IPMAT

QUANTITATIVE APTITUDE

For Students Chasing Big Goals, Your IPMAT Story Begins Here

900+ Questions

KEY FEATURES

- Complete Topic Coverage
- Chapterwise PYQs from Past Years
- Based on latest exam pattern.
- Includes 5 sectional tests & 5 full length mock tests

Ideal for IPMAT Indore, Rohtak & JIPMAT

CONTENTS

CHAPTER 4 RATIO, PROPORTION, VARIATION AND PARTNERSHIP

Definition of Ratio

Ratio is the comparison between two quantities in terms of their value.

Ratio of a and b is expressed as $a : b$

$$a : b = \frac{a}{b}$$

Properties of Ratio

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

If two or more ratios are same, then the ratio of sum of all numerators and sum of all denominators is same as the original ratio.

Example 1 Ages of Sashi and Rekha are in the ratio 3 : 4. After 3 years, the new ratio becomes 5 : 6. What is Rekha's present age?

Solution: Let the ages of Sashi & Rekha be $3x$ and $4x$ respectively age

Ratio of ages after 3 years = $\frac{3x+3}{4x+3} = \frac{5}{6}$

$\Rightarrow 6(3x + 3) = 5\,(4x + 3)$

$\Rightarrow 18x + 18 = 20x + 15$

$\Rightarrow x = 3/2$

Present age of Rekha = $\frac{3}{2} \times 4 = 6$ years.

Proportion

When two ratios are equal, the four quantities together are in proportion

of $\frac{a}{b} = \frac{c}{d}$, then a, b, c, d are in proportion.

Here, $a : b :: c : d$

$$\underbrace{a : \underbrace{b :: c}_{\text{means}} : d}_{\text{extremes}}$$

Product of means = Product of extremes

$bc = ad$.

Properties of proportion

A. Componendo: $\frac{a}{b} = \frac{c}{d} \Leftrightarrow \frac{a+b}{b} = \frac{c+d}{d}$

B. Dividendo: $\frac{a}{b} = \frac{c}{d} \Leftrightarrow \frac{a-b}{b} = \frac{c-d}{d}$

Therefore, $\frac{a+b}{a-b} = \frac{c+d}{c-d} \Leftrightarrow \frac{a}{b} = \frac{c}{d}$

C. Mean Proportion of a, c is $b = \sqrt{ac}$

D. Third Proportion of $a : b :: b : c$ is c

Where $c = \frac{b^2}{a}$

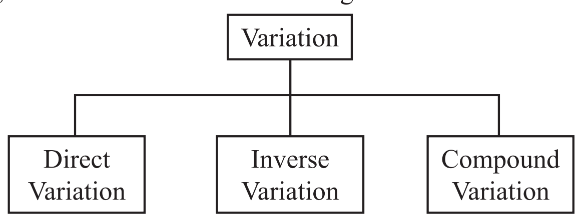
E. Fourth Proportion of $a : b :: c : d$ is d.

Variation

If change is one quantity leads to change in another quantity, then the two quantities are in variation.

If the cost of 10 pens is ₹100 and we increase the number of pens to 20, the total cost will also go up.

It 3 cows are grazing a field and if we increase the number of cows, then the area of field left to be grazed will decrease.



Direct Variation

If one quantity increases, other one also increases.

If one quantity decreases, other one also decreases.

$$x \propto y$$

Here, '$\propto$' 'means 'varies as' or 'proportional to'.

It can be written as $x = ky$, where k is constant.

'k' is also called constant of proportionality.

Hence, $\frac{x}{y} = k$ (constant)

$\Rightarrow \frac{x_1}{y_1} = \frac{x_2}{y_2} = k$

Inverse Variation

If one quantity increases, other one decreases.

If one quantity decreases other one increases.

This is represented as $y \propto \frac{1}{x}$

y is inversely proportional to x.

$\Rightarrow y = \frac{k}{x}$, where k is constant

$\Rightarrow xy = k$ (constant)

$\Rightarrow x_1y_1 = x_2y_2 = k$

Compound Variation

If $x \propto y$ and $x \propto \frac{1}{z}$, then

$x = \frac{ky}{z}$, where k is constant.

Example 2 Vineeta takes 7 hours to complete a task. How much time will she take to complete two such tasks?

Solution:

Number of task $\propto$ Number of hours taken

Let the number of hours taken be x.

$$\frac{x_1}{y_1} = \frac{x_2}{y_2}$$

$$\Rightarrow \frac{1}{7} = \frac{2}{y_2}$$

$\Rightarrow y_2 = 14$ hours.

Hence, the time taken is 14 hours.

Example 3 25 machines produce 5 tires in 12 hours. How many tires will 10 machines produce in 18 hours?

Solution:

Here, the number of tires produced depends on number of machines and number of hours.

When the number of tire increases, the number of hours and machines also increases.

No. of tires $\propto$ (no. of hours) (no. of machines)

$t = k.hm$

$$\Rightarrow 5 = k \times 12 \times 25 \Rightarrow k = \frac{5}{12 \times 25} = \frac{1}{60}$$

When machines are 10 and hours are 18,

$$t = \frac{1}{60} \times 18 \times 10 = 3$$

$\Rightarrow$ Number of tires produced = 3

Example 4 Density of a liquid is directly proportional to its mass and inversely proportional to its volume.

Two liquids of same density have their masses in the ratio of 10 : 11. Find the ratio of their volumes.

Solution: Density $\propto$ mass

$$\text{Density} \propto \frac{1}{\text{volume}}$$

$$\Rightarrow \text{Density} = k \times \frac{\text{mass}}{\text{volume}}$$

Let the mass of two liquids be m_1 and m_2 and their respective volumes be v_1 and v_2

$$\Rightarrow k\frac{m_1}{v_1} = k\frac{m_2}{v_2}$$

$$\Rightarrow \frac{m_1}{m_2} = \frac{v_1}{v_2} = \frac{10}{11}$$

$$\Rightarrow \frac{v_1}{v_2} = \frac{10}{11}$$

Hence, the ratio of their volumes is 10 : 11.

Partnership

When two or more persons invest an amount in a business, they work in partnership. They share profit and losses as per the time period of investment and amount invested.

Time period of Investment	Capital Invested	Profit share
Same for each partner	All partners invest different amounts	Ratio of capital invested
Different for each partner	All partners invest same amounts	Ratio of time periods
Different for each partner	All partners invest different amounts	Ratio of product of investment and time period.

Example 5 Aishwarya started a business with ₹20000. After 3 months, Varsha joined her with ₹50000. After some time, Ravi joined them with ₹100000. Varsha received ₹18000 out of the total annual profit of ₹60000. Approximate how many months after Aishwarya started the business did Ravi join?

Solution:

Let Ravi joined x months after Aishwarya.

Capital Invested by	Time period
Aishwarya – 20000	12 months
Varsha – 50000	9 months
Ravi – 100000	$(12 - x)$ months

Ratio of Profits $\rightarrow$ Aishwarya : Varsha : Ravi

$20000 \times 12 : 50000 \times 9 : 100000 \times (12 - x)$

Varsha's share of profit = ₹18000

$$\Rightarrow \frac{50000 \times 9}{(20000 \times 12) + (50000 \times 9) + (100000 \times (12 - x))} = \frac{18000}{60000}$$

$$\Rightarrow \frac{450000}{690000 + 1200000 - 100000x} = \frac{18}{60}$$

$$\Rightarrow \frac{450000}{1890000 - 100000x} = \frac{18}{60}$$

$$\Rightarrow \frac{45}{189 - 10x} = \frac{18}{60}$$

$$\Rightarrow 189 - 10x = \frac{45 \times 60}{18} = 150$$

$\Rightarrow 10x = 189 - 150 = 39$

$x = 3.9$

Hence, Ravi joined after 4 months (approximately).

CONCEPT CRAFTER EXERCISE

1. The ratio of marks scored by Ram and Shyam is in the ratio 3:4 and the ratio of marks scored by Shyam and Tom is in the ratio 5:7. If sum of their scores is 1260, find the score of Tom.

(*a*) 400 (*b*) 500
(*c*) 560 (*d*) 600

Sol. The score of Ram and Shyam = 3 : 4 …(1)

The score of Shyam and Tom = 5 : 7 …(2)

We can see that Shyam's score is common in both ratios. This means we need to make Shyam's score the same in both ratios so we can compare Ram, Shyam, and Tom together.

To bring Shyam's score to a common point in both ratios, we need to multiply the ratios by a number that makes Shyam's score the same.

Multiply (1) with 5 and multiply (2) with 4, we get:

The score of Ram and Shyam = 15 : 20

The score of Shyam and Tom = 20 : 28

Since we have brought Shyam's score to a common point, the ratio of their scores is 15 : 20 : 28.

Let the scores be $15x$, $20x$, and $28x$.

$15x + 20x + 28x = 1260$

$63x = 1260$

$x = 20$

Therefore the score of Tom is $28x = 28(20) = 560$

2. If $(3p + 2q) : (3p - 2q) = 2 : 1$, then find the value of $(p + q) : (p - q)$.

(*a*) 6 : 1 (*b*) 5 : 1
(*c*) 4 : 1 (*d*) 3 : 1

Sol. Given that, $(3p + 2q) : (3p - 2q) = 2 : 1$

i.e., $\frac{3p+2q}{3p-2q} = \frac{2}{1}$

Using Componendo and Dividendo, we get

$$\frac{3p+2q+3p-2q}{3p+2q-3p+2q} = \frac{2+1}{2-1}$$

$$\frac{6p}{4q} = \frac{3}{1}$$

$$\frac{p}{q} = \frac{2}{1}$$

Again, using Componendo and Dividendo, we get

$$\frac{p+q}{p-q} = \frac{2+1}{2-1} = \frac{3}{1}$$

i.e., $(p + q) : (p - q) = 3 : 1$

3. What number must be added to each of the following numbers so that the resulting numbers become in continued proportion? 5, 9, 17

(*a*) 1 (*b*) 2
(*c*) – 1 (*d*) – 2

Sol. Let the number be x.

Then, according to the definition of continued proportion, we get

$$\frac{5+x}{9+x} = \frac{9+x}{17+x}$$

$85 + x^2 + 22x = 81 + x^2 + 18x$

$4x = -4$

$x = -1$

So, – 1 is to be added to get the given numbers in a continued proportion such that:

4 : 8 : : 8 : 16.

4. If $x : (y + z) = 1 : 4$ and $z : (x + y) = 4 : 11$, then find the value of $y : (x + z)$.

(*a*) 8 : 7 (*b*) 8 : 5
(*c*) 7 : 5 (*d*) 7 : 8

Sol. Given that,

$x : (y + z) = 1 : 4$ ...(*i*)

So, from (*i*), we get, $x + y + z = 1 + 4$

i.e., $x + y + z = 5$

$z : (x + y) = 4 : 11$ ...(ii)

From (*ii*), we get, $x + y + z = 4 + 11$

i.e., $x + y + z = 15$

Since, everywhere the value of $(x + y + z)$ must be the same, so let's multiply the equation (i) by 3 and (ii) by 1, then write the revised ratios:

$x : (y + z) = (1 : 4) \times 3$

i.e., $x : (y + z) = 3 : 12$ ...(iii)

and $z : (x + y) = 4 : 11$ ...(ii)

Therefore, $x = 3$ units, $z = 4$ units. Now, $y + z = 12$ units

So, $y = 12 - z = 12 - 4 = 8$ units

Hence, $y : (x + z) = 8 : (3 + 4) = 8 : 7$

5. Sixteen years ago, the ratio of age of Shankar and Bhola was 1 : 2. Ratio of their present age is 13 : 18. What is the present age of Mahadev (in years) if Shankar is 7 years older than Mahadev?

(*a*) 17 (*b*) 33
(*c*) 19 (*d*) 29

Sol. Given that, 16 years ago, the age ratio was, Shankar : Bhola = 1 : 2

The present age ratio, Shankar : Bhola = 13 : 18

Currently, the difference between the age ratio of Shankar and Bhola 16 years ago is not equal to the difference between the age ratio of Shankar and Bhola in the present.

So, let's make them equal. Thus, the revised ratios are:

16 years ago, age ratio, Shankar : Bhola = (1 : 2) × 5 = 5 : 10

At present, the age ratio, Shankar : Bhola = 13 : 18

Therefore, 13 – 5 = 18 – 10 = 8 units = 16 years (Given)

1 unit = 2 years

So, at present, the age of Shankar = 13 × 2 = 26 years

Thus, the present age of Mahadev = 26 – 7 = 19 years

6. In a bag, there are 2 rupee coins, 20 paise coins, and 25 paise coins. Combining all the coins, Suman has a total of 1449 rupees in his bag. If the coins are in the ratio of 3 : 4 : 5, respectively, how many 20 paise coins are there in the bag?

Sol. The total amount of money in the bag is 1449 INR.

The coins are in the ratio of 3:4:5, which means that for every 3 units of 2-rupee coins, there are 4 units of 20-paise coins and 5 units of 25-paise coins.

Let's assume the number of 2-rupee coins is $3x$, the number of 20-paise coins is $4x$, and the number of 25-paise coins is $5x$.

- Value of 2-rupee coins: $3x \times 2 = 6x$
- Value of 20-paise coins: $4x \times 0.20 = 0.80x$
- Value of 25-paise coins: $5x \times 0.25 = 1.25x$

The total value of the coins is the sum of the values of each type of coin:

$6x + 0.80x + 1.25x = 1449$

$8.05x = 1449$

$x = 180$

Number of 20-paise coins = $4x = 4 \times 180 = 720$

Alternatively,

2 rupee coins : 20 paise coins : 25 paise coins

Number ratio = 3 : 4 : 5

Value ratio (in ₹) = $(3 \times 2) = 6 : \frac{20}{100}\times 4 = \frac{4}{5} : \frac{25}{100}\times 5 = \frac{5}{4}$

[Since, 20 paise = $\frac{20}{100}$ rupee, and 25 paise = $\frac{25}{100}$ rupee]

$= 6 : \frac{4}{5} : \frac{5}{4}$

So, total amount of money Suman has = $\left(6+\frac{4}{5}+\frac{5}{4}\right) = \frac{161}{20}$ units = 1449 Rupees

i.e., 1 unit = $1449\times\frac{20}{161}$ = 180 Rupees

So, 4 units = (180 × 4) = 720

Thus, number of 20-paise coins = 720

7. Koutilya, Chanakya and Vishnugupta started a business by investing ₹140000, ₹125000, and ₹160000 respectively for 1 year. Find the share (in ₹) of Chanakya out of an annual profit of ₹59500.

(*a*) 17500 (*b*) 19600

(*c*) 22400 (*d*) 24500

Sol. The investment ratio, Koutilya : Chanakya : Vishnugupta

= 140000 : 125000 : 160000

= 140 : 125 : 160

= 28 : 25 : 32

So, the share of Chanakya from the total profit of ₹59500

$= 59500\times\frac{25}{28+25+32} = 59500\times\frac{25}{85} = 59500\times\frac{5}{17}$

= 3500 × 5 = ₹ 17,500

8. Chandra, Ashoka and Bindusara entered into a partnership at the start of the year. Chandra invests 4 times as much as Ashoka invests and Ashoka invests three-fourths of what Bindusara invests. At the end of the year, the profit earned is ₹11400. What is the share (in ₹) of Bindusara?

(*a*) 1800 (*b*) 2400

(*c*) 4200 (*d*) 7200

Sol. Let the capital of Bindusara = ₹x

Then, the capital of Ashoka = $\frac{3x}{4}$

Also, the capital of Chandra = ₹$3x$

Thus, the ratio of their capitals, Chandra : Ashoka : Bindusara = $3x : \frac{3x}{4} : x$ = 12 : 3 : 4

So, the share of Bindusara

$= 11400\times\frac{4}{12+3+4} = 11400\times\frac{4}{19} =$ ₹ 2400

9. Three friends started a placement business with a capital of ₹7600. Bihu invests ₹500 less than Anu, and Chanu invests ₹400 less than Bihu. What is the share of Anu (in ₹) in a profit of ₹912?

Sol. Let the capital invested by Anu = ₹x

Then the capital invested by Bihu = ₹$(x – 500)$

and the capital invested by Chanu = ₹$(x – 500 – 400)$

= ₹$(x – 900)$

Thus, we have

$x + (x – 500) + (x – 900) = 7600$

$3x – 1400 = 7600$

$3x = 9000$

$x = 3000$

So, the ratio of capital, Bihu : Anu : Chanu

= (3000 – 500) : 3000 : (3000 – 900) = 2500 : 3000 : 2100 = 25 : 30 : 21

Thus, the share of Anu

$= 912\times\frac{30}{25+30+21} = 912\times\frac{30}{76} =$ ₹360

10. A varies directly to B when C is constant and directly to the square of C when B is constant. When B = 1 and C = 3, A = 108. What will be the positive integral value of C when A = 4056 and B = 2 ?

(*a*) 11 (*b*) 12

(*c*) 13 (*d*) 14

Sol. Topic - Ratio, Proportion and Variation

$A \propto B$, when C is constant

$A \propto C^2$, when B is constant

By concept of Joint variation,

$A \propto BC^2$

Thus, $A = k. BC^2$

By the conditions given in the question

$108 = k \times 1 \times 3^2$

So, $k = 12$

So now putting the values given

$4056 = 12 \times 2 \times C^2$,

$C^2 = 169$,

or, $C = 13$

PRACTICE EXERCISE

1. The price of a stone is directly proportional to the square of its weight. The stone broke down into three pieces with weights in the ratio of 2:3:4. If the value of the stone decreased by 1352 rupees, find the original price of the stone.

(*a*) 2106 (*b*) 2268

(*c*) 1944 (*d*) 1782

2. The number of apples and mangoes in the first basket is 4:5, while the number of apples and mangoes in the second basket is 1:2. If the number of fruits in the second basket is four times that of the first basket, find the ratio of apples in the first basket to the second basket.

(*a*) 1:2 (*b*) 1:3

(*c*) 1:4 (*d*) 3:4

3. If $\frac{a}{6} = \frac{b}{8} = \frac{3c}{4} = \frac{5d}{12}$, find the value of $\frac{c+5d}{2a+b}$.

(*a*) $\frac{2}{3}$ (*b*) $\frac{3}{2}$

(*c*) $\frac{4}{3}$ (*d*) $\frac{3}{4}$

4. The ratio of men to women in an office is 4:3. If the number of skilled men to unskilled women is 2:3, and the skilled people make up $\frac{2}{5}^{th}$ of the strength of the total office, find the ratio of skilled men to unskilled men.

(*a*) 1:4 (*b*) 2:3

(*c*) 3:7 (*d*) 1:9

5. If $(a + b) : (b + c) : (c + a) = 4 : 6 : 5$ and $a + b + c = 30$.

Consider the following statements:

i. $a > b$ ii. $c - b = 4$

iii. $c - b = c - a$

Which of the following is/are true?

(*a*) Only i (*b*) Only ii

(*c*) i., ii. and iii (*d*) Neither i. nor ii

6. The sum of the present age of Chandan and his wife is 60 years. After 4 years this ratio will be 9 : 8. When they were married, the sum of their ages was 50 years, then find the ratio of their ages at the time of their marriage.

(*a*) 7 : 6 (*b*) 27 : 23

(*c*) 9 : 8 (*d*) None of these

7. Three numbers a, b and c are in continued proportion. If 3 is subtracted from each number, the ratio of these numbers is 3 : 5 : 8. Find the value of $(a + b + c)$?

(*a*) 57 (*b*) 40

(*c*) 60 (*d*) 20

8. If the ratio of the population of town Timbuktoo to that of Gimbuktoo is 7:9. Total male population of Timbuktoo is equal to female population of Gimbuktoo and the ratio of the female population of Timbuktoo to the male population of Gimbuktoo be 2 : 3, then what is the ratio of the male population of Timbuktoo to the male population of Gimbuktoo?

(*a*) 1:3 (*b*) 1:2

(*c*) 1:4 (*d*) Cannot be determined

9. In an election with only two parties A and B, the ratio of number votes to A and B is in the ratio 4:5. The number of males to females who voted is 2:1. Two-thirds of the females voted for B. If one-fourth of the total votes of A and one-sixth the males votes of B were deemed invalid, B won the election by 18,000 votes. Find the number of women who voted for party A.

(*a*) 12,000 (*b*) 18,000

(*c*) 8,000 (*d*) 6,000

10. The profit earned by a taxi is directly proportional to the number of passengers over a certain minimum number and the distance traveled by the taxi. When 45 passengers travel for 42 kilometers, the taxi makes a profit of 3080 rupees. When 60 passengers travelled for 20 kilometers, the profit is 3300 rupees. Find the minimum number of passengers such that the taxi does not make any loss.

(*a*) 33 (*b*) 34

(*c*) 36 (*d*) 39

11. Anu, Vinu and Punit started a business with initial investment Rs. 8000, Rs. 12000 and Rs. 10000, respectively and after 1 year, Anu and Punit again invested Rs. 2000 each, then what is the ratio of share of profit of Anu, Vinu and Punit after two years?

(*a*) 9: 12: 7 (*b*) 9: 10: 11

(*c*) 9: 12: 11 (*d*) 8:12:11

12. Aleksandar and Binny started a business in partnership investing Rs. 24000 and Rs. 16000 respectively. After six months, Charli joined them with Rs. 20000. What will be Binny's share (in Rs.) in the total profit of Rs. 32,890 earned at the end of 2 years from the starting of the business?

(*a*) 5986 (*b*) 6895
(*c*) 8695 (*d*) 9568

13. An expensive gem worth Rs. 10368 fell and broke into three pieces, the weights of which are proportional to 1: 2: 3. The value of each gem is directly proportional to the square of its weight. Determine the loss occurred due to the breaking.

(*a*) Rs. 3624 (*b*) Rs. 4228
(*c*) Rs. 6336 (*d*) Rs. 7510

14. A drone has a standard speed of 50 km/h. The increase in its speed above the standard is directly proportional to the square root of its horsepower and inversely proportional to the square of the weight it carries. When equipped with a 560-horsepower engine, the drone reached a speed of 86 km/h. However, when the engine was replaced with a 35-horsepower engine and the weight carried was reduced by 3 kg, the speed dropped to 66 km/h. What was the weight the drone was carrying when its speed was 86 km/h (In kg)?

(*a*) 18 (*b*) 15
(*c*) 12 (*d*) 9

15. A starts business with \$2000 and after 6 months, B joins with A as his partner. C joined in sometime before the end of the year and invested \$6000. After a year, the profit divided in the 4 : 5 : 3 among A, B & C respectively. Had B invested his amount for the same period of time as C what would have been his profit share out of a total profit of \$1900?

(*a*) \$ 400 (*b*) \$ 500
(*c*) \$ 600 (*d*) \$ 450

ANSWERS

1. (*a*)	**2.** (*b*)	**3.** (*a*)	**4.** (*d*)	**5.** (*b*)
6. (*b*)	**7.** (*a*)	**8.** (*b*)	**9.** (*a*)	**10.** (*a*)
11. (*c*)	**12.** (*d*)	**13.** (*c*)	**14.** (*c*)	**15.** (*b*)

EXPLANATION

1. (*a*) Given that the price of a stone is directly proportional to the square of the weight,

price = k (weight)^2, where k is a constant.

Let the total weight of the stone be $9x$. After breaking down, the weights of the stone are $2x$, $3x$, $4x$.

Original price = $k(9x)^2$

New price = $k(2x)^2 + k(3x)^2 + k(4x)^2$

The stone's value decreased by 1352 rupees,

New price = Original price-1352

$k(2x)^2 + k(3x)^2 + k(4x)^2 = k(9x)^2 - 1352$

$29kx^2 = 81kx^2 - 1352 \Rightarrow 52kx^2 = 1352$

$kx^2 = 26$

Therefore the original price of the stone is $81kx^2 = 81(26) = 2{,}106$

2. (*b*) Let the number of apples and mangoes in the first basket be $4x$ and $5x$.

Let the number of apples and mangoes in the second basket be y and $2y$.

If the number of fruits in the second basket is four times that of the first basket,

$(y + 2y) = 4(4x + 5x)$

$3y = 4(9x)$

$y = 12x$.

The ratio of apples in the first to second baskets is $4x : y = 4x : 12x = 1 : 3$.

3. (*a*) Let us say that all these values are equal to k, i.e

$\frac{a}{6} = \frac{b}{8} = \frac{3c}{4} = \frac{5d}{12} = k$, then

$a = 6k$, $b = 8k$, $c = \frac{4}{3}k$, and $d = \frac{12}{5}k$

$a : b : c : d = 6k : 8k : \frac{4}{3}k : \frac{12}{5}k$

Multiply the ratio with 15(LCM of the terms in the denominator), we get:

$6k(15) : 8k(15) : \frac{4}{3}k(15) : \frac{12}{5}(15)$

$a : b : c : d = 90k : 120k : 20k : 36k$

$$\frac{c+5d}{2a+b} = \frac{20k+5(36k)}{2(90)k+120k} = \frac{200k}{300k} = \frac{2}{3}$$

4. (*d*) Let the number of men and women in the office be $4x$ and $3x$ respectively.

Let the number of skilled men be $2y$, then the number of unskilled women is $3y$.

Therefore the number of unskilled men = $4x - 2y$ and the number of skilled women = $3x - 3y$

	Total	Skilled	Unskilled
Men	$4x$	$2y$	$4x - 2y$
Women	$3x$	$3x - 3y$	$3y$

The total number of skilled people = $2y + 3x - 3y = 3x - y$

Since skilled people make up two-fifth of the total office,

$$\frac{3x-y}{7x} = \frac{2}{5}$$

$15x - 5y = 14x$

$x = 5y$.

The ratio of number of skilled to unskilled women

$$= \frac{2y}{4x-2y} = \frac{2y}{4(5y)-2y} = \frac{2y}{18y} = \frac{1}{9}$$

5. (*b*) We have:

$(a + b) : (b + c) : (c + a) = 4k : 6k : 5k$

$\Rightarrow a + b + b + c + c + a = 4k + 6k + 5k$

$\Rightarrow a + b + c = \frac{15k}{2}$ ...(i)

Given: $a + b + c = 30$ ... (ii)

Equating equations (i) and (ii), we get:

$\frac{15k}{2} = 30$

$\Rightarrow k = 4$

$\therefore a = 30 - (b + c) = 30 - 24 = 6$

$c = 30 - (a + b) = 30 - 16 = 14$ and

$b = 30 - (a + c) = 30 - 20 = 10$

i. $a > b \Rightarrow 6 > 10$, false.

ii. $c - b = 4 \Rightarrow 14 - 10 = 4$, true.

iii. $c - b = c - a$

$\Rightarrow c - a = 14 - 6 = 8$, false.

6. (*b*) Let x, y be the present age of Chandan and his wife.

According to the question:

$x + y = 60$ ...(i)

$\frac{x+4}{y+4} = \frac{9}{8}$

$\Rightarrow 8x + 32 = 9y + 36$

$\Rightarrow 8x - 9y = 4$ ...(ii)

Solving equations (i) and (ii), we get:

$x = 32$ and $y = 28$

$\therefore$ The present age of Chandan = 32 years and the present age of his wife = 28 years

Suppose they have married m years ago.

$(32 - m) + (28 - m) = 50$

$\Rightarrow 2m = 10$

$\Rightarrow m = 5$

Required age ratio at the time of marriage

$\frac{32-5}{28-5} = \frac{27}{23} = 27 : 23$

7. (*a*) *a*, *b* and *c* are in proportion.

$\frac{a}{b} = \frac{b}{c}$

or, $b^2 = ac$ ...(i)

3 is subtracted from each number, then the ratio is 3 : 5 : 8.

$(a - 3) : (b - 3) : (c - 3) = 3 : 5 : 8$

$a - 3 = 3k$ or, $a = 3k + 3$

$b - 3 = 5k$ or, $b = 5k + 3$

$c - 3 = 8k$ or, $c = 8k + 3$

Put *a*, *b* and *c* in equation (1)

$(5k + 3)^2 = (3k + 3)(8k + 3)$

$25k^2 + 30k + 9 = 24k^2 + 33k + 9$

$k^2 - 3k = 0$

$k(k - 3) = 0$

Either $k = 0$ or 3 [but k cannot be 0]

So, $k = 3$

$a = 3 \times 3 + 3 = 12$

$b = 5 \times 3 + 3 = 18$

$c = 8 \times 3 + 3 = 27$

The sum of $a + b + c$ is $12 + 18 + 27 = 57$.

8. (*b*) Let male population of Timbuktoo be m_1 and male population of Gimbuktoo be m_2.

Let the female population of Timbuktoo be f_1 and female population of Gimbuktoo be f_2.

So, $(m_1 + f_1): (m_2 + f_2) = 7:9$

$m_1 = f_2$

$f_1 : m_2 = 2:3$

$\Rightarrow 3f_1 = 2m_2$

So $(m_1 + \frac{2}{3} m_2): (m_2 + m_1) = 7:9$

$9m_1 + 6m_2 = 7m_2 + 7m_1$

$m_1 : m_2 = 1 : 2$

9. (*a*) Let the total number of people in the election be 36x.

Since votes of A and B are in the ratio 4 : 5, $4y + 5y = 36x$

$y = 4x$

Votes for $A = 16x$ and votes for $B = 20x$.

The number of males to females who voted were in the ratio 2 :1,

So,

number of males = $24x$ and the number of females = $12x$

two-thirds of the women voted for B, i.e $\frac{2}{3}(12x) = 8x$

The number of men who voted for $B = 20x - 8x = 12x$

The number of women who voted for $A = 12x - 8x = 4x$.

The number of men who voted for $A = 16x - 4x = 12x$

	A	B
Total	$16x$	$20x$
Males	$12x$	$12x$
Females	$4x$	$8x$

One fourth of the total votes of A were deemed invalid, therefore the valid votes of $A = \frac{3}{4}(16x) = 12x$

One-sixth of the male votes were deemed invalid for B, therefore total valid votes of $B = \frac{5}{6}(12x) + 8x = 18x$

B won by a margin of 18,000 votes, so

$18x - 12x = 18{,}000$

$6x = 18{,}000$

$x = 3{,}000$

Therefore the number of females who voted for

$A = 4x = 4(3{,}000) = 12{,}000$

10. (*a*) Let the minimum required number of passengers be n.

Above n, the number of people is directly proportional to the profit.

The profit is also directly proportional to the kilometers it travelled, therefore

Profit $\propto$ (passengers above n)(kilometers)

Profit = k (passengers above n)(kilometers)

When 45 passengers travel for 42 kilometers,

$3080 = k(45 - n)(42)$ ...(1)

When 60 passengers traveled for 20 kilometers,

$3300 = k(60 - n)(20)$ .... (2)

Divide equation (1) by equation (2)

$$\frac{3080}{3300} = \frac{k(45-n)(42)}{k(60-n)(20)}$$

$$\frac{14}{15} = \frac{(45-n)42}{(60-n)20}$$

$$\frac{1}{3} = \frac{(45-n)(3)}{(60-n)(4)}$$

$4(60 - n) = 9(45 - n)$

$240 - 4n = 405 - 9n$

$5n = 165$

$n = 33$

So when 33 people take the taxi, it does not make a loss

11. (*c*) Ratio of profit of Anu, Vinu and Punit

$= (8000 \times 1 + 10000 \times 1) : (12000 \times 2) : (10000 \times 1 + 12000 \times 1)$

$= 9 : 12 : 11$

12. (*d*) Here we are given the investment of Aleksandar as Rs. 24000, investment of Binny as Rs. 16000, and investment of Charli as Rs.20000.

Now since Aleksandar and Binny started the business so they invested for the full 2 years. 1 year has 12 months.

So, 2 years = 24 months.

Therefore, Aleksandar and Binny invested for 24 months.

Investment of Aleksandar becomes $\Rightarrow$ Rs. 24000 × 24

= Rs.5,76,000

Similarly, investment of Binny becomes $\Rightarrow$ Rs.16000 × 24

= Rs. 3,84,000

Now, Charli joined them later after 6 months so his investment will be for (24 – 6) months i.e., 18 months

So, investment of Charli becomes

$\Rightarrow$ Rs. 20000 × 18 = Rs. 3,60,000

Now let us calculate the ratio of their shares in investment for the company, we have the ratio as

Aleksandar: Binny: Charli = 5,76,000 : 3,84,000 : 3,60,000

Dividing all the ratios by common ratio 24000 we get,

Aleksandar : Binny : Charli = 24 : 16 : 15.

Total ratio is equal to 24 + 16 + 15 = 55.

So, Binny's Share = $\frac{16}{55}$ × Rs. 32,890 = Rs. 9568.

13. (*c*) Given, $V \propto w^2$;

$V = kw^2$

Let the weights be x, $2x$ and $3x$ and the respective values be V_1, V_2 and V_3.

Total weight = $6x$ and Total Value = V

$V = k(36x^2) = 10368$

or, $kx^2 = 288$

$V_1 = kx^2$;

$V_2 = k(4x^2)$;

$V_3 = k(9x^2)$

Therefore,

$V_1 + V_2 + V_3 = 14kx^2$ and

$V = k(36x^2)$

Loss = $36kx^2 - 14kx^2 = 22kx^2 = 22 \times 288 = 6336$.

14. (*c*) Increase in speed $\alpha \sqrt{horse\ power}$ and increase in speed

$$\alpha \frac{1}{(weight)^2}$$

Therefore increase in speed = $k\left(\frac{\sqrt{\text{horse power}}}{(\text{weight})^2}\right)$

Let the weight being carried by the drone during 86 km/hr be w kg, then the weight carried during 66 km/hr would be w – 3.

Case (1): when the speed was 86 km/hr:

Increase in speed = 86 – 50 = 36

$$36 = k\left(\frac{\sqrt{560}}{(w)^2}\right) \quad ...(1)$$

Case (2): when the speed was 66 km/hr:

Increase in speed = 66 – 50 = 16

$$16 = k\left(\frac{\sqrt{35}}{(w-3)^2}\right) \quad ...(2)$$

From (1) and (2),

$$\frac{36}{16} = \frac{k\left(\frac{\sqrt{560}}{w^2}\right)}{k\left(\frac{\sqrt{35}}{(w-3)^2}\right)}$$

$$\frac{9}{4} = \frac{(w-3)^2}{w^2}\left(\sqrt{16}\right)\frac{9}{16} = \frac{(w-3)^2}{w^2}$$

Applying square root on both sides,

$$\frac{3}{4} = \frac{w-3}{w}$$

$3w = 4w - 12$

$w = 12$

Therefore the weight being carried when the speed was 86 km/hr is 12 kgs

15. (*b*) A's total investment is $2000 × 12 = $24000

Let us assume the B invested a capital of $*x*.

Also let us assume that C invested for a period of t months.

So,

$24000 : 6x : 6000t = 4 : 5 : 3$

$\Rightarrow \frac{24000}{6x} = \frac{4}{5}$

$\Rightarrow \frac{4000}{x} = \frac{4}{5}$

$\Rightarrow x = 5000$

Hence, B invested $5000.

Also,

$\frac{24000}{6000t} = \frac{4}{3}$

$\Rightarrow t = 3$

Hence, C invested for 3 months.

Had B invested the same amount for 3 months instead of 6 months, the ratio of A, B & C's share will be 4 : 2.5 : 3

= 8 : 5 : 6

So, B would have gotten $\frac{5}{8+5+6} = \frac{5}{19}$ of the profit.

So, B would have gotten $5 \times \frac{\$1900}{19} = \$500$ of the profit.

CHAPTER BASED PYQ

1. Three friends divided some apples in the ratio 3:5:7 among themselves. After consuming 16 apples they found that the remaining number of apples with them was equal to largest number of apples received by one of them at the beginning. Total number of apples these friends initially had was ____.

2. An alloy P has copper and zinc in the proportion of 5:2 (by weight), while another alloy *Q* has the same metals in the proportion of 3:4 (by weight). If these two alloys are mixed in the proportion of *a*:*b* (by weight), a new alloy *R* is formed, which has equal contents of copper and zinc. Then, the proportion of copper and zinc in the alloy *S*, formed by mixing the two alloys *P* and in the proportion of *b*:*a* (by weight) is

(*a*) 7:9 (*b*) 9:7

(*c*) 9:5 (*d*) 5:9

3. Ashok started a business with a certain investment. After few months, Bharat joined him investing half amount of Ashok's initial investment. At the end of the first year, the total profit was divided between them in ratio 3:1. Bharat joined Ashok after

(*a*) 2 months (*b*) 3 months

(*c*) 4 months (*d*) 6 months

4. A fruit seller has oranges, apples and bananas in the ratio 3:6:7. If the number of oranges is a multiple of both 5 and 6, then the minimum number of fruits the seller has is

5. Let *a*, *b*, *c*, *d* be positive integers such that $a + b + c + d = 2023$ If $a : b = 2:5$ and $c : d = 5:2$ then the maximum possible value of $a + c$ is _________.

6. If $\frac{a+b}{b+c} = \frac{c+d}{d+a}$, is always true? which of the following statements

(*a*) $a = c$ (*b*) $a = c$ and $b = d$

(*c*) $a + b + c + d = 0$ (*d*) $a = c$ or $a + b + c + d = 0$

7. The cost of a piece of jewellery is proportional to the square of its weight. A piece of jewellery weighing 10 grams is INR 3600. The cost of a piece of jewellery of the same kind weighing 4 grams is

(*a*) INR 576 (*b*) INR 1220

(*c*) INR 1440 (*d*) INR 600

ANSWERS

1. [30] **2.** (*c*) **3.** (*c*) **4.** [160] **5.** [1442]
6. (*d*) **7.** (*a*)

EXPLANATION

1. [30] Let the total number of apples initially be *x*.

Since they divided the apples in the ratio 3:5:7,

we express their shares as:

$\frac{3}{3+5+7} \times x \Rightarrow \frac{3}{15}x \Rightarrow \frac{x}{5}$

$\frac{5}{15}x \Rightarrow \frac{x}{3}$

$\frac{7}{15}x \Rightarrow \frac{7x}{15}$

So, the three friends initially had $\frac{x}{5}, \frac{x}{3}, \frac{7x}{15}$

After consuming 16 apples, the remaining apples equal the largest initial share.

$x - 16 = \frac{7x}{15}$

Solving for x

$$x - \frac{7x}{15} = 16$$

$$x\left(1 - \frac{7}{15}\right) = 16$$

$$x \times \frac{8}{15} = 16$$

$x = 30$

2. (c) We are given two alloys, P and Q, with different compositions of copper (Cu) and zinc (Zn) by

weight:

Alloy *P*: Cu:Zn = $\frac{5}{2}$

Copper fraction $= \frac{5}{7}$, Zinc fraction $= \frac{2}{7}$

Alloy *Q*: Cu:Zn = $\frac{3}{4}$

→ Copper fraction $= \frac{3}{7}$, Zinc fraction $= \frac{4}{7}$

A new alloy R is formed by mixing P and Q in the ratio a:b, where R has equal contents of copper and zinc.

Express Copper and Zinc in Terms of a and b

The total copper content in $R: \frac{5}{7}a + \frac{3}{7}b$

The total zinc content in $R: \frac{2}{7}a + \frac{4}{7}b$

Since R has equal amounts of copper and zinc, we set them equal:

$$\frac{5}{7}a + \frac{3}{7}b = \frac{2}{7}a + \frac{4}{7}b$$

Solving,

$5a + 3b = 2a + 4b$

$3a = b$

Find the Composition of Alloy S

Now, we mix P and Q in the ratio b : a (which is $3a$: a or 3:1) to form alloy S.

The copper content in S:

$$\frac{5}{7} \times 3 + \frac{3}{7} \times 1 \Rightarrow \frac{18}{7}$$

The zinc content in S: $\frac{2}{7} \times 3 + \frac{4}{7} \times 1 \Rightarrow \frac{10}{7}$

So, the proportion of Cu : Zn in alloy S is: $\frac{\frac{18}{7}}{\frac{10}{7}} \Rightarrow \frac{18}{10} \Rightarrow \frac{9}{5}$

The proportion of copper to zinc in alloy S is $\frac{9}{5}$.

3. (c) Let Ashok's initial investment be ₹A.

Since Bharat invested half of Ashok's investment, his investment = ₹$A/2$.

Ashok remained in the business for the entire year, i.e., 12 months.

Let Bharat have joined after x months.

So, Bharat worked for $(12 - x)$ months.

Profit-sharing is done based on the product of investment time.

- Ashok's share = ₹ $A \times 12 = 12A$
- Bharat's share = ₹$\left(\frac{A}{2}\right) \times (12 - x)$

Now, we are given that the profit is divided in the ratio:

$$\frac{\text{Ashok's share}}{\text{Bharat's share}} = \frac{3}{1}$$

Substitute the values:

$$\frac{12A}{\frac{A}{2}(12-x)} = \frac{3}{1}$$

$$\frac{12}{\frac{1}{2}(12-x)} = 3$$

$$\frac{24}{12-x} = 3$$

$24 = 3(12 - x)$

$24 = 36 - 3x$

$3x = 12$

$x = 4$

4. [160]

Let the number of oranges be $3x$, apples be $6x$, and bananas be $7x$ for some integer.

A number that is a multiple of both 5 and 6 must be a multiple of LCM(5, 6).

$$\text{LCM}(5, 6) = 30$$

So, $3x$ must be a multiple of 30.

The smallest value of that makes $3x$ a multiple of 30 is:

$3x = 30$

$3x = 10$

Total fruits = $3x + 6x + 7x = 3(10) + 6(10) + 7(10)$

$= 30 + 60 + 70 = 160$

5. [1442] Let a, b, c, d be positive integers such that:

$a + b + c + d = 2023$

$a : b = 2 : 5$

$c : d = 5 : 2$

Find the maximum possible value of $a + c$.

Express variables using ratios

From the ratio $a : b = 2 : 5$, let:

$a = 2k$, $b = 5k$ for some positive integer k

From the ratio, let:

$c = 5m$, $d = 2m$ for some positive integer m

Given:

$a + b + c + d = 2023$

Substitute the expressions:

$2k + 5k + 5m + 2m = 2023 \Rightarrow 7k + 7m = 2023$

$k + m = 289$ ...(i)

We are asked to find the maximum value of:

$a + c = 2k + 5m$

From equation (i), express k in terms of m:

$k = 289 - m$

Substitute into the expression for $a + c$:

$a + c = 2(289 - m) + 5m = 578 - 2m + 5m = 578 + 3m$

To maximize $a + c = 578 + 3m$, we need to maximize.

Since both k and m must be positive integers,

and:

$k = 289 - m \geq 1 \Rightarrow m \leq 288$

Also, since $m \geq 1$, valid values of m range from 1 to 288.

The maximum value of m is 288.

Substitute $m = 288$ into $a + c$:

$a + c = 578 + 3 \times 288$

$a + c = 578 + 864$

$a + c = 1442$

6. (d) **Given:**

$$\frac{a+b}{b+c} = \frac{c+d}{d+a}$$

Cross-multiplying:

$(a + b)\ (d + a) = (c + d)\ (b + c)$

Now, expand both sides:

Solving Left-hand side:

$(a + b)(d + a) = ad + a^2 + bd + ab = a^2 + ab + ad + bd$

Solving Right-hand side:

$(c + d)(b + c) = cb + c^2 + db + dc = c^2 + cb + db + dc$

Now equating both expressions:

$a^2 + ab + ad + bd = c^2 + cb + db + dc$

$a^2 + a(b + d) = + c^2\ (b + d)$

$a^2 - c^2 = c(b + d) - a(b + d)$

$a^2 - c^2 = (b + d) \times (c - a)$

$(a + c) \times (a - c) = (b + d) \times (c - a)$

$(a + c) = -(b + d)$

So, $a - c = 0$ therefore, $a = c$

$(a + c) = -\ (b + d)$

$a + c + b + d = 0$

Therefore $a = c$ or $a + b + c + d = 0$

7. (a) The cost of a piece of jewellery is proportional to the square of its weight.

This means:

Cost $\propto$ (Weight)^2

Or,

Cost $= k \cdot$ (Weight)^2

Where k is the constant of proportionality.

We are told that a 10-gram piece costs ₹3600:

$3600 = k \times 10^2$

Use k to find the cost of a 4-gram piece

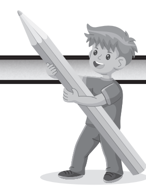
Now:

Cost $= 36 \times 4^2$

Cost $= 36 \times 16$

Cost $= 576$

FORMULA FLASH



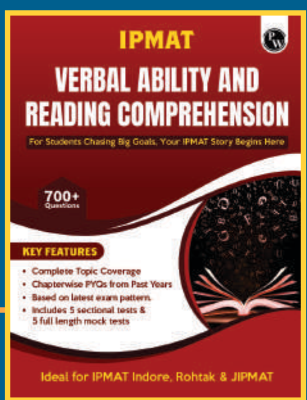
1. $\frac{a}{b} = \frac{c}{d} = \frac{a+c}{b+d}$
2. Product of means = Product of extremes
3. $\frac{a+b}{a-b} = \frac{c+d}{c-d} \Leftrightarrow \frac{a}{b} = \frac{c}{d}$
4. $xy \Rightarrow \frac{x_1}{y_1} = \frac{x_2}{y_2} = k$
5. $x\ \frac{1}{y} \Rightarrow x_1y_1 = x_2y_2 = k$
6. Profit share in partnership = Ratio of (Amount Invested) × (Time Period)

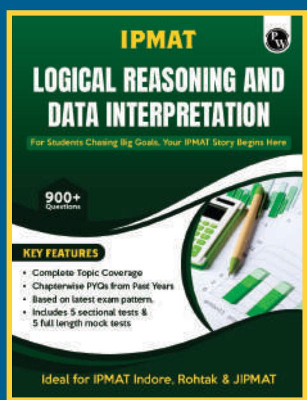
"Conquer The Numbers, Conquer The Test"

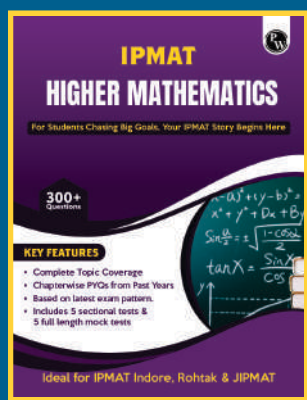
MASTER THE QUANT SECTION OF IPMAT

This Quantitative Aptitude guide comes packed with Formula Flash Sheets for rapid revision, a unique Concept Crafter section to simplify the toughest ideas, and a rich bank of practice questions that build both speed and accuracy. Each chapter is paired with Chapterwise PYQs to give you a real taste of the exam, Whether you're starting fresh or sharpening your edge, this book is your ultimate companion on the road to IPMAT mastery.

OTHER BOOKS IN THIS SERIES







PHYSICS WALLAH PUBLICATION

To Buy PW Books
SCAN ME!

To share Feedback
SCAN ME!

₹ 369/-

ISBN 978-93-6897-261-7

9 789368 972617

ad1ee5f2-1520-4e96-96b4-720178482d6b