000}.$$

EXERCISE 13A

(OBJECTIVE TYPE QUESTIONS)

Directions : Mark (✓) against the correct answer :

1. P and Q started a business investing Rs. 85,000 and Rs. 15,000 respectively. In what ratio the profit earned after 2 years be divided between P and Q respectively ?
 (a) 3 : 4 (b) 3 : 5 (c) 15 : 23 (d) 17 : 23 (e) None of these
 (B.S.R.B. 2003)
2. Anand and Deepak started a business investing Rs. 22,500 and Rs. 35,000 respectively. Out of a total profit of Rs. 13,800, Deepak's share is :
 (a) Rs. 5400 (b) Rs. 7200 (c) Rs. 8400 (d) Rs. 9600
3. A, B, C enter into a partnership investing Rs. 35,000, Rs. 45,000 and Rs. 55,000 respectively. The respective shares of A, B, C in an annual profit of Rs. 40,500 are :
 (a) Rs. 10,500, Rs. 13,500, Rs. 16,500 (b) Rs. 11,500, Rs. 13,000, Rs. 16,000
 (c) Rs. 11,000, Rs. 14,000, Rs. 15,500 (d) Rs. 11,500, Rs. 12,500, Rs. 16,500
 (C.B.I. 1997)
4. Reena and Shaloo are partners in a business. Reena invests Rs. 35,000 for 8 months and Shaloo invests Rs. 42,000 for 10 months. Out of a profit of Rs. 31,570, Reena's share is :
 (a) Rs. 9471 (b) Rs. 12,628 (c) Rs. 18,040 (d) Rs. 18,942
5. Kamal started a business investing Rs. 9000. After five months, Sameer joined with a capital of Rs. 8000. If at the end of the year, they earn a profit of Rs. 6970, then what will be the share of Sameer in the profit ?
 (R.R.B. 2003)
 (a) Rs. 1883.78 (b) Rs. 2380 (c) Rs. 3690 (d) Rs. 3864
6. Simran started a software business by investing Rs. 50,000. After six months, Nanda joined her with a capital of Rs. 80,000. After 3 years, they earned a profit of Rs. 24,500. What was Simran's share in the profit ?
 (Bank P.O. 2004)
 (a) Rs. 9423 (b) Rs. 10,250 (c) Rs. 12,500 (d) Rs. 14,000 (e) None of these

7. A and B started a business in partnership investing Rs. 20,000 and Rs. 15,000 respectively. After six months, C joined them with Rs. 20,000. What will be B's share in the total profit of Rs. 25,000 earned at the end of 2 years from the starting of the business ? (S.B.I.P.O. 2000)
(a) Rs. 7500 (b) Rs. 9000 (c) Rs. 9500 (d) Rs. 10,000 (e) None of these
8. Aman started a business investing Rs. 70,000. Rakhi joined him after six months with an amount of Rs. 1,05,000 and Sagar joined them with Rs. 1.4 lakhs after another six months. The amount of profit earned should be distributed in what ratio among Aman, Rakhi and Sagar respectively, 3 years after Aman started the business ?
(a) 7 : 6 : 10 (b) 12 : 15 : 16 (c) 42 : 45 : 56
(d) Cannot be determined (e) None of these (Bank P.O. 2003)
9. Arun, Kamal and Vinay invested Rs. 8000, Rs. 4000 and Rs. 8000 respectively in a business. Arun left after six months. If after eight months, there was a gain of Rs. 4005, then what will be the share of Kamal ? (R.R.B. 1998)
(a) Rs. 890 (b) Rs. 1335 (c) Rs. 1602 (d) Rs. 1780
10. A, B and C enter into a partnership. They invest Rs. 40,000, Rs. 80,000 and Rs. 1,20,000 respectively. At the end of the first year, B withdraws Rs. 40,000, while at the end of the second year, C withdraws Rs. 80,000. In what ratio will the profit be shared at the end of 3 years ? (Hotel Management, 1997)
(a) 2 : 3 : 5 (b) 3 : 4 : 7 (c) 4 : 5 : 9 (d) None of these
11. A, B and C enter into a partnership. A initially invests Rs. 25 lakhs and adds another Rs. 10 lakhs after one year. B initially invests Rs. 35 lakhs and withdraws Rs. 10 lakhs after 2 years and C invests Rs. 30 lakhs. In what ratio should the profits be divided at the end of 3 years ?
(a) 10 : 10 : 9 (b) 20 : 20 : 19 (c) 20 : 19 : 18 (d) None of these
12. Shekhar started a business investing Rs. 25,000 in 1999. In 2000, he invested an additional amount of Rs. 10,000 and Rajeev joined him with an amount of Rs. 35,000. In 2001, Shekhar invested another additional amount of Rs. 10,000 and Jatin joined them with an amount of Rs. 35,000. What will be Rajeev's share in the profit of Rs. 1,50,000 earned at the end of 3 years from the start of the business in 1999 ?
(a) Rs. 45,000 (b) Rs. 50,000 (c) Rs. 70,000 (d) Rs. 75,000 (e) None of these (S.B.I.P.O. 2001)
13. A and B entered into a partnership investing Rs. 16,000 and Rs. 12,000 respectively. After 3 months, A withdrew Rs. 5000 while B invested Rs. 5000 more. After 3 more months, C joins the business with a capital of Rs. 21,000. The share of B exceeds that of C, out of a total profit of Rs. 26,400 after one year by :
(a) Rs. 2400 (b) Rs. 3000 (c) Rs. 3600 (d) Rs. 4800
14. A and B start a business with investments of Rs. 5000 and Rs. 4500 respectively. After 4 months, A takes out half of his capital. After two more months, B takes out one-third of his capital while C joins them with a capital of Rs. 7000. At the end of a year, they earn a profit of Rs. 5080. Find the share of each member in the profit.
(a) A - Rs. 1400, B - Rs. 1900, C - Rs. 1780
(b) A - Rs. 1600, B - Rs. 1800, C - Rs. 1680
(c) A - Rs. 1800, B - Rs. 1500, C - Rs. 1780
(d) A - Rs. 1680, B - Rs. 1600, C - Rs. 1800
(e) None of these (Bank P.O. 2003)
15. A, B, C subscribe Rs. 50,000 for a business. A subscribes Rs. 4000 more than B and B Rs. 5000 more than C. Out of a total profit of Rs. 35,000, A receives :
(a) Rs. 8400 (b) Rs. 11,900 (c) Rs. 13,600 (d) Rs. 14,700

16. Three partners A, B, C start a business. Twice A's capital is equal to thrice B's capital and B's capital is four times C's capital. Out of a total profit of Rs. 16,500 at the end of the year, B's share is :
(a) Rs. 4000 (b) Rs. 6000 (c) Rs. 7500 (d) Rs. 6600
17. If 4 (A's capital) = 6 (B's capital) = 10 (C's capital), then out of a profit of Rs. 4650, C will receive :
(a) Rs. 465 (b) Rs. 900 (c) Rs. 1550 (d) Rs. 2250
18. A, B and C enter into partnership. A invests some money at the beginning, B invests double the amount after 6 months and C invests thrice the amount after 8 months. If the annual profit be Rs. 27,000, C's share is :
(a) Rs. 8625 (b) Rs. 9000 (c) Rs. 10,800 (d) Rs. 11,250
19. A, B, C hired a car for Rs. 520 and used it for 7, 8 and 11 hours respectively. Hire charges paid by B were :
(a) Rs. 140 (b) Rs. 160 (c) Rs. 180 (d) Rs. 220
20. A, B and C rent a pasture. A puts 10 oxen for 7 months, B puts 12 oxen for 5 months and C puts 15 oxen for 3 months for grazing. If the rent of the pasture is Rs. 175, how much must C pay as his share of rent ? (S.S.C. 2000)
(a) Rs. 45 (b) Rs. 50 (c) Rs. 55 (d) Rs. 60
21. In a business, A and C invested amounts in the ratio $2 : 1$, whereas the ratio between amounts invested by A and B was $3 : 2$. If Rs. 1,57,300 was their profit, how much amount did B receive ? (Bank P.O. 1999)
(a) Rs. 24,200 (b) Rs. 36,300 (c) Rs. 48,400 (d) Rs. 72,600
22. A and B started a partnership business investing some amount in the ratio of $3 : 5$. C joined them after six months with an amount equal to that of B. In what proportion should the profit at the end of one year be distributed among A, B and C ?
(a) $3 : 5 : 2$ (b) $3 : 5 : 5$ (c) $6 : 10 : 5$
(d) Data inadequate (e) None of these (Bank P.O. 2000)
23. A, B and C enter into a partnership and their shares are in the ratio $\frac{1}{2} : \frac{1}{3} : \frac{1}{4}$. After 2 months, A withdraws half of his capital and after 10 months, a profit of Rs. 378 is divided among them. What is B's share ? (S.S.C. 2000)
(a) Rs. 129 (b) Rs. 144 (c) Rs. 156 (d) Rs. 168
24. A, B and C enter into a partnership in the ratio $\frac{7}{2} : \frac{4}{3} : \frac{6}{5}$. After 4 months, A increases his share by 50%. If the total profit at the end of one year be Rs. 21,600, then B's share in the profit is : (L.I.C.A.A.O. 2003)
(a) Rs. 2100 (b) Rs. 2400 (c) Rs. 3600 (d) Rs. 4000
25. A, B, C started a business with their investments in the ratio $1 : 3 : 5$. After 4 months, A invested the same amount as before and B as well as C withdrew half of their investments. The ratio of their profits at the end of the year is :
(a) $4 : 3 : 5$ (b) $5 : 6 : 10$ (c) $6 : 5 : 10$ (d) $10 : 5 : 6$
26. A and B entered into partnership with capitals in the ratio $4 : 5$. After 3 months, A withdrew $\frac{1}{4}$ of his capital and B withdrew $\frac{1}{5}$ of his capital. The gain at the end of 10 months was Rs. 760. A's share in this profit is : (A.A.O. Exam, 2003)
(a) Rs. 330 (b) Rs. 360 (c) Rs. 380 (d) Rs. 430
27. In a partnership, A invests $\frac{1}{6}$ of the capital for $\frac{1}{6}$ of the time, B invests $\frac{1}{3}$ of the capital for $\frac{1}{3}$ of the time and C, the rest of the capital for the whole time. Out of a profit of Rs. 4600, B's share is :
(a) Rs. 650 (b) Rs. 800 (c) Rs. 960 (d) Rs. 1000

28. A, B and C jointly thought of engaging themselves in a business venture. It was agreed that A would invest Rs. 6500 for 6 months, B, Rs. 8400 for 5 months and C, Rs. 10,000 for 3 months. A wants to be the working member for which he was to receive 5% of the profits. The profit earned was Rs. 7400. Calculate the share of B in the profit.
(a) Rs. 1900 (b) Rs. 2660 (c) Rs. 2800 (d) Rs. 2840 (M.B.A. 2002)
29. X and Y invested in a business. They earned some profit which they divided in the ratio of 2 : 3. If X invested Rs. 40,000, the amount invested by Y is :
(a) Rs. 45,000 (b) Rs. 50,000 (c) Rs. 60,000 (d) Rs. 80,000
30. Manick received Rs. 6000 as his share out of the total profit of Rs. 9000 which he and Raunaq earned at the end of one year. If Manick invested Rs. 20,000 for 6 months, whereas Raunaq invested his amount for the whole year, what was the amount invested by Raunaq ?
(a) Rs. 4000 (b) Rs. 5000 (c) Rs. 6000 (d) Rs. 10,000
31. A, B and C enter into a partnership with a capital in which A's contribution is Rs. 10,000. If out of a total profit of Rs. 1000, A gets Rs. 500 and B gets Rs. 300, then C's capital is :
(a) Rs. 4000 (b) Rs. 5000 (c) Rs. 6000 (d) Rs. 9000
32. A, B and C started a shop by investing Rs. 27,000, Rs. 72,000 and Rs. 81,000 respectively. At the end of the year, the profits were distributed among them. If C's share of profit be Rs. 36,000, then the total profit was :
(a) Rs. 80,000 (b) Rs. 95,600 (c) Rs. 1,08,000 (d) Rs. 1,16,000
33. A and B started a business jointly. A's investment was thrice the investment of B and the period of his investment was two times the period of investment of B. If B received Rs. 4000 as profit, then their total profit is :
(a) Rs. 16,000 (b) Rs. 20,000 (c) Rs. 24,000 (d) Rs. 28,000
34. A started a business with Rs. 21,000 and is joined afterwards by B with Rs. 36,000. After how many months did B join if the profits at the end of the year are divided equally ?
(a) 3 (b) 4 (c) 5 (d) 6
35. A began a business with Rs. 85,000. He was joined afterwards by B with Rs. 42,500. For how much period does B join, if the profits at the end of the year are divided in the ratio of 3 : 1 ?
(N.I.F.T. 2003)
(a) 4 months (b) 5 months (c) 6 months (d) 8 months.
36. A starts business with Rs. 3500 and after 5 months, B joins with A as his partner. After a year, the profit is divided in the ratio 2 : 3. What is B's contribution in the capital ?
(S.S.C. 2000)
(a) Rs. 7500 (b) Rs. 8000 (c) Rs. 8500 (d) Rs. 9000
37. A and B start a business jointly. A invests Rs. 16,000 for 8 months and B remains in the business for 4 months. Out of total profit, B claims $\frac{2}{7}$ of the profit. How much money was contributed by B ?
(a) Rs. 10,500 (b) Rs. 11,900 (c) Rs. 12,800 (d) Rs. 13,600
38. Two friends P and Q started a business investing in the ratio of 5 : 6. R joined them after six months investing an amount equal to that of Q's. At the end of the year, 20% profit was earned which was equal to Rs. 98,000. What was the amount invested by R ?
(S.B.I.P.O. 1999)
(a) Rs. 1,05,000 (b) Rs. 1,75,000 (c) Rs. 2,10,000
(d) Data inadequate (e) None of these
39. Three partners shared the profit in a business in the ratio 5 : 7 : 8. They had partnered for 14 months, 8 months and 7 months respectively. What was the ratio of their investments ?
(Hotel Management, 1998)
(a) 5 : 7 : 8 (b) 28 : 49 : 64 (c) 38 : 28 : 21 (d) None of these

40. A and B invest in a business in the ratio 3 : 2. If 5% of the total profit goes to charity and A's share is Rs. 855, the total profit is :
 (a) Rs. 1425 (b) Rs. 1500 (c) Rs. 1537.50 (d) Rs. 1576
41. A and B started a business with initial investments in the ratio 14 : 15 and their annual profits were in the ratio 7 : 6. If A invested the money for 10 months, for how many months did B invest his money ?
 (a) 6 (b) 7 (c) 8 (d) 9
42. A and B are partners in a business. A contributes $\frac{1}{4}$ of the capital for 15 months and B received $\frac{2}{3}$ of the profit. For how long B's money was used ? (S.S.C. 2000)
 (a) 6 months (b) 9 months (c) 10 months (d) 1 year

ANSWERS

1. (e) 2. (c) 3. (a) 4. (b) 5. (b) 6. (e) 7. (a) 8. (b) 9. (a)
 10. (b) 11. (d) 12. (b) 13. (c) 14. (b) 15. (d) 16. (b) 17. (b) 18. (b)
 19. (b) 20. (a) 21. (c) 22. (c) 23. (b) 24. (d) 25. (b) 26. (a) 27. (b)
 28. (b) 29. (c) 30. (b) 31. (b) 32. (a) 33. (d) 34. (c) 35. (d) 36. (d)
 37. (c) 38. (c) 39. (d) 40. (b) 41. (c) 42. (c)

SOLUTIONS

1. $P : Q = 85000 : 15000 = 85 : 15 = 17 : 3$.

2. Ratio of their shares = $22500 : 35000 = 9 : 14$.

Deepak's share = Rs. $\left(13800 \times \frac{14}{23} \right) = \text{Rs. } 8400$.

3. $A : B : C = 35000 : 45000 : 55000 = 7 : 9 : 11$.

A's share = Rs. $\left(40500 \times \frac{7}{27} \right) = \text{Rs. } 10500$.

B's share = Rs. $\left(40500 \times \frac{9}{27} \right) = \text{Rs. } 13500$.

C's share = Rs. $\left(40500 \times \frac{11}{27} \right) = \text{Rs. } 16500$.

4. Ratio of their shares = $(35000 \times 8) : (42000 \times 10) = 2 : 3$.

Reena's share = Rs. $\left(31570 \times \frac{2}{5} \right) = \text{Rs. } 12628$.

5. Kamal : Sameer = $(9000 \times 12) : (8000 \times 7) = 108 : 56 = 27 : 14$.

∴ Sameer's share = Rs. $\left(6970 \times \frac{14}{41} \right) = \text{Rs. } 2380$.

6. Simran : Nanda = $(50000 \times 36) : (80000 \times 30) = 3 : 4$.

∴ Simran's share = Rs. $\left(24500 \times \frac{3}{7} \right) = \text{Rs. } 10500$.

7. $A : B : C = (20000 \times 24) : (15000 \times 24) : (20000 \times 18) = 4 : 3 : 3$.

∴ B's share = Rs. $\left(25000 \times \frac{3}{10} \right) = \text{Rs. } 7500$.

8. Aman : Rakhi : Sagar = $(70000 \times 36) : (105000 \times 30) : (140000 \times 24) = 12 : 15 : 16$.
9. Arun : Kamal : Vinay = $(8000 \times 6) : (4000 \times 8) : (8000 \times 8) = 48 : 32 : 64 = 3 : 2 : 4$.
 Kamal's share = Rs. $\left(4005 \times \frac{2}{9}\right)$ = Rs. 890.
10. A : B : C = $(40000 \times 36) : (80000 \times 12 + 40000 \times 24) : (120000 \times 24 + 40000 \times 12)$
 $= 144 : 192 : 336 = 3 : 4 : 7$.
11. A : B : C = $(25 \text{ lakhs} \times 1) + (35 \text{ lakhs} \times 2) : (35 \text{ lakhs} \times 2 + 25 \text{ lakhs} \times 1) : (30 \text{ lakhs} \times 3)$
 $= 95 \text{ lakhs} : 95 \text{ lakhs} : 90 \text{ lakhs} = 19 : 19 : 18$.
12. Shekhar : Rajeev : Jatin = $(25000 \times 12 + 35000 \times 12 + 45000 \times 12) : (35000 \times 24) : (35000 \times 12)$
 $= 1260000 : 840000 : 420000 = 3 : 2 : 1$.
 Rajeev's share = Rs. $\left(150000 \times \frac{2}{6}\right)$ = Rs. 50000.
13. A : B : C = $(16000 \times 3 + 11000 \times 9) : (12000 \times 3 + 17000 \times 9) : (21000 \times 6)$
 $= 147 : 189 : 126 = 7 : 9 : 6$.
 Difference of B and C's shares = Rs. $\left(26400 \times \frac{9}{22} - 26400 \times \frac{6}{22}\right)$ = Rs. 3600.
14. A : B : C = $(5000 \times 4 + 2500 \times 8) : (4500 \times 6 + 3000 \times 6) : (7000 \times 6)$
 $= 40000 : 45000 : 42000 = 40 : 45 : 42$.
 A's share = Rs. $\left(5080 \times \frac{40}{127}\right)$ = Rs. 1600;
 B's share = Rs. $\left(5080 \times \frac{45}{127}\right)$ = Rs. 1800;
 C's share = Rs. $\left(5080 \times \frac{42}{127}\right)$ = Rs. 1680.
15. Let C = x. Then, B = x + 5000 and A = x + 5000 + 4000 = x + 9000.
 So, x + x + 5000 + x + 9000 = 50000 $\Leftrightarrow 3x = 36000 \Leftrightarrow x = 12000$.
 A : B : C = 21000 : 17000 : 12000 = 21 : 17 : 12.
 A's share = Rs. $\left(35000 \times \frac{21}{50}\right)$ = Rs. 14,700.
16. Let C = x. Then, B = 4x and 2A = 3 \times 4x = 12x or A = 6x.
 A : B : C = 6x : 4x : x = 6 : 4 : 1.
 So, B's capital = Rs. $\left(16500 \times \frac{4}{11}\right)$ = Rs. 6000.
17. Let 4A = 6B = 10C = k. Then, A = $\frac{k}{4}$, B = $\frac{k}{6}$ and C = $\frac{k}{10}$.
 A : B : C = $\frac{k}{4} : \frac{k}{6} : \frac{k}{10} = 15 : 10 : 6$.
 Hence, C's share = Rs. $\left(4650 \times \frac{6}{31}\right)$ = Rs. 900.
18. Let A's investment be Rs. x.
 Then, Ratio of capitals = $(x \times 12) : (2x \times 6) : (3x \times 4) = 12x : 12x : 12x = 1 : 1 : 1$.
 C's share = Rs. $\left(27000 \times \frac{1}{3}\right)$ = Rs. 9000.

19. $A : B : C = 7 : 8 : 11$.
 Hire charges paid by B = Rs. $\left(\frac{8}{26} \times 520 \right) = \text{Rs. } 160$.

20. $A : B : C = 10 \times 7 : 12 \times 5 : 15 \times 3 = 70 : 60 : 45 = 14 : 12 : 9$.

$$\therefore C's \text{ rent} = \text{Rs. } \left(175 \times \frac{9}{35} \right) = \text{Rs. } 45. \quad \text{B's share} = \text{Rs. } \left(\frac{14}{35} \times 680 \right) = \text{Rs. } 280.$$

21. $A : B = 3 : 2 \Rightarrow B : A = 2 : 3 = 4 : 6$ and $A : C = 2 : 1 = 6 : 3$.

So, $B : A : C = 4 : 6 : 3$ or $A : B : C = 6 : 4 : 3$.

$$\therefore B's \text{ share} = \text{Rs. } \left(157300 \times \frac{4}{13} \right) = \text{Rs. } 48400.$$

22. Let the initial investments of A and B be $3x$ and $5x$.

$$A : B : C = (3x \times 12) : (5x \times 12) : (5x \times 6) = 36 : 60 : 30 = 6 : 10 : 5.$$

$$\therefore \text{Ratio of initial investments} = \frac{1}{2} : \frac{1}{3} : \frac{1}{4} = 6 : 4 : 3.$$

Let their initial investments be $6x$, $2x$ and $3x$ respectively.

$$A : B : C = (6x \times 2 + 3x \times 10) : (4x \times 12) : (3x \times 12) = 42 : 48 : 36 = 7 : 8 : 6.$$

$$\therefore B's \text{ share} = \text{Rs. } \left(378 \times \frac{8}{21} \right) = \text{Rs. } 144.$$

$$\therefore \text{B's share} = \text{Rs. } \left(\frac{7}{2} : \frac{4}{3} : \frac{6}{5} = 105 : 40 : 36 \right) = \text{Rs. } 105.$$

Let the initial investments be $105x$, $40x$ and $36x$.

$$\therefore A : B : C = \left(105x \times 4 + \frac{150}{100} \times 105x \times 8 \right) : (40x \times 12) : (36x \times 12) = 1680x : 480x : 432x = 35 : 10 : 9.$$

$$\therefore \text{Hence, B's share} = \text{Rs. } \left(21600 \times \frac{10}{54} \right) = \text{Rs. } 4000.$$

25. Let their initial investments be x , $3x$ and $5x$ respectively. Then,

$$A : B : C = (x \times 4 + 2x \times 8) : \left(3x \times 4 + \frac{3x}{2} \times 8 \right) : \left(5x \times 4 + \frac{5x}{2} \times 8 \right) = 20x : 24x : 40x = 5 : 6 : 10.$$

$$26. A : B = \left[4x \times 3 + \left(4x - \frac{1}{4} \times 4x \right) \times 7 \right] : \left[5x \times 3 + \left(5x - \frac{1}{5} \times 5x \right) \times 7 \right] = (12x + 21x) : (15x + 28x) = 33x : 43x = 33 : 43.$$

$$\therefore A's \text{ share} = \text{Rs. } \left(760 \times \frac{33}{76} \right) = \text{Rs. } 330.$$

27. Suppose A invests Rs. $\frac{x}{6}$ for $\frac{y}{6}$ months. Then, B invests Rs. $\frac{x}{3}$ for $\frac{y}{3}$ months.

C invests $\left[x - \left(\frac{x}{6} + \frac{x}{3} \right) \right]$ i.e., Rs. $\frac{x}{2}$ for y months.

$$\therefore A : B : C = \left(\frac{x}{6} \times \frac{y}{6} \right) : \left(\frac{x}{3} \times \frac{y}{3} \right) : \left(\frac{x}{2} \times y \right) = \frac{1}{36} : \frac{1}{9} : \frac{1}{2} = 1 : 4 : 18.$$

$$\therefore \text{Hence, B's share} = \text{Rs. } \left(4600 \times \frac{4}{23} \right) = \text{Rs. } 800.$$

28. For managing, A receives = 5% of Rs. 7400 = Rs. 370.

Balance = Rs. $(7400 - 370) = \text{Rs. } 7030$.

Ratio of their investments = $(6500 \times 6) : (8400 \times 5) : (10000 \times 3)$

$$= 39000 : 42000 : 30000 = 13 : 14 : 10. \quad \text{B : A : C}$$

$$\therefore \text{B's share} = \text{Rs.} \left(7030 \times \frac{14}{37} \right) = \text{Rs. } 2660. \quad \text{B's share} = \text{Rs. } 2660$$

29. Suppose Y invested Rs. y . Then, $\frac{40000 \times 3}{y} = \frac{2}{3}$ or $y = \left(\frac{40000 \times 3}{2} \right) = \text{Rs. } 60000$.

30. Suppose Raunaq invested Rs. x . Then, Manick : Raunaq = $(20000 \times 6) : (x \times 12)$

$$\therefore \frac{120000}{12x} = \frac{6000}{3000} \text{ or } x = \frac{120000}{24} = 5000. \quad \text{A's initial investment} = 5000$$

31. A : B : C = 500 : 300 : 200 = 5 : 3 : 2.

Let their capitals be $5x$, $3x$ and $2x$ respectively. Then, $5x = 10000 \Leftrightarrow x = 2000$.

$\therefore \text{C's capital} = 2x = \text{Rs. } 4000$.

32. A : B : C = 27000 : 72000 : 81000 = 3 : 8 : 9. So, C's share : Total Profit = 9 : 20.

Let the total profit be Rs. x . Then, $\frac{9}{20} = \frac{36000}{x}$ or $x = \frac{36000 \times 20}{9} = 80000$.

33. Suppose B invested Rs. x for y months. Then, A invested Rs. $3x$ for $2y$ months.

So, A : B = $(3x \times 2y) : (x \times y) = 6xy : xy = 6 : 1$.

$\therefore \text{B's profit : Total profit} = 1 : 7$.

Let the total profit be Rs. x . Then, $\frac{1}{7} = \frac{4000}{x}$ or $x = 28000$.

34. Suppose B joined after x months.

Then, $21000 \times 12 = 36000 \times (12 - x) \Leftrightarrow 36x = 180 \Leftrightarrow x = 5$.

Hence, B joined after 5 months.

35. Suppose B joined for x months. Then, $\frac{85000 \times 12}{42500 \times x} = \frac{3}{1}$ or $x = \frac{85000 \times 12}{42500 \times 3} = 8$.

So, B joined for 8 months.

36. Let B's capital be Rs. x . Then, $\frac{3500 \times 12}{7x} = \frac{2}{3} \Leftrightarrow 14x = 126000 \Leftrightarrow x = 9000$.

37. Let the total profit be Rs. x . Then, $B = \frac{2x}{7}$ and $A = \left(x - \frac{2x}{7} \right) = \frac{5x}{7}$.

So, A : B = $\frac{5x}{7} : \frac{2x}{7} = 5 : 2$.

Let B's capital be Rs. y . Then, $\frac{16000 \times 8}{y \times 4} = \frac{5}{2} \Leftrightarrow y = \left(\frac{16000 \times 8 \times 2}{5 \times 4} \right) = 12800$.

38. Let the total profit be Rs. x .

Then, 20% of $x = 98000 \Leftrightarrow x = \left(\frac{98000 \times 100}{20} \right) = 490000$.

Let the capitals of P, Q and R be Rs. $5x$, Rs. $6x$ and Rs. $6x$ respectively. Then,

$$(5x \times 12) + (6x \times 12) + (6x \times 6) = 490000 \times 12$$

$$\Leftrightarrow 168x = 490000 \times 12 \Leftrightarrow x = \left(\frac{490000 \times 12}{168} \right) = 35000. \quad \text{P : Q : R} = 0 : 8 : 6$$

$\therefore \text{R's investment} = 6x = \text{Rs. } (6 \times 35000) = \text{Rs. } 210000$.

39. Let their investments be Rs. x for 14 months; Rs. y for 8 months and Rs. z for 7 months respectively.

Then, $14x : 8y : 7z = 5 : 7 : 8$.

$$\text{Now, } \frac{14x}{8y} = \frac{5}{7} \Leftrightarrow 70x = 40y \Leftrightarrow y = \frac{7}{4}x.$$

$$\text{And, } \frac{14x}{7z} = \frac{5}{8} \Leftrightarrow 112x = 35z \Leftrightarrow z = \frac{112}{35}x = \frac{16}{5}x.$$

$$\therefore x : y : z = x : \frac{16}{4}x : \frac{16}{5}x = 20 : 35 : 16.$$

40. Let the total profit be Rs. 100.

After paying to charity, A's share = Rs. $\left(95 \times \frac{3}{5}\right)$ = Rs. 57.

If A's share is Rs. 57, total profit = Rs. 100.

If A's share is Rs. 855, total profit = $\left(\frac{100}{57} \times 855\right) = 1500$.

41. Suppose A invested Rs. $14x$ for 10 months and B invested Rs. $15x$ for y months. Then,

$$\frac{14x \times 10}{15x \times y} = \frac{7}{6} \Leftrightarrow y = \frac{840}{105} = 8.$$

Hence, B invested the money for 8 months.

42. Let the total profit be Rs. z . Then,

$$\text{B's share} = \text{Rs. } \frac{2z}{3}, \text{ A's share} = \text{Rs. } \left(z - \frac{2z}{3}\right) = \text{Rs. } \frac{z}{3}.$$

$$\therefore A : B = \frac{z}{3} : \frac{2z}{3} = 1 : 2.$$

Let the total capital be Rs. x and suppose B's money was used for x months. Then,

$$\frac{\frac{1}{4}x \times 15}{\frac{3}{4}x \times y} = \frac{1}{2} \Leftrightarrow y = \left(\frac{15 \times 2}{3}\right) = 10.$$

Thus, B's money was used for 10 months.

EXERCISE 13B

(DATA SUFFICIENCY TYPE QUESTIONS)

Directions (Questions 1 to 4): Each of the questions given below consists of a statement and/or a question and two statements numbered I and II given below it. You have to decide whether the data provided in the statement(s) is/are sufficient to answer the question. Read both the statements and

Give answer (a) if the data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question;

Give answer (b) if the data in Statement II alone are sufficient to answer the question, while the data in Statement I alone are not sufficient to answer the question;

Give answer (c) if the data either in Statement I or in Statement II alone are sufficient to answer the question;

Give answer (d) if the data even in both Statements I and II together are not sufficient to answer the question;

Give answer (e) if the data in both Statements I and II together are necessary to answer the question.

1. Ravi, Gagan and Nitin are running a business firm in partnership. What is Gagan's share in the profit earned by them ?
(M.B.A. 2002)
- I. Ravi, Gagan and Nitin invested the amounts in the ratio of 2 : 4 : 7.
II. Nitin's share in the profit is Rs. 8750.
2. A and B start a business jointly. What is A's share out of an annual profit of Rs. 23,800 ?
- I. B's investment is $12\frac{1}{2}\%$ more than A's investment.
II. A's investment is Rs. 1,20,000.
3. A and B are in a partnership business of one year. At the end of the year, a profit of Rs. 20,000 was earned. What is A's share ?
- I. A invested Rs. 50,000.
II. B withdrew his capital after 8 months.
4. Rahul, Anurag and Vivek started a business together. In what proportion would the annual profit be distributed among them ?
(Bank P.O. 1999)
- I. Rahul got one-fourth of the profit.
II. Rahul and Vivek contributed 75% of the total investment.

Directions (Questions 5 to 8) : Each of the questions given below consists of a question followed by three statements. You have to study the question and the statements and decide which of the statement(s) is/are necessary to answer the given question.

5. What is R's share of profit in a joint venture ?
(S.B.I.P.O. 2000)
- I. Q started business investing Rs. 80,000.
II. R joined him after 3 months.
III. P joined after 4 months with a capital of Rs. 1,20,000 and got Rs. 6000 as his share of profit.
- (a) All I, II and III (b) I and III only (c) II and III only
(d) Even with all I, II, and III, the answer cannot be arrived at.
(e) None of these
6. What is the difference in the shares of profit between P and Q in a joint business at the end of one year ?
- I. P invested Rs. 80,000 and withdrew Rs. 20,000 after 6 months.
II. Q joined four months after the start of business.
III. Q's amount was 80% of P's amount during the last six months.
- (a) I and II only (b) II and III only (c) All I, II and III
(d) Even with all I, II and III together, the answer cannot be arrived at.
(e) None of these.
7. A, B and C together start a business with a total investment of Rs. 15,000. At the end of the year, the total profit is Rs. 3000. What is A's share in the profit ?
- I. A's contribution is $\frac{3}{2}$ times B's.
II. B's contribution is twice that of C.
III. A's contribution is thrice that of C.
- (a) I and II only (b) II and III only (c) All I, II and III
(d) Any two of the three (e) None of these
8. How much did Rohit get as profit at the year-end in the business done by Nitin, Rohit and Kunal ?
(S.B.I.P.O. 1999)
- I. Kunal invested Rs. 8000 for nine months, his profit was $\frac{3}{2}$ times that of Rohit's, and his investment was four times that of Nitin.

Directions (Questions 9-10) : Each of these questions is followed by three statements. You have to study the question and all the three statements given to decide whether any information provided in the statement(s) is redundant and can be dispensed with while answering the given question.

9. Three friends, P, Q and R started a partnership business investing money in the ratio of $5 : 4 : 2$ respectively for a period of 3 years. What is the amount received by P as his share in the total profit ? (S.B.I.P.O. 2000)

 - Total amount invested in the business is Rs. 22,000.
 - Profit earned at the end of 3 years is $\frac{3}{8}$ of the total investment.
 - The average amount of profit earned per year is Rs. 2750.

(a) I or II or III	(b) Either III only, or I and II together
(c) Any two of the three	(d) All I, II and III are required
(e) None of these	

10. What will be the percentage share of Y in the profit earned by X, Y and Z together ?

 - X, Y and Z invested a total amount of Rs. 25,000 for a period of two years.
 - The profit earned at the end of 2 years is 30%.
 - The amount invested by Y is equal to the amount invested by X and Z together.

(a) I and II only	(b) II and III only
(c) Any two of the three	(d) All I, II and III are required
(e) Question cannot be answered even with information in all the three statements.	

ANSWERS

1. (e) 2. (a) 3. (d) 4. (e) 5. (d) 6. (d) 7. (d)
8. (d) 9. (b) 10. (a)

SOLUTIONS

1. Let us name Ravi, Gagan and Nitin by R, G and N respectively.

I. $R : G : N = 2 : 4 : 7$.

II. $N = 8750$.

From I and II, we get :

When $N = 7$, then $G = 4$. When $N = 8750$, then $G = \left(\frac{4}{7} \times 8750\right) = 5000$.

Thus, both I and II are needed to get the answer.

\therefore Correct answer is (e).

2. Annual profit = Rs. 23800.

I. Let A's investment = Rs. x . Then, B's investment = $112\frac{1}{2}\%$ of Rs. x = Rs.

- $\therefore A : B = x : \frac{9x}{8} = 8 : 9$
- A's share = $Rs. \left(23800 \times \frac{8}{17} \right) = Rs. 11200$.
- Thus, I only gives the answer.
- II. A's investment = Rs. 120000.
 This is not sufficient to get the answer.
- Thus, I gives the answer but II is not sufficient to get the answer.
- ∴ Correct answer is (a).
3. i Since B's investment is not given, both the statements even do not give the answer.
- ∴ Correct answer is (d).
4. Let the total investment be Rs. x . Then, $R = \frac{x}{4}$.
- $$R + V = \left(\frac{75}{100} \times x \right) = \frac{3x}{4} \Rightarrow V = \left(\frac{3x}{4} - \frac{x}{4} \right) = \frac{x}{2}$$
- $$\therefore A = x - \left(\frac{x}{4} + \frac{x}{2} \right) = \frac{x}{4}$$
- $R : A : V = \frac{x}{4} : \frac{x}{4} : \frac{x}{2} = 1 : 1 : 2$
- Thus, both I and II are needed to get the answer.
- ∴ Correct answer is (e).
5. From I, II and III, we get $P : Q : R = (120000 \times 8) : (80000 \times 12) : (x \times 9)$.
 Since R's investment is not given, the above ratio cannot be given.
- Given data is inadequate.
- ∴ Correct answer is (d).
6. I. P's investment = $(80000 \times 6 + 60000 \times 6) = 840000$ for 1 month.
 II & III. Q's investment = 80% of Rs. 60000 for 8 months
 $= Rs. (48000 \times 8)$ for 1 month = 384000 for 1 month
 $P : Q = 840000 : 384000 = 35 : 16$.
 But, the total profit is not given, so data is inadequate.
- ∴ Correct answer is (d).
7. Let C's contribution be Rs. x .
- From I and II, we get : $C = Rs. x$, $B = Rs. 2x$ and $A = Rs. \left(\frac{3}{2} \times 2x \right) = Rs. 3x$.
- From II and III, we get $C = Rs. x$, $B = Rs. 2x$ and $A = Rs. 3x$.
- From I and III, we get $C = Rs. x$, $A = Rs. 3x$ and $B = Rs. \left(\frac{2}{3} \times 3x \right) = Rs. 2x$.
- Thus, $A : B : C = 3x : 2x : x = 3 : 2 : 1$.
- A's share = $Rs. \left(3000 \times \frac{3}{6} \right) = Rs. 1500$.
- Thus, any two of three give the answer.
- ∴ Correct answer is (d).

8. I and II give, K = Rs. (8000×9) for 1 month = Rs. 72000 for 1 month.

$$N = \text{Rs. } \left(\frac{1}{4} \times 8000 \times 12 \right) \text{ for 1 month} = \text{Rs. 24000 for 1 month.}$$

R = Rs. 48000 for 1 month.

$$\therefore K : N : R = 72000 : 24000 : 48000 = 3 : 1 : 2.$$

III gives, total profit = Rs. 1000.

$$\therefore \text{Rohit's share} = \text{Rs. } \left(1000 \times \frac{2}{6} \right) = \text{Rs. } 333\frac{1}{3}.$$

\therefore Correct answer is (d).

$$9. \text{I and II give, profit after 3 years} = \text{Rs. } \left(\frac{3}{8} \times 22000 \right) = \text{Rs. 8250.}$$

From III also, profit after 3 years = Rs. (2750×3) = Rs. 8250.

$$\therefore P's \text{ share} = \text{Rs. } \left(8250 \times \frac{5}{11} \right) = \text{Rs. 3750.}$$

Thus, (either III is redundant) or (I and II are redundant).

\therefore Correct answer is (b).

10. From III, $Y = X + Z \Rightarrow$ Y's investment is 50%.

\therefore Share of Y is 50%.

Thus, I and II are redundant.

\therefore Correct answer is (a).

14. CHAIN RULE

IMPORTANT FACTS AND FORMULAE

1. 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)
 2. 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. If 15 toys cost Rs. 234, what do 35 toys cost ?

Sol. Let the required cost be Rs. x. Then,

More toys, More cost (*Direct Proportion*)

$$\therefore 15 : 35 :: 234 : x \Leftrightarrow (15 \times x) = (35 \times 234) \Leftrightarrow x = \left(\frac{35 \times 234}{15} \right) = 546.$$

Hence, the cost of 35 toys is Rs. 546.

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*)

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

Hence, 15 men can do it in 60 hours.

Ex. 3. If the wages of 6 men for 15 days be Rs. 2100, then find the wages of 9 men for 12 days.

Sol. Let the required wages be Rs. x.

More men, More wages (*Direct Proportion*)

Less days, Less wages (*Direct Proportion*)

$$\begin{aligned} \text{Men } 6 : 9 \\ \text{Days } 15 : 12 \end{aligned} :: 2100 : x$$

$$\text{done work of 10 hours} \Rightarrow 6 \times 15 \times x = (9 \times 12 \times 2100) \Leftrightarrow x = \left(\frac{9 \times 12 \times 2100}{6 \times 15} \right) = 2520.$$

Hence, the required wages are Rs. 2520.

Ex. 4. 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)

Men $20 : 35 \Rightarrow 56 : x$

Days $6 : 3 \Rightarrow x : 56$

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

Hence, the required length is 49 m.

Ex. 5. If 15 men, working 9 hours a day, can reap a field in 16 days, in how many days will 18 men reap the field, working 8 hours a day?

Sol. Let the required number of days be x .

More men, Less days (Indirect Proportion)

Less hours per day, More days (Indirect Proportion)

Men $18 : 15 \Rightarrow 16 : x$

$$\therefore (18 \times 8 \times x) = (15 \times 9 \times 16) \Leftrightarrow x = \left(\frac{15 \times 144}{144} \right) = 15.$$

Hence, required number of days = 15.

Ex. 6. 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.

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

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

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)

Number of engines $9 : 8 \Rightarrow 24 : x$

Working hours $8 : 13 \Rightarrow x : 13$

Rate of consumption $\frac{1}{3} : \frac{1}{4} \Rightarrow x : \frac{1}{3}$

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

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

Ex. 7. 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?

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

Let the total men working at it be x .

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

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

$$\left. \begin{array}{l} \text{Work} \\ \text{Days} \\ \text{Hours} \end{array} \right\} \frac{4}{7} : \frac{3}{7} = \left(80 \times 6 \times 80 \right) : \left(x \times 8 \times 60 \right)$$

$$\therefore \frac{4}{7} \times 13 \times 9 \times x = \frac{3}{7} \times 33 \times 8 \times 117 \text{ or } x = \left(\frac{3 \times 33 \times 8 \times 117}{4 \times 13 \times 9} \right) = 198.$$

Ex. 8. 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*)

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

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

$$\therefore \text{Strength of reinforcement} = (5500 - 3300) = 1700$$

EXERCISE 14

(OBJECTIVE TYPE QUESTIONS)

Directions : Mark (/) against the correct answer.

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

 - 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) Rs. $\left(\frac{xy}{d}\right)$
 - (b) Rs. (xd)
 - (c) Rs. (yd)
 - (d) Rs. $\left(\frac{yd}{x}\right)$
 - If the price of 6 toys is Rs. 264.37, what will be the approximate price of 5 toys ? (Bank PO, 2000)
 - (a) Rs. 140
 - (b) Rs. 100
 - (c) Rs. 200
 - (d) Rs. 220
 - (e) Rs. 240

3. The price of 357 mangoes is Rs. 1517.25. What will be the approximate price of 9 dozens of such mangoes ?
(a) Rs. 3000 (b) Rs. 3500 (c) Rs. 4000 (d) Rs. 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
(C.B.I. 2001)
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 ?
(a) 178 (b) 195 (c) 204 (d) 488
(M.B.A. 2003)
8. 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
9. 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 ?
(a) 5 (b) 6 (c) 7 (d) $7\frac{1}{2}$
(M.B.A. 2003)
10. 36 men can complete a piece of work in 18 days. In how many days will 27 men complete the same work ?
(Bank P.O. 1998)
(a) 12 (b) 18 (c) 22 (d) 24 (e) None of these
11. A fort had provision of food for 150 men for 45 days. After 10 days, 25 men left the fort. The number of days for which the remaining food will last, is : (S.S.C. 2001)
(a) $29\frac{1}{5}$ (b) $37\frac{1}{4}$ (c) 42 (d) 54
12. 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
(M.A.T. 2000)
13. 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
(Railways, 2003)
14. The cost of 16 packets of salt, each weighing 900 grams is Rs. 28. What will be the cost of 27 packets, if each packet weighs 1 kg ?
(a) Rs. 52.50 (b) Rs. 56 (c) Rs. 58.50 (d) Rs. 64.75
15. 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
16. Running at the same constant rate, 6 identical machines can produce a total of 270 bottles per minute. At this rate, how many bottles could 10 such machines produce in 4 minutes ?
(M.A.T. 2004)
(a) 648 (b) 1800 (c) 2700 (d) 10800

17. 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 ?
(Railways, 2003)
- (a) 1 (b) $\frac{1}{40}$ (c) 40 (d) 80
18. 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 :
(I.T.O.R.S., 2003)
- (a) 4 (b) 5 (c) 6 (d) 8
19. 10 men, working 6 hours a day can complete a work in 18 days. How many hours a day must 15 men work to complete the same work in 12 days ?
(S.S.C. 2004)
- (a) 6 (b) 10 (c) 12 (d) 15
20. 39 persons can repair a road in 12 days, working 5 hours a day. In how many days will 30 persons, working 6 hours a day, complete the work ?
(C.B.I. 2003)
- (a) 10 (b) 13 (c) 14 (d) 15
21. 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 ?
(M.B.A. 2002)
- (a) 9 (b) 10 (c) 11 (d) 12
22. If 8 men can reap 80 hectares in 24 days, then how many hectares can 36 men reap in 30 days ?
(C.B.I. 2001)
- (a) 350 (b) 400 (c) 425 (d) 450
23. 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 :
(2009)
- (a) 400 m (b) 500 m (c) 800 m (d) 900 m
24. 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 ?
(2009)
- (a) 12 (b) 15 (c) 18 (d) 21
25. 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 :
(2009)
- (a) 2 days (b) $2\frac{1}{2}$ days (c) $2\frac{3}{5}$ days (d) 3 days
26. 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 :
(2009)
- (a) 15 (b) 21 (c) 22 (d) 25
27. If 7 spiders make 7 webs in 7 days, then 1 spider will make 1 web in how many days ?
(2009)
- (a) 1 (b) $\frac{7}{2}$ (c) 7 (d) 49
- (Railways, 2003)**
28. 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 ?
(2003)
- (a) 6 (b) 7 (c) 8 (d) 9
29. If 80 lamps can be lighted, 5 hours per day for 10 days for Rs. 21.25, then the number of lamps, which can be lighted 4 hours daily for 30 days, for Rs. 76.50, is :
(2002)
- (a) 100 (b) 120 (c) 150 (d) 160
30. 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 ?
(2002)
- (a) 1260 (b) 1320 (c) 920 (d) 1380

31. 400 persons, working 9 hours per day complete $\frac{1}{4}$ th of the work in 10 days. The number of additional persons, working 8 hours per day, required to complete the remaining work in 20 days, is :
(a) 675 (b) 275 (c) 250 (d) 225
32. 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
33. 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
34. 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 ?
(a) 10 (b) 12 (c) 15 (d) 20
35. If 18 binders bind 900 books in 10 days, how many binders will be required to bind 660 books in 12 days ?
(a) 22 (b) 14 (c) 13 (d) 11
36. If $\frac{3}{5}$ of a cistern is filled in 1 minute, how much more time will be required to fill the rest of it ?
(a) 30 sec (b) 40 sec (c) 36 sec (d) 24 sec
37. 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) $\frac{y^3}{x^3}$ (d) $\frac{y^2}{x^2}$
38. 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
39. 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 ?
(a) $3\frac{1}{8}$ (b) 8 (c) $8\frac{8}{9}$ (d) $6\frac{12}{25}$
40. 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
41. 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
42. A certain number of men can finish a piece of work in 100 days. If, there were 10 men less, it would take 10 days more for the work to be finished. How many men were there originally ?
(a) 75 (b) 82 (c) 100 (d) 110

43. In a camp, 95 men had provisions for 200 days. After 5 days, 30 men left the camp. For how many days will the remaining food last now ?
(a) 180 (b) 285 (c) $139\frac{16}{19}$ (d) None of these
44. 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 ?
(a) 15 (b) 16 (c) $17\frac{1}{2}$ (d) 18
45. 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 ?
(a) 15 days (b) 25 days (c) 35 days (d) 50 days
46. 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
47. A contractor undertook to do a certain piece of work in 9 days. He employed certain number of men, but 6 of them being absent from the very first day, the rest could finish the work in 15 days. The number of men originally employed were :
(a) 12 (b) 15 (c) 18 (d) 24
48. A contractor undertakes to do a piece of work in 40 days. He engages 100 men at the beginning and 100 more after 35 days and completes the work in stipulated time. If he had not engaged the additional men, how many days behind schedule would it be finished ?
(a) 3 (b) 5 (c) 6 (d) 9
49. 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) $1\frac{1}{2}$
50. 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
51. 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 compete 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
52. 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

ANSWERS

1. (d) 2. (d) 3. (d) 4. (a) 5. (a) 6. (d) 7. (b) 8. (b) 9. (b)
10. (d) 11. (c) 12. (b) 13. (b) 14. (a) 15. (d) 16. (b) 17. (c) 18. (d)
19. (a) 20. (b) 21. (d) 22. (d) 23. (b) 24. (b) 25. (c) 26. (b) 27. (c)

28. (b) 29. (b) 30. (d) 31. (b) 32. (c) 33. (b) 34. (b) 35. (d) 36. (b)
 37. (d) 38. (b) 39. (b) 40. (b) 41. (c) 42. (d) 43. (b) 44. (a) 45. (d)
 46. (d) 47. (b) 48. (b) 49. (a) 50. (b) 51. (b) 52. (b)
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SOLUTIONS

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

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

2. Let the required price be Rs. x . Then, **Less toys, Less cost (Direct Proportion)**

$$\therefore 6 : 5 :: 264.37 : x \Leftrightarrow 6x = (5 \times 264.37) \Leftrightarrow x = \frac{(5 \times 264.37)}{6} \Leftrightarrow x = 220.308.$$

\therefore Approximate price of 5 toys = Rs. 220.

3. Let the required price be Rs. x . Then, **More mangoes, More price (Direct Proportion)**

$$\therefore 357 : (49 \times 12) :: 1517.25 : x \Leftrightarrow 357x = (49 \times 12 \times 1517.25) \Leftrightarrow x = \frac{(49 \times 12 \times 1517.25)}{357} \Leftrightarrow x = 2499.$$

Hence, the approximate price is Rs. 2500.

4. Let the required cost be x paise. **Less weight, Less cost (Direct Proportion)**

$$\therefore 250 : 200 :: 60 : x \Leftrightarrow 250 \times x = (200 \times 60) \Leftrightarrow x = \frac{(200 \times 60)}{250} \Leftrightarrow x = 48.$$

5. Let the required weight be x kg. Then, **Less length, Less weight (Direct Proportion)**

$$\therefore 11.25 : 6 :: 42.75 : x \Leftrightarrow 11.25 \times x = 6 \times 42.75 \Leftrightarrow x = \frac{(6 \times 42.75)}{11.25} \Leftrightarrow x = 22.8.$$

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

More distance on the map, More is the actual distance (Direct Proportion)

$$\therefore 0.6 : 80.5 :: 6.6 : x \Leftrightarrow 0.6x = 80.5 \times 6.6 \Leftrightarrow x = \frac{80.5 \times 6.6}{0.6} \Leftrightarrow x = 885.5.$$

7. Let the required time be x seconds. Then, **More metres, more time (Direct Proportion)**

$$\therefore 0.128 : 25 :: 1 : x \Leftrightarrow 0.128 \times x = 25 \times 1 \Leftrightarrow x = \frac{25}{0.128} = \frac{25 \times 1000}{128} \Leftrightarrow x = 195.31.$$

\therefore Required time = 195 sec (approximately).

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

Less lengthy shadow, Less is the height (Direct Proportion)

$$\therefore 40.25 : 28.75 :: 17.5 : x \Leftrightarrow 40.25 \times x = 28.75 \times 17.5 \Leftrightarrow x = \frac{(28.75 \times 17.5)}{40.25} \Leftrightarrow x = 12.5.$$

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

Less work, Less days (Direct Proportion)

Let the required number of days be x .

$$\text{Then, } \frac{5}{8} : \frac{3}{8} :: 10 : x \Leftrightarrow \frac{5}{8} \times x = \frac{3}{8} \times 10 \Leftrightarrow x = \left(\frac{3}{8} \times 10 \times \frac{8}{5} \right) = 6.$$

10. Let the required number of days be x . (a) 18 (b) 18 (c) 22 (d) 28

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

$$\therefore 27 : 36 :: 18 : x \Leftrightarrow 27 \times x = 36 \times 18 \Leftrightarrow x = \frac{36 \times 18}{27} \Leftrightarrow x = 24.$$

11. After 10 days : 150 men had food for 35 days.

Suppose 125 men had food for x days. Now, **Less men, More days (Indirect Proportion)**

$$\therefore 125 : 150 :: 35 : x \Leftrightarrow 125 \times x = 150 \times 35 \Leftrightarrow x = \frac{150 \times 35}{125} \Leftrightarrow x = 42.$$

Hence, the remaining food will last for 42 days.

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

Then, **More cogs, Less revolutions (Indirect Proportion)**

$$\therefore 14 : 6 :: 21 : x \Leftrightarrow 14 \times x = 6 \times 21 \Leftrightarrow x = \left(\frac{6 \times 21}{14} \right) = 9.$$

13. 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

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

14. Let the required cost be Rs. x . Then,

More packets, More cost (Direct Proportion)

(not) **More weight, More cost (Direct Proportion)**

Packets $\{ 16 : 27 \} :: 28 : x$

Weight $900 : 1000$

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

15. Let the required number of mats be x .

More weavers, More mats (Direct Proportion)

More days, More mats (Direct Proportion)

Weavers $\{ 4 : 8 \} :: 4 : x$

Days $\{ 4 : 8 \} :: 4 : x$

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

16. Let the required number of bottles be x .

More machines, More bottles (Direct Proportion)

More minutes, More bottles (Direct Proportion)

Machines $\{ 6 : 10 \} :: 270 : x$

Time (in Minutes) $\{ 1 : 4 \} :: 270 : x$

$$\therefore 6 \times 1 \times x = 10 \times 4 \times 270 \Leftrightarrow x = \frac{10 \times 4 \times 270}{6} \Leftrightarrow x = 1800.$$

17. Let the required number of days be x .

Less cows, More days (Indirect Proportion)

Less bags, Less days (Direct Proportion)

Cows $\{ 1 : 40 \} :: 40 : x$

Bags $\{ 40 : 1 \} :: 1 : x$

$$\therefore 1 \times 40 \times x = 40 \times 1 \times 40 \Leftrightarrow x = 40. \quad \frac{x}{40} = \frac{1}{40} \quad \frac{x}{40} = \frac{1}{40}$$

18. Let the required number of men be x .

Less days, More men \Rightarrow $x \propto \frac{1}{d}$ (Indirect Proportion)

More working hrs per day, Less men \Rightarrow $x \propto \frac{1}{h}$ (Indirect Proportion)

$$\begin{matrix} \text{Days} & 8 : 10 \\ \text{Working Hrs} & 15 : 8 \end{matrix} \Rightarrow 12 : x \quad \left(\frac{8}{10} \times \frac{15}{8} = \frac{12}{x} \right) \Rightarrow x = 10 \times 8 \times 12 / 15 = 64$$

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

19. Let the required number of hours per day be x .

More men, Less hours per day $\Rightarrow x \propto \frac{1}{m}$ (Indirect Proportion)

Less days, More hours per day $\Rightarrow x \propto \frac{1}{d}$ (Indirect Proportion)

$$\begin{matrix} \text{Men} & 15 : 10 \\ \text{Days} & 12 : 18 \end{matrix} \Rightarrow 6 : x \quad \left(\frac{15}{10} \times \frac{18}{12} = \frac{6}{x} \right) \Rightarrow x = 10 \times 18 / 6 = 30$$

$$\therefore 15 \times 12 \times x = 10 \times 18 \times 6 \Leftrightarrow x = \frac{10 \times 18 \times 6}{15 \times 12} \Leftrightarrow x = 6.$$

20. Let the required number of days be x .

Less persons, More days $\Rightarrow x \propto \frac{1}{p}$ (Indirect Proportion)

More working hrs per day, Less days $\Rightarrow x \propto \frac{1}{h}$ (Indirect Proportion)

$$\begin{matrix} \text{Persons} & 30 : 39 \\ \text{Working hrs/day} & 6 : 5 \end{matrix} \Rightarrow 12 : x \quad \left(\frac{30}{39} \times \frac{5}{6} = \frac{12}{x} \right) \Rightarrow x = 39 \times 5 \times 12 / 30 \times 6 = 13$$

$$\therefore 30 \times 6 \times x = 39 \times 5 \times 12 \Leftrightarrow x = \frac{39 \times 5 \times 12}{30 \times 6} \Leftrightarrow x = 13.$$

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

More pumps, Less working hours per day $\Rightarrow x \propto \frac{1}{p}$ (Indirect Proportion)

Less days, More working hours per day $\Rightarrow x \propto \frac{1}{d}$ (Indirect Proportion)

$$\begin{matrix} \text{Pumps} & 4 : 3 \\ \text{Days} & 1 : 2 \end{matrix} \Rightarrow 8 : x \quad \left(\frac{4}{3} \times \frac{2}{1} = \frac{8}{x} \right) \Rightarrow x = 3 \times 2 \times 8 / 4 = 12$$

$$\therefore 4 \times 1 \times x = 3 \times 2 \times 8 \Leftrightarrow x = \frac{3 \times 2 \times 8}{4} \Leftrightarrow x = 12.$$

22. Let the required number of hectares be x . Then,

More men, More hectares $\Rightarrow x \propto p$ (Direct Proportion)

More days, More hectares $\Rightarrow x \propto d$ (Direct Proportion)

$$\begin{matrix} \text{Men} & 8 : 36 \\ \text{Days} & 24 : 30 \end{matrix} \Rightarrow 80 : x \quad \left(\frac{8}{36} \times \frac{30}{24} = \frac{80}{x} \right) \Rightarrow x = 36 \times 30 \times 80 / (8 \times 24) = 450$$

$$\therefore 8 \times 24 \times x = 36 \times 30 \times 80 \Leftrightarrow x = \frac{(36 \times 30 \times 80)}{(8 \times 24)} \Leftrightarrow x = 450.$$

23. Let the required length be x metres.

More breadth, Less length $\Rightarrow x \propto \frac{1}{b}$ (Indirect Proportion)

More depth, Less length $\Rightarrow x \propto \frac{1}{d}$ (Indirect Proportion)

More days, More length $\Rightarrow x \propto d$ (Direct Proportion)

Breadth $20 : 50$ $\Rightarrow 100 : x$ $\left(\frac{20}{50} = \frac{100}{x} \right) \Rightarrow x = 50 \times 100 / 20 = 250$

Depth $15 : 10$ $\Rightarrow 100 : x$ $\left(\frac{15}{10} = \frac{100}{x} \right) \Rightarrow x = 100 \times 10 / 15 = 200$

Days $10 : 30$ $\Rightarrow 100 : x$ $\left(\frac{10}{30} = \frac{100}{x} \right) \Rightarrow x = 100 \times 30 / 10 = 300$

$$\therefore 20 \times 15 \times 10 \times x = 50 \times 10 \times 30 \times 100 \Leftrightarrow x = \frac{(50 \times 10 \times 30 \times 100)}{(20 \times 15 \times 10)} \Leftrightarrow x = 500.$$

24. Let the required number of days be x .

$$5 \text{ men} = 9 \text{ women} \Leftrightarrow 3 \text{ men} = \left(\frac{9}{5} \times 3\right) \text{ women} = \frac{27}{5} \text{ women}$$

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

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

$$\therefore \frac{57}{5} : 9 :: 19 : x \Leftrightarrow \frac{57}{5} \times x = 9 \times 19 \Leftrightarrow x = \left(9 \times 19 \times \frac{5}{57}\right) = 15$$

25. Let the required number of days be x . Then,

More pumps, Less days (Indirect Proportion)

Less working hrs/day, More days (Indirect Proportion)

$$\begin{aligned} \text{Pumps} & \quad 196 : 49 \\ \text{Working Hrs/Day} & \quad 5 : 8 \end{aligned} \Leftrightarrow \frac{13}{2} : x$$

$$\therefore 196 \times 5 \times x = 49 \times 8 \times \frac{13}{2} \Leftrightarrow x = \left(49 \times 8 \times \frac{13}{2} \times \frac{1}{196 \times 5}\right) \Leftrightarrow x = \frac{13}{5} = 2\frac{3}{5}$$

26. Let the required number of labourers be x . Then,

Less working hrs/day, More labourers (Indirect Proportion)

More days, Less labourers (Indirect Proportion)

$$\begin{aligned} \text{Working Hrs/Day} & \quad 6 : 7 \\ \text{Days} & \quad 30 : 18 \end{aligned} \Leftrightarrow 30 : x$$

$$\therefore 6 \times 30 \times x = 7 \times 18 \times 30 \Leftrightarrow 6x = 126 \Leftrightarrow x = 21$$

27. Let the required number of days be x . Then,

Less spiders, More days (Indirect Proportion)

Less webs, Less days (Direct Proportion)

$$\begin{aligned} \text{Spiders} & \quad 1 : 7 \\ \text{Webs} & \quad 7 : 1 \end{aligned} \Leftrightarrow 7 : x$$

$$\therefore 1 \times 7 \times x = 7 \times 1 \times 7 \Leftrightarrow x = 7$$

28. 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)

$$\begin{aligned} \text{Pumps} & \quad 16 : 18 \\ \text{Weight} & \quad 2170 : 1736 \end{aligned} \Leftrightarrow 10 : x$$

$$\begin{aligned} \text{Hours/Day} & \quad 9 : 7 \\ \therefore (16 \times 2170 \times 9 \times x) & = (18 \times 1736 \times 7 \times 10) \Leftrightarrow x = \frac{18 \times 1736 \times 7 \times 10}{16 \times 2170 \times 9} = 7 \end{aligned}$$

29. 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)

$$\begin{aligned} \text{Hours per day} & \quad 4 : 5 \\ \text{Money} & \quad 21.25 : 76.50 \end{aligned} \Leftrightarrow 80 : x$$

$$\begin{aligned} \text{Number of days} & \quad 30 : 10 \\ \therefore 4 \times 21.25 \times 30 \times x & = 5 \times 76.50 \times 10 \Leftrightarrow x = 80 \end{aligned}$$

- $x = \frac{5 \times 76.50 \times 10 \times 80}{4 \times 21.25 \times 30} \Leftrightarrow x = 120.$
30. 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)
- $$\begin{aligned} \text{Carpenters} & \quad 12 : 18 \\ \text{Hours per day} & \quad 6 : 8 \\ \text{Days} & \quad 24 : 36 \end{aligned}$$
- $$\begin{aligned} \therefore 12 : 18 & \Rightarrow \frac{12}{18} = \frac{x}{460} \Leftrightarrow \left(12 \times 8 \times \frac{1}{6} \right) = \left(x \times 24 \times \frac{1}{36} \right) \\ \therefore 460 : x & \Rightarrow 460 = \left(x \times 24 \times \frac{1}{36} \right) \times 8 \\ \therefore (18 - 12) & = \text{Required no. of chairs} \\ \therefore (12 \times 6 \times 24 \times x) & = (18 \times 8 \times 36 \times 460) \Leftrightarrow x = \frac{(18 \times 8 \times 36 \times 460)}{(12 \times 6 \times 24)} = 1380. \\ \therefore \text{Required number of chairs} & = 1380. \end{aligned}$$
31. Let the number of persons completing the work in 20 days be x .
- Work done* = $\frac{1}{4}$, *Remaining work* = $\left(1 - \frac{1}{4}\right) = \frac{3}{4}$.
- Less hours per day, More men required* (Indirect Proportion)
More work, More men required (Direct Proportion)
More days, Less men required (Indirect Proportion)
- $$\begin{aligned} \text{Hours per day} & \quad 8 : 9 \\ \text{Work} & \quad \frac{1}{4} : \frac{3}{4} \\ \text{Days} & \quad 20 : 10 \end{aligned}$$
- $$\begin{aligned} \therefore 8 : 9 & \Rightarrow \frac{8}{9} = \left(\frac{1}{4} - \frac{1}{x} \right) \Leftrightarrow \frac{8}{9} = \frac{3}{4x} \Leftrightarrow x = \frac{27}{8} = 3.375 \\ \therefore \frac{1}{4} : \frac{3}{4} & \Rightarrow \frac{1}{4} = \frac{3}{4x} \Leftrightarrow \frac{1}{4} = \frac{3}{400} \Leftrightarrow x = 100 \\ \therefore 20 : 10 & \Rightarrow \frac{20}{10} = \frac{3}{x} \Leftrightarrow x = \frac{3}{2} = 1.5 \end{aligned}$$
- $$\therefore 8 \times \frac{1}{4} \times 20 \times x = 9 \times \frac{3}{4} \times 10 \times 400 \Leftrightarrow 40x = 27000 \Leftrightarrow x = 675.$$
- $$\therefore \text{Additional men} = (675 - 400) = 275.$$
32. 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)
- $$\begin{aligned} \text{Examiners} & \quad 4 : 9 \\ \text{Days} & \quad 30 : 12 \\ \text{Answer books} & \quad 1 : 2 \end{aligned}$$
- $$\begin{aligned} \therefore 4 : 9 & \Rightarrow \frac{4}{9} = \frac{1}{x} \Leftrightarrow 4x = 9 \Leftrightarrow x = 2.25 \\ \therefore 30 : 12 & \Rightarrow \frac{30}{12} = \frac{1}{x} \Leftrightarrow 30x = 12 \Leftrightarrow x = 0.4 \\ \therefore 1 : 2 & \Rightarrow \frac{1}{2} = \frac{1}{x} \Leftrightarrow 2x = 1 \Leftrightarrow x = 0.5 \end{aligned}$$
- $$\therefore (4 \times 30 \times 1 \times x) = (9 \times 12 \times 2 \times 5) \Leftrightarrow 120x = 1080 \Leftrightarrow x = 9.$$
33. 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)
- $$\begin{aligned} \text{Length} & \quad (26 : 39) \\ \text{Days} & \quad (6 : 18) \\ \text{Hours per day} & \quad (9 : 8) \end{aligned}$$
- $$\begin{aligned} \therefore 26 : 39 & \Rightarrow \frac{26}{39} = \frac{x}{(39 \times 18 \times 8 \times 17)} \Leftrightarrow x = \frac{(39 \times 18 \times 8 \times 17)}{(26 \times 6 \times 9)} = 68. \\ \therefore 6 : 18 & \Rightarrow \frac{6}{18} = \frac{x}{(26 \times 6 \times 9)} \Leftrightarrow x = \frac{(26 \times 6 \times 9)}{3} = 51. \\ \therefore 9 : 8 & \Rightarrow \frac{9}{8} = \frac{x}{(26 \times 6 \times 9)} \Leftrightarrow x = \frac{(26 \times 6 \times 9)}{8} = 190.5. \end{aligned}$$
- $$\therefore (\text{Number of more labourers}) = (68 - 51) = 17.$$
34. Let the total number of men be x . Work done = $\frac{1}{3}$, Remaining work = $\left(1 - \frac{1}{3}\right) = \frac{2}{3}$.

More work, More men (Direct Proportion)

More days, Less men (Indirect Proportion) $\Rightarrow \frac{08 \times 01 \times 06.87 \times 8}{08 \times 25 \times 4} = x$

$$\begin{aligned} \text{Work} & \left. \begin{aligned} \frac{1}{3} : \frac{2}{3} \\ \therefore 20 : x \end{aligned} \right\} \text{More work, more men} \\ \text{Days} & \left. \begin{aligned} 25 : 20 \\ \therefore 12 : x \end{aligned} \right\} \text{More days, less men} \\ \therefore \left(\frac{1}{3} \times 25 \times x \right) &= \left(\frac{2}{3} \times 20 \times 12 \right) \Leftrightarrow x = \frac{800}{25} = 32 \end{aligned}$$

∴ More men to be employed = (32 - 20) = 12.

35. Let the required number of binders be x .

Less books, Less binders (Direct Proportion)

More days, Less binders (Indirect Proportion)

$$\begin{aligned} \text{Books} & 900 : 600 \left\{ \begin{aligned} \text{More books, more binders} \\ \therefore 18 : x \end{aligned} \right. \\ \text{Days} & 12 : 10 \left\{ \begin{aligned} \text{More days, less binders} \\ \therefore \frac{12}{x} = \left(\frac{1}{10} - \frac{1}{12} \right) \end{aligned} \right. \end{aligned}$$

∴ $(900 \times 12 \times x) = (600 \times 10 \times 18) \Leftrightarrow x = \frac{600 \times 10 \times 18}{900 \times 12} = 11$

36. Let the required time be x seconds.

$$\text{Part filled} = \frac{3}{5}, \text{ Remaining part} = \left(1 - \frac{3}{5}\right) = \frac{2}{5}$$

Less part, Less time (Direct Proportion)

$$\therefore \frac{3}{5} : \frac{2}{5} :: 60 : x \Leftrightarrow \left(\frac{3}{5} \times x \right) = \left(\frac{2}{5} \times 60 \right) \Leftrightarrow x = 40.$$

37. 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)

$$\begin{aligned} \text{Men} & x : y \\ \text{Hours per day} & x : y \left\{ \begin{aligned} \text{More working hours, more work} \\ \therefore x : z \end{aligned} \right. \\ \text{Days} & x : y \left\{ \begin{aligned} \text{More days, more work} \\ \therefore z : y \end{aligned} \right. \end{aligned}$$

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

38. Let the required number of rounds be x .

More radius, Less rounds (Indirect Proportion)

$$\therefore 20 : 14 :: 70 : x \Leftrightarrow (20 \times x) = (14 \times 70) \Leftrightarrow x = \frac{14 \times 70}{20} \Leftrightarrow x = 49.$$

Hence, the required number of rounds = 49.

39. 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)

$$\begin{aligned} \text{Engines} & 5 : 8 \\ \text{Hours per day} & 9 : 10 \left\{ \begin{aligned} \text{More hours per day, more coal} \\ \therefore 6 : x \end{aligned} \right. \\ \text{Rate} & \frac{1}{3} : \frac{1}{4} \left\{ \begin{aligned} \text{More rate, more coal} \\ \therefore x : 16 \end{aligned} \right. \end{aligned}$$

$$\therefore \left(5 \times 9 \times \frac{1}{3} \times x \right) = \left(8 \times 10 \times \frac{1}{4} \times 6 \right) \Leftrightarrow \frac{(15 \times 8 \times 6)}{24} = (x \times 8 \times 6) \Leftrightarrow$$

40. Let the required number of hours be x .

Speeds of working of first and second type of men are $\frac{1}{2}$ and $\frac{1}{3}$, new need

More work, More time (Direct Proportion)

Less speed, More time (Indirect Proportion)

$$\text{Work } 1 : 2 \left\{ \begin{array}{l} \text{Speeds double when it is fast} \\ \text{Speed } \frac{1}{3} : \frac{1}{2} \end{array} \right\} :: 25 : x$$

$$\text{Speed } \frac{1}{3} : \frac{1}{2} \left\{ \begin{array}{l} \text{Speed is slow requires more time} \\ \text{Speed } \frac{1}{2} \text{ is slow requires less time} \end{array} \right\} :: 25 : x$$

$$\therefore \left(1 \times \frac{1}{3} \times x \right) = \left(2 \times \frac{1}{2} \times 25 \right) \Leftrightarrow x = \frac{(2 \times 25)}{\frac{1}{3}} = 150$$

41. 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)

$$\text{Men } 2x : x \left\{ \begin{array}{l} \text{More per day less days} \\ \text{Men per day less days} \end{array} \right\} :: 12 : z$$

$$\text{Work } 1 : \frac{1}{2} \left\{ \begin{array}{l} \text{Days per day less days} \\ \text{Work per day less days} \end{array} \right\} :: z : 12$$

$$\therefore (2x \times 1 \times z) = \left(x \times \frac{1}{2} \times 12 \right) \Leftrightarrow 2xz = 6x \Leftrightarrow z = 3.$$

42. Originally, let there be x men.

Less men, More days (Indirect Proportion)

$$\therefore (x - 10) : x :: 100 : 110 \Leftrightarrow (x - 10) \times 110 = x \times 100 \Leftrightarrow 10x = 1100 \Leftrightarrow x = 110.$$

43. Let the remaining food will last for x days.

95 men had provisions for 195 days. 65 men had provisions for x days.

Less men, More days (Indirect Proportion)

$$\therefore 65 : 95 :: 195 : x \Leftrightarrow (65 \times x) = (95 \times 195) \Leftrightarrow x = \frac{95 \times 195}{65} = 285.$$

44. Let the remaining food will 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)

$$\therefore 800 : 500 :: 24 : x \Leftrightarrow (800 \times x) = (500 \times 24) \Leftrightarrow x = \frac{500 \times 24}{800} = 15.$$

45. 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.

$$\therefore x(y - 10) = \frac{4x}{5} \times y \Leftrightarrow 5xy - 50x = 4xy \Leftrightarrow xy - 50x = 0 \Leftrightarrow$$

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

46. 3 women = 2 men. So, 21 women = 14 men.

Less men, More days (Indirect Proportion)

Less hours per day, More days (Indirect Proportion)

$$\text{Men } 14 : 15 \left\{ \begin{array}{l} \text{Hours per day less days} \\ \text{Men per day less days} \end{array} \right\} :: 21 : x$$

$$\text{Hours per day } 6 : 8 \left\{ \begin{array}{l} \text{Hours per day less days} \\ \text{Hours per day more days} \end{array} \right\} :: x : 15$$