Ratio, Proportion & Partnership

RATIO

Ratio is strictly a mathematical term to compare two similar quantities expressed in the same units.

The ratio of two terms 'x' and 'y' is denoted by $x : y$.

In general, the ratio of a number x to a number y is defined as the quotient of the numbers x and y.

Comparison of Two or More Ratios

Method : Cross Multiplication Method

$\frac{a}{b} > \frac{c}{d}$, if $ad > bc$ and $\frac{a}{b} < \frac{c}{d}$, if $ad < bc$

For example: $\frac{6}{7} > \frac{3}{5}$ because $6 \times 5 > 7 \times 3$

and $\frac{4}{5} < \frac{7}{8}$ because $4 \times 8 < 5 \times 7$

Remember...

- In the ratio of two quantities the two quantities must be of the same kind and in same unit.
- The ratio is a pure number, i.e., without any unit of measurement.
- The ratio would stay unaltered even if both the numerator and the denominator are multiplied or divided by the same number.

PROPORTION

When two ratios are equal, the four quantities composing them are said to be in proportion.

If $\frac{a}{b} = \frac{c}{d}$, then a, b, c, d are in proportions.

This is expressed by saying that 'a' is to 'b' as 'c' is to 'd' and the proportion is written as

$a : b :: c : d$ or $a : b = c : d$

Here 'a' is called first proportion, 'b' is called second proportion, 'c' is called third proportion and 'd' is called fourth proportion.

The terms a and d are called the extremes while the terms b and c are called the means.

Remember...

- If four quantities are in proportion, the product of the extremes is equal to the product of the means.

  i.e., $\frac{a}{b} = \frac{c}{d} \Rightarrow ad = bc$.
- If three quantities a, b and c are in continued proportion, then $a : b = b : c$

  $\therefore \quad ac = b^2$

  b is called mean proportional.
- If a, b, c, d, ... are in continue proportion, then $\frac{a}{b} = \frac{b}{c} = \frac{c}{d} \ldots$

Properties of Proportion

(i) Invertendo : If $\frac{a}{b} = \frac{c}{d}$, then $\frac{b}{a} = \frac{d}{c}$.

(ii) Alternendo : If $\frac{a}{b} = \frac{c}{d}$, then $\frac{a}{c} = \frac{b}{d}$,

(iii) Componendo : If $\frac{a}{b} = \frac{c}{d}$, then $\frac{a+b}{b} = \frac{c+d}{d}$.

(iv) Dividendo : If $\frac{a}{b} = \frac{c}{d}$, then $\frac{a-b}{b} = \frac{c-d}{d}$.

(v) Componendo and Dividendo : If $\frac{a}{b} = \frac{c}{d}$,

then $\frac{a+b}{a-b} = \frac{c+d}{c-d}$.

(vi) If $\frac{a}{b} = \frac{c}{d} = \frac{e}{f} = \ldots\ldots$. Then,

$$\text{Each ratio} = \frac{\text{Sum of Numerators}}{\text{Sum of Denominators}}$$

i.e. $\frac{a}{b} = \frac{c}{d} = \frac{e}{f} = \ldots = \frac{a+c+e+\ldots}{b+d+f+\ldots}$

Example **1. A man completes 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)** $37\frac{1}{4}$

Sol. (b) Work done = $\frac{5}{8}$. Balance work = $1-\frac{5}{8}=\frac{3}{8}$.

Less work, Less days (Direct Variation)

Let the required number of days be x. Then,

Work	days
5/8	10
3/8	x

Then, $\frac{5}{8}:\frac{3}{8}::10:x \Rightarrow \frac{5}{8}\times x=\frac{3}{8}\times 10$

$\Rightarrow x=\frac{3}{8}\times 10\times\frac{8}{5}=6$

Example **2. 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 :**

(a) $29\frac{1}{5}$ **(b)** $37\frac{1}{4}$ **(c)** 42 **(d)** 54

Sol. (c) Suppose 125 men had food for x days. Now,

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

Then,

men	days
150	35
125	x

$\therefore \quad 125:150::x:35 \Rightarrow 125\times x=150\times 35$

$\Rightarrow x=\frac{150\times 35}{125} \Rightarrow x=42.$

Hence, the remaining food will last for 42 days.

PARTNERSHIP

A partnership is an association of two or more persons who invest their money to start or to carry on a certain business.

A partner who manages the business is called the **working partner** and the one who simply invests the money is called the **sleeping partner.**

Partnership is of two kinds :

(i) Simple (ii) Compound.

Simple partnership: If the capitals is of the partners are invested for the same period, the partnership is called simple partnership.

Compound partnership : If the capitals of the partners are invested for different lengths of time, the partnership is called compound partnership.

Monthly Equivalent Investment

It is the product of the capital invested and the period for which it is invested.

Share of Profit or Loss in the Partnership

(i) If the period of investment is same for each partner, then the profit or loss is divided in the ratio of their investments.

(a) If A and B are partners in a business, then

$$\frac{\text{Investment of } A}{\text{Investment of } B}=\frac{\text{Profit of } A}{\text{Profit of } B} \text{ or } \frac{\text{Loss of } A}{\text{Loss of } B}$$

(b) If A, B and C are partners in a business, then

Investment of A : Investment of B : Investment of C

= Profit of A : Profit of B : Profit of C

or Loss of A : Loss of B : Loss of C

(ii) When the amount of capital invested by different partners is same (say ₹ x) for differend time periods, t_1, t_2, t_3, ..., then Ratio of profit/loss = Ratio of time period for which the capital is invested

$P_1 : P_2 : P_3 : \ldots$ or $L_1 : L_2 : L_3 : \ldots = t_1 : t_2 : t_3 : \ldots$

(iii) If capital investments and also period of investment are different, then the profit or loss is divided in the ratio of their Monthly Equivalent Investment.

$$\frac{\text{Monthly Equivalent Investment of } A}{\text{Monthly Equivalent Investment of } B}$$

$$=\frac{\text{Profit of } A}{\text{Profit of } B} \text{ or } \frac{\text{Loss of } A}{\text{Loss of } B}$$

i.e., $$\frac{\text{Investment of } A\times\text{Period of Investment of } A}{\text{Investment of } B\times\text{Period of Investment of } B}$$

$$=\frac{\text{Profit of } A}{\text{Profit of } B} \text{ or } \frac{\text{Loss of } A}{\text{Loss of } A}$$

EXERCISE

1. *A* and *B* started a business by investing ₹ 35,000 and ₹ 20,000 respectively. *B* left the business after 5 months and *C* joined the business with a sum of ₹ 15,000. The profit earned at the end of the year is ₹ 84,125. What is *B*'s share of profit?
(a) ₹14133 (b) ₹15,000
(c) ₹13,460 (d) Cannot be determined
(e) None of these

2. A man ordered 4 pairs of black socks and some pairs of brown socks. The price of a black socks is double that of a brown pair. While preparing the bill the clerk interchanged the number of black and brown pairs by mistake which increased the bill by 50%. The ratio of the number of black and brown pairs of socks in the original order was :
(a) 2 : 1 (b) 1 : 4 (c) 1 : 2 (d) 4 : 1

3. A vessel contains 60 litres of milk. 12 litres of milk taken out from it and replaced by water. Then again from mixture, 12 litres are again taken out and replaced by water. The ratio of milk and water in the resultant mixture is :
(a) 16 : 10 (b) 9 : 5 (c) 15 : 10 (d) 16 : 9

4. In a college the number of students studying Arts, Commerce and Science are in the ratio of 3 : 5 : 8 respectively. If the number of students studying Arts, Commerce and Science is increased by 20%, 40% and 25% respectively, what will be the new ratio of students in Arts, Commerce and Science respectively?
(a) 18 : 35 : 50 (b) 3 : 10 : 10
(c) 4 : 8 : 5 (d) 32 : 35 : 25
(e) None of these

5. The respective ratio between the monthly salary of Neil and that of Dipti is 5 : 6. Neil and Dipti, both save 40% and 25% out of their respective monthly salaries. Neil invests $\frac{5}{8}$th of his savings in LIC and Dipti invests $\frac{3}{5}$th of her savings in LIC. If Neil invests ₹ 1750 more than Dipti in LIC, what is Neil's monthly salary?
(a) ₹ 20000 (b) ₹ 25000 (c) ₹ 40000 (d) ₹ 15000
(e) ₹ 30000

6. *A*, *B* and *C* started a business with their investments in the ratio 1 : 2 : 4. After 6 months *A* invested the half amount more as before and *B* invested the same amount as before while *C* with drew one-fourth of his investment. Find the ratio of their profits at the end of the year.
(a) 5 : 12 : 13 (b) 5 : 11 : 14
(c) 5 : 12 : 14 (d) 5 : 12 : 10
(e) None of these

7. In a class of 168 students, boys and girls are in the ratio 5 : 7. 50% of the total students can speak only Hindi. The ratio of number of students speaking only Hindi to that speaking only English is 21 : 16. The ratio of boys speaking English only to that of girls speaking English only is 3 : 5. If the number of boys speaking both English and Hindi is 12, what is the number of girls speaking Hindi only? (Assume that all students speak at least one language).
(a) 48 (b) 50 (c) 52 (d) 55
(e) None of these

8. Ratio of the earnings of *A* and *B* is 4 : 7 respectively. If the earnings of *A* increase by 50% and the earnings of *B* decrease by 25% the new ratio of their earnings becomes 8 : 7 respectively. What are A's earnings.?
(a) ₹ 26, 000 (b) ₹ 28, 000
(c) ₹ 21, 000 (d) Data inadequate
(e) None of these

9. Monthly salary of Dex is $\frac{1}{4}$th of his father's monthly salary. Dex's sister's monthly salary is $\frac{2}{5}$th of their father's monthly salary. Dex's sister pays ₹ 12, 8000, which is $\frac{1}{4}$th of her monthly salary as study loan. Savings and expenses made out of the monthly salary, by Dex is in the respective ratio 3 : 5. How much does Dex save each month?
(a) ₹ 12, 000 (b) ₹ 10, 600
(c) ₹ 10, 400 (d) ₹ 10, 600
(e) ₹ 12, 400

10. Sia gave $\frac{1}{4}$th of the money she had with her to her brother. Her brother, from the money he received from Sia, spent $\frac{1}{8}$th on his bus fair, $\frac{1}{4}$th on tuition fees. After the mentioned expenses, Sia's brother had ₹ 1875 remaining with him. How much money did Sia have initially?
(a) ₹ 15000 (b) ₹ 10, 900
(c) ₹ 9, 000 (d) ₹ 4, 990
(e) ₹ 12, 000

11. Raja gives 30% of his salary to his mother, 40% of the remaining salary he invests in an insurance scheme and PPF in the respective ratio of 4 : 3 and the remaining he keeps in his bank account. If the difference between the amount he gives to his mother and that he invests in insurance scheme is ₹ 8400, how much is Raja's salary?
(a) ₹ 60,000 (b) ₹ 6,000
(c) ₹ 64,000 (d) ₹ 65,000
(e) ₹ 54,000

12. The sum of Shilpa's age after 4 years and Raghu's age 4 years ago is 63 years and the respective ratio between the Shilpa's age four years ago and Raghu's age after 3 years is 10 : 21. What is Shilpa's present age? (in years)
(a) 25 (b) 34 (c) 24 (d) 28
(e) 39

13. *A*, *B* and *C* started a business in partnership with investments of ₹ 12000, ₹ 26000 and ₹ 32000 respectively. After 4 months *A* leaves. After 6 months *B* leaves and *A* joins with an amount equal to his earlier investment. After 10 months *C* leaves and *B* joins with his prior investment. At the end of the year they earn a profit of ₹ 53622. Find the share of *B* in the annual profit.
(a) ₹ 17221 (b) ₹ 17212 (c) ₹ 17222 (d) ₹ 18212
(e) None of these

14. Two persons *A* and *B* start a business with investments of ₹ 24000 and ₹ 28000 respectively. After 4 months *C* also joined them with certain investment. Total profit at the end of the year was ₹ 19950. *C*'s share in profit was ₹ 7600. What was the *C*'s investment in the business?
(a) ₹ 48000 (b) ₹ 45000
(c) ₹ 50000 (d) ₹ 40000
(e) None of these

15. *A*, *B* and *C* started a business by investing ₹ 20,000 ₹ 28,000 and ₹ 36,000 respectively. After 6 months, *A* and *B* withdrew an amount of ₹ 8,000 each and *C* invested an additional amount of ₹ 8,000. All of them invested for equal period of time. If at the end of the year, *C* got ₹ 12,550 as his share of profit, what was the total profit earned?
(a) ₹ 25,100 (b) ₹ 26,600
(c) ₹ 24,300 (d) ₹ 22,960
(e) ₹ 21,440

16. *A* and *B* started a business with the investments in the ratio of 5 : 3 respectively. After 6 months from the start of the business, *C* joined them and the respective ratio between the investments of *B* and *C* was 2 : 3. If the annual profit earned by them was ₹ 12,300. What was the difference between *B*'s share and *C*'s share in the profit?
(a) ₹ 900 (b) ₹ 800 (c) ₹ 600 (d) ₹ 400
(e) ₹ 700

17. *A*, *B* and *C* started a business with investments of ₹ 1500, ₹ 550 and ₹ 2400 respectively. After 8 months from the start of the business, *A* and *C* left and *B* invested an additional amount of ₹ 450. If difference between the share in annual profit received by *B* and the total annual profit was ₹ 13,000, what was the total annual profit received?
(a) ₹ 16,500 (b) ₹ 18,150
(c) ₹ 13,200 (d) ₹ 19,800
(e) ₹ 16,750

18. *A* starts a business with ₹ 2500. After one month from the start of the business, *B* joined with ₹ 4500 and *A* withdrew completely after eleven months from the start of the business. If the difference between *A*'s and *B*'s respective shares in the annual profit was ₹ 4800, what was the annual profit earned?
(a) ₹ 14800 (b) ₹ 16800
(c) ₹ 14400 (d) ₹ 11400
(e) ₹ 15600

19. *A* started a business with an investment of ₹ 12,000. At the end of six months from the start of the business. *A* withdrew half of his initial investment and *B* and *C* invested in the ratio of 10 : 9 respectively. If A's share in annual profit of ₹ 14,000 was ₹ 4,500, what was the investment made by *B*?
(a) ₹ 20,000 (b) ₹ 25,000
(c) ₹ 10,000 (d) ₹ 18,000
(e) ₹ 35,000

20. Ninad, Vikash and Manav enter into a partnership. Ninad invests some amount at the beginning. Vikash invests double the amount after 6 months and Manav invests thrice the amount invested by Ninad after 8 months. They earn a profit of ₹ 45,000 at the end of the year. What is Manav's share in the profit?
(a) ₹ 25,000 (b) ₹ 15,000
(c) ₹ 12,000 (d) ₹ 9,000
(e) None of these

21. *A* started a business with an investment of ₹ 16,000. After 6 months from the start of the business, *B* and *C* joined with ₹ 12,000 and ₹ 18,000 respectively and *A* invested an additional amount of ₹ 4000. If the difference between *A*'s share and *B*'s share in the annual profit is ₹ 6000. What was the annual profit received?
(a) ₹ 17,600 (b) ₹ 13,200
(c) ₹ 14,300 (d) ₹ 16,500
(e) ₹ 11,000

22. *P* and *Q* started a business by investing ₹ 15000 and ₹ 18000 respectively. After four months *R* joined them with a capital of ₹ 10000. After two more months *Q* left the business with his capital. At the end of the year P got a share of ₹ 4500 in the profit. What is the total profit earned?
(a) ₹ 6800 (b) ₹ 7600
(c) ₹ 8600 (d) ₹ 9200
(e) ₹ 9600

23. *A* and *B* started a business by investing ₹ 18,000 and ₹ 24,000 respectively. At the end of 4th month from the start of the business, *C* joins with ₹ 15,000. At the end of 8th month *B* quits at which time *C* invests ₹ 3000 more. At the end of 10^{th} month *B* rejoins with the same investment. If profit at the end of the year is ₹ 12,005. What is *B*'s share in the profit?
(a) ₹ 4,000 (b) ₹ 4,440
(c) ₹ 4,360 (d) ₹ 4,900
(e) ₹ 3,920

24. Acid and water are mixed in a vessel A in the ratio of 5 : 2 and if the vessel B in the ratio 8 : 5. In what proportion should quantities be taken out from the two vessels so as to form a mixture in which the acid and water will be in the ratio of 9 : 4 ?

(a) 7 : 2 (b) 2 : 7
(c) 7 : 4 (d) 2 : 3

25. In two types of stainless steel the ratio of chromium and steel are 2 : 11 and 5 : 21 respectively. In what proportion should the two types be mixed so that the ratio of chromium to steel in the mixed type becomes 7 : 32?

(a) 2 : 3 (b) 3 : 4
(c) 1 : 2 (d) 1 : 3

26. A man divides his property so that his son's share to his wife's and wife's share to his daughter's are both as in the ratio 3 : 1. If the daughter gets ₹10,000 less than son, the value (in rupees) of the whole property is

(a) ₹16,250 (b) ₹16,000
(c) ₹18,250 (d) ₹17,000

27. A and B enter into partnership investing ₹ 48,000 and ₹ 60,000 respectively. After 3 months, A withdraws ₹ 8,000 while B invests ₹ 6,000 after 6 months of starting of business. Out of the total amount of profit, if A gets ₹ 12,000 as his share at the end of the year total profit is:

(a) ₹ 24,000 (b) ₹ 30,000
(c) ₹ 36,000 (d) ₹ 37,000

28. M, P and Q together started a business. M invested ₹ 6,500 for 6 months, P invested ₹ 8,400 for 5 months and Q invested ₹ 10,000 for 3 months. M is working member for which he gets 5% of total profit extra. If the total gain is ₹ 7,400, then Q's share is:

(a) ₹ 1,900 (b) ₹ 2,100
(c) ₹ 3,200 (d) Data are incomplete

29. Three partners started a business by investing ₹ 60,000, ₹ 80,000 and ₹ 1,20,000 respectively. First partner left the business after 4 months, second after 9 months and third remained in the business for the whole year. At the end of year the total profit earned is ₹ 1,60,480, then find their shares of profit.

(a) ₹ 16840, ₹ 44188, ₹ 92686
(b) ₹ 16048, ₹ 48144, ₹ 96288
(c) ₹ 16042, ₹ 14842, ₹ 9862
(d) ₹ 15000, ₹ 13423, ₹ 7562

30. A started a business by investing some money and B invested ₹ 5000 more than that of A. A remained in business for 5 months and B remained in business 1 month more than A. Out of the total profit of ₹ 26000, B got ₹ 6000 more than A. Find the capitals invested A and B.

(a) ₹ 29,000, ₹ 18,000
(b) ₹ 25,000, ₹ 30,000
(c) ₹ 15,000, ₹ 10,000
(d) ₹ 15,000, ₹ 20,000

Hints & Solutions

1. (c) Ratio of equivalent capitals of A, B and C for 1 month
$= 35000 \times 12 : 20000 \times 5 : 15000 \times 7$
$= 35 \times 12 : 20 \times 5 : 15 \times 7 = 84 : 20 : 21$
Sum of the ratios $= 84 + 20 + 21 = 125$

$\therefore$ B's share $= ₹\left(\frac{20}{125} \times 84125\right) = ₹13460$

2. (b) Number of pair of brown socks $= x$
Price of brown socks $= ₹\ y$ per pair
Price of black socks $= ₹\ 2y$ per pair

$\therefore \quad 4y + x \times 2y = \frac{150}{100}(4 \times 2y + xy)$

$\Rightarrow \quad 4 + 2x = \frac{3}{2}(8 + x) \quad \Rightarrow \quad 8 + 4x = 24 + 3x$

$\Rightarrow \quad x = 24 - 8 = 16$

$\therefore$ Required ratio $= 4 : 16 = 1 : 4$

3. (d) 12ℓ of milk taken out of 60ℓ milk So 20% water is added to milk
Milk $= 48\ell$; Water $= 12\ell$
Now, again 20% water is added to this mixture

$$\underset{\text{(milk)}}{48} \xrightarrow[-9.6]{20\%} \underset{\text{(milk)}}{38.4} \text{ and } \underset{\text{(water)}}{21.6}$$

So, ratio of milk and water $= 38.4 : 21.6 = 16 : 9$

4. (a) Let the number of students in Arts, Commerce and Science be $3x$, $5x$ and $8x$ respectively. On increasing their respective numbers,
Required ratio

$$= 3x \times \frac{120}{100} : 5x \times \frac{140}{100} : 8x \times \frac{125}{100}$$

$= 360 : 700 : 1000 = 18 : 35 : 50$

5. (b) Neil's monthly salary $= ₹\ 5x$
Dipti's monthly salary $= ₹\ 6x$

Neil's savings $= \frac{5x + 40}{100} = ₹\ 2x$

Dipti's savings $= \frac{6x \times 25}{100} = ₹\ \frac{3x}{2}$

According to the question.
Neil's investment – Dipti's investment $= 1750$

$\Rightarrow \quad 2x \times \frac{5}{8} - \frac{3x}{2} \times \frac{3}{5} = 1750 \quad \Rightarrow \quad \frac{5x}{4} - \frac{9x}{10} = 1750$

$\Rightarrow \quad \frac{25x - 18x}{20} = 1750 \quad \Rightarrow \quad 7x = 1750 \times 20$

$\Rightarrow \quad x = \frac{1750 \times 20}{7} = 5000$

Neil's monthly salary $= 5 \times 5000 = ₹25{,}000$

6. (c) Ratio of the equivalent capitals of A, B and C for 1 month

$$= \left(x \times 6 + \frac{3x}{2} \times 6\right) : (2x \times 6 + 4x \times 6) : (4x \times 6 + 3x \times 6)$$

$= (6x + 9x) : (12x + 24x) : (24x + 18x)$
$= 15x : 36x : 42x = 5 : 12 : 14$ = Ratio of shares

7. (b) Number of boys in class

$\left(\frac{5}{5+7}\right) \times 168 = 70$

Number of girls $= 168 - 70 = 98$
Number of students speaking
Hindi only $= \frac{168}{2} = 84$

$\Rightarrow$ Number of students speaking English only

$= \frac{16}{21} \times 84 = 64$

Number of girls speaking English only $= 64 - 24 = 40$
Number of students speaking both
$= 168 - (84 + 64) = 20$
Number of girls speaking both $= 20 - 12 = 8$

$\therefore$ Number of girls speaking only Hindi
$= 98 - (40 + 8) = 50$

8. (d) Let the earnings of A and B be $₹\ 4x$ and $7x$ respectively.
After 50% increase, A's earnings = 150% of $4x$
After 5% decrease,
B's earning = 75% of $7x$
Ratio = 150% of $4x$: 75% of $7x = 8 : 7$
But their total earnings are unknown. Hence A's earnings can't be known.

9. (a) Dex's sister's Monthly salary $= ₹\ (12800 \times 4)$
$= ₹\ 51200$
Dex's father's Monthly salary

$= ₹\left(\frac{51200 \times 5}{2}\right) = ₹\ 128000$

$\therefore$ Dex's Monthly Salary.

$= 128000 \times \frac{1}{4} = ₹\ 32000$

Dex's Monthly Savings $= ₹\left(\frac{3}{8} \times 32000\right) = ₹\ 12000$

10. (e) Initial money with Sia $= ₹\ x$

Money given to her brother $= ₹\ \frac{x}{4}$

His expenses $= \left(\frac{1}{8} + \frac{1}{4}\right)$ parts $= \left(\frac{1+2}{8}\right) = \frac{3}{8}$ parts

Remaining part $= 1 - \frac{3}{8} = \frac{5}{8}$

$\therefore \quad \frac{5}{8}$ of $\frac{x}{4} = 1875 \Rightarrow x = \frac{1875 \times 8 \times 4}{5} = ₹\ 12000$

11. (a) Let Raja's salary = 100 unit
His mother got 30% = 30 unit
Remaining = 70 unit
40% of Remaining = 28 unit

Investment in insurance = $\frac{4}{7} \times 28 = 16$ unit

Investment in PPF = $\frac{3}{7} \times 28 = 12$ unit

ATQ
$30 - 16 \Rightarrow 84000$
14 unit $\Rightarrow 84000$
1 unit $\Rightarrow 6000$
100 unit $\Rightarrow 60000$
Raja's salary = ₹ 60000

12. (c) According to the question,
Sum of the present ages of Shilpa and Raghu = 63 years
Shilpa's present age = x years (let)
$\therefore$ Raghu's present age = $(63 - x)$ years
Shilpa's age 4 years ago = $(x - 4)$ years
and Raghu's age 3 years hence
$= (63 - x + 3)$ years $= (66 - x)$ years
ATQ,

$$\therefore \quad \frac{x-4}{66-x} = \frac{10}{21} \Rightarrow 21x - 84 = 660 - 10x$$

$$\Rightarrow 21x + 10x = 660 + 84 \Rightarrow 31x = 744$$

$\Rightarrow x = 744 \div 31 = 24$ years

13. (b) Ratio of the equivalent capitals of A, B and C for 1 month
$(12000 \times 4 + 12000 \times 6) : (26000 \times 6 + 2 \times 26000) : 32000 \times 10$
$= 120000 : 208000 : 320000$
$= 120 : 208 : 320 = 15 : 26 : 40$
Sum of ratios $= 15 + 26 + 40 = 81$

$$\therefore \quad B\text{'s share} = \frac{26}{81} \times 53622 = ₹\ 17212$$

14. (a) 'C's investment = ₹ x thousand
$\therefore$ Ratio of their equivalent capitals for 1 month
$= 12 \times 24000 : 12 \times 28000 : 8 \times x \times 1000$
$= 36 : 42 : x$
Sum of ratios $= 36 + 42 + x = 78 + x$

$$\therefore \quad \text{'C's share} = \frac{x}{78+x} \times 19950$$

$$\Rightarrow \frac{19950x}{78+x} = 7600 \Rightarrow 1995x = 760 \times 78 + 760x$$

$$\Rightarrow 1995x - 760x = 760 \times 78 \Rightarrow 1235x = 59280$$

$$\Rightarrow x = \frac{59280}{1235} = ₹\ 48 \text{ thousand}$$

15. (a) Ratio of the equivalent capitals of A, B and C for 1 month
$= (20000 \times 6 + 12000 \times 6) : (28000 \times 6 + 20000 \times 6) : (36000 \times 6 + 44000 \times 6)$
$= (120 + 72) : (168 + 120) : (216 + 264)$
$= 192 : 288 : 480 = 2 : 3 : 5$
If the total profit at the end of the year be ₹ x, then

$$C\text{'s share} = \frac{5}{10} \times x = ₹\ \frac{x}{2}$$

$$\therefore \quad \frac{x}{2} = 12550 \Rightarrow x = 2 \times 12550 = ₹\ 25100$$

16. (a) $A : B = 5 : 3 = 10 : 6$
$B : C = 2 : 3 = 6 : 9$
$\therefore \quad A : B : C = 10 : 6 : 9$
Ratio of the equivalent capitals of A, B and C for 1 month
$= 10x \times 12 : 6x \times 12 : 9x \times 6 = 20 : 12 : 9$
Sum of the terms of ratio $= 20 + 12 + 9 = 41$
$\therefore$ Difference between the shares of B and C

$$= \left(\frac{12-9}{41}\right) \times 12300 = ₹\ 900$$

17. (a) Ratio of equivalent capitals of A, B and C for 1 month
$= 1500 \times 8 : (550 \times 8 + 1000 \times 4) : 2400 \times 8$
$= 12000 : (4400 + 4000) : 19200$
$= 120 : 84 : 192 = 30 : 21 : 48$
Sum of the terms of ratio $= 30 + 21 + 48 = 99$
Let the total annual profit be ₹ x
According to the question,

$$x - \frac{21}{99}x = 13000 \Rightarrow \frac{99x - 21x}{99} = 13000$$

$$\Rightarrow 78x = 13000 \times 99 \Rightarrow x = \frac{13000 \times 99}{78} = ₹\ 16500$$

18. (b) Ratio of equivalent capitals of A and B for 1 month
$= 2500 \times 11 : 4500 \times 11 = 5 : 9$
Sum of the terms of ratio $= 5 + 9 = 14$
If total annual profit be ₹ x, then

$$\frac{9x}{14} - \frac{5x}{14} = 4800 \Rightarrow \frac{4x}{14} = 4800$$

$$\Rightarrow 4x = 4800 \times 14$$

$$\Rightarrow x = ₹\left(\frac{4800 \times 14}{4}\right) = ₹\ 16800$$

19. (a) B's investment = ₹ $10x$
C's investment = ₹ $9x$
Ratio of the equivalent capitals of A, B and C for 1 month
$= (12000 \times 6 + 6000 \times 6) : 10x \times 6 : 9x \times 6$
$= (72000 + 36000) : 60x : 54x$
$= 108000 : 60x : 54x = 18000 : 10x : 9x$

$$\therefore \quad A\text{'s share} = \frac{18000}{19x+18000} \times 14000 = 4500$$

$$\Rightarrow 19x + 18000 = 56000$$

$$\Rightarrow 19x = 56000 - 18000 = 38000$$

$$\Rightarrow x = \frac{38000}{19} = 2000$$

$\therefore$ B's investment $= 10 \times 2000 = ₹\ 20000$

20. (b) Let Ninad invest ₹ x
$\therefore$ Vikash's investment = ₹ $2x$
Manav's investment = ₹ $3x$

Ratio of the equivalent capitals for 1 month of Ninad, Vikash and Manav respectively

$= x \times 12 : 2x \times 6 : 4 \times 3x = 1 : 1 : 1$

Clearly, the profit will be shared equally.

$\therefore$ Manav's share $= ₹\left(\frac{1}{3} \times 45000\right) = ₹\ 15000$

21. (d) Ratio of the equivalent capitals of A, B and C for 1 month

$= (16000 \times 6 + 20000 \times 6) : (12000 \times 6) : (18000 \times 6)$

$= (96 + 120) : 72 : 108 = 216 : 72 : 108 = 6 : 2 : 3$

Sum of the terms of ratio $= 6 + 2 + 3 = 11$

If the total annual profit be ₹ x, then

According to the question,

Difference between the shares of A and B = ₹ 6000

$$\Rightarrow \quad \frac{6x}{11} - \frac{2x}{11} = 6000 \quad \Rightarrow \quad \frac{4x}{11} = 6000$$

$$\Rightarrow \quad 4x = 6000 \times 11 \quad \Rightarrow \quad x = \frac{6000 \times 11}{4} = ₹\ 16500$$

22. (d) Ratio of the equivalent capitals of P, Q and R for 1 month

$= 15000 \times 12 : 18000 \times 6 : 10000 \times 8$

$= 15 \times 12 : 18 \times 6 : 10 \times 8 = 45 : 27 : 20$

Sum of the terms of ratio $= 45 + 27 + 20 = 92$

If total annual profit be ₹ x.

then P's share $= \frac{45}{92}x = 4500$

$$\Rightarrow \quad x = \frac{4500 \times 92}{45} = ₹\ 9200$$

23. (d) Ratio of the equivalent capitals of A, B and C for 1 month

$= 18000 \times 12 : 24000 \times 10 : (15000 \times 4 + 18000 \times 4)$

$= 18000 \times 12 : 240000 : (60000 + 72000)$

$= 18000 \times 12 : 240000 : 132000 = 18 : 20 : 11$

Sum of the terms of ratio $= 18 + 20 + 11 = 49$

B's share $= ₹\left(\frac{20}{49} \times 12005\right) = ₹\ 4900$

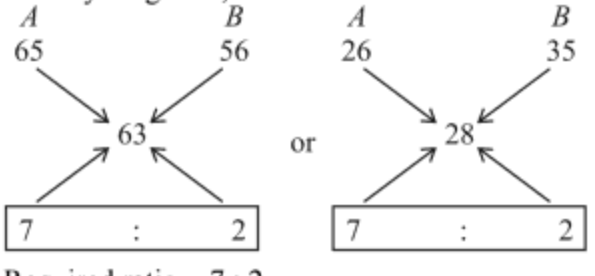
24. (a)

	Acid	:	Water
A	5	:	$2 = 7_{\times 13}$
B	8	:	$5 = 13_{\times 7}$
New	9	:	$4 = 13_{\times 7}$

Make quantities equal

	Acid	:	Water
A	65	:	$26 = 91$
B	56	:	$35 = 91$
New	63	:	$28 = 91$

$\therefore$ By alligation,



Required ratio = 7 : 2

25. (c)

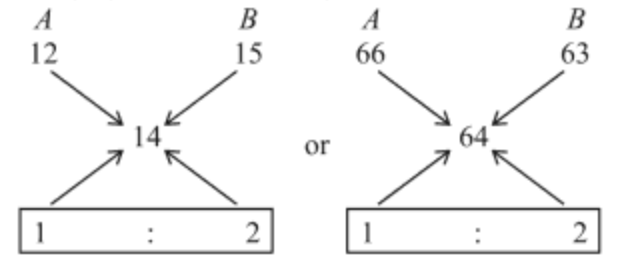
	Chromium	:	Steel
A	2	:	$11 = 13_{\times(2\times3)}$
B	5	:	$21 = 26_{\times 3}$
New mixture	7	:	$32 = 39_{\times 2}$

Make amount equal by taking LCM

$= 13, 26, 39 = 13 \times 2 \times 3$

	Chromium	:	Steel
A	12	:	66
B	15	:	63
New mixture	14	:	64

$\therefore$



Required ratio = 1 : 2

26. (a)

Share of Son	:	Wife	:	Daughter are
S	:	W	:	D
3	:	1	:	
		3	:	1
9	:	3	:	1

Total $\Rightarrow 9x + 3x + x = 13x \Rightarrow$ share of son $= 9x$

Share of daughter $= x$

= Difference between share of son and share of daughter

$$\Rightarrow \quad 9x - x = 8x = 10000$$

$$x = ₹\ 1250$$

$\therefore$ Total property $= 13x = 13 \times 1250 = ₹\ 16250$

27. (b) Total capital of A invested in 1 year

$= 48{,}000 \times 3 + 40{,}000 \times 9$

$= 1{,}44{,}000 + 3{,}60{,}000 = ₹\ 5{,}04{,}000$

Total capital of B invested in 1 year

$= 60{,}000 \times 6 + 66{,}000 \times 6 = ₹\ 7{,}56{,}000$

		A	:	B
Capital	$\rightarrow$	504000	:	756000
Profit	$\rightarrow$	2	:	3
		$\downarrow \times 6000$		$\downarrow \times 6000$
		12,000		18,000

$\therefore$ Total profit $= (2 + 3) \times 6000 = ₹\ 30{,}000$

28. (a)

	M		P		Q
Capital $\longrightarrow$	6500	$\times$	8400	$\times$	10,000
Time $\longrightarrow$	6		5		3
	390	:	420	:	300
Profit $\longrightarrow$	13	:	14	:	10

M's extra share on working partner

$$= 7400 \times \frac{5}{100} = ₹\ 370$$

Remaining Profit = ₹ 7400 – ₹ 370 = ₹ 7030

According to the question,

(13 + 14 + 10) units = ₹ 7030

37 units = ₹ 7030

1 units = ₹ $\frac{7030}{37}$

Profit of Q = 10 units = ₹ $\frac{7030}{37} \times 10$ = ₹1900

29. (b)

		A	:	B	:	C
Capital	→	60000	:	80000	:	120000
Time	→	4	:	9	:	12
Profit	→	240,000	:	720,000	:	1440,000
		1	:	3	:	6

According to the question,

(1 + 3 + 6) units = ₹1,60,480

10 units = ₹1,60,480

1 unit = ₹16,048

Share of A = 16,048 × 1 = ₹ 16,048

Share of B = 16,048 × 3 = ₹ 48,144

Share of C = 16,048 × 6 = ₹ 96,288

30. (d) Let amount invested by A = ₹ x

	A	:	B
Capital →	x	:	$(x + 5000)$

According to the question,

Share of A in profit = $\frac{(26000 - 6000)}{2}$ = ₹10,000

Share of B in profit = (26000 – 10000) = ₹ 16,000

By using formulaes: $\boxed{\frac{C_1 \times T_1}{C_2 T_2} = \frac{P_1}{P_2}}$

$$\frac{x \times 5}{(x+5000) \times 6} = \frac{10,000}{16,000}$$

$4x = 3x + 15000$

x = ₹ 15000

Required capital of A = ₹ 15,000

Required capital of B = (15,000 + 5000) = ₹ 20,000