6 PROFIT, LOSS AND DISCOUNT

This chapter is as much important as other chapters in the arithmetic section, since it is a chapter of applications by which we calculate profit, loss, discount in day-to-day business. So in the entrance exams of MBA it plays a crucial role in determining the selection of an aspirant. Particularly in CAT the questions asked in QA are very logical in nature, apart from the simple application in Data interpretation (D.I.) and Data sufficiency (D.S.). Entrance exams like FMS, IIFT, NIFT and MAT ask plethora of questions. Infact a normal question paper seems to be incomplete without having the problems based on profit, loss and discount.

THEORY AND CONCEPTS

In day-to-day life we sell and purchase the things as per our requirement. A customer can get things in the following manner :

Manufacturer (or producer) → Whole-saler (dealer) → (Shopkeeper) Retailer (or sales person) → Customer

TERMINOLOGY

Cost price (CP) : The money paid by the shopkeeper to the manufacturer or whole-saler to buy the goods is called the cost price (CP) of the goods purchased by the shopkeeper.

NOTE If an article is purchased for some amount and there are some additional expenses on transportation labour, commission etc., these are to be added in the cost price. Such expenses are called overhead expenses or overheads.

Selling Price (SP) : The price at which the shopkeeper sells the goods is called the selling price (SP) of the goods sold by the shopkeeper.

Profit : If the selling price of an article is more than its cost price, then the dealer (or shopkeeper) makes a profit (or gain)

i.e., Profit = SP – CP; SP > CP

Loss : If the selling price of an article is less than its cost price, then the dealer suffers a loss.

i.e., loss = CP – SP; CP > SP

Important Formulae

(i) Profit = SP – CP

(ii) Loss = CP – SP

(iii) Profit percentage $= \dfrac{\text{profit}}{\text{cost price}} \times 100$

(iv) Loss percentage $= \dfrac{\text{loss}}{\text{cost price}} \times 100$

(v) $SP = \left(\dfrac{100 + \text{gain}\%}{100} \times CP\right) = \left(\dfrac{100 - \text{loss}\%}{100} \times CP\right)$

(vi) $CP = \left(\dfrac{100}{100 + \text{gain}\%} \times SP\right) = \left(\dfrac{100}{100 - \text{loss}\%} \times SP\right)$

(vii) SP = $(100 + k)\%$ of CP; when profit = $k\%$ of CP

(viii) SP = $(100 - k)\%$ of CP; when loss = $k\%$ of CP

NOTE Profit or loss is always calculated on the basis of cost price unless otherwise mentioned in the problem.

EXAMPLE 1 *A fruit seller buys 300 oranges at 5 for Rs. 8 and sold at 2 for Rs. 5. Find :*

(i) the cost price of each orange

(ii) the selling price of each orange

(iii) profit or loss on selling one orange

(iv) his total profit or loss on selling all the oranges.

SOLUTION (i) Since the cost price of 5 oranges = Rs. 8

∴ Cost price of one (or each) orange = Rs. $\frac{8}{5}$ = Rs. 1.60

(ii) Since the selling price of 2 oranges = Rs. 5

∴ the selling price of one orange = Rs. $\frac{5}{2}$ = Rs. 2.50

(iii) Since SP is more than CP, there is a profit.

So profit on selling one orange = SP – CP

= 2.5 – 1.6 = Re. 0.90

(iv) Profit on selling all the oranges

= Rs. (0.90 × 300) = Rs. 270

Hence the total profit on selling all oranges = Rs. 270

EXAMPLE 2 *A shopkeeper buys 100 eggs at Rs. 1.20 per piece. Unfortunately 4 eggs got spoiled during transportation. The shopkeeper sells the remaining eggs at Rs. 15 a dozen. Find his profit or loss.*

SOLUTION Cost price of all eggs = Rs. 100×1.2 = Rs. 120

Selling price of one egg $= \frac{15}{12}$ = Rs. 1.25

$\therefore$ Selling price of 96 eggs $= 96 \times \frac{15}{12}$ = Rs. 120

HINT After spoiling 4 eggs, only 96 eggs are left.

Now, since the total selling price and total cost price is same, the shopkeeper neither makes a profit nor suffers a loss.

EXAMPLE 3 *Aviral purchased a computer for Rs. 47,000. He had to sell it for Rs. 45,800. Find his profit or loss per cent.*

SOLUTION Since SP < CP, there will be loss

$$\text{loss (\%)} = \frac{\text{loss}}{\text{CP}} \times 100 = \frac{47000 - 45800}{47000} \times 100$$

$$= \frac{1200}{47000} \times 100 = 2\frac{26}{47}\%$$

EXAMPLE 4 *A dealer sold 600 quintals of sugar at a profit of 7%. If a quintal of sugar cost him Rs. 1600, find his total profit and the selling price.*

SOLUTION CP = 1600×600 = Rs. 9,60,000

Rate of Profit = 7%

$$\text{Profit} = 9{,}60{,}000 \times \frac{7}{100} = \text{Rs. } 67200$$

$\therefore$ SP = CP + Profit = Rs. 9,60,000 + Rs. 67,200

= Rs. 1027200

Thus profit = Rs. 67200 and selling price = Rs. 10,27,200

EXAMPLE 5 *A dealer buys 200 quintals of wheat at Rs. 1200 a quintal. He spends Rs. 10,000 on transportation and storage. Then he sells the wheat at Rs. 13 per kg. Find his profit or loss. Also calculate it as a percentage.*

SOLUTION CP = 1200×200 = Rs. 2,40,000

Transportation and storage cost = Rs. 10,000

Total CP = 2,40,000 + 10,000

= Rs. 2,50,000

Total SP = $13 \times 200 \times 100$

= Rs. 2,60,000

$\therefore$ Now, since SP > CP, hence there will be profit.

Profit = SP – CP = Rs. (2,60,000 – 2,50,000) = Rs. 10,000

$$\text{Profit (\%)} = \frac{\text{Profit}}{\text{CP}} \times 100$$

$$= \frac{10{,}000}{2{,}50{,}000} \times 100 = 4\%$$

EXAMPLE 6 *Find the cost price of an article which is sold for Rs. 220 at a loss of 12%.*

SOLUTION SP = Rs. 220, Loss = 12%

Let CP = Rs. x

then SP = 88% of CP

$$220 = \frac{88}{100} \times x$$

$\Rightarrow$ $x = 250$

Therefore cost price = Rs. 250

EXAMPLE 7 *By selling a colour TV for Rs. 23520, a dealer suffers a loss of 4%. What is the cost price of the colour TV? At what price should he sell it to gain 8%?*

SOLUTION SP = 96% of CP $\because$ (loss is 4%)

$\therefore$ $23520 = \frac{96}{100} \times \text{CP}$

CP = 24500

Now gain % = 8%

$\therefore$ New selling price = (100 + 8)% of CP

$$= \frac{108}{100} \times 24500 = \text{Rs. } 26460$$

INTRODUCTORY EXERCISE-6.1

1. A towel is sold for Rs. 198 at a gain of 10%. What is the cost price of the towel? At what price must it be sold to gain 25%?
2. A man sold a watch at Rs. 6000, at a loss of $33\frac{1}{3}\%$. Find the cost price?
3. By selling a shirt for Rs. 285 a shopkeeper loses 5%. At what price should he sell the shirt so as to gain 15%?
4. Sufyan bought 1200 eggs at Rs. 16 a dozen. At what price per hundred must he sell the eggs so as to earn a profit of 15%?
5. Ram Singh purchased two camels for Rs. 18,000 and Rs. 15,000 respectively. He sold them at a loss of 15% and a gain of 19% respectively. Find the selling price of each of the camels. Also find the overall gain or loss per cent in the transaction.

MARK UP AND DISCOUNT

Marked price: Basically to avoid loss due to bargaining by the customer and to get the profit over the cost price trader increases the cost price by a certain value, this increase in value over cost price is known as markup and the increased price (*i.e.*, CP + Markup) is called the marked price or printed price or list price of the goods.

Marked price = CP + Markup
Marked price = CP + (% markup on CP)

Generally goods are sold at marked price, if there is no further discount, then in this case selling price equals to marked price.

Discount : Discount means reduction of marked price to sell at a lower rate or literally discount means concession. Basically it is calculated on the basis of marked price.

∴	Selling price = Marked price – Discount
or	Selling price = Marked price (MP) – (% discount on MP)

Since marked price = CP + % markup on CP

Remember **markup** is calculated on the basis of CP while **discount** is calculated on the basis of MP.

In general, CP < SP < MP at profit

CP = SP < MP at no profit no loss

SP < CP < MP at loss

Also $\text{CP} \xrightarrow{\text{Markup}} \text{MP}$

and $\text{SP} \xleftarrow{\text{discount}} \text{MP}$

NOTE You will find wide application of percentage calculation, percentage change graphic etc. so to move further you must know the concepts of percentages.

EXAMPLE 8 *If the cost price of an article is Rs. 300 and the per cent markup is 20%. What is the marked price?*

SOLUTION MP = CP + % markup on CP

$$= 300 + 300 \times \frac{20}{100}$$

MP = Rs. 360

Alternatively : SP = 300 × 1.2 = 360

EXAMPLE 9 *If the marked price of an article is Rs. 450 and markup percentage is 12.5%, what is the cost price?*

SOLUTION MP = 112.5 of CP

$$\therefore \quad 450 = \frac{112.5}{100} \times \text{CP}$$

$$450 = \frac{9}{8} \times \text{CP}$$

$$\Rightarrow \quad \text{CP} = \text{Rs. } 400$$

Alternatively : Change your outlook to visulize the problem differently for smarter calculation.

You can see that MP is 12.5% (*i.e.*, $\frac{1}{8}$ times) greater than CP. So CP will be $\frac{1}{9}$ times less than MP. This percentage (or fraction) change rule has been throughly discussed through different illustrations in percentage chapter. In my opinion if you change your observation *i.e.*, you mould your thinking in a CAT oriented approach you will not change only your attitude and aptitude but the whole scenario will be changed. So look this problem like me :

$$\text{CP} \underset{1/9 \downarrow}{\overset{1/8 \uparrow}{\rightleftarrows}} \text{MP} \qquad \left(\frac{n}{d+n}\right) \begin{array}{l} n \rightarrow \text{numerator} \\ d \rightarrow \text{denominator} \end{array}$$

So, the CP will be $\frac{1}{9}$ times less than MP, which is rather too much easier to calculate than the traditional method given at the beginning of the solution.

EXAMPLE 10 *If the marked price of an article is Rs. 660 and the discount is 10%, then what is the selling price of the article?*

SOLUTION **General Solution :**

SP = MP – Discount

$$\text{SP} = 660 - 660 \times \frac{10}{100}$$

SP = 594

Alternatively: SP = 90% of MP

SP = 0.9 × 660

SP = 594

Alternatively: We can see that when SP is 10% (*i.e.*, $\frac{1}{10}$) less than MP, it means MP is $\frac{1}{9}$ times greater than SP.

Therefore $\text{MP} = \frac{10}{9}\text{SP}$ $\left(1 + \frac{1}{9} = \frac{10}{9}\right)$

Ultimately I would like to say that you should see the core of the problem and solution both, instead of taking help from any formula. In other words formulae make you logically blind particularly in context of CAT where your intelligence is tested rather than your memory and theory of the maths.

EXAMPLE 11 *If the markup percentage of an article is 50% and discount percentage is also 20%, then the profit percentage will be :*

(a) 10% (b) 0% (c) 30% (d) 20%

SOLUTION See the smartest calculation technique and follow me to be smarter.

CP	SP	MP
100	120	150

Therefore profit = 20% $\left(\frac{120-100}{100} \times 100 = 20\%\right)$

Explanation: MP = 150% of CP (∵ markup is 50%)

SP = 80% of MP (∵ discount is 20%)

Once again I am reiterating on the gist of this chapter. What is that gist? The gist is that this chapter test nothing but your grip on the concepts of percentage change. I think CP, SP, MP etc., are just the words, the crux is that how CP, SP and MP etc., change with respect to each other. So those students who have grasped and internalised the most important concept of percentage change, they will not find any difficulty in understanding the concept of the profit-loss problems. Believe me when your visualisation will be improved, you will be master on this chapter. So try to have a different approach.

EXAMPLE 12 *A trader markup the goods by 10% and then gives a discount of 10%. What is the profit or loss percentage?*

SOLUTION

CP	SP	MP
100	99	110

So there is a loss of 1%.

Explanation: MP = 110% of CP (10% markup)

SP = 90% of MP (10% discount)

EXAMPLE 13 *Successive discount of 10% and 5% is equivalent to :*

(a) 16.5% *(b) 15%*

(c) 15.5% *(d) 14.5%*

SOLUTION

100 ↓ (–10%)

14.5

90 ↓ (–5%)

85.5

NOTE There is no difference in two different cases *i.e.*, either you decrease 100 at first by 10% and then by 5% or decrease 100 at first by 5% and then by 10%.

100 ↓ (–5%)

14.5

95 ↓ (–10%)

85.5

Explanation : $100 \times 0.9 \times 0.95 = 85.5$

∴ Single discount equivalent to 10% and 5% is 14.5%

(100 – 85.5)%

or $(100 \times 0.95 \times 0.9 = 85.5)$

Some Important Concepts

(1) When two articles are sold at same price but one of them at a profit and another at a loss and the percentage profit is the same as the percentage loss. In this case there is always a loss.

$$\text{loss (\%)} = \left(\frac{\text{Common gain or loss}}{10}\right)^2$$

EXAMPLE 14 *A man sells two wrist watches one at a profit of 10% and another at a loss of 10%, but the selling price of each watch is Rs. 200. Find the :*

(1) percentage profit or loss

(2) net amount of profit or loss

SOLUTION (1) Since there is always loss.

(**Logic:** To get the logic you should refer the percentage chapter)

Now, $\text{loss \%} = \left(\frac{\text{Common gain or loss}}{10}\right)^2 \%$

$$\text{loss \%} = \left(\frac{10}{10}\right)^2 \% = 1\%$$

(2) Amount of loss.

Total SP = Rs. 400 (200 + 200)

again, total SP = 99% of CP (1% loss)

$$400 = \frac{99}{100} \times \text{CP}$$

$\Rightarrow$ CP = Rs. 404.04

∴ loss = CP – SP = Rs. 4.04 (= 404.04 – 400)

EXAMPLE 15 *There were two articles and the sum of cost prices of these articles is Rs. 500. One of them was sold at a profit of 20% and another at a loss of 20%. Besides if the selling prices of both the articles were same. Find the amount of overall loss.*

SOLUTION $x \times \frac{120}{100} = (500 - x)\frac{80}{100}$

$\Rightarrow$ $x = 200$

So, the CP of profit yielding article = Rs. 200

and the CP of loss giving article = Rs. 300 (500 – 200)

and the common SP = Rs. 240 = $(200 \times 1.2 = 300 \times 0.8)$

So the loss = CP – SP

$= 500 - 2 \times 240 =$ Rs. 20

(2) When the selling price of 'm' articles is same as the cost price of 'n' similar articles.

EXAMPLE 16 *If the cost price of 15 apples is same as the selling price of 20 apples. What is the gain or loss per cent?*

SOLUTION CP of 15 apples = SP of 20 apples

$\Rightarrow$ $\text{CP} \times 15 = \text{SP} \times 20$

$\Rightarrow$ $\frac{\text{CP}}{\text{SP}} = \frac{4}{3}$

So you can see that CP > SP, therefore, there will be loss.

Now consider CP = 4, then SP = 3

∴ loss = 1

∴ $\text{loss (\%)} = \frac{\text{loss}}{\text{CP}} \times 100$

$= \frac{1}{4} \times 100 = 25\%$

loss = 25%

EXAMPLE 17 *If the selling price of 10 CDs is the same as the cost price of 12 CDs. What is the profit or loss per cent?*

SOLUTION SP of 10 CDs = CP of 12 CDs

$\Rightarrow$ $\text{SP} \times 10 = \text{CP} \times 12$

$\Rightarrow$ $\frac{\text{SP}}{\text{CP}} = \frac{12}{10} = \frac{6}{5}$

$\Rightarrow$ SP > CP, therefore there will be a profit

$$\text{Profit (\%)} = \frac{(\text{SP} - \text{CP})}{\text{CP}} \times 100$$

$$= \frac{(6-5)}{5} \times 100 = 20\% \text{ (profit)}$$

(3) When a person recovers the cost price of 'm' articles by selling 'n' articles ($n < m$), then

$$\text{Profit (\%)} = \frac{\text{goods left}}{\text{goods sold}} \times 100$$

$$= \frac{m-n}{n} \times 100$$

In this case money is equated in terms of no. of (or amount) articles.

For your convenience always assume the CP of an article as Re 1. (or Rs. 100)

EXAMPLE 18. *A dealer by selling 12 oranges gets the cost price of 15 oranges. What is the percentage profit?*

SOLUTION Profit (%) $= \frac{\text{goods left}}{\text{goods sold}} \times 100 = \frac{15-12}{12} \times 100 = 25\%$

Alternatively : Suppose CP of one orange = Re. 1

then CP of 12 oranges = Rs. 12

and SP of 12 oranges = CP of 15 oranges = Rs. 15

$\therefore$ profit $= \frac{15-12}{12} \times 100 = 25\%$

EXAMPLE 19. *By selling 8 bananas, a fruit seller gains the selling price of 1 banana. Calculate his gain per cent.*

SOLUTION Let the SP of one banana = Re. 1

then SP of 8 bananas = Rs. 8

and profit = Re. 1

$\therefore$ CP = 8 − 1 = Rs. 7

$\therefore$ profit % $= \frac{1}{7} \times 100 = 14\frac{2}{7}\%$

EXAMPLE 20. *By selling 18 chocolates, a vendor loses the selling price of 2 chocolates. Find his loss per cent.*

SOLUTION Let the SP of 1 chocolate = Re. 1

$\therefore$ SP of 18 chocolate = Rs. 18

and loss = Rs. 2

$\therefore$ CP = SP + loss

= 18 + 2 = Rs. 20

$\therefore$ Percentage loss $= \frac{\text{loss}}{\text{CP}} \times 100$

$= \frac{2}{20} \times 100 = 10\%$

EXAMPLE 21. *A trader sell all his articles at the cost price but gives 10% less amount as he should give. What is his percentage profit?*

SOLUTION Profit (%) $= \frac{\text{goods left}}{\text{goods sold}} \times 100$

$= \frac{10}{90} \times 100 = 11\frac{1}{9}\%$

Since if we assume that the CP of 1 article is Re. 1.

Now since he gives only 90% article instead of 100% and save 10% article. So his profit will be the equal to the remaining articles (over the sold articles).

It means when he sells the articles (actually) worth Rs. 90 then he gains by articles worth Rs. 10.

Hence profit % $= \frac{10}{90} \times 100 = 11\frac{1}{9}\%$

(The selling price $= \frac{100}{90} = \frac{10}{9}$ = Rs. 1.11

EXAMPLE 22. *A trader by means of his false balance defrauds to the extent of 10% in buying goods and also defrauds to 10% in selling. Find his gain per cent.*

SOLUTION Let the actual CP of an article be Re. 1, then the effective CP $= \frac{100}{110} = \frac{10}{11}$

(Since he purchases 110 articles by paying Rs. 100)

again SP $= \frac{100}{90} = \frac{10}{9}$

(Since he sells only 90 articles charging the CP of 100 articles)

$\therefore$ Gain % $= \frac{\text{SP} - \text{CP}}{\text{CP}} \times 100 = \frac{\frac{10}{9} - \frac{10}{11}}{\frac{10}{11}} \times 100$

$= \frac{20}{99} \times \frac{11}{10} \times 100$

$= \frac{200}{9} = 22\frac{2}{9}\%$

INTRODUCTORY EXERCISE-6.2

1. The cost price of a scooter is Rs. 20,000 and the profit percent is 12%. What is the selling price?
   (a) 2400 (b) 22040
   (c) 2600 (d) 22400
2. The SP of an article is Rs. 3200 and the profit per cent is $33\frac{1}{3}\%$. Find the cost price.
   (a) Rs. 20000 (b) Rs. 2000
   (c) Rs. 2400 (d) Rs. 3000
3. The CP of an article is 5/6th of the SP. What is the percentage profit or loss?
   (a) 20% loss (b) 16.66% profit
   (c) 16.66% loss (d) 20% profit
4. The MP of a camera is 3/2 of the CP and SP is 9/10 of MP. Find the percentage profit or loss.
   (a) 25% profit (b) 35% profit
   (c) 33.33% loss (d) none of these
5. The MP of an article is 30% higher than its CP and 20% discount is allowed on this article then the profit percentage :
   (a) 10% (b) 14%
   (c) 4% (d) 26%
6. An article is sold for Rs. 1980 at 10% profit. What is the cost price?
   (a) Rs. 198 (b) Rs. 1800
   (c) Rs. 1900 (d) Rs. 1600

7. On selling an article for Rs. 576 a trader loses 4%. In order to gain $4\frac{1}{6}$%, he must sell that article for :
(a) Rs. 636 (b) Rs. 676
(c) Rs. 625 (d) can't be determined

8. The per cent profit made when an article is sold for Rs. 56 is thrice as when it is sold for Rs. 42. The cost price of the article is :
(a) Rs. 48 (b) Rs. 49
(c) Rs. 50 (d) Rs. 35

9. A shopkeeper uses a weight of 460 g instead of 500 g and sells the articles at the cost price. What is the profit percentage?
(a) 40% (b) 23%
(c) $8\frac{16}{23}$% (d) 20%

10. A trader uses a weight of 920 g instead of 1 kg and sells the articles at the marked price which is 15% above the cost price. Find the profit percentage.
(a) 20% (b) 23%
(c) 25% (d) can't be determined

11. If a gift pack is sold at a gain of 6% instead of at a loss of 6%, then the seller gets Rs. 6 more. The cost price of the article is :
(a) Rs. 60 (b) Rs. 66
(c) Rs. 50 (d) Rs. 36

12. A man sells a bicycle at a gain of 10%. If he had bought it at 10% less and sold it for Rs. 132 less, he would have still gained 10%. The cost price of the article is :
(a) Rs. 1000 (b) Rs. 1200
(c) Rs. 1500 (d) Rs. 1320

13. An item costing Rs. 600 is being sold at 20% loss. If the price is further reduced by 12.5%, the selling price will be :
(a) Rs. 400 (b) Rs. 380
(c) Rs. 420 (d) Rs. 525

14. While selling an electric fan, a dealer gives a discount of 5%. If he gives a discount of 8%, he earns Rs. 36 less as profit. The marked price of the fan is :
(a) Rs. 1000 (b) Rs. 1200
(c) Rs. 800 (d) none of these

15. If a commission of 10% is given on the marked price of a book, the publisher gains 20%. If the commission is increased to 15%, the gain of publisher is :
(a) 13.33% (b) 15%
(c) 18% (d) data insufficient

16. A retailer buys a cellphone at a discount of 15% and sells it for Rs. 5865. Thus, he makes a profit of 15%. The discount is :
(a) Rs. 200 (b) Rs. 850
(c) Rs. 750 (d) Rs. 900

17. At what per cent above the cost price must an articles be marked so as to gain 17% after allowing a discount of 10%?
(a) 34% (b) 70%
(c) 30% (d) 27%

18. A merchant marks his goods at Rs. 900 and allows a discount of 25%. If he still gain 12.5%, then the cost price of the article is :
(a) Rs. 500 (b) Rs. 600
(c) Rs. 720 (d) can't be determined

19. A vendor buys oranges @ Rs. 2 for 3 oranges and sells them at a rupee each. To make a profit of Rs. 10, he must sell :
(a) 10 oranges (b) 20 oranges
(c) 30 oranges (d) 40 oranges

EXERCISE

LEVEL 1

1. Abhishek and Bhanu both are dealers of KML scooters. The price of a KML Scooter is Rs. 28,000. Abhishek gives a discount of 10% on whole, while Bhanu gives a discount of 12% on the first Rs. 20,000 and 8% on the rest Rs. 8000. What is the difference between their selling prices?
(a) Rs. 240 (b) Rs. 420
(c) Rs. 640 (d) none of these

2. A trader sells two articles, one at a loss of 10% and another at a profit of 15% but finally there is no loss or gain. If the total sale price of these two articles is Rs. 30,000, find the difference between their cost prices :
(a) Rs. 5000 (b) Rs. 6000
(c) Rs. 7500 (d) none of these

3. A milkman purchases the milk at Rs. x per litre and sells it at Rs. $2x$ per litre still he mixes 2 litres water with every 6 litres of pure milk. What is the profit percentage?
(a) 116% (b) 166.66%
(c) 60% (d) 100%

4. 60% goods are sold at 5% loss while rest are sold at 10% profit. If there is a total profit of Rs. 100, then the worth of goods sold is :
(a) Rs. 6000 (b) Rs. 5000
(c) Rs. 10000 (d) none of these

5. A retailer bought 20 kg tea at a discount of 10%. Besides 1 kg tea was freely offered to him by the wholesaler at the purchase of 20 kg tea. Now he sells all the tea at the marked price to a customer. What is profit percentage of retailer?
(a) 30% (b) 12%
(c) 16.66% (d) none of these

6. Two articles are sold at the same price. One at a profit of 75% and another one at a loss of 30%. What is the overall profit or loss?
(a) 22.5% profit (b) 57.5 profit
(c) $13\frac{2}{7}$% loss (d) none of these

7. What is percentage profit in selling an article at a discount of 20% which was earlier being sold at a 40% profit?
(a) 20% (b) 14%
(c) 28% (d) 12%

8. A man bought 18 oranges for a rupee and sold them at 12 oranges for a rupee. What is the profit percentage?
(a) 33.33% (b) 50%
(c) 66.66% (d) none of these

9. A dealer buys a product at Rs. 1920, He sells at a discount of 20% still he gets the profit of 20%. What is the selling price of that product?
(a) Rs. 2304 (b) Rs. 1536
(c) Rs. 2200 (d) it is not possible

10. Tinkawala purchased the articles for Rs. 123684. He sold 60% of those at a profit of 16.66% and rest at a loss. Find the loss percentage on the remaining if the overall loss is 14%?
(a) 20% (b) 30%
(c) 60% (d) 66.66%

11. What should be the minimum markup percentage such that after giving a discount of $66\frac{2}{3}$%, there will not be a loss?
(a) 200% (b) 133.33%
(c) 100% (d) 150%

12. The ratio of cost price and marked price of an article is 2 : 3 and ratio of percentage profit and percentage discount is 3 : 2. What is the discount percentage?
(a) 16.66% (b) 20%
(c) 25% (d) 33.33%

13. A dealer gives as much discount (in per cent) as the markup (in per cent) above the cost price. What is the profit or loss per cent?
(a) 10% (b) 1%
(c) 4% (d) can't be determined

14. In the above problem, what is the markup percentage when there is a loss in percentage be half of the percentage markup?
(a) 20% (b) 40%
(c) can't be determined (d) none of these

15. A shopkeeper sold 12 cameras at a profit of 20% and 8 cameras at a profit of 10%. If he had sold all the 20 cameras at a profit of 15%, then his profit would have been reduced by Rs. 36. What is the cost price of each camera?
(a) 100 (b) 150
(c) 180 (d) 220

16. Mr. Mittal purchased a car for Rs. 3,00,000 and a bike for his son for Rs. 1,00,000. He sold the car at a profit of 10% and bike at a loss of 20%. What is the net gain or loss?
(a) 2% gain (b) 1.5% loss
(c) 2.5% loss (d) 2.5% gain

17. A trader sells 20 kg of sugar at Rs. 400. A customer asks 20% discount and he agrees to it but instead of 1 kg he gives 4% less sugar. What is the effective discount that the customer gets?
(a) 16% (b) 16.66%
(c) 15.5% (d) 19.6%

18. The profit percentage on the three articles A, B and C is 10%, 20% and 25% and the ratio of the cost price is 1 : 2 : 4. Also the ratio of number of articles sold of A, B and C is 2 : 5 : 2, then the overall profit percentage is :
(a) 18.5% (b) 21%
(c) 75% (d) none of these

19. The marked price of an article is increased by 25% and the selling price is increased by 16.66%, then the amount of profit doubles. If the original marked price be Rs. 400 which is greater than the corresponding cost price by 33.33%, what is the increased selling price?
(a) 240 (b) 360
(c) 420 (d) 600

20. A shopkeeper calculated his profit per cent on the selling price which comes out to be 30%. If it had been calculated as usual on the cost price then what is the required percentage profit?
(a) $42\frac{6}{7}$% (b) $4\frac{7}{27}$%
(c) $7\frac{6}{42}$% (d) none of these

21. An item was sold after giving two successive discount of 20% and 10% respectively. If the item was sold for Rs. 468. The marked price of that item is :
(a) Rs. 600 (b) Rs. 500
(c) Rs. 575 (d) Rs. 650

22. The cost price of an article '*A*' is Rs. 160 and selling price of another article '*B*' is Rs. 240. If the selling price of *A* will be equal to the cost price of *B*, then the profit after selling *A* is 20%. What is the profit on '*B*'?
(a) 16.66% (b) 50%
(c) 25% (d) none of these

23. A single discount equivalent to three successive discounts of 5%, 10%, 20% is :
(a) 68.4% (b) 35%
(c) 31.6% (d) 32%

24. Ragini purchases oranges at Rs. 10 per dozen and sells them at Rs. 12 for every 10 oranges. What is the profit percentage?
(a) 40% (b) 44%
(c) 60% (d) 48%

25. A trader uses a weighing balance that shows 1250 g for a kilogram. He further marks-up his cost price by 20%. What is the profit percentage?
(a) 5% (b) 45%
(c) 50% (d) 30%

26. On selling an article for Rs. 240, a trader loses 4%. In order to gain 10% he must sell that article for :
(a) Rs. 275 (b) Rs. 340
(c) Rs. 320 (d) Rs. 264

27. A merchant marks his goods at Rs. 300 and allows a discount of 25%. If he still gains 12.5%, then the cost price of article is :
(a) Rs. 220 (b) Rs. 200
(c) Rs. 240 (d) Rs. 260

28. An item costing Rs. 200 is being sold at 10% loss. If the price is further reduces by 5%, the selling price will be :
(a) Rs. 170 (b) Rs. 171
(c) Rs. 180 (d) Rs. 181

29. A person sold two cows each for Rs. 9900. If he gained 10% on one and lost 20% on the other, then which of the following is true?
(a) He gained Rs. 200
(b) He lost Rs. 200
(c) He neither gained nor lost
(d) None of the above

30. Two third of a consignment was sold at a profit of 5% and the remainder at a loss of 2%. If the total profit was Rs. 400, the value of the consignment (in rupees) was :
(a) 15000 (b) 20000
(c) 10000 (d) 12000

31. A fruit seller declares that he sells fruits at the cost price. However, he uses a weight of 450 g instead of 500 g. His percentage profit is :
(a) 10% (b) $11\frac{1}{9}$%
(c) 12% (d) $12\frac{2}{9}$%

32. A person loses Rs. 20 by selling some bananas at the rate of Rs. 3 per banana and gains Rs. 30, if he sells them at Rs. 3.25 per banana. The number of bananas sold by him :
(a) 100 (b) 200
(c) 120 (d) 2400

33. Due to an increase of 30% in the price of eggs, 3 eggs less are available for Rs. 9.10. The present rate per egg is :
(a) 91 paise (b) 78 paise
(c) 48 paise (d) 84 paise

34. By selling 12 apples for a rupee, a man loses 20%. How many for a rupee should he sell to gain 20%?
(a) 8 (b) 10
(c) 15 (d) 16

35. A dealer buys a washing machine, listed at Rs. 10000 and gets 10% and 20% successive discounts. He spends 10% of his CP on transport. At what price (in rupees) should he sell the washing machine to earn a profit of 10%?
(a) 8722 (b) 7892
(c) 8712 (d) 8840

36. 6% more is gained by selling a coat for Rs. 1425 than by selling it for Rs. 1353. The cost price of the coat is :
(a) Rs. 1000 (b) Rs. 1250
(c) Rs. 1500 (d) Rs. 1200

37. By selling a wrist watch at Rs. 405 the shopkeeper incurs a loss of 10%. What is the gain or loss percentage if he sells the same watch at Rs. 465?
(a) profit of 10% (b) loss of 6%
(c) profit of 3.33% (d) no profit no loss

38. Titan sells a wrist watch to a wholesaler making a profit of 10%. The wholeseler, in turn, sells it to the retailer making a profit of 10%. A customer purchases it by paying Rs. 990. Thus the profit of retailer is $2\frac{3}{11}$%. What is the cost incurred by the Titan to produce it?
(a) 768 (b) 750
(c) 800 (d) 820

39. Pepsi and Coke, there are two companies, selling the packs of cold-drinks. For the same selling price Pepsi gives two successive discounts of 10% and 25%. While Coke sells it by giving two successive discounts of 15% and 20%. What is the ratio of their marked price?
(a) 143 : 144 (b) 19 : 11
(c) 136 : 135 (d) 73 : 77

40. When a shopkeeper reduces the selling price from 1080 to 1026 its loss increases by 4 percentage point. What is the selling price of this same article when it fetches a profit of 4%?

(a) Rs. 1392 (b) Rs. 1404
(c) Rs. 1450 (d) Rs. 1350

41. The difference between CP and SP of a table fan is Rs. 175 when it gives the profit of 14%. What is the selling price of that fan?
(a) 1225 (b) 1450
(c) 1425 (d) 1275

42. A company instead of raising the mark-up by 20% discounted the cost price by 20% while stiching the price tag on its product. Further the company offers a discount of 6.25% to its customer. In this process company incurs a loss of Rs. 37.5 on a single article. What is the selling price of that article?
(a) 417.5 (b) 112.5
(c) 365.5 (d) none of these

43. When an article is sold for Rs. 703 loss incurred is 25% less than the profit earned on selling it at Rs. 836. What is the selling price of the article when it earns a profit of 20%?
(a) 912 (b) 1576
(c) 1532 (d) 1092

44. Arun bought toffees at 6 for a rupee. How many for a rupee he should sell to gain 20%?
(a) 3 (b) 4
(c) 5 (d) can't be determined

45. A scientific calculator is available at Universal Shoppe in Hazratganz at 20% discount and the same is available at only 15% discount at Universal Shoppe Bhootnath Market. Ms. Agrawal has just sufficient amount of Rs. 800 to purchase it at Universal Shoppe Hazratganz. What is the amount that Ms. Agrawal has less than the required amount to purchase it at Universal Shoppe Bhootnath?
(a) Rs. 70 (b) Rs. 50
(c) Rs. 100 (d) data insufficient

46. A balance of a trader weighs 10% less than it should be. Still the trader marks-up his goods to get the overall profit of 20%. What is the markup on the cost price?
(a) 40% (b) 8%
(c) 25% (d) 16.66%

47. ITC sells one product at a profit of 20% another at a loss of 20% at the same selling price. What is the loss incurred by ITC?
(a) 1% (b) 2%
(c) 4% (d) 0%

48. In the previous question, if SP of each article be Rs. 200, what is the amount of loss?
(a) Rs. 10 (b) Rs. 16
(c) Rs. 16.66 (d) none of these

49. The cost price of 19 articles is same as the selling price of 29 articles. What is the loss %?
(a) 35% (b) 34.48%
(c) 52.63% (d) none of these

50. The selling price of 13 articles is same as the cost price of 23 articles. What is the profit percentage?
(a) 43.47% (b) 74.83%
(c) 78% (d) 76.92%

51. A trader can procure 34 pencils by selling 28 pencils. What is the ratio of cost price to the selling price of a pencil?
(a) 2 : 3 (b) 14 : 17
(c) 9 : 7 (d) 4 : 7

52. At style cloth emporium the shopkeeper measures 20% less for every metre of cloth also he marks-up goods by 20%. What is the profit percentage?
(a) 50% (b) 80%
(c) 75% (d) none of these

53. A bookseller procures 40 books for Rs. 3200 and sells them at a profit equal to the selling price of 8 books. What is the selling price of one dozen books, if the price of each book is same?
(a) 720 (b) 960
(c) 1200 (d) 1440

54. The profit percentage of A and B is same on selling the articles at Rs. 1800 each but A calculates his profit on the selling price while B calculates it correctly on the cost price which is equal to 20%. What is the difference in their profits?
(a) Rs. 360 (b) Rs. 60
(c) Rs. 540 (d) Rs. 450

55. Each of A and B sold their article at Rs. 1818 but A incurred a loss of 10% while B gained by 1%. What is the ratio of cost price of the articles of A to that of B?
(a) 101 : 90 (b) 85 : 89
(c) 81 : 75 (d) none of these

56. A trader sold an article at a loss of 5% but when he increased the selling price by Rs. 65 he gained 3.33% on the cost price. If he sells the same article at Rs. 936, what is the profit percentage?
(a) 15% (b) 16.66%
(c) 20% (d) data insufficient

57. Even after a discount of q% on marked price a trader gains by p%. What is the markup percentage over the cost price?
(a) $\frac{p+q}{(q-p)} \times 100$ (b) $\frac{p+q}{(100-p)} \times 100$
(c) $\frac{p+q}{(100-q)} \times 100$ (d) not possible

58. A milkman mixes 10% water in pure milk but he is not content with it so he again mixes 10% more water in the previous mixture. What is the profit percentage of milkman if he sells it at cost price :
(a) 11.11% (b) 20%
(c) 21% (d) 12.1%

59. A person sold an electronic watch at Rs. 96 in such a way that his percentage profit is same as the cost price of the watch. If he sells it at twice the percentage profit of its previous percentage profit then the new selling price will be :
(a) Rs. 132 (b) Rs. 150
(c) Rs. 192 (d) Rs. 180

60. A trader mixes 25% kerosene to his petrol and then he sells the whole mixture at the price of petrol. If the cost price of kerosene be 50% of the cost price of petrol, what is the net profit percentage?
(a) $11\frac{1}{9}$% (b) $12\frac{1}{9}$%
(c) $9\frac{1}{11}$% (d) 20%

61. A retailer cheats both to his whole-seller and his customer by 10% by his faulty balance *i.e.,* he actually weighs 10% more while purchasing from wholesaler and weighs 10% less while selling to his customer. What is his net profit percentage, when he sells at CP?
(a) $22\frac{2}{11}\%$ (b) $22\frac{2}{9}\%$
(c) 20% (d) 21%

62. A trader procures his goods from a wholesaler, whose balance reads 1200 g for 1000 g. The trader sells all the procured goods to a customer after marking up the goods at 20% above the cost price. What is his overall percentage profit or loss in the whole transaction?
(a) 38% profit
(b) 50% profit
(c) no profit no loss
(d) none of the above

63. A person wants to reduce the trade tax so he calculates his profit on the sale price instead of on the cost price. In this way by selling a article for Rs. 280 he calculates his profit as $14\frac{2}{7}\%$. What is his actual profit percentage?
(a) 20% (b) 16.66%
(c) 25% (d) data insufficient

64. A vendor sells his articles at a certain profit percentage. If he sells his articles at 1/3 of his actual selling price, then he incurs a loss of 40%. What is his actual profit percentage?
(a) 72% (b) 120%
(c) 80% (d) none of these

65. A retailer increases the selling price by 25% due to which his profit percentage increases from 20% to 25%. What is the percentage increase in cost price?
(a) 20% (b) 30%
(c) 25% (d) 50%

66. Abhinav saves Rs. 25 by getting 6.66% discount on a textbook. What is the amount of money (in Rs.) paid by him?
(a) 450 (b) 350
(c) 225 (d) 375

67. At kul-kul petrol pump the operator gives 5% less petrol but he sells it at the cost price. What is his profit in this way?
(a) 5% (b) 5.6%
(c) 5.26% (d) 4.78%

68. Due to reduction of 25% in price of oranges a customer can purchase 4 oranges more for Rs. 16. What is original price of an orange?
(a) Re 1 (b) Rs. 1.33
(c) Rs. 1.5 (d) Rs. 1.6

69. A reduction of 20% in the price of sugar enables a housewife to purchase 6 kg more for Rs. 240. What is the original price per kg of sugar?
(a) Rs. 10 per kg (b) Rs. 8 perkg
(c) Rs. 6 per kg (d) Rs. 5 per kg

70. A wholesaler sells toys at a profit of 20% to a retailer and retailer sells these toys to its customer at a profit of 25%. What is the profit percentage of the retailer?
(a) 5% (b) 80%
(c) 20% (d) 25%

LEVEL 2

1. An automobile agency launched a scheme that if a customer purchases two Jabaaj Discover bikes, one extra Jabaaj Discover will be free and if he purchases 3 Jabaaj Pulser he will get one extra Jabaaj Pulser free. If the cost price of 3 Jabaaj Discover and 4 Jabaaj Pulser be Rs. 67500 and Rs. 232500 respectively. If a customer purchases 2 bikes of Jabaaj Discover and 3 bikes of Jabaaj Pulser as per scheme he availed 1 bike free of each category, then at what price these bikes should be sold so that the agency can get overall profit of 17.5% :
(a) 235250 (b) 352500
(c) 368000 (d) 268000

2. Rahul went to purchase a Nokia mobile handset, the shopkeeper told him to pay 20% tax if he asked the bill. Rahul manages to get the discount of 5% on the actual saleprice of the mobile and he paid the shopkeeper Rs. 3325 without tax. Besides he manages to avoid to pay 20% tax on the already discounted price, what is the amount of discount that he has gottten?
(a) 750 (b) 375
(c) 875 (d) 525

3. When a bicycle manufacturer reduced its selling price by 50%, the number of bicycles sold radically increased by 600%. Initially the manufacturer was getting only 140% profit. What is the percentage increase of his profit?
(a) 10% (b) 14%
(c) 0% (d) can't be determined

4. A trader marks his goods such that he can make 32% profit after giving 12% discount. However a customer availed 20% discount instead of 12%. What is the new profit percentage of trader?
(a) 20% (b) 44%
(c) 30% (d) 28.8%

5. A retailer bought 3850 Linc pens and 1848 Cello pens at the same price. He sells Linc pens in such a way that he can buy 650 Linc pens with the sale price of 481 Linc pens. Again he can buy only 408 Cello pens with the sale price of 629 pens. What is the overall percentage of profit of the retailer?
(a) 4.8% (b) 9.6%
(c) 13% (d) none of these

6. The ratio of selling price of 3 articles A, B and C is 8 : 9 : 5 and the ratio of percentage profit is 8 : 7 : 14 respectively. If the profit percentage of A is 14.28% and the cost price of B is Rs. 400, what is the overall percentage gain?
(a) 14.28% (b) 14.87%
(c) 16.66% (d) none of these

7. Anna sold his car to Boney at a profit of 20% and Boney sold it to Chakori at a profit of 10%. Chakori sold it to mechanic at a loss of 9.09%. Mechanic spent 10% of his purchasing price and then sold it at a profit of 8.33% to Anna once again. What is the loss of Anna?
(a) 23% (b) 29%
(c) 50% (d) 40%

8. In an office the number of employees reduces in the ratio of 3 : 2 and the wages increases in the ratio of 20 : 27. What is the profit percentage of employees over the previous wages?
(a) 10% (b) 9.09%
(c) 11.11% (d) none of these

9. I asked the shopkeeper the price of a wristwatch. I found that I had just the required sum of money. When the shopkeeper allowed me a discount of 25%, I could bought another watch worth Rs. 940 for my younger sister. What is the price which I have paid for my own watch?
(a) Rs. 2700 (b) Rs. 1800
(c) Rs. 2820 (d) Rs. 3760

10. *A* and *B* are two partners and they have invested Rs. 54,000 and Rs. 90,000 in a business. After one year *A* recieved Rs. 1800 as his share of profit out of total profit of Rs. 3600 including his certain commission on total profit since he is a working partner and rest profit is received by *B*. What is the commission of *A* as a percentage of the total profit?
(a) 20% (b) 10%
(c) 5% (d) 25%

11. A trader sells goods to a customer at a profit of k% over the cost price, besides it he cheats his customer by giving 880 g only instead of 1 kg. Thus his overall profit percentage is 25%. Find the value of k?
(a) 8.33% (b) 8.25%
(c) 10% (d) 12.5%

12. A trader sells two brands of petrol; one is Extra Premium (EP) and other one is 'Speed' (SP). He mixes 12 litres of EP with 3 litres of speed and by selling this mixture at the price of EP he gets the profit of 9.09%. If the price of Extra Premium be Rs. 48 per litre, then the price of Speed (SP) is :
(a) Rs. 38 per litre (b) Rs. 42 per litre
(c) Rs. 28 per litre (d) none of these

13. *A*, *B* and *C* invest in the ratio of 3 : 4 : 5. The percentage of return on their investments are in the ratio of 6 : 5 : 4. Find the total earnings, if *B* earns Rs. 250 more than *A* :
(a) Rs. 6000 (b) Rs. 7250
(c) Rs. 5000 (d) none of these

14. Ajay bought a motor cycle for Rs. 50,000. 2 years later he sold it to Bijoy at 10% less of the cost price. Bijoy spend 5% of the purchasing price on its maintenance. Later Bijoy displayed the sale price of his motorcycle Rs. 50,000. Chetan wanted to purchase it at 15% discount but Bijoy gave him two successive discounts of 10% and 5% instead of 15% in one time. What is the actual discount availed by Chetan?
(a) 15% (b) 15.5%
(c) 14.5% (d) none of these

15. Kamal bought a house in Sushant city, whose sale price was Rs. 8 lakh. He availed 20% discount as an early bird offer and then 10% discount due to cash payment. After that he spent 10% of the cost price in interior decoration and lawn of the house. At what price should he sell the house to earn a profit of 25%?
(a) Rs. 9 lakh (b) Rs. 7.99 lakh
(c) Rs. 7.92 lakh (d) none of these

16. I wanted to purchase 10 chairs for the class room whose cost was Rs. 200 each. The trader offered me a discount if I were to purchase a set of 12 chairs. So I calculated that if I assume the normal price of 10 chairs then we can purchase 2 extra chairs which cost me only Rs. 80 each of two chairs at the cost price of 12 chairs after discount. What is the percentage discount?
(a) 6% (b) 8%
(c) 12% (d) 10%

17. The cost of servicing of a Maruti car at Maruti care Pvt. Ltd. is Rs. 400. Manager of service centre told me that for the second service within a year a customer can avail a 10% discount and further for third and fourth servicing he can avail 10% discount of the previous amount paid, within a year. Further if a customer gets more than 4 services within a year he has to pay just 60% of the servicing charges on these services. A customer availed 5 services from the same servicing station, what is the total percentage discount fetched by the customer?
(a) 19.42% (b) 18.5%
(c) 17.6% (d) 26%

18. The cost price of an article is *C* and the selling price of the same article is *S*, where *Z* is the profit or loss percentage. If the cost price and selling price both are increased by same amount then which of the following is true :
(a) *Z* increases (b) *Z* decreases
(c) remains constant (d) none of these

19. Cost price of 12 oranges is equal to the selling price of 9 oranges and the discount on 10 oranges is equal to the profit on 5 oranges. What is the percentage point difference between the profit percentage and discount percentage?
(a) 20 (b) 22.22
(c) 16.66 (d) 15

20. A car mechanic purchased four old cars for Rs. 1 lakh. He spent total 2 lakh in the maintenance and repairing of these four cars. What is the average sale price of the rest three cars to get 50% total profit if he has already sold one of the four cars at Rs. 1.2 lakh?
(a) 1.5 lakh (b) 1.1 lakh
(c) 1.2 lakh (d) 1.65 lakh

21. The cost of setting up a magazine is Rs. 2800. The cost of paper and ink etc is Rs. 80 per 100 copies and printing cost is Rs. 160 per 100 copies. In the last month 2000 copies were printed but only 1500 copies could be sold at Rs. 5 each. Total 25% profit on the sale price was realized. There is one more resource of income from the magazine which is advertising. What sum of money was obtained from the advertising in magazine?
(a) Rs. 1750 (b) Rs. 2350
(c) Rs. 1150 (d) Rs. 1975

22. DSNL charges a fixed rental of Rs. 350 per month. It allows 200 calls free per month. Each call is charged at Rs. 1.4 when the number of calls exceeds 200 per month and it charges Rs. 1.6 when the number of calls exceeds 400 per month and so on. A customer made 150 calls in February and 250 calls in March. By how much per cent the each call is cheaper in March than each call in February?
(a) 28% (b) 25%
(c) 18.5% (d) none of these

23. In the Bargain Bazar everyone purchases with a fair bargaining, so the traders markup the prices too much. A trader marked up an article at Rs. M expected huge profit if it is sold on the marked price. But a customer purchased it at $M/2$ with his fine bargaining skills, so the expected profit of the trader diminished by 66.66%. What is the percentage discount fetched by the customer through bargaining?
(a) 33.33% (b) 50%
(c) 66.66% (d) none of these

24. Tika Chand has a weighing balance in which there is a technical fault. The right pan of his balance measures always 200 g more than its left pan. Tika Chand as usual misutilise this balance in his business. While purchasing the articles he puts goods in the left pan and weight in the right pan while selling he reverse the order *i.e.,* goods in the right pan and weight in the left pan. He uses only 2 kg weight for the measurement and to measure $2n$ kg weight he measures n times by 2-2 kg but he sells goods at cost price. What is his profit percentage?
(a) 20% (b) $22\frac{2}{9}$%
(c) $18\frac{2}{11}$% (d) none of these

25. Akram Miya has two types of grapes. One is the fresh grapes containing 80% water and dry grapes containing 25% water. He sells 20 kg dry grapes, by adding water to the dry grapes, at cost price. What is the total profit percentage when after adding water the weight of 20 kg dry grapes increased in the proportion of water in fresh grapes?
(a) 275% (b) 200%
(c) 80% (d) 125%

26. Pankaj and Sushil invested some amount of money in the ratio of 3 : 5 for the same period in a business. They decided that at the end of year 20% profit was to be given to AIDS Control Society of India as a donation. Out of the remaining, 75% was to be reinvested and the rest of the profit was to be divided as interest on their capitals. If the difference in their shares is Rs. 1200. Find the total profit?
(a) Rs. 18000 (b) Rs. 24000
(c) Rs. 20000 (d) none of these

27. Jagran group launched a new magazine in January 2004. The group printed 10000 copies initially for Rs. 50000. It distributed 20% of its stock freely as specimen copy and 25% of the rest magazines are sold at 25% discount and rest at 16.66% discount whose printing price was Rs. 12 per copy. What is the overall gain or loss in the first month's issue of magazine, if the magazine could not realize the income from advertisements or other resources?
(a) 56% profit (b) 27% loss
(c) 16.66% profit (d) 38% profit

28. Teenagers shoe company sells the shoes whose prices *i.e.,* cost prices and selling prices are the multiples of either 13, 14, 15, 16, 17, 18 or 19, starting from Rs. 399 to Rs. 699 (i.e., $399 \le CP/SP \le 699$). What can be the maximum profit of the company?
(a) Rs. 292 (b) RS. 398
(c) Rs. 298 (d) Rs. 300

29. Jhun Jhunwala makes 1000 toys and incurs a cost of Rs. 1.2 for each toy. He marks-up the price in such a way that if he sells only 70% of the manufactured toys he will realize 16.66% overall profit. He sells only 750 articles at the marked price since rest of the toys are found to be defective so can't be sold. What is the net profit or loss of Jhun Jhunwala?
(a) 14.44% loss (b) 25% profit
(c) 33.33% profit (d) none of these

30. Anupam sells a painting to Bhargava at 4/5th the rate of profit at which Bhargava sells it to Chaudhary. Further Chaudhary sells it to Dara Singh at half the rate of profit at which Anupam sold it to Bhargava. If Chaudhary earns a profit of 10% by selling it to Dara Singh for Rs. 2805. What is the cost price of painting for Bhargava?
(a) 1896 (b) 2040
(c) 1680 (d) 2000

31. A dishonest retailer cheats his wholesaler and customer both. He purchases 19% more from the wholesaler and sells 15% less while selling to its customer. What is profit percentage by selling the goods at cost price?
(a) 36.78% (b) 34%
(c) 40% (d) 36.85%

32. Rotomac produces very fine quality of writing pens. Company knows that on an average 10% of the produced pens are always defective so are rejected before packing. Company promises to deliver 7200 pens to its wholesaler at Rs. 10 each. It estimates the overall profit on all the manufactured pens to be 25%. What is the manufacturing cost of each pen?
(a) Rs. 6 (b) Rs. 7.2
(c) Rs. 5.6 (d) Rs. 8

33. Pratibha printers prepares diaries expecting to earn a profit of 40% by selling on the marked price. But during transportation 8% diaries were got spoiled due to at random rain and 32% could be sold only at 75% of the cost price. Thus the remaining 60% diaries could be sold at the expected price. What is the net profit or loss in the whole consignment?
(a) 6% (b) 10%
(c) 8% (d) can't be determined

34. Radhey Lal markup the prices of sweets by 40% and he sold only 40% of those at this price. He sells half of the rest at $14\frac{2}{7}$% discount and rest at 25% discount. What is the net profit of Radhey Lal?
(a) 26.5% (b) 23.5%
(c) 30% (d) 28.6%

35. The price of an article reduces to 576 after two successive discounts. The markup is 80% above the cost price of Rs. 500. What is the new profit percentage if instead of two successive discounts the markup price was further increased successively two times by the same percentage?
(a) 259.2% (b) 59.2%
(c) 159.2% (d) can't be determined

36. A trader marks-up his goods by 80% and gives discount of 25%. Besides it he weighs 10% less amount while selling his goods. What is the net profit of trader?
(a) 50% (b) 35%
(c) 45% (d) 55%

37. A dishonest trader marks up his goods by 80% and gives discount of 25%. Besides he gets 20% more amount per kg from wholesaler and sells 10% less per kg to customer. What is the overall profit percentage?
(a) 80% (b) 60%
(c) 70% (d) none of these

38. A dishonest dealer purchases goods at 20% discount of the cost price of Rs x and also cheats his wholesaler by getting 20% extra through false weighing, per kg. Then he marks up his goods by 80% of x, but he gives a discount of 25% besides he cheats his customer by weighing 10% less than the required. What is his overall profit percentage?
(a) 125% (b) 100%
(c) 98.66% (d) 120%

39. Anjuli, Bhoomika and Chawla went to market to purchase the rings whose costs were same. But each ring was available with two successive discounts. Anjuli availed two successive discounts of 5% and 20%. Bhoomika availed two successive discounts 10% and 15% while Chawla availed two successive discounts of 12% and 13%. Who gets the maximum possible discount?
(a) Anjuli (b) Bhoomika
(c) Chawla (d) all of these

40. An egg seller sells his eggs only in the packs of 3 eggs, 6 eggs, 9 eggs, 12 eggs etc., but the rate is not necessarily uniform. One day Raju (which is not the same egg seller) purchased at the rate of 3 eggs for a rupee and the next hour he purchased equal number of eggs at the rate of 6 eggs for a rupee. Next day he sold all the eggs at the rate of 9 eggs for Rs. 2. What is his percentage profit or loss?
(a) 10% loss (b) 11.11% loss
(c) 3% loss (d) 2.5% profit

41. Virendra and Gurindra purchased one camera each at the same prices. Later on Amrendra purchased both cameras at equal prices from Virendra and Gurindra. But the profit percentage of Virendra was P while the same of Gurindra was Q since Gurindra calculated his profit on the selling price. Thus $Q = 41\frac{2}{3}\%$ of P. If Amrendra sells one of the camera to Dholakiya at $P\%$ profit then what is the cost price for Dholakiya, while Amrendra purchased each of the camera at Rs. 240?
(a) Rs. 676 (b) Rs. 500
(c) Rs. 576 (d) none of these

42. A merchant earns 25% profit in general. Once his 25% consignment was abducted forever by some goondas. Trying to compensate his loss he sold the rest amount by increasing his selling price by 20%. What is the new percentage profit or loss?
(a) 10% loss (b) 12.5% loss
(c) 12.5% profit (d) 11.11% loss

43. A milkman purchases 10 litres of milk at Rs. 7 per litre and forms a mixture by adding freely available water which constitutes 16.66% of the mixture. Later on he replaced the mixture by some freely available water and thus the ratio of milk is to water is 2 : 1. He then sold the new mixture at cost price of milk and replaced amount of mixture at twice the cost of milk then what is the profit percentage?
(a) 68% (b) 34%
(c) 40% (d) none of these

44. Profit on selling 10 candles equals selling price of 3 bulbs. While loss on selling 10 bulbs equals selling price of 4 candles. Also profit percentage equals to the loss percentage and cost of a candle is half of the cost of a bulb. What is the ratio of selling price of candle to the selling price of a bulb?
(a) 5 : 4 (b) 3 : 2
(c) 4 : 5 (d) 3 : 4

45. Cost price of two motorcycles is same. One is sold at a profit of 15% and the other for Rs. 4800 more than the first. If the net profit is 20%. Find the cost price of each motorcycle :
(a) Rs. 48000 (b) Rs. 52000
(c) Rs. 36000 (d) Rs. 42500

Answers

INTRODUCTORY EXERCISE-6.1

1. Rs. 180 and Rs. 225 **2.** Rs. 9000 **3.** Rs. 345 **4.** Rs. $153\frac{1}{3}$ per hundred **5.** Rs. 15300, Rs. 17850, gain = $\frac{5}{11}$%

INTRODUCTORY EXERCISE-6.2

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

LEVEL-1

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

LEVEL-2

1 (b)	**2.** (c)	**3.** (c)	**4.** (a)	**5.** (d)	**6.** (d)	**7.** (a)	**8.** (a)	**9.** (c)	**10.** (a)
11. (c)	**12.** (c)	**13.** (b)	**14.** (c)	**15.** (c)	**16.** (d)	**17.** (a)	**18.** (b)	**19.** (b)	**20.** (b)
21. (d)	**22.** (a)	**23.** (b)	**24.** (b)	**25.** (a)	**26.** (b)	**27.** (a)	**28.** (c)	**29.** (b)	**30.** (b)
31. (c)	**32.** (b)	**33.** (c)	**34.** (b)	**35.** (c)	**36.** (a)	**37.** (a)	**38.** (a)	**39.** (a)	**40.** (b)
41. (c)	**42.** (c)	**43.** (a)	**44.** (b)	**45.** (a)					

Hints & Solutions

LEVEL 1

1.

	Abhishek	Bhanu
Discount →	2800	2400 + 640 = 3040

The difference in selling price is same as difference in discount which Rs. 240 (= 3040 – 2800)

2. ∵ 10 % x = 15% of y, where $x + y = 30000$

$$\Rightarrow \quad \frac{x}{y} = \frac{3k}{2k}$$

Hence, the difference = k = 6000

3. Let the cost price of 1 litre pure milk be Re. 1, then

$$\left.\begin{cases} 6 \text{ litres (milk)} \rightarrow \text{CP} = \text{Rs. } 6 \\ 2 \text{ litres (water)} \rightarrow \text{CP} = \text{Rs. } 0 \end{cases}\right\} \rightarrow \text{CP} = \text{Rs. } 6 \text{ only.}$$

and 8 litre mixture → SP → 8 × 2 = Rs. 16

$$\text{Profit} = \frac{16-6}{6} \times 100 = \frac{1000}{6} = 166.66\%$$

4.

$$\left.\begin{array}{l} \text{SP of 60\% goods} = 0.6x \times 0.95 = 0.57x \\ \text{SP of 40\% goods} = 0.4x \times 1.1 = 0.44x \end{array}\right\} \text{Total SP} = 1.01x$$

$$\text{Profit} = 0.01x = 100$$

$$\Rightarrow \quad x = 10000$$

Alternatively: From option (c)

10000

6000 → loss = 300 4000 → gain = 400

net gain = 400 – 300 = Rs. 100,

Hence, option (c) is correct.

5. Let the MP of 1 kg tea be Re. 1, then CP of 20 kg with discount = 20 × 0.9 = Rs. 18

also 1 kg tea is free. So the retailer gets tea worth Rs. 21 by paying Rs. 18 only.

$$\text{Profit \%} = \frac{\text{goods left}}{\text{goods sold}} \times 100$$

$$= \frac{21-18}{18} \times 100 = 16.66\%$$

(Since the retailer earns Rs. 3 on each Rs. 18)

6. Let the CP of profit yielding article be Rs. 100 then

$$\left.\begin{array}{l} \quad\quad\quad\quad 250 \;\; \text{CP} \\ \quad\quad\quad\quad\quad\downarrow \\ 75\% \text{ profit} \left\{\begin{array}{l} \text{SP} \;\; 175 \leftrightarrow 175 \;\; \text{SP} \\ \quad\;\; \uparrow \\ \text{CP} \;\; 100 \end{array}\right. \end{array}\right\} 30\% \text{ loss}$$

Total CP = 350, Total SP = 350

So there is no profit no gain.

Alternatively: $1.75x = 0.7y$

$$\Rightarrow \quad \frac{x}{y} = \frac{2}{5}$$

again $\begin{bmatrix} 2 \times 1.75 = 3.5 \\ 5 \times 0.7 = 3.5 \end{bmatrix}$

and

Total cost price = 2 + 5 = Rs. 7

Total selling price = 3.5 + 3.5 = Rs. 7

Hence, no loss no gain.

7.

	CP	SP	MP	
Initially :	100	140	×	(since profit = 40%)
New prices :	100	112	140	

profit = 12% discount = 20%

8.

$$\frac{\text{CP}}{\text{SP}} = \frac{2}{3}$$

$$\therefore \quad \text{profit (\%)} = \frac{1}{2} \times 100 = 50\%$$

Alternatively: $\text{CP} = \frac{100}{18} = 5.55$ paise

$$\text{SP} = \frac{100}{12} = 8.33 \text{ paise}$$

$$\text{Profit} = \frac{8.33 - 5.55}{5.55} \times 100 = 50\%$$

9.

CP	SP	MP
100	120	150

20% profit 20% discount

But it can be directly solved as SP = 1.2 CP = Rs. 2304

NOTE There is no role of discount.

10. Note: There is no role of cost price of article (Rs. 123684)

(Consider) CP → 100

60 40

16.66% of profit + 10 –24 60% loss

70 16

(100 –14) = SP 86

Since, the overall % loss = 14%.

Thus option (c) is correct.

Alternatively: $0.6x + k \times 0.4x = 0.86x$

$$\Rightarrow \quad 0.4kx = 0.16x$$

$$\Rightarrow \quad k = 0.4$$

Therefore loss = 1 – 0.4 = 0.6 *i.e.*, 60%

11. Go through options

CP	SP	MP
100	100	300

$-66\frac{2}{3}\%$

$+200\%$

NOTE When there is no loss, CP = SP.

Alternatively: $\boxed{CP = SP}$ $\boxed{MP}$

100 $\xrightarrow{2/1\uparrow}$ $K = 100 + 200 = 300$

$2/3\downarrow$

From percentage change graphic :

Decrease	**Increase**
$\frac{2}{3}\downarrow$	$\frac{2}{3-2} = \frac{2}{1}\uparrow$
$= 66.66\%$	$= 200\%$

So, when CP = 100, markup % = 200, MP = 300

$$\text{Discount} = 66\frac{2}{3}\% = 200,\ SP = 100 = CP$$

Alternatively : $(CP = SP) = \frac{1}{3}MP$

$\Rightarrow$ $(CP = SP) : MP = 1 : 3$

12. $CP : MP = 2x : 3x$

$\Rightarrow$ Profit $= x$

(%) profit : (%) discount = 3 : 2

Let $CP = 200,\ SP = 300$

But $\frac{3x}{100} \times 200 + \frac{2x}{100} \times 300 = 100$

$\Rightarrow$ $x = 8.33\%$

Discount $2x = 16.66\%$

13. It is dependent upon the markup (%) or discount (%)

Since,

100 $\xrightarrow{+20\%}$ 120

96 $\xleftarrow{-20\%}$ 120

loss = 4%

Again

100 $\xrightarrow{50\%}$ 150

75 $\xleftarrow{50\%}$ 150

loss = 25%

Hence we can't determine.

14. CP → Profit (%) → MP

$100 \to x\% \to 100 + \frac{100x}{100} = (100 + x)$

Again, MP → discount → SP

$(100 + x) \to x\% \to (100 + x) - (100 + x)\frac{x}{100}$

$$= (100 + x)\left(1 - \frac{x}{100}\right)$$

Now $\frac{(100 + x)}{(100 + x)\left(1 - \frac{x}{100}\right)} = \frac{2}{1}$

$\Rightarrow$ $\left(1 - \frac{x}{100}\right) = \frac{1}{2}$ $\Rightarrow$ $x = 50\%$

This can be observed in the solution of the previous problem.

15. Go through option

$180 \times 12 \times 1.2 + 180 \times 8 \times 1.1 = 180\,[14.4 + 8.8]$

$= 180\,(23.2) = 4176$

and $180 \times 20 \times 1.15 = 4140$

Therefore loss $= 4176 - 4140 = 36$

Hence option (c) is correct.

16. Gain = 30000

loss = 20000

net gain = 10000 over Rs. 4 lakh

Hence, profit $= \frac{10000}{400000} \times 100 = 2.5\%$

17. Let the MP = Re 1 per kg then

Weight	**MP**	**Rate**
100	100	1
96	$\underset{SP}{\underset{\sim}{80}}$	$\frac{80}{96}$

Effective discount $= 1 - \frac{80}{96} = \frac{16}{96}$

% discount $= \frac{16}{96} \times 100 = 16.66\%$

18. CP of $A + B + C = 2x \times y + 5x \times 2y + 2x \times 4y = 20xy$

Profit of $A = 0.2xy$

Profit of $B = 2xy$

Profit of $C = 2xy$

Total profit $= 4.2xy$

% profit $= \frac{4.2xy}{20xy} \times 100 = 21\%$

19.

	CP	Profit	SP	MP
Initially	100	x	$(100 + x)$	133.33
After change	100	$2x$	$(100 + x)\frac{7}{6}$	

Now, since $(100 + x)\frac{7}{6} - 100 = 2x$

$\Rightarrow$ $x = 20\%$

	CP	**Profit**	**SP**	**MP**
	100	20	120	133.33
So,	300	60	360	400
Again	300	120	420	

So the increased selling price = Rs. 420

20. From percentage change graphic

$3/10\downarrow$

30%

(CP) 70 $\longleftrightarrow$ 100 (SP)

$\frac{3}{10-3} = \frac{3}{7}\uparrow$

$42\frac{6}{7}\%$

$$\text{Decrease} = \frac{3}{10}\downarrow = 30\%$$

$$\text{Increase} = \frac{3}{(10-3)} = \frac{3}{7}\uparrow = 42\frac{6}{7}\%$$

21. Let the price be x, then

$$x \times 0.8 \times 0.9 = 468$$

$\Rightarrow x = 650$, therefore marked price = Rs. 650

Alternatively: $650 \times 0.8 \times 0.2 = 468$

Hence option (d) is correct.

22.

	CP		SP
A →	160	20% Profit	192
B →	192	25% Profit	240

23. Reduced price $= 100 \times 0.95 \times 0.90 \times 0.80 = 68.40$

$\therefore$ Single discount $= (100 - 68.4)\% = 31.6\%$

24. $\text{CP} = \frac{10}{12}, \quad \text{SP} = \frac{12}{10}$

$$\text{Profit (\%)} = \frac{\frac{12}{10} - \frac{10}{12}}{\frac{10}{12}} \times 100 = 44\%$$

25. Let the cost price of one gram be Re. 1, then the markup price be Rs. 1.2 per g.

Now he sells 1000 g which seems to be 1250 g so he charges to a customer $1250 \times 1.2 =$ Rs. 1500 for 1000 g (or Rs. 1000)

$$\text{Thus his profit \%} = \frac{1500 - 1000}{1000} \times 100 = 50\%$$

26. Let the CP be Rs. x, then SP be $0.96x$

$\therefore \quad 0.96x = 240 \Rightarrow x = 250$

Now the new SP $= 250 \times 1.1 = 275$

27.

CP	SP	MP
x	$112.5x = 225$	300

(−25%)

$\therefore x = 200$, hence the cost price be Rs. 200.

NOTE It can also be solved by using option.
First of all find the SP by decreasing MP by 25% then this SP will be equal to 112.5% (12.5% is the profit) of the cost price so the CP can be find as given above.

28.

$$\text{CP} \xrightarrow{(-10\%)} (\text{SP})_1 \xrightarrow{(-5\%)} (\text{SP})_2$$

200 → 180 → 171

29. The CP of profitable cow $= \frac{9900}{1.1} = 9000$

and profit = Rs. 900

The CP of loss yielding cow $= \frac{9900}{0.8} = 12375$

and loss = Rs. 2475

So, the net loss $= 2475 - 900 = 1575$

30. The best way is to go through option. Consider option (a)

15000

$\left(\frac{2}{3}\right)$ $\left(\frac{1}{3}\right)$

10000 5000

(5% profit) ↓ ↓ 2% loss

500 100

Net gain = Rs. 400 (= 500 − 100)

Hence, option (a) is correct.

Alternatively: $\left[\left(1.05 \times \frac{2x}{3} + 0.98\,\frac{x}{3}\right) - x\right] = 400$

$\Rightarrow \quad x = 15000$

31. $\text{Profit (\%)} = \frac{\text{goods left}}{\text{goods sold}} \times 100 = \frac{50}{450} \times 100 = 11\frac{1}{9}\%$

Alternatively: Suppose CP of 1 g is Re. 1 then he sells goods worth Rs. 450 only and charges Rs. 500. So the profit is Rs. 50 over the sale price of Rs. 450.

32. Go through options. Consider option (b)

$200 \times 3.25 - 200 \times 3 =$ Rs. 50 (= 30 + 20)

Hence, option (b) is correct.

Alternatively: Rs. 0.25 is the difference on 1 banana

$\therefore$ Re 1 is the difference on $\frac{1}{0.25} = 4$ bananas

$\therefore$ Rs. 50 is the difference on $4 \times 50 = 200$ bananas

33. By percentage change (or fraction change) graphic

increase decrease

$30\% = \frac{3}{10}\uparrow \qquad \frac{3}{13}\downarrow$ [Since product *i.e.*, price is constant]

It means now $\frac{3}{13}$ times less eggs are available which is equal to 3 eggs.

i.e., $\frac{3x}{13} = 3$

$\Rightarrow \quad x = 13$ eggs (initially)

Now available eggs on the same price $= 13 - 3 = 10$

Thus, the new price $= \frac{910}{10} = 91$ paise

Alternatively : Go through options.

New or changed	No. of eggs	Rate	= total prices
	10	× 91	= 910 paise
Initial →	13	× 70	= 910 paise

(+3) (+30%)

Therefore option (a) is correct.

34. $\text{SP} = \frac{100}{12}$ paise

$\text{CP} = x, \text{SP} = 0.8x = \frac{100}{12} \Rightarrow x = \frac{100}{9.6}$ paise

Therefore, $\text{CP} = \frac{100}{9.6}$ paise

Thus, the new SP (with 20% profit) $= \frac{100}{9.6} \times 1.2 = \frac{100}{8}$ paise

Hence, 8 apples can be purchased for Re. 1 to gain 20%.

35. $10000 \xrightarrow{-10\%} 9000 \xrightarrow{-20\%} 7200 \xrightarrow{+10\%} 7920 \xrightarrow{+10\%} 8712$

36. $1425 - 1353 = 72 = 6\%$ of CP

$\Rightarrow$ CP = 1200

37. $\text{CP} = \frac{405}{0.9} = 450$

New SP = Rs. 465

$\text{Profit (\%)} = \frac{465 - 450}{450} \times 100 = 3.33\%$

38. $\left[\left((x \times 1.1) \times 1.1\right) \times \frac{1125}{1100}\right] = 990$

$\Rightarrow$ $x = 800$

Alternatively: Go through options or by the reverse process.

39. Best way is to go through option

Alternatively : $P \times 0.9 \times 0.75 = C \times 0.85 \times 0.80$

$\Rightarrow$ $\frac{P}{C} = \frac{136}{135}$

40. Let the CP be x then

$0.04x = 54\ (= 1080 - 1026)$

$\Rightarrow$ $x = \frac{54}{0.04} = 1350$ (CP)

CP = 1350

SP = 1350 × 1.04 = 1404

41. SP − CP = 175 = 14% of CP

$\Rightarrow$ CP = 1250

$\therefore$ SP = 1250 + 175 = 1425

42. CP = 100, then

Tag price = 80

SP, after discount = 75

Total loss = 25

$\because$ Rs. 25 are being less at CP of Rs. 100

$\therefore$ Rs. 37.5 are being less at CP of Rs. $\frac{100}{25} \times 37.5 = 150$

Hence, SP = 150 − 37.5 = 112.5

Alternatively: 112.5 + 37.5 = 150 = CP

Again $150 \times 0.8 \times .9375 = 112.5 = \text{SP}$

Hence, option (b) is correct.

43. $\text{CP} + 4k = \text{SP}_1$ (gives profit)

$\text{CP} - 3k = \text{SP}_2$ (gives loss)

since loss ($3k$) is 25% less than profit ($4k$)

$\therefore$ $\text{SP}_1 - \text{SP}_2 = 7k = 836 - 703 = 133$

$\Rightarrow$ $k = 19$

$\therefore$ $\text{CP} = \text{SP}_1 - 4k = \text{SP}_2 + 3k = 760$

Therefore required SP = 760 × 1.2 = 912

44. You can go through options.

$\text{CP} = \frac{100}{6} = 16.66$ paise

$\text{SP} = \frac{100}{5} = 20$ paise

$\text{profit (\%)} = \frac{20 - 16.66}{16.66} \times 100 = \frac{3.33}{16.66} \times 100$

$= \frac{1}{5} \times 100 = 20\%$

Hence, option (c) is correct.

Alternatively: $\text{CP} = \frac{100}{6}$

$\text{SP} = \frac{100}{6} \times 1.2 = \frac{100}{5}$

Hence, he should sell 5 toffees for Re. 1 (= 100 paise)

45. CP MP

$800 = 0.8x$ x

20% discount

$\Rightarrow$ x = Rs. 1000 = MP

SP at Hazratganz = Rs. 800

SP at Bhootnath = 1000 × 0.85 = 850

So, she requires Rs. 50 more to purchase the same calculator at Bhootnath.

46. Let the CP be Re. 1 per g

but he weighs 900 g for every 1000 g

$\therefore$ Value of goods sold = 900

Now, let the markup be x%

$\therefore$ $\text{MP} = 1000 + \frac{1000x}{100} = (1000 + 10x)$

but since MP = SP, $\therefore$ SP = $(1000 + 10x)$

Hence, $\text{profit (\%)} = \frac{(1000 + 10x) - 900}{900} \times 100 = 20$

$\Rightarrow$ $x = 8$

Thus the markup = 8%.

47. $\text{Loss \%} = \left(\frac{\text{common gain or loss}}{10}\right)^2 \%$

$= \left(\frac{20}{10}\right)^2 \% = 4\%$

48. Since loss = 4%

Now assume total CP of both articles be x, then

$\text{SP} = 0.96x = 400$

$\Rightarrow$ $x = \frac{400}{0.96} = \text{CP}$

$\therefore$ loss = 4% of CP

$\frac{4}{100} \times \frac{400}{0.96} = \text{Rs. } 16.66$

49. $\frac{\text{CP}}{\text{SP}} = \frac{29x}{19x}$

$\text{loss \%} = \frac{29x - 19x}{29x} \times 100 = 34.48\%$

(To understand the concept assume CP of each article Rs. 29 and SP of each article = Rs. 19)

50. $\frac{CP}{SP} = \frac{13}{23}$

profit (%) $= \frac{23-13}{13} \times 100 = \frac{10}{13} \times 100 = 76.92\%$

51. $\frac{CP}{SP} = \frac{28}{34} = \frac{14}{17}$

52. MP = Rs. 1.2, if CP = Re. 1
But he gives the cloth worth Rs. 0.8 instead of Re. 1.

Therefore profit % $= \frac{1.2-0.8}{0.8} = \frac{0.4}{0.8} \times 100 = 50\%$

53. CP = Rs. 80 $\left(= \frac{3200}{40}\right)$

Now SP of 40 books = CP of 40 books + SP of 8 books

$\Rightarrow$ SP of 32 books = 3200

$\Rightarrow$ SP of 1 book = Rs. 100

$\therefore$ Required SP of 1 dozen books = Rs. 1200

54. Profit of $A = 1800 \times \frac{20}{100}$ = Rs. 360

CP of $B = \frac{1800}{1.2} = 1500$

$\therefore$ Profit of B = Rs. 300 (= 1800 − 1500)

$\therefore$ Difference in profit of A and B = Rs. 60

55. CP of $A = \frac{1818}{0.9} = 2020$

CP of $B = \frac{1818}{1.01} = 1800$

$\frac{\text{CP of } A}{\text{CP of } B} = \frac{2020}{1800} = \frac{101}{90}$

56. 103.33 CP − 0.95 CP = 65

$\Rightarrow$ CP = Rs. 780

Profit (%) $= \frac{936-780}{780} \times 100 = 20\%$

57. Best way is to assume some proper values then verify it.

58. Let us assume initially he has 100 l of milk
So, after 10% of water addition new amount of mixture = 110 l
Again adding 10% more then the final amount of mixture = 121 l

Profit % $= \frac{21}{100} \times 100 = 21\%$

59. SP $= x + \frac{x \times x}{100} = 96\%$

$\Rightarrow$ $x = 60$

New, SP $= 60 + \left(\frac{60 \times 120}{100}\right)$ = Rs. 132

60. $K \to 1$ litre, price of $K \to 1$
$P \to 4$ litre, price of $P \to 2$
Price of total (new) mixture $= 1 \times 1 + 4 \times 2$ = Rs. 9
Price of pure petrol of same quantity = 5 × 2 = Rs. 10
Percentage profit $= \frac{1}{9} \times 100 = 11\frac{1}{9}\%$

61. Amount purchased = 1100 g
Amount sold = 900 g

Profit % $= \frac{200}{900} \times 100 = 22\frac{2}{9}\%$

62. If CP be Re. 1 per g, then he pays Rs. 1200 for 1000 g
Again he obtains Rs. 1200 for 1000 g (by selling at 20% profit). Thus there is no loss no gain.

63.

CP	SP
240	280

$\left(-14\frac{2}{7}\%\right)$

Actual profit (%) $= \frac{40}{240} \times 100 = 16.66\%$

NOTE Here you can apply base change concept.

increase decrease

16.66% $14\frac{2}{7}\%$

$\frac{1}{6}\uparrow \leftarrow \frac{1}{7}\downarrow$

64. Go through options :

$100 \xrightarrow{80\%} 180$

New SP $= \frac{180}{3} = 60$

Percentage loss = 40% (100 − 60)
Hence, (c) is correct choice.

65.

CP	Profit	SP
100	20	120
x	25	150

+25%

$x \times 1.25 = 150 \Rightarrow x = 120$

% change $= \frac{120-100}{100} \times 100 = 20\%$

66. 6.66% of MP = 25

$\Rightarrow$ MP = 375

$\therefore$ SP = MP − 25 = 350

67. Profit % $= \frac{5}{95} \times 100 = 5.26\%$

68. Recall it is based on inverse proportion or product constancy concept.

Reduction in price increase in amount

$25\%\left(\frac{1}{4}\right)\downarrow$ $\uparrow\left(\frac{1}{3}\right)$ 33.33% = 4 oranges

It means original number of oranges = 4 × 3 = 12

$\therefore$ Original price of oranges $= \frac{16}{12}$ = Rs. 1.33

69. Reduction in price increase in amount

$20\%\left(\frac{1}{5}\right)\downarrow$ $\frac{1}{4}\uparrow$ (25%) = 6 kg

It means original amount of sugar needed = 6 × 4 = 24 kg

$\therefore$ Original price of the sugar $= \frac{240}{24}$ = Rs. 10 per kg.

70. Just a sitter. Don't be bogged down. Its simple *i.e.*, 25%, nothing else, which is very obvious.

LEVEL 2

1. Just a sitter but a logical problem.

CP of 5 bikes = 67500 + 232500 = 300000

Now, since we require 17.5% profit, so SP = $300000 \times \frac{117.5}{100}$

= Rs. 352500

2. CP = 100, SP (with tax) = 120

New SP = 100 − 5 = 95

∴ Effective discount = 120 − 95 = 25

So, at SP of 95 → discount = 25

and at SP of 3325 → discount = $\frac{25}{95} \times 3325 = 875$

3. Let the CP of a bicycle = Rs. 100

Now, since profit 140%

∴ SP = 240

Now, 7 bicycles are being sold instead if 1 bicycle, but the sale price of new bicycle = Rs. 120

Therefore total sale price of new sale of bicycles

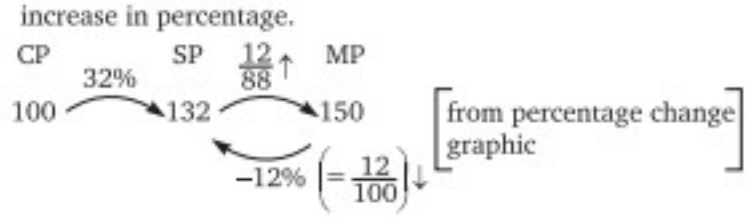
$= 7 \times 120 = 840$

and the CP = $7 \times 100 = 700$

So, the new profit = 840 − 700 = Rs. 140

Since the initial profit is same as the new so there is no increase in percentage.

4.



NOTE In this case first of all find the SP, after adding profit percentage to CP then find the MP through SP.

Now,

Here first of all we subtract discount from the MP then the resultant value will be SP.

5.

Linc pens	Cello pens
CP : SP	CP : SP
37 : 50	37 : 24

Profit % = $\frac{13}{37} \times 100$

and Loss% = $\frac{13}{37} \times 100$

Since Profit = loss

Hence option (d) is correct.

6.

	A		B		C
SP	$\frac{1}{7}\left(\frac{8}{7}\right)\frac{1}{8}$	:	$\frac{1}{8}\left(\frac{9}{8}\right)\frac{1}{9}$	:	$\frac{1}{4}\left(\frac{5}{4}\right)\frac{1}{5}$

Since 14.28% = $\frac{1}{7}$

So, the ratio of profit percentage of

A		B		C	
8	:	7	:	14	(Given)
↓		↓		↓	
$\frac{1}{7}$		$\frac{1}{8}$		$\frac{1}{4}$	

Thus the ratio of CP of $A : B : C$

$7 : 8 : 4$

Therefore % profit = $\frac{(8 + 9 + 5) - (7 + 8 + 4)}{(7 + 8 + 4)} \times 100$

$= \frac{3}{19} \times 100 = 15.78\%$

7.

	A	B	C	M
CP →	100	120	132	(120 + 12) = 132
SP →	120	132	120	143
CP →	143			

Loss of A = 143 − 120 = 23

% loss of A = $\frac{23}{100} \times 100 = 23\%$

8. Total wages = no. of employees × wage per employee

$60xy = 3x \times 20y$

$54xy = 2x \times 27y$

Profit (%) = $\frac{60 - 54}{60} \times 100 = 10\%$

9. If I had Rs. 100

Discount = 25 = cost of my sister's watch

then cost of my own watch = 75

Thus the ratio of cost of my own watch to that of my sister's watch = 3 : 1

10. Ratio of profit of $A : B$ (excluding commission of A)

= 3 : 5 (∵ 54 : 90 = 3 : 5)

Now the share of profit of B = 3600 − 1800 = Rs. 1800

So the share of profit of A (excluding commission) = Rs. 1080

So the commission of A = 1800 − 1080 = 720

Therefore the required percentage = $\frac{720}{3600} \times 100 = 20\%$

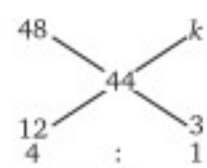
11. Profit % = $\frac{25}{100} = \frac{120 + k}{880}$ (Profit)/(Sale) ⇒ $k = 100$

Therefore, net profit % = $\frac{100}{1000} \times 100 = 10\%$

12. SP = $\frac{12}{11}$ of CP

$48 = \frac{12}{11}$ of CP ⇒ CP = 44

Now, by alligation



∴ $k = 28$

Thus the price of speed brand is Rs. 28/litre.

13.

	A	B	C
Investment	$3x$	$4x$	$5x$
Rate of return	$6y\%$	$5y\%$	$4y\%$
Return	$\frac{18xy}{100}$	$\frac{20xy}{100}$	$\frac{20xy}{100}$

$$\text{Total} = (18 + 20 + 20) = \frac{58xy}{100}$$

$$B\text{'s earnings} - A\text{'s earnings} = \frac{2xy}{100} = 250$$

$$\text{Total earning} = \frac{58xy}{100} = 7250$$

14. MP after first discount after second discount

100 90 85.5

So, the net discount = 100 − 85.5 = 14.5%

15. MP CP Total CP

$100 \xrightarrow{-20\%} 80 \xrightarrow{-10\%} 72 \xrightarrow{+10\%} 79.2$

SP = 125% of CP

SP = 1.25 × 79.2

SP = 99

So, initially marked price = 100 ⇒ 8,00,000

Final sale price = 99 ⇒ 7,92,000

16. Price of 10 chairs = 10 × 200 = 2000

Price of 12 chairs (without discount) = 12 × 200 = 2400

Price of 12 chairs with discount = 10 × 200 + 2 × 80 = 2160

therefore discount = 2400 − 2160 = 240

Hence discount % = $\frac{240}{2400} \times 100 = 10\%$

17. Amount paid in Ist service = 100 (suppose)

Amount paid in IInd service = 90

Amount paid in IIIrd service = 81

Amount paid in IVth service = 72.9

Amount paid in Vth service = 60

Total amount paid 403.9

Discount = 500 − 403.9 = 96.1

$$\text{Discount \%} = \frac{96.1}{500} \times 100 = 19.42\%$$

18. Consider some proper values and then check out.

19. CP : SP

3 : 4

Profit on 3 apples = Re 1 (consider CP = Re 1)

Profit = 33.33%

and discount = 11.11%

Since CP SP MP

$3 \xrightarrow{(1)} 4 \xrightarrow{(0.5)} 4.5$

Profit is double that of discount

So, the percentage point difference = 33.33% − 11.11%

= 22.22% point

20. Total cost of 4 cars = 1 + 2 = 3 lakh

Total SP of 4 cars = 3 × 1.5 = 4.5 lakh

SP of 1 car = 1.2 lakh

SP of rest 3 cars = 4.5 − 1.2 = 3.3 lakh

Average SP of all the 3 cars = 1.1 lakh

21. Setup cost = Rs. 2800

Paper etc. = Rs. 1600

Printing cost = Rs. 3200

Total cost = Rs. 7600

Total sale price = 1500 × 5 = 7500

Let the amount obtained from advertising is x then

$(7500 + x) - (7600) = 25\%$ of 7500

$x = 1975$

22. Charge of 1 call in February = $\frac{350}{150} = \frac{7}{3}$

$$\text{Charge of 1 call in March} = \frac{350 + 50 \times 1.4}{250}$$

$$= \frac{420}{250} = \frac{42}{25}$$

$$\text{\% cheapness of a call in March} = \frac{\frac{7}{3} - \frac{42}{25}}{\frac{7}{3}} \times 100 = 28\%$$

23. Let the CP be 100 and % markup be k% then

$$\text{MP} = 100 + k$$

$$100 \xrightarrow{k\%} (100 + k) \text{ MP (also expected SP)}$$

$$\text{but actual SP} = \frac{100 + k}{2}$$

$$\therefore \quad \frac{\left[\left(\frac{100 + k}{2}\right)\right]}{k} = \frac{200}{3 \times 100} \; (= 66.66\%)$$

$$\Rightarrow \quad k = 300$$

Therefore CP MP (initially)

100 400

$$\text{Finally SP} = \frac{400}{2} = 200$$

$$\therefore \quad \text{Discount} = \frac{200}{400} \times 100 = 50\%$$

Alternatively: MP → M

SP → $\frac{M}{2}$

$$\text{Discount (\%)} = \frac{M/2}{M} \times 100 = 50\%$$

24. Let the CP and SP of 1 g = Re 1, then

He spends Rs. 2000 and purchase 2200 g

and he charges Rs. 2000 and sells 1800 g

$$\text{profit (\%)} = \frac{\text{goods left}}{\text{goods sold}} \times 100$$

$$= \frac{400}{1800} \times 100 = 22\frac{2}{9}\%$$

25.

Fresh grapes

Water		Pulp
80%		20%
4	:	1

Dry grapes

Water		Pulp
25%		75%
1	:	3
5 kg		15 kg] out of 20 kg dry grapes

	80%	20%	Required proportion of water and pulp
+ (55 kg)	4	1	
	60 kg	15 kg	

Thus to make dry grapes similar to the fresh grapes, Akram requires 55 kg water with 20 kg of dry grapes.

So, the profit (%) $= \frac{55}{20} \times 100 = 275\%$

26. Let the total profit be 100

Amount left after donation $= 80$

Amount left after reinvestment $= 20$

Now, $\frac{5x}{8} - \frac{3x}{8} = 1200$

where x is the amount left after reinvestment

$$\frac{2x}{8} = 1200 \Rightarrow x = 4800$$

Therefore, total profit $= 4800 \times 5 = 24000$

Alternatively: Go through options.

27. Total cost = Rs. 50,000

Total sale price (or revenue) $= 2000 \times 9 + 6000 \times 10 = 78{,}000$

$$\text{profit (\%)} = \frac{28000}{50000} \times 100 = 56\%$$

28. The maximum possible profit

= maximum possible difference in SP and CP.

It means SP be maximum and CP be minimum

$CP_{(min)}$ = Rs. 399 $\qquad 19\,m = 399$

where m is an integer.

Again $SP_{(max)}$ = Rs. 697, which is very close to 699

Here $697 = 17k$; k is a positive integer.

So, the maximum profit = 697 − 399 = Rs. 298

29. Total cost price $= 1000 \times 1.2$ = Rs. 1200

Expected selling price $= 700 \times x = 1200 \times 1.1666 = 1400$

$\Rightarrow \quad x$ = Rs. 2 per toy

Now the real selling price $= 750 \times 2$ = Rs. 1500

$\therefore$ Profit = Rs. 300 (= 1500 − 1200)

$\therefore$ Profit % $= \frac{300}{1200} \times 100 = 25\%$

30. Chaudhary's profit = 10%

Anupam's profit = 20%

Bhargava's profit = 25%

i.e., $A \xrightarrow{20\%} B \xrightarrow{25\%} C \xrightarrow{10\%} D$

100 → 120 → 150 → 165

Now

17 times (120 → 2040) (165 → 2805) 17 times

31. From the statements it is clear that he purchases 119 g instead of 100 g and he sells 85 g instead of 100 g. Therefore in this whole transaction he saves 19 + 15 = 34 g

Thus the profit $= \frac{34}{85} \times 100 = \left(\frac{\text{Goods left}}{\text{Goods sold}} \times 100\right) = 40\%$

NOTE In this type of question always equate either money or weight for simple solution.

32. You must know that the company is able to deliver only 90% of the manufactured pens. So let K be the manufacturing price of a pen, then

total income (including 25% profit) $= (8000 \times K) \times 1.25$

also this same income is obtained by selling 90% manufactured pens at Rs. 10 which is equal to 7200×10

Thus $\quad (8000 \times K)\,1.25 = 7200 \times 10$

$\Rightarrow \quad K$ = Rs. 7.2 $\qquad$ (90% of 8000 = 7200)

33. Let the number of diaries (produced) be 100 and the cost price of a diary be Re 1 then

Total cost incurred $= 100 \times 1 = 100$

Total sale price $= 32 \times 0.75 + 60 \times 1.4 = 108$

Therefore profit = Rs. 8

Thus there is 8% profit

NOTE Marked price (*i.e.*, expected) = 40% above the cost price.

34. Let the number of sweets be 100 and the cost price of one piece of sweet = Re. 1

then, total cost price $= 100 \times 1$ = Rs. 100

Total sale price $= 40 \times 1.4 + 30 \times 1.2 + 30 \times 1.05 = 123.5$

$\therefore \quad$ profit (%) = 23.5% $\qquad (= 123.5 - 100)$

35.

CP	SP	MP
500	576	900

Again $SP = MP\left[\left(1 - \frac{r}{100}\right)^2\right] \qquad [r \to$ rate of discount in %]

$$\Rightarrow \quad 576 = 900\left(1 - \frac{r}{100}\right)^2$$

$$\Rightarrow \quad \frac{24}{30} = \left(1 - \frac{r}{100}\right) \Rightarrow r = 20\%$$

Again, new $SP = MP\left(1 + \frac{r}{100}\right)^2 = 900\left(1 + \frac{20}{100}\right)^2 = 1296$

New, profit percentage $= \frac{SP - CP}{CP} \times 100$

$$= \frac{1296 - 500}{500} \times 100 = 159.2\%$$

36. Consider actual price of 1 g goods = Re. 1 then

he sells the product equals to Rs. 90 only (10% less weighing)

Again MP = Rs. 1.8 and SP = 1.35 for 1 g.

Thus he gives the goods worth Rs. 90 and charges Rs. 135 after 25% discount. Thus the profit %

$$= \frac{135 - 90}{90} \times 100 = 50\%$$

37. $\quad CP = \frac{100}{120} = \frac{10}{12}$

(since he purchases 120 g and pays Rs. 100, by assumption actual CP of 1 g = Re. 1)

$$SP = \frac{135}{90} = \frac{3}{2} = \frac{18}{12}$$

(Since actual MP = 180, actual SP = 135, with 25% discount and he sells only 90 g instead of 100 g)

$$\text{profit (\%)} = \frac{\frac{18}{12} - \frac{10}{12}}{\frac{10}{12}} \times 100 = 80\%$$

38. Let the actual cost price of an article be Re 1 (in place of x)
Now he purchases goods worth Rs. 120 and pays Rs. 80, since 20% discount is allowed.

So the $CP = \frac{80}{120} = \frac{2}{3}$

Again MP = 180, SP = 135 (since 25% discount)

Thus the trader sells goods worth Rs. 90 instead of 100 g and charges Rs. 135. Therefore the effective $SP = \frac{135}{90} = \frac{3}{2}$

$$\therefore \quad \text{profit (\%)} = \frac{\frac{3}{2} - \frac{2}{3}}{2/3} \times 100 = 125\%$$

39.

Anjuli		Bhoomika		Chawla	
	100		100		100
	↓ – 20%		↓ – 15%		↓ – 12%
24	80	23.5	85	23.44	88
	↓ – 5%		↓ – 10%		↓ – 13%
	76		76.5		76.56

Thus it is clear from the graphical solution that the maximum discount is availed by Anjuli.

NOTE It does not matter that we first decrease by 20% and then by 5% or *vice-versa*. This concept has been already illustrated in percentage chapter. Try to do it for your concept clarification.

40. CP of one egg (in first case) $= \frac{1}{3} = 33.33$ paise

CP of one egg (in second case) $= \frac{1}{6} = 16.66$ paise

Average CP of one egg $= \frac{(33.33 + 16.66)}{2} = 25$ paise

SP of one egg $= \frac{200}{9}$ (Re. 1 = 100 paise)

$$\text{profit-loss} = \frac{25 - \frac{200}{9}}{25} \times 100 \qquad \left(\text{loss\%} = \frac{CP - SP}{CP} \times 100\right)$$

$= 11.11\%$ loss

41. This question is based on fundamental concept of percentage change.

$$\text{Virendra} = CP_V \xrightarrow{\rightarrow P\%} SP_V$$

$$\text{Gurindra} = CP_G \xrightarrow{Q\% \leftarrow} SP_G$$

Here, $CP_V = CP_G$ and $SP_V = SP_G$

But $P \neq Q$

also, $P\%$ of $CP_V = Q\%$ of SP_G

also $Q = 41\frac{2}{3}\%$ of $P = \frac{125}{3} \times \frac{P}{100}$

and $Q = \frac{P}{100 + P} \times 100$

(From the concept of percentage change)

$$\therefore \quad \frac{P}{100 + P} \times 100 = \frac{125}{3} \times \frac{P}{100} \qquad \left(41\frac{2}{3} = \frac{125}{3}\right)$$

$\Rightarrow \quad P = 140$

$\therefore \quad CP = 100$ when $SP = 240$

Where $CP = CP_V = CP_G$ and $SP = SP_V = SP_G$

Again SP for Amrindra = 240 + 140% of 240 = 576

42. Let the CP of one article be Rs. 1
then the SP be Re. 1.25
Again the new SP be $(1.25) \times 1.2 = 1.5$
Now, if he sell initially 100 articles, then

$CP = 100 \times 1 =$ Rs. 100

$SP = 100 \times 1.25 =$ Rs. 125

New $SP = 75 \times 1.5 = 112.5$ (since 25% articles were abducted)

$\therefore$ New profit percentage = 12.5%

43. **Note :** First of all the price of milk does not matter. You can assume any convenient price. Besides it instead of 10 l of milk you can consider 100 l of milk to avoid calculations in decimal.
Now, since water is 16.66% in the mixture of milk, therefore with 100 l pure milk 20 l water is added. Again note that in replacement method the quantity of mixture does not increase except to the variation in ratio of contents.
Again by replacement formula

$$\frac{80}{120} = \frac{100}{120}\left(1 - \frac{K}{120}\right) \Rightarrow K = 24\,l$$

Thus he replaces 24 l of mixture with water.
(Note the required ratio of milk is to water is 2 : 1. It means in 3 l of new mixture, there will be 2 l of water)
Thus if the price of new mixture be Re 1, then the price of replaced mixture be Rs. 2.

Therefore, total $SP = 120 \times 1 + 24 \times 2 = 168$

and $CP = 100 \times 1 = 100$

$\therefore$ Profit % = 68%

44.

	Candle	Bulb
CP	a	c
SP	b	d

and $c = 2a$

Profit $= 10\,(b - a) = 3d$

and Loss $= 10\,(c - d) = 4b$

$$\text{Profit (\%)} = \frac{3d}{10a} \times 100$$

and $$\text{Loss (\%)} = \frac{4b}{10c} \times 100$$

Again $$\frac{3d}{10a} \times 100 = \frac{4b}{10c} \times 100$$

$$\Rightarrow \quad \frac{3d}{a} = \frac{4b}{c} \Rightarrow \frac{3d}{a} = \frac{4b}{2a} \qquad (\because c = 2a)$$

$$\Rightarrow \quad \frac{b}{d} = \frac{3}{2}$$

45. Let the CP of each motorcycle be Rs. x, then

$$2\,(1.15x) + 4800 = 2(1.2x)$$

$$\Rightarrow \quad 0.\,x = 4800 \Rightarrow x = 48000$$

❑❑❑

5 PERCENTAGES

It is one of the most important chapters which is the backbone of calculations either involved in commercial arithmetic or in real life. Personally I do maximum arithmetical calculation using percentage and others too. So in the context of calculation it is necessary to know the clear concepts of percentage which plays a very vital role in Data Interpretation besides quantitative Aptitude section. On an average two problems *i.e.*, nearly 4–5 % problems in QA only, are being asked in CAT every year.

In other entrance/competitive exams like MAT, XAT and UPMCAT, etc there are too many questions asked from this chapter.

PERCENTAGE AND ITS APPLICATION

A fraction with denominator 100 is called a per cent. Per cent is an abbreviation for the latin word "percentum" meaning "per hundred " or "hundredhs" and is denoted by symbol %.

NOTE A fraction with denominator 10 is called as decimal.

Since per cent is a form of fraction, we can express per cent as fractions (or decimals) and *vice-versa.*

CONVERSION OF A FRACTION INTO PERCENTAGE

To convert a fraction into a percentage, multiply the fraction by 100 and put "%" sign.

EXAMPLE 1 *Convert the following fractions into percentages:*

(i) $\frac{1}{2}$ *(ii)* $\frac{3}{4}$ *(iii)* $\frac{4}{5}$ *(iv)* $\frac{7}{8}$

SOLUTION (i) $\frac{1}{2} \to \frac{1}{2} \times 100 = 50\%$

(ii) $\frac{3}{4} \to \frac{3}{4} \times 100 = 75\%$

(iii) $\frac{4}{5} \to \frac{4}{5} \times 100 = 80\%$

(iv) $\frac{7}{8} \to \frac{7}{8} \times 100 = 87.5\%$

CONVERSION OF A PERCENTAGE INTO A FRACTION

To convert a percentage into a fraction, replace the % sign with $\frac{1}{100}$ and reduce the fraction to simplest form.

EXAMPLE 2 *Express the following percentage as fraction*

(i) 20% *(ii)* 30% *(iii)* 45% *(iv)* $5\frac{1}{8}$ %

(v) 155%

SOLUTION (i) $20\% = \frac{20}{100} = \frac{1}{5}$

(ii) $30\% = \frac{30}{100} = \frac{3}{10}$

(iii) $45\% = \frac{45}{100} = \frac{9}{20}$

(iv) $5\frac{1}{8}\% = \frac{41}{8 \times 100} = \frac{41}{800}$

(v) $155\% = \frac{155}{100} = \frac{31}{20} = 1\frac{11}{20}$

CONVERSION OF A PERCENTAGE INTO A RATIO

To convert a percentage into a ratio, first convert the given percentage into a fraction in simplest form and then to a ratio.

EXAMPLE 3 *Solve the following :*

(i) 38% *(ii) 25%* *(iii) 66.66%*

SOLUTION (i) $38\% = \frac{38}{100} = \frac{19}{50} = 19 : 50$

(ii) $25\% = \frac{25}{100} = \frac{1}{4} = 1 : 4$

(iii) $66.66\% = 66\frac{2}{3}\% = \frac{200}{3 \times 100} = \frac{2}{3} = 2 : 3$

CONVERSION OF A RATIO INTO A PERCENTAGE

To convert a ratio into a percentage, first convert the given ratio into a fraction then to a percentage.

EXAMPLE 4 *Express the following ratios as percentage :*
(i) 1 : 5 (ii) 2 : 3 (iii) 4 : 9

SOLUTION (i) $1:5=\frac{1}{5}=\frac{1}{5}\times 100=20\%$

(ii) $2:3=\frac{2}{3}=\frac{2}{3}\times 100=66.66\%$

(iii) $4:9=\frac{4}{9}=\frac{4}{9}\times 100=44.44\%$

CONVERSION OF A PERCENTAGE INTO A DECIMAL

To convert a percentage into a decimal remove the % sign and move the decimal point two places to the left.

EXAMPLE 5 *Convert the following percentages into decimals :*
(i) 36% (ii) 250% (iii) 57.5% (iv) $17\frac{1}{5}$% (v) 7%

SOLUTION (i) 36% = 0.36

(ii) 250% = 2.50 = 2.5

(iii) 57.5% = 0.575

(iv) $17\frac{1}{5}\% = 17.2\% = 0.172$

(v) 7% = 0.07

CONVERSION OF A DECIMAL INTO A PERCENTAGE

To convert a decimal into a percentage, move the decimal point two place to the right (adding zeros if necessary) and put % sign.

EXAMPLE 6 *Convert the following decimals into percentages :*
(i) 0.35 (ii) 8.12 (iii) 0.018

SOLUTION (i) 0.35 = 35%

(ii) 8.12 = 812%

(iii) 0.018 = 1.8%

- Work out some more examples so that all these thing rest on your fingure tips.

Remember $\frac{1}{2}=\frac{2}{4}=\frac{3}{6}=\frac{4}{8}=\ldots=50\%$ etc.

Learn and practice all the values given below.

CONVERSION OF FRACTION INTO PERCENTAGE

NUMERATORS

DENOMINATORS	1	2	3	4	5	6	7	8	9	10	11	12
1	100	200	300	400	500	600	700	800	900	1000	1100	1200
2	50	100	150	200	250	300	350	400	450	500	550	600
3	33.33	66.66	100	133.33	166.66	200	233.33	266.66	300	333.33	366.60	400
4	25	50	75	100	125	150	175	200	225	250	275	300
5	20	40	60	80	100	120	140	160	180	200	220	240
6	16.66	33.33	50	66.66	83.33	100	116.66	133.33	150	166.66	183.33	200
7	14.28	28.56	42.85	57.13	71.42	85.71	100	114.28	128.56	142.85	157.13	171.42
8	12.5	25	37.5	50	62.5	75	87.5	100	112.5	125	137.5	150
9	11.11	22.22	33.33	44.44	55.55	66.66	77.77	88.88	100	111.11	122.22	133.33
10	10	20	30	40	50	60	70	80	90	100	110	120
11	9.09	18.18	27.27	36.36	45.45	54.54	63.63	72.72	81.81	90.9	100	109.09
12	8.33	16.66	25	33.33	41.66	50	58.33	66.66	75	83.33	91.66	100
15	6.66	13.33	20	26.66	33.33	40	46.66	53.33	60	66.66	73.33	80

(PERCENTAGE-FRACTION CONVERSION TABLE)

Remember : $\frac{1}{7}=14.28\%$ and $\frac{1}{14}=7.14\%$

$\frac{1}{6}=16.66\%$ and $\frac{1}{15}=6.66\%$

$\frac{1}{9}=11.11\%$ and $\frac{1}{11}=9.09\%$

$\frac{1}{15}=6.66\%$ and $\frac{1}{16}=6.25\%$

$\frac{1}{3}=33.33\%$ and $\frac{3}{10}=30\%$

99.99% is equivalent to 100% (in calculation)

SOME OTHER TYPICAL VALUES

$\frac{1}{13}=7.69\%\approx 7.7\%$, $\frac{1}{17}=5.88\%$, $\frac{1}{19}=5.26\%$,

$\frac{1}{21}=4.76\%$, $\frac{1}{23}=4.35\%$, $\frac{1}{24}=4.166\%$

Learnings from the table :

(i) This table is a first hand support as a percentage values of some frequently used fractions.

(ii) All the percentage values whose decimal part is 0.33, 0.66, 0.00 contain the denominator 3 in the fraction.

(iii) Similarly if there is 0.16, 0.33, 0.50, 0.66, 0.83, 0.00 it means there is a 6 in the denominator of the fraction.

(iv) Similarly if there is 0.28, 0.56, 0.85, 0.13, 0.42, 0.71 it means there is a 7 as denominator.

(v) If there is 0.11, 0.22, 0.33, 0.44 … 0.99 etc. It means there is 9 as the denominator of the fraction.

(vi) If there is 0.09, 0.18, 0.27 … it means there is 11 as the denominator of the fraction.

(viii) If two percentage values have different decimal values (there must be different denominators) then their addition or subtraction results always in decimal *i.e.*, never as an integer.

PERCENTAGE OF A QUANTITY

EXAMPLE 1 *Find the no. of male students (i.e., boys), if there are 42% male students in the school and the total no. of students in the school is 1000.*

SOLUTION Required number of male students

$$= 42\% \text{ of } 1000$$
$$= \frac{42}{100} \times 1000 = 420$$

EXAMPLE 2 *A student scored 85% marks. Total marks were 400. How much did he score?*

SOLUTION Marks scored = 85% of 400

$$= \frac{85}{100} \times 400$$
$$= 340$$

EXAMPLE 3 *In an orchard $16\frac{2}{3}$% of the trees are mango trees. If the total number of trees in the orchard is 360, find the number of other types of trees in the orchard.*

SOLUTION Total number of trees = 360

Number of mango trees = $16\frac{2}{3}$% of 360

$$= \frac{50}{3 \times 100} \times 360 = 60$$

Therefore, the number of other trees = 360 − 60 = 300

Alternatively: Number of mango trees = $16\frac{2}{3}$%

It means no. of other types of trees = $\left(100 - 16\frac{2}{3}\right)$%

$$= 83\frac{1}{3}\%$$

Thus number of other types of trees = $83\frac{1}{3}$% of 360 = 300

INTRODUCTORY EXERCISE-5.1

1. Find the value of :
   (i) 25% of 200 (ii) 30% of 180
   (iii) 37.5% of 300 (iv) 83.33% of 480
   (v) 100% of 2 quintal (vi) 165% of 330 litre
   (vii) $5\frac{1}{2}$% of Rs. 1600 (viii) 10% of 1 hour
   (ix) 66.66% of 300
   (x) 20% of 1 million rupees.
2. Mr. Arvind Vidyarthi spends 30% of his money on education and he has total Rs. 15,000. How many rupees he spends on education?
3. Sonia purchased 80 metres of cloth, out of which 35% was used for making trousers. How much cloth was used by her for making trousers?
4. The total no. of students in the school are 1250. 40% of the students are girls. Find the number of boys.
5. William's monthly salary was Rs. 1140 . His salary is increased by 16.66%. How much increase has he gotten? Also find the salary if his salary increased by 33.33%.
6. The population of Vatican city is 700. If it increases by 7.14% per annum (*i.e.*, every year). Find the population of the Vatican city after one year.
7. The speed of a car is 85 km/hr. It is increased by 20%. Find the increased speed of the car?
8. A shopkeeper annonces a reduction of 8.33% on all its prices after new year. If a wrist watch was earlier for Rs. 2400. How much would it costs now?
9. 44% of the students in a class are females and the number of male students is 42. Find the total no. of students in the class.
10. 30% of a number is 225. Find the number.
11. A horse costing Rs 80,000 one year ago now costs 25% less. Find the changed price.
12. 1700 students took an exam 85% students passed it. Find the number of students who failed in the exam.

CAT Tips Now I would like to suggest you that all the problems mentioned in the exercise must be done using fractions instead of percentage, in order to make the calculation simple and handy.

For example see the solution of question 2 :

$15000 \times 0.3 = 4500 \quad \left[\text{Recall } \frac{x \times 30}{100} = 0.3x\right]$

Solution for question 5 : Since $16.66\% = \frac{1}{6}$

So the new salary will increase by $\frac{1}{6}$ it means the absolute value of new salary will be $\frac{7}{6}\left(= 1 + \frac{1}{6}\right)$ times of the original salary.

So the increase in salary = $1140 \times \frac{1}{6}$ = Rs. 190

and increased salary = original salary + increase in salary

$$= 1 + \frac{1}{6} = \frac{7}{6} = \frac{7}{6} \times 1140 = \text{Rs.}1330$$

Similarly if the salary is increased by 33.33% it means

$$33.33\% = \frac{1}{3}$$

Therefore new salary $= 1 + \frac{1}{3} = \frac{4}{3} = \frac{4}{3} \times 1140 = 1520$

Solution for question 6: Since $7.14\% = \frac{1}{14}$

So the new population of the city $= 700 \times \left(1 + \frac{1}{14}\right)$

$$= 700 \times \frac{15}{14} = 750$$

Solution for question 8: The reduced price of the watch

$$= 2400\left(1 - \frac{1}{12}\right) \qquad \left\{\because 8.33\% = \frac{1}{12}\right\}$$

$$= 2400 \times \frac{11}{12} = 2200$$

EXPRESSING ONE QUANTITY AS A PERCENTAGE OF ANOTHER QUANTITY

EXAMPLE 1 *What per cent is number 3 of number 20 ?*

SOLUTION As per cent means out of 100. Then by unitary method

out of 20 → 3

out of 1 → $\frac{3}{20}$

out of 100 → $\frac{3}{20} \times 100 = 15\%$

Hence to find what per cent the first number is of second number, we divide the first number by the second number and multiply the result by 100.

EXAMPLE 2 *Ravi obtained 325 marks out of a maximum of 400 marks. Find the percentage of marks obtained by him.*

SOLUTION Required percentage of marks $= \frac{325}{400} \times 100 = 81.25\%$

EXAMPLE 3 *In a factory of 150 workers, 18 were absent in a day what percentage were present?*

SOLUTION Present $= 150 - 18 = 132$

Percentage presence $= \frac{132}{150} \times 100 = 88\%$

EXAMPLE 4 *Kurla obtained 480 marks out of 600 and Birla obtained 560 marks out of 800. Whose performance is better?*

SOLUTION % marks of Kurla $= \frac{480}{600} \times 100 = 80\%$

% marks of Birla $= \frac{560}{800} \times 100 = 70\%$

So, obviously Kurla's performance is better than that of Birla even though getting less absolute marks.

INTRODUCTORY EXERCISE-5.2

1. What per cent is :
   (i) 30 out of 600 ?
   (ii) 25 out of 160 ?
   (iii) 75 out of 225 ?
   (iv) 36 kg of 150 kg ?
   (v) 90 cm of 4.5 metre.
   (vi) 60 litres of 40 litres
   (vii) 800 shirts out of 1200 shirts?
   (viii) 875 m of 2 km. ?
2. Express:
   (i) 20 as a percentage of 500.
   (ii) 60 kg as a per cent age of 80 kg .
   (iii) 350 ml as a percentage of 5.6 litre.
   (iv) Rs. 13 as a percentage of Rs. 39.
   (v) 15 seconds as a percentage of 1 hour.
   (vi) 27° as a percentage of 360°.
3. Manu scored 384 marks out of 450. What per cent marks did she get?
4. In an election, out of 60,000 eligible voters 42000 cast their vote. Calculate the percentage of voters casting their votes.
5. A tin contains 24 litres of milk. Due to leakage, 720 ml is lost. What per cent of milk is still present in the tin?
6. Price of an item increased from 16.50 to Rs. 41. 25. Find the percentage increase in price.
7. The excise duty on a certain item has been reduced to Rs. 3480 from Rs. 5220 . Find the percentage reduction in the excise duty for that item.
8. Out of total production of 6450 tonnes of a coalmine a quantity of 645 tonnes was lost during extraction. What per cent of the total production was the net coal extracted?
9. A cricket team played 24 matches. The team won 9 matches and lost 3 matches, 12 matches ended in draw. What per cent of the total matches did the team lose?
10. In a particular month, Rs. 10,000 were allocated for the food items in a hostel out of total Rs. 50,000 budget. Further Rs. 2000 is allocated for the fruits out of Rs.10,000 (allocated for food items) what per cent of total budget is spend on fruits only?

SOME MOST IMPORTANT VALUES

$\frac{1}{2} \to 50\%$, $\frac{1}{3} = 33.33\%$,

$\frac{2}{3} = 66.66\%$, $\frac{1}{4} \to 25\%$,

$\frac{3}{4} \to 75\%$, $\frac{1}{5} \to 20\%$,

$\frac{2}{5} \to 40\%$, $\frac{3}{5} \to 60\%$,

$\frac{1}{6} \to 16.66\%$, $\frac{5}{6} \to 83.33\%$

NOTE The application of percentage is very diverse in nature *e.g.* profit and loss, Simple and compound interest etc. All these are exactly based on the percentage increase/decrease of the original (or actual) value.

Percentage increase/decrease in a quantity

$$= \left(\frac{\text{change in quantity}}{\text{original quantity}} \times 100\right)\%$$

EXAMPLE 1 *The height of Abhimanyu some times ago was 110 cm. Now his height is 120 cm. Find the percentage change in his height.*

SOLUTION $\frac{120-110}{110} \times 100 = 9.09\%$

SHORTCUT $\frac{10}{110} \to \frac{1}{11} \to 9.09\%$

Alternatively: $\frac{12}{11} \to 109.09\%$, so increase = 9.09%

EXAMPLE 2 *The total expenses of a hostel were Rs. 8000 per month. Some students left the hostel due to which the new expenses come down by Rs. 1000. Find the percentage decrease in expenses of the hostel.*

SOLUTION $\frac{1000}{8000} \to \frac{1}{8} \to 12.5\%$

EXAMPLE 3 *Salary of Raja is Rs. 9000 per month and salary of Rani is Rs. 10,000 per month.*

(i) What per cent is the salary of Rani to that of Raja ?

(ii) What per cent is the salary of Raja to that of Rani?

SOLUTION (i) $\frac{10,000}{9,000} \times 100 = 111.11\%$

Alternatively:

$\frac{10}{9} \to \frac{9}{9} + \frac{1}{9} \to 100\% + 11.11\% \to 111.11\%$

(ii) $\frac{9}{10} \to 90\%$ $\left(\because \frac{1}{10} \to 10\%\right)$

Hence, salary of Raja is 90% to the salary of Rani.

PERCENTAGE CHANGE AND PERCENTAGE POINT CHANGE

Last year Abhijeet's salary was Rs. 10,000 and Sonu's salary was Rs. 8,000. This year Abhijeet's salary is Rs. 12,000 while Sonu's salary is Rs. 10,000.

1. (i) What is the percentage increase of Abhijeet's salary?

(ii) What is the percentage increase of Sonu's salary?

(iii) Percentage increase in Sonu's salary is how much percent greater than the percentage increase in Abhijeet's salary?

(iv) What is the percentage point change in the salary of Sonu and Abhijeet?

SOLUTION (i) $\frac{12,000-10,000}{10,000} \times 100 = 20\%$

or $\frac{2}{10} \to \frac{1}{5} \to 20\%$

(ii) $\frac{2}{8} \to \frac{1}{4} \to 25\%$

(iii) Percentage increase of Sonu's salary = 25

Percentage increase of Abhijeet's salary = 20

So the required percentage $= \frac{25-20}{20} \times 100 = 25\%$

It means percentage increase of Sonu's salary is 25% greater than the percentage increase of Abhijeet's salary.

(iv) Percentage point change

= (Percentage increase in Sonu's salary

– Percentage increase in Abhijeet's salary)

= 25 – 20 = 5 percentage point

Infact percentage point change is the difference between two percentage values.

ADVANCED CONCEPT OF PERCENTAGE CHANGE

(A) If a value p is increased by $x\%$, then we have to decrease the resultant value by $\left(\frac{x}{x+100} \times 100\right)\%$ to get back to the original value p.

$$\underset{p}{\text{Original value}} \xrightarrow{\text{increasing value}} \underset{\text{increasing value}}{\frac{p \times x}{100}} \longrightarrow \underset{= p\left(\frac{100+x}{100}\right)}{\text{Increased value}} \left(p + \frac{px}{100}\right)$$

Now the percentage decrease

$$= \frac{\left[p\left(\frac{100+x}{100}\right) - p\right]}{p\left(\frac{100+x}{100}\right)} \times 100 = \left(\frac{x}{100+x} \times 100\right)\%$$

In other words (*i.e.*, in terms of fraction) if a value is increased by $\frac{n}{d}$ then to get back the same number p from the resultant value, we have to decrease the increased value by $\left(\frac{n}{d+n}\right)$.

EXAMPLE 1 *Salary of Rajeev Ratan in 2001 was \$100 per day and his salary in 2002 was \$ 125 per day. Again in 2003 his salary was \$ 100 per day.*

(i) What is the percentage increase in his salary in 2002?

(ii) What is the percentage decrease in his salary in 2003 over 2002?

SOLUTION (i) $\frac{125-100}{100} \times 100 = 25\%$

(ii) $\frac{125-100}{125} \times 100 = 20\%$

In fact there is same absolute change but percentage change is different due to different denominator (*i.e.,* base change). So the base change is as much important as the numerator or absolute change in quantity.

EXAMPLE 2 *Age of Ravi is 20 years. If the Shyam's age is 25% greater than that of Ravi then how much per cent Ravi's age is less than Shyam's age ?*

SOLUTION Age of Ravi Age of Shyam

$$20 \underset{(-20\%)}{\overset{(+25\%)}{\rightleftarrows}} 25$$

Solution using percentage change formula

Here $x = 25$, then

percentage decrease (or less) $= \frac{25}{125} \times 100 = 20\%$

Solution using fractional change formula

Since increase $= \frac{1}{4}$ $\quad \because \left(25\% = \frac{1}{4}\right)$

Therefore decrease $= \frac{1}{4+1} = \frac{1}{5} \rightarrow 20\%$

EXAMPLE 3 *Gautam has 33.33% more pencils than Rahul has. By how much per cent less pencils Rahul has than that of Gautam?*

SOLUTION

$$\text{Rahul} \underset{-25\% = \frac{1}{4} = \frac{1}{3+1}}{\overset{33.33\% \rightarrow \frac{1}{3}}{\rightleftarrows}} \text{Gautam}$$

So Rahul has 25% less pencils than Gautam has.

EXAMPLE 4 *Height of Amitabh is 50% greater than the height of Amir Khan. Height of Amir Khan is how much per cent less than that of Amitabh?*

SOLUTION

$$\text{Amir} \underset{-33.33\% = \frac{1}{3} = \frac{1}{2+1}}{\overset{+50\% \rightarrow \frac{1}{2}}{\rightleftarrows}} \text{Amitabh}$$

Thus the height of Amir is 33.33% less than Amitabh.

Explanation of Concept : Assume A has 10 apples and B has 20 apples, then we say that B has 100% more apples than A has. Again we can say that A has 50% less apples than B has.

To calculate the percentage change :

$$A \underset{-50\% = \frac{1}{2} = \frac{1}{1+1}}{\overset{100\% \rightarrow \frac{1}{1}}{\rightleftarrows}} B$$

Consider another example : Let us assume A has 6 chocolates and B has 10 chocolates then we can say that B has 66.66% more chocolates than A. So again we can also say that A has 40% less chocolates than B.

$$A \underset{-40\% = \frac{2}{5} = \frac{2}{3+2}}{\overset{66.66\% \rightarrow \frac{2}{3}}{\rightleftarrows}} B$$

Remember the percentage change graphic is almost 70–80% better in giving quick and simple results. So instead of using the percentage formula, use the percentage change graphic method. For this you are just required to know the percentage fraction conversion table.

(B) If a value P is first decreased by x% then to get back the original value P, we have to increase the decreased (resultant) value by $\left(\frac{x}{100-x} \times 100\right)$

$$\overset{\text{original value}}{P} \xrightarrow[\frac{Px}{100}]{\text{(decreasing value)}} \overset{\text{decreased value}}{\left(P - \frac{Px}{100}\right)} = P\left(1 - \frac{x}{100}\right)$$

$$\text{Now, the per cent increase} = \frac{\left[P - P\left(1 - \frac{x}{100}\right)\right]}{P\left(1 - \frac{x}{100}\right)} \times 100$$

$$= \frac{x}{100-x} \times 100$$

In terms of fraction, if a value P is first decreased by n/d then to get back the original number P. We have to increase the decreased (or resultant) value by $\frac{n}{d-n}$.

EXAMPLE 5 *Due to irregular working habits of Ramachandran, his salary was reduced by 20% but after some months his salary was increased to the original salary. What is the percentage increase in salary of Ramachandran?*

SOLUTION Let initial salary be Rs. 100

$$100 \underset{+25\%}{\overset{-20\%}{\rightleftarrows}} 80$$

Alternatively : Here $x = 20$

then % increase $= \frac{20}{(100-20)} \times 100 = 25\%$

Alternatively:

$$-20\% \rightarrow \frac{1}{5}$$

(Initial salary) P ⟶ Q (Decreased salary)

$$+\ 25\% = \frac{1}{4} = \frac{1}{(5-1)} \qquad \left[\frac{n}{d-n}\right]$$

Hence his salary will be incresed by 25%.

EXAMPLE 6 *Kajol usually wears saree, which is 16.66% less than the actual length of the saree. By how much per cent the actual length of the saree is greater than the length of saree which kajol usually wears?*

SOLUTION Actual length — Usual length

$$-16.66\% = \frac{1}{6}$$

$$A \longrightarrow U$$

$$+20\% = \frac{1}{5} = \left(\frac{1}{6-1}\right) \qquad \because \left[\frac{n}{d-n}\right]$$

So the actual length of the saree is 20% greater than the usually used saree.

NOTE (1) If a value X is first increased by p% to Y then Y is again decreased to X by q% then p is always greater than q (for positive values)

(2) If a value X is first decreased by p% to Y and then Y is increased by q% to X, then p is always less than q.

(3) If a value A is increased by p% then again by q% once again it is increased by r%, then the final value will be same as if you change the order of p, q, r *i.e.*, A can be first increased by r% then by q% and then by p% still the result will be same.

(4) The rule 3 is also applicable for the decreasing of the values. A value 'A' is first decreased by p%, then by q% and then by r% and so on, the resultant value will be same as when A is first decreased by q% then by p% and then by r% etc.

Note : In case 3 and 4 we are discussing the successive increase or decrease in the value.

(5) A value 'A' is first increased by p% then by q% and then it is reduced by r% will give the same results as when A is first decreased by r%, then increased by q% and then by p% etc.

EXAMPLE 7 *Initially Ms. Rakhi Sawant has Rs. 200 in her wallet then she increased it by 20%. Once again she increased her amount by 25%. The final value of money in her wallet will be how much per cent greater than the initial amount.*

SOLUTION $200 \xrightarrow{+\ 20\%} 240 \xrightarrow{+\ 25\%} 300$

So the required % increase $= \dfrac{300-200}{200} \times 100 = 50\%$

EXAMPLE 8 *The age of B is 50% greater than the age of A. The age of C is 20% less than the age of B. By how much percentage the age of C is greater than the age of A.*

SOLUTION $\underset{100}{A} \xrightarrow{+\ 50\%} \underset{150}{B} \xrightarrow{-\ 20\%} \underset{120}{C}$

So the required percentage change $= \dfrac{20}{100} \times 100$

$= 20\%$

CONCEPT OF PRODUCT CONSTANCY

It is the same as we know the inverse proportion in the chapter of Ratio, Proportion and Variation.

e.g., When the rate of a pencil is Rs. 1.25 then we can purchase 16 pencils by paying Rs. 20. If the rate of a pencil is decreased by Rs. 0.25 then we can purchase 20 pencils by paying Rs. 20.

Explanation : Rate × No. of pencils = Price

$$1.25 \times 16 = 20$$

$$1.00 \times 20 = 20$$

So you can see that here the product (20) is constant in both the cases. Thus it is clear that if we reduce the price of a pencil to Rs. 0.50, then we can purchase 40 pencils in Rs. 20.

Some more examples of product constancy :

(i) speed × time = distance
(ii) rate × time = cost
(iii) efficiency × time = work
(iv) length × breadth = area
(v) average × no of elements = total value
(vi) rate × quantity = price (or expenditure)

e.g., The price of sugar is increased by 25% then by how much per cent should a customer reduce the consumption (*i.e.*, quantity used) of sugar so that he has not to increase his expenses on sugar.

price × quantity = expenditure

$$100 \times 100 = 10{,}000$$

$$125 \times x = 10{,}000$$

$\Rightarrow x = \dfrac{10{,}000}{125} = 80$. Therefore % reduction = 20%

or $1 \times 1 = 1$

$$1.25 \times k = 1 \Rightarrow k = 0.8$$

thus there will be 20% decrease in the consumption of sugar in order to maintain the same expenditure on sugar.

PRODUCT CONSTANCY CONDITIONS

- When one factor of a product is increased by p% then the other factor will be decreased by $\left(\dfrac{p}{100+p} \times 100\right)$%

  It means when one factor of a product is increased by $\dfrac{n}{d}$ then the other factor is decreased by $\dfrac{n}{(d+n)}$

- When one factor of a product is decreased by p% then the other factor will be increased by $\left(\dfrac{p}{100-p} \times 100\right)$%

  It means when one factor of a product is decreased by $\dfrac{n}{d}$ then the other factor will must be increased by $\dfrac{n}{(d-n)}$.

EXAMPLE 1 *If the price of a commodity be raised by 20%, then by how much per cent a house holder reduce his consumption of the same commodity so that his expenditure does not increase.*

SOLUTION Since here product (*i.e.*, expenditure) is constant rate × consumption = expenditure

initially → $1 \times 1 = 1$

After change $1.2 \times x = 1$

$\Rightarrow x = 0.833 \therefore$ decrease in value = 16.66%

Alternatively:

Increase in rate → Decrease in consumption

$\boxed{+20\% = +\frac{1}{5}} \longrightarrow \boxed{-16.66\% = -\frac{1}{6}}$

EXAMPLE 2 *If the price of petrol falls down by 20% by how much per cent must a person increase its consumption, so as not to decrease the expenditure on this item?*

SOLUTION Since product is constant

decrease by → increase by

$20\% = \frac{1}{5} \longrightarrow \frac{1}{4} = 25\% \quad \left[\because \frac{n}{d} \to \frac{n}{(d-n)}\right]$

EXAMPLE 3 *Due to 50% increase in the price of rice . We purchased 5 kg less rice with the same amount of Rs. 60. What is the new price of rice?*

(a) Rs. 4.66 (b) Rs. 5
(c) Rs. 4 (d) Rs. 6

SOLUTION Increase in price → Decrease in amount

$50\% = \frac{1}{2} \longrightarrow \frac{1}{3} = 33.33\%$

Since the new quantity of rice decreases by 33.33% which is equal to 5 kg it means initially there was 15 kg rice to be used.

So, the initial price = Rs. 4 $\quad \because \left(\frac{60}{15} = 4\right)$

and final price = Rs. 6 $\quad \because \left(\frac{60}{10} = 6\right)$

Alternatively: From the options.

Let us consider choice (d).

Therefore $[6 \times 10 = 60]$ (finally)

Hence $[4 \times 15 = 60]$ (initialy)

EXAMPLE 4 *The length of a plot is decreased by 33.33%. By how much % the breadth of the plot will be increased so that the area remains constant?*

SOLUTION (Decrease) → (Increase)

$33.33 = \frac{1}{3} \longrightarrow \frac{1}{2} = 50\% \quad \left[\frac{1}{2} = \frac{1}{3-1}\right]$

CONCEPT OF 'BY' AND 'TO'

Please note that there is a clear difference between "by" and "to". *e.g.*, the income is reduced by 40% it means the new income is 60% of the original and the income is reduced to 40% means the new income is 40% of the original value. Thus "by" represents difference and "to" represents final value.

e.g., The income of Sarika is increased by 20% means its new income is $100 + 20 = 120$ % of the original income. The income of Sarika is increased to 120% means the new income of Sarika is 120% of the original income.

EXAMPLE 1 *In an election between two candidates, the candidate who got 57% valid votes won by a majority of 420 votes. Find the total no. of valid votes .*

SOLUTION Winner Loser

$0.57x \quad 0.43x \qquad [100 - 57 = 43]$

$0.14x \qquad [57 - 43 = 14]$

$0.14\,x = 420$

$x = 3000$

Hence total valid votes = 3000

EXAMPLE 2 *Due to fall in manpower, the production in the factory decreases by 60%. By what per cent should the working hour be increased to restore the original production in the factory?*

SOLUTION Manpower × Working hours = Production

$(-60\%) = \frac{3}{5} \longrightarrow \frac{3}{2} = (+150\%) \quad \left[\frac{3}{5} \to \frac{3}{5-3} = \frac{3}{2}\right]$

Hence by 150% working hours will be increased. It means the new working hours will be 2.5 times (not 1.5 times) of the original time.

EXAMPLE 3 *Two numbers are respectively 25% and 40% less than a third number. What per cent is the second of the first ?*

SOLUTION Consider A, B, C three numbers and assume $C = 100$ (as a base)

$A \quad B \quad C$

$75 \quad 60 \xleftarrow{(-40\%)} 100$

(-25%)

Now $\frac{60}{75} \times 100 = 80\%$

EXAMPLE 4 *A person gives 10% to his wife 10% of the remaining to a hospital (as a donation) again 10% of the remaining to prime minister's relief Fund. Then he has only 7290 Rs. with him. What was the initial sum of money with that person?*

SOLUTION Since he gives 10% so he is left with 90% of the original sum and since he does the same with the remaining (or left) amount. So it forms a chain.

$\therefore$ Remaining amount $= (x) \times 0.9 \times 0.9 \times 0.9$

$= 0.729\,x = 7290$

$\Rightarrow x = 10{,}000$, where x is supposed to be initial amount.

EXAMPLE 5 *Initially a shopkeeper had n chocolates. A customer bought 10% chocolate from n then another customer bought 20% of the remaining chocolates, after that one more customer purchased 25% of the remaining chocolates. Finally shopkeeper is left with 270 chocolates in his shop. How many chocolates were there initially in his shop?*

(a) 300 (b) 450 (c) 500 (d) 600

SOLUTION $n \times 0.9 \times 0.8 \times 0.75 = 270$

$$n = \frac{270 \times 10{,}000}{9 \times 8 \times 75}$$

$$n = 500$$

NOTE These type of problems (see example no. 4 and 5) can be solved with a great convenience if we solve in reverse order, with the aid of given choices.
Let us consider option (c)

$500 \times 0.9 = 450$
$450 \times 0.8 = 360$
$360 \times 0.75 = 270$

Hence presumed option is correct.

POPULATION RELATED MATHEMATICAL PROBLEMS

If the original population of a locality (*i.e.*, region) be P and the annual growth rate be $r\%$. The population after n years

$$= P\left(1+\frac{r}{100}\right)^n$$

change (or increase) in the population

$$= P\left[\left(1+\frac{r}{100}\right)^n - 1\right]$$

If there is decrease in population be $r\%$ then,

total population after n years $= P\left(1-\frac{r}{100}\right)^n$

and decrease in population $= P\left[1-\left(1-\frac{r}{100}\right)^n\right]$

EXAMPLE 1 *If the annual increase in the population be 20% and the present population be 10,000. What will be the population after 3 years hence?*

(a) 16,000 (b) 17,280
(c) 14,400 (d) 1,728

SOLUTION $10{,}000\left(1+\frac{20}{100}\right)^3 = 10{,}000\left(\frac{6}{5}\right)^3$

$$= 10{,}000 \times (1.2)^3 = 17{,}280$$

Hence (b) is correct.

EXAMPLE 2 *The population of a town in the first year increases by 10% in the next year it decreases by 10%. Once again in the third year it increase by 10% and in the fourth year it decrease by 10%. If the present population be 20,000 then the population after four years will be :*

(a) 16,902 (b) 19,602
(c) 20,000 (d) none of these

SOLUTION $20{,}000\left(1+\frac{10}{100}\right)\left(1-\frac{10}{100}\right)\left(1+\frac{10}{100}\right)\left(1-\frac{10}{100}\right)$

$$= 20{,}000\,(1.1)\,(0.9)\,(1.1)\,(0.9)$$
$$= 20{,}000 \times 1.21 \times 0.81 = 19{,}602$$

Thus option (b) is correct.

NOTE If the value of a number is first increased by $x\%$ and then decreased by $x\%$, the net change is always a decreases (or loss) in original value.

Hence, $\%\ \text{loss} = \left(\frac{x}{10}\right)^2\%$

EXAMPLE 1 *Shweta is a very expert in bargaining. Once she went to a nearby shop. When Shweta asked the price of Shampoo Sachet the shopkeeper told her the price by increasing 15% of the original cost. But Shweta insisted to decrease the price by 15% so the shopkeeper sold it by decreasing the price by 15%. What is the loss or profit of shopkeeper and by how much percent?*

(a) no loss (b) profit of 1.5%
(c) loss of 2.25% (d) none of these

SOLUTION Let the actual price be 100

$$100 \xrightarrow{+15\%} 115 \xrightarrow{-15\%} 97.75 \qquad \text{(loss of 2.25\%)}$$

Alternatively: $\text{loss}\% = \left(\frac{15}{10}\right)^2 = 2.25\%$

There is always a loss.

EXAMPLE 2 *If the length and breadth of a rectangle are changed by + 20% and −10%. What is the percentage change in area of rectangle?*

(a) 8% (b) 10.8%
(c) 20% (d) data insufficient

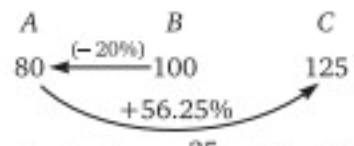
SOLUTION $l \times b = \text{area}$

$$1 \times 1 = 1$$
$$1.2 \times 0.9 = 1.08$$

So there is 8% increase in the area of rectangle.

EXAMPLE 3 *The salary of A is 20% lower than B's salary and the salary of C is 56.25% greater than A's salary. By how much percent the salary of B is less than the salary of C.*

SOLUTION



(Consider the salary of $B = 100$)

The required value $= \frac{25}{125} \times 100 = 20\%$

Remember: Percentage change

$$= \left(\frac{\text{difference between original value and new value}}{\text{original value}}\right) \times 100$$

$$\text{Percentage increase} = \frac{\text{increased value} - \text{original value}}{\text{original value}} \times 100$$

$$\text{Percentage decrease} = \frac{\text{original value} - \text{decreased value}}{\text{original value}} \times 100$$

NOTE (1) There is a huge difference between "decreased value" and "decrease in value" and between "increased value" and "increase in value".

For example : Initial value = 70

Final value = 90

it means increased value is = 90

but increase in value is 20

and % increase $= \frac{90-70}{70} \times 100 = 28.57\%$

(2) If there is increase of $\frac{x}{y}$ in any value P then the increased value will be $P\left(1+\frac{x}{y}\right)$.

(3) If there is decrease of $\frac{x}{y}$ in any value, then the decreased value will be $P\left(1-\frac{x}{y}\right)$.

EXAMPLE 1 *Nishith is now 20 years old. Some years later his age will increase by 50% of himself. What will be the new age at that time?*

SOLUTION $20\left(1+\frac{1}{2}\right) = 30$ years $\left[\because 20 + 20 \times \frac{1}{2} = 20\left(1+\frac{1}{2}\right)\right]$

EXAMPLE 2 *The average salary of Purushottam in Infosys is 20% less than that was in Microsoft. If the salary of Purushottam in Microsoft be \$ 80,000 per month then what is the salary of Purushottam in Infosys?*

SOLUTION $20\% = \frac{1}{5}$

So new salary $= 80{,}000\left(1-\frac{1}{5}\right)$

$= 80{,}000 \times \frac{4}{5} = \$\,64{,}000$

NOTE Remember this type of problems can also be solved exactly through percentages.

As $80{,}000 \times 0.8$ $(100 - 20 = 80\%)$

$= 64{,}000$

but the technique given above is not less important. Some where it becomes very necessary to solve through fractions.
So, keep your eyes open mind focussed and use your wits to solve the problems intelligently as per the situation.

EXAMPLE 3 *Which one of the following is greatest* $\frac{3}{4}, \frac{7}{8}, \frac{16}{19}, \frac{13}{15}$?

SOLUTION

$$\frac{3}{4} = 75\%$$
$$\frac{7}{8} = 87.5\%$$
$$\frac{16}{19} = 84.21\%$$
$$\frac{13}{15} = 86.66\%$$

So, $\frac{7}{8}$ is the greatest fraction (or rational number)

INTRODUCTORY EXERCISE-5.3

1. What per cent of $\frac{3}{7}$ is $\frac{1}{105}$?
(a) 10% (b) 2.22%
(c) 45% (d) 450%

2. What per cent is 3% of 15%?
(a) 15% (b) 20%
(c) 40% (d) 66.66%

3. If the cost of a calculator worth Rs 250 is increased by Rs. 100, the rate of increase is
(a) 100% (b) 40%
(c) 25% (d) none of these

4. A number increased by 37.5% gives 99 the number is
(a) 140 (b) 61.5
(c) 72 (d) 48

5. When 40% of a number is added to 42, the result is the number itself. The number is:
(a) 105 (b) 72
(c) 70 (d) 82

6. In an examination 52% of the candidates failed in Science 42% in Mathematics and 17% in both. The no. of those who passed in both the subjects, is :
(a) 83% (b) 64%
(c) 23% (d) 55.55%

7. The price of an item is increased by 20% and then decreased by 20%. The final price as compared to original price
(a) 4% more (b) 20% more
(c) 20% less (d) 4% less

8. Two candidates fought an election. One got 65% of the votes and won by 600 votes. The total no. of votes polled is:
(a) 12,000 (b) 10,000
(c) 2,000 (d) 8,000

9. Out of a no. of electronic items, a person purchases 60% coloured TVs 5% of these were found to be defective. The percentage of defective TVs in all is
(a) 3% (b) 6%
(c) 12% (d) can't be determined

10. *A*'s salary is half that of *B*. If *A* got a 50% rise in his salary and *B* got a 25% rise in his salary, then the percentage increase in combined salaries of both is
(a) 30% (b) 33.33%
(c) 55% (d) 28%

EXERCISE

LEVEL 1

1. In our Singapore office there are 60% female employees. 50% of all the male employees are computer literate. If there are total 62% employees computer literate out of the total 1600 employees, then the no. of female employees who are computer literate :
(a) 690 (b) 672
(c) 960 (d) can't be determined

2. The price of a car depreciates in the first year by 25% in the second year by 20% in the third year by 15% and so on. The final price of the car after 3 years, if the present cost of the car is Rs. 10,00,000 :
(a) 7,80,000 (b) 5,10,000
(c) 6,90,000 (d) 1,70,000

3. A shopkeeper charges sales tax of x% up to Rs. 2,000 and above it he charges y%.A customer pays total tax of Rs 320, when he purchases the goods worth Rs. 6,000 and he pay's the total tax of Rs. 680 for the goods worth Rs. 12,000. The value of $(x - y)$ is :
(a) 0 (b) – 2
(c) – 4 (d) 5

4. 40% of a number when added to the square of the same number, then it is increased to 4040% of itself the actual number is :
(a) 175 (b) 400
(c) 40 (d) 120

5. In my office there are 30% female employees and 30% of these earn greater than Rs. 8,000 per month and 80% of male employees earn less than Rs. 8,000 per month. What is the percentage of employees who earn more than Rs. 8,000 per month?
(a) 30% (b) 23%
(c) 60% (d) can't be determined

6. 600 students took the test on physics and chemistry. 35% students failed in Physics and 45% students failed in chemistry and 40% of those who passed in chemistry also passed in Physics, then how many students failed in both :
(a) 162 (b) 138
(c) 60 (d) none of these

7. In an examination 70% of the candidates passed in History and 50% in Geography and 20% students failed in both the subjects. If 500 students passed in both the subjects, then how many candidates appeared for the exam ?
(a) 1,000 (b) 1,500
(c) 2,500 (d) none of these

8. My salary is Rs. 12,345 per month. The salary of my brother is 10% greater than that of mine. The salary of my only sister is 9.09% greater than my only brother. The salary of my wife is $56\frac{12}{23}$% less than the total salary of my brother and sister together, then the salary of my wife is :
(a) greater than my sister's salary
(b) $33\frac{11}{23}$% less than my sister's salary
(c) equal to my salary
(d) $44\frac{11}{23}$% greater than my own salary

9. MDTV is a very popular TV channel. It telecasts the programmes from 8 : 00 a.m. to 12 : 00 p.m. It telecasts 60 advertisements each of 8 seconds and 16 advertisements each of 30 seconds. What is the percentage of time devoted in a day for the advertisements?
(a) 1.5% (b) 1.66%
(c) 2% (d) 2.5%

10. Lagaan is levied on the 60% of the cultivated land. The revenue department collected total Rs. 3,84,000 through the lagaan from the village of Sukhiya. Sukhiya, a very rich farmer, paid only Rs. 480 as lagaan. The percentage of total land of Sukhiya over the total taxable land of the village is :
(a) 0.15% (b) 15%
(c) 0.125% (d) none of these

11. The actual area of a rectangle is 60 cm^2, but while measuring its length a student decreases it by 20% and the breadth increases by 25%. The percentage error in area, calculated by the student is :
(a) 5% (b) 25%
(c) can't be determined (d) none of these

12. The cost of packaging of the mangoes is 40% the cost of fresh mangoes themselves. The cost of mangoes increased by 30% but the cost of packaging decreases by 50%, then the percentage change of the cost of packed mangoes, if the cost of packed mangoes is equal to the sum of the cost of fresh mangoes and cost of packaging :
(a) 14.17% (b) 7.14%
(c) 6.66% (d) none of these

13. Abhinav scores 80% in Physics and 66% in chemistry and the maximum marks of both the papers are 100. What per cent does he score in maths which is of 200 marks, if he scores 80% marks in all the three subjects :
(a) 74% (b) 84%
(c) 87% (d) 83%

14. In the New York Stock Exchange there are 45% female employees and thus the number of male employees is exceeded by 72. Hence the total no. of employees in the New York Stock Exchange is :
(a) 540 (b) 720
(c) 7200 (d) 550

15. Three candidates *A*, *B* and *C* contested an election. Out of the total votes on a voter list 25% did not vote and 6.66% votes polled were invalid. *C* got 2450 valid votes, which were 40% more than that of *B*. If *A* got only 40% of the total votes, then who is the winner?
(a) A (b) B
(c) C (d) can't be determined

16. The cost of a car is 400% greater than the cost of a bike. If there is an increase in the cost of the car is 15% and that of bike is 20%. Then the total increase in the cost of the 5 cars and 10 bikes is :
(a) 17.5% (b) $16\frac{3}{7}$%
(c) 18.5% (d) 18.25%

17. The square of a positive number is 2,000% greater than the number itself, then the square of that number is :
(a) 1762 (b) 1635
(c) 441 (d) 139

18. The monthly salary of Shahid and Kareena together is \$ 28,000. The salary of Shahid and Kareena is increased by 25% and 12.5% respectively then the new salary of Kareena becomes 120% of the new salary of Shahid. The new (or increased) salary of Shahid is :
(a) \$ 15,000 (b) \$ 18,000
(c) \$ 14,000 (d) \$ 16,000

19. 80% of a smaller number is 4 less than 40% of a larger number. The larger number is 85 greater than the smaller one. The sum of these two numbers is :
(a) 325 (b) 425
(c) 235 (d) 500

20. 220% of a number '*X*' is 44. What is 44% of '*X*' ?
(a) 88 (b) 8.8
(c) 66 (d) data insufficient

21. The shopkeeper increased the price of a product by 25% so that customer finds it difficult to purchase the required amount. But somehow the customer managed to purchase only 70% of the required amount. What is the net difference in the expenditure on that product ?
(a) 10% more (b) 5% more
(c) 12.5% less (d) 17.5% less

22. In the previous government, party *Q* was in the opposition. Now increasing the seats by 33.33% Q is the ruling party and thus party Q enjoys twice the majority than that of party *P* in the previous government. If there were only two parties *P* and *Q* and the fix no. of seats be 500 in the parliament of Hum-Tum, then the no. of seats of the Q in the new government is :
(a) 225 (b) 200
(c) 275 (d) 300

23. In an examination a candidate got 30% marks and failed by 30 marks. If the passing marks are 60% of the total marks, then the maximum marks will be :
(a) 450 (b) 600
(c) 300 (d) 100

24. In a school there are 1800 students. Last day except 4% of the boys all the students were present in the school. Today except 5% of the girls all the students are present in the school, but in both the days no. of students present in the school, were same. The no. of girls in the school is :
(a) 1200 (b) 800
(c) 1000 (d) 600

25. In a library 60% of the books are in Hindi, 60% of the remaining are in English and rest of the books are in Urdu. If there are 3600 books in English, then the total no. of books in Urdu are :
(a) 2400 (b) 2500
(c) 3000 (d) none of these

26. In a test there are total *n* questions. Bhanu answers 20 out of 25 questions correctly in the first section. In the second section he answers 60% question correct and thus his total score is 66.66% in the test. Given that all the questions carry equal marks, without any negative marking. The total no. of question in the test is :
(a) 50 (b) 60
(c) 75 (d) 100

27. In a class of MBA students 16.66% students are from Science background and 12.5% students are from commerce background and 6.66% students from arts background and rest are from Engineering background. The minimum possible students of engineeering background are :
(a) 45 (b) 77
(c) 100 (d) 120

28. An alloy contains the copper and aluminium in the ratio of 7 : 4. While making the weapons from this alloy, 12% of the alloy got destroyed. If there is 12 kg of aluminium in the weapon, then the weight of the alloy required is :
(a) 48 kg (b) 40 kg
(c) 37.5 kg (d) 14.4 kg

29. Hariharan goes to a shop to buy an FM radio costing Rs. 1404 including sales tax at 8%. He asks the shopkeeper to reduce the price of radio so that he can save the amount equal to the sales tax. The reduction of the price of the radio is :
(a) Rs. 108 (b) Rs.104
(c) Rs. 112.32 (d) none of these

30. The average weight of a class of students is 67.5 kg. The weight of the class teacher is 25% more than the average weight of the class. The average weight of the class is less than the class teacher by *x*%. The value of *x* is :
(a) 33.33% (b) 25%
(c) 20% (d) can't be determined

31. Last year in CAT, each section of the question paper had different weightage. The weightage of QA, DI and VA/RC sections was 8, 9 and 10 respectively. The maximum marks in all the three sections together were 810. Wrong answer did not carry negative marks as a penalty. If Padma had gotten 20% more marks in QA and 8% more marks in DI and 7.14…% more marks in VA/RC, then she must had gotten 100% marks in all the three sections. The total marks that Padma had scored :
(a) 730 (b) 700
(c) 750 (d) 775

32. A salesman gets commission on total sales at 9%. If the sale is exceeded Rs. 10,000 he gets an additional commission as bonus of 3% on the excess of sales over Rs. 10,000. If he gets total commission of Rs. 1380, then the bonus he received is :
(a) Rs. 180 (b) Rs. 120
(c) Rs. 480 (d) data insufficient

33. In Veeru Bhai Pvt. limited company 60% of the employees are men and 48% of the employees are Engineer and 66.6% of these are men. The percentage of women who are not engineers :
(a) 33.33% (b) 60%
(c) 52% (d) 46.66%

34. Initially Veer had 60% more love letters than that of Zara. In the last month the no. of love letters of Veer increased by 25% and that of Zara decreased by 25%. Again in the present month the no. of love letters of Veer decreased to 60% and that of Zara increased by 60%. Then which of the following statements is correct regarding the present no. of love letters :
(a) Veer has 40% more letters than that of Zara
(b) Zara has 20% less letters than that of Veer
(c) Veer and Zara have equal no of letters
(d) Zara has 37.5% less letters than that of Veer.

35. The charges per hour of internet surfing is increased by 25% then find the percentage decrease in the time period of surfing of a user (a net savy) who can afford only a 10% increase in expenditure :
(a) 22% (b) 12%
(c) 15% (d) 9.09%

36. The average earning of each member of the Ambani family is 20% less than the average earning of each member of the Sahara family and the total earning of Ambani's family is 20% more than the total earning of Saharas's family. The no. of family members in the Sahara is what per cent of the no. of family members of Ambani :
(a) 25% (b) 20%
(c) 66.66% (d) none of these

37. From 2000 onwards, till 2003 the price of computers increased every year by 10%. After that due to government subsidy the price of computers decreases every year by 10%. The price of a computer in 2006 will be approx. how much per cent less than the price in 2000 if the same pattern of price is continued :
(a) 2 (b) 3
(c) 4 (d) none of these

38. A book consists of 30 pages, 25 lines on each page and 35 characters on each line. If this content is written in another note book consisting of 30 lines and 28 characters per line, then the required no. of pages will how much per cent greater than the previous pages?
(a) 4.16% (b) 5%
(c) 6.66% (d) none of these

39. The rate of increase of the price of sugar is observed to be two per cent more than the inflation rate expressed in percentage. The price of sugar on January 1, 2004 is Rs. 20 per kg. The inflation rates of the years 2004 and 2005 are expected to be 8% each. The expected price of sugar on January 1, 2006 would be :
(a) Rs. 23.60 (b) Rs. 24.00
(c) Rs. 24.20 (d) Rs. 24.60

40. A club has raised 75% of the amount it needs for a new building by receiving an average donation of Rs. 600 from the people already solicited. The people already solicited represents 60% of the people the club will ask for donations. If the club is to raise exactly the amount needed for the new building, what should be the average donation from the remaining people to be solicited?
(a) 250 (b) 300
(c) 400 (d) 600

41. A number x is mistakenly divided by 10 instead of being multiplied by 10. What is the percentage error in the result?
(a) – 99% (b) + 99%
(c) – 100% (d) + 100%

42. What is the percentage change in the result when we add 50 to a certain number x, instead of subtracting 50 from the same number x ?
(a) 50% (b) 100%
(c) 300% (d) can't be determined

43. In the Regional Science Centre, Lucknow the rate of ticket is increased by 50% to increase the revenue, but simultaneously 20% of the visitors decreased. What is percentage change in the revenue of Regional Science Centre. If it is known that the centre collects the revenue only from the visitors and it has no other financial supports :
(a) + 20% (b) – 25%
(c) + 30% (d) can't be determined

44. Recently when I visited a show room of shoes shopkeeper told me that he could reduce the price of Bata shoes by 49% and if I were to purchase woodland shoes he could reduce the price to 51% of the original price. If the marked price (*i.e.,* printed price) of both the shoes was same, then which shoes was cheap to buy :
(a) Wood land (b) Bata
(c) both (d) can't say

45. Selling price of a shirt and a coat is Rs. 4000. The cost price of a shirt is 58.33% of the cost price of a coat and so amount of profit on both the shirt and coat is same, then the price of the shirt could be :
(a) Rs 2100 (b) Rs. 2525
(c) Rs. 2499 (d) Rs. 1120

46. On the April 1, 2005 my salary increased from Rs. 10,000 to Rs. 16,000. Simultaneously the rate of income tax decreased by 37.5% , So the amount of income tax paid by me remains constant what is the value of income tax paid by me :
(a) Rs. 3000 (b) Rs. 6000
(c) Rs. 1600 (d) can't be determined

47. In the previous question, if the difference in the rate of income tax be 9 (in percent) then the income tax paid by me :
(a) Rs. 2000 (b) Rs. 2400
(c) Rs. 1600 (d) none of these

48. The average of a set of whole numbers is 27.2. When the 20% of the elements (ie numbers) are eliminated from the set of numbers then the average becomes 34. The number of elements in the new set of numbers can be :
(a) 27 (b) 35
(c) 52 (d) 63

49. In a class, the no. of boys is more than the no. of girls by 12% of the total strength. The ratio of boys to girls is :
(a) 15 :11 (b) 11 : 14
(c) 14 :11 (d) 8 : 11

50. The population of a village is 5000 and it increases at the rate of 2% every year. After 2 years, the population will be :
(a) 5116 (b) 5202
(c) 5200 (d) 5204

51. A customer asks for the production of x number of goods. The company produces y number of goods daily. Out of which z% are unfit for sale. The order will be completed in :
(a) $\frac{x}{100\,y\,(1-z)}$ days (b) $\frac{100\,yz}{x}$ days
(c) $\frac{100\,x}{y\,(100-z)}$ days (d) $\frac{100}{y\,(z-1)}$ days

LEVEL 2

1. In the Awadh school Gomti Nagar, there are 500 students. 60% of the students are boys, 40% of whom play hockey and the girls don't play hockey, 75% of girls play badminton. There are only two games to be played. The number of students who don't play any game is :
(a) 10% (b) 36%
(c) 46% (d) can't be determined

2. A fraction in reduced form is such that when it is squared and then its numerater is increased by 25% and the denominator is reduced to 80% it results in 5/8 of the original fraction. The product of the numerator and denominator is :
(a) 6 (b) 12
(c) 10 (d) 7

3. In the Chidambaram's family the ratio of expenses to the savings is 5 : 3. But his expenses is increased by 60% and income increases by only 25% thus there is a deficit of Rs. 3500 in the savings. The increased income of Mr. Chidambaram's family is :
(a) Rs. 35,000 (b) Rs. 28,000
(c) Rs. 25,000 (d) Rs. 18,500

4. In the Presidency College two candidates contested a presidential election. 15% of the voters did not vote and 41 votes were invalid. The elected contestant got 314 votes more than the other candidate. If the elected candidate got 45% of the total eligible votes, which is equal to the no. of all the students of the college. The individual votes of each candidate are :
(a) 2250 and 1936 (b) 3568 and 3254
(c) 2442 and 2128 (d) 2457 and 2143

5. The annual earning of Mr. Sikkawala is Rs. 4 lakhs per annum for the first year of his job and his expenditure was 50%. Later on for the next 3 years his average income increases by Rs. 40,000 per annum and the saving was 40%, 30% and 20% of the income. What is the percentage of his total savings over the total expenditure if there is no any interest is applied on the savings for these four years :
(a) $49\frac{37}{87}$% (b) $41\frac{73}{83}$%
(c) 53% (d) none of these

6. In an election only two candidates contested 20% of the voters did not vote and 120 votes were declared as invalid. The winner got 200 votes more than his opponents thus he secured 41% votes of the total voters on the voter list. Percentage votes of the defeated candidate out of the total votes casted is :
(a) 47.5% (b) 41%
(c) 38% (d) 45%

Directions for questions 7, 8 and 9: *Pujari ji, the chief of a temple's trust, has a beautiful daughter Nirjala and a son in law, Radhey. Pujarin, the wife of Pujari ji, lives her own life by receiving the alms from the devotees and receives 9.09% earning of her husband and the daughter together. The earning of Nirjala in each month is Rs. 8000 less than her husband Radhey. The earning of Pujari ji and Radhey together is Rs. 30,000 per month. The earning of Radhey and Nirjala together is Rs. 133.33% greater than that of Pujari ji.*

7. The average earning of each Pujari ji. Nirjala and Radhey is :
(a) Rs. 13333.33 (b) Rs. 888.88
(c) Rs. 15,000 (d) none of these

8. What is the earning of Pujarin from the alms?
(a) Rs. 1800 (b) Rs. 2000
(c) Rs. 3600 (d) can't be determined

9. The earning of Radhey is how much per cent greater than that of his wife?
(a) 50% (b) 80%
(c) $47\frac{11}{13}$% (d) none of these

10. A sales executive gets 20% bonus of the total sales value and 10% commission besides the bonus on the net profit after charging such commission. If the total sales value be Rs. 10 lakh per annum and the total profit of the company be Rs. 1.32 lakh, then his total earning per annum will be, given that he is not entitled to receive any fixed salary from the company :
(a) 2.3 lakh (b) 3.2 lakh
(c) 2.32 lakh (d) 2.12 lakh

11. Mr Scindia after selling 5.5% stock at Rs. 92 realizes Rs. 32200. Then he invested $\frac{1}{3}$ of the amount in 4.5% stock at Rs. 92, $\frac{2}{5}$ of the amount at Rs. 115 in 5% stock and the remaining in 6% stock at Rs. 56. The change in his income is :
(a) Rs. 56 loss (b) Rs. 78 profit
(c) Rs. 80 profit (d) Rs. 70 loss

12. Each edge of a cube is increased by 20% then the percentage increase in surface area of the cube is :
(a) 144% (b) 40%
(c) 44% (d) 72.8%

Directions for question number 13 and 14: *Pati, Patni and Woh (the three persons) were playing a game. At the begining of the game Pati and Patni together had 100% more money than Woh. Patni and Woh together had 300% more than Pati. By the end of the game Pati and Patni together had 100% more money than Woh had and Pati had 12.5% less money than Patni and Woh together had. Finally Pati gained Rs. 800 by the end of the game.*

13. Who has suffered the loss?
(a) Patni (b) Woh
(c) Patni and Woh both (d) can't be determined

14. The percentage change of money of Patni is :
(a) 40% (b) 30%
(c) 57.1428% (d) 42.857%

15. The raw material and manufacturing cost formed individually 70% and 30% of the total cost and the profit percentage is 14.28% of the raw material. If the cost of raw material increase by 20% and the cost of manufacturing is increased by 40% and the selling price is increased by 80%, then the new profit percentage is :
(a) 57% (b) 65.8%
(c) 60% (d) can't determined

16. A, B, C and D purchased a cine-multiplex for Rs. 56 lakhs. The contribution of B, C and D together is 460% that of A, alone.The contribution of A, C and D together is 366.66% that of B's contribution and the contribution of C is 40% that of A, B and D together. The amount contributed by D is :
(a) 10 lakh (b) 12 lakh
(c) 16 lakh (d) 18 lakh

17. In a village three people contested for the post of village Pradhan. Due to their own interest, all the voters voted and no one vote was invalid. The losing candidate got 30% votes. What could be the minimum absolute margin of votes by which the winning candidate led by the nearest rival, if each candidate got an integral per cent of votes?
(a) 4 (b) 2
(c) 1 (d) none of these

18. Every day a mango seller sells half his stock, 10% of the stock overnight gets spoiled. If 1983 mangoes rotted over 3 nights then how many did he start with on the first day?
(a) 25,000 (b) 24,000
(c) 30,000 (d) 32,000

19. A man lost half of his initial amount in the gambling after playing 3 rounds. The rule of gambling is that if he wins he will receive Rs. 100, but he has to give 50% of the total amount after each round. Luckily he won all the three rounds. The initial amount with which he had started the gambling was :
(a) $\frac{500}{3}$ (b) $\frac{700}{3}$
(c) 300 (d) 600

20. In a factory there are three types of Machines M_1, M_2 and M_3 which produces 25% , 35%, and 40% of the total products respectively. M_1, M_2 and M_3 produces 2%, 4% and 5% defective products, respectively. What is the percentage of non-defective products?
(a) 89% (b) 97.1%
(c) 96.1% (d) 86.1%

21. A company has 12 machines of equal efficiency in its factory. The annual manufacturing expenses are Rs. 24,000 and the establishment charges are Rs. 10,000. The annual output of the company is Rs. 48,000. The annual output and manufacturing costs are directly proportional to the no. of machines while the share holders get the 10% profit, which is directly proportional to the annual output of the company. If 8.33% machines remained close throughout the year. Then the percentage decrease in the amount of Share holders is :
(a) 16.66% (b) 14.28%
(c) 8.33% (d) none of these

22. In every month Ravindra consumes 25 kg rice and 9 kg wheat. The price of rice is 20% of the price of wheat and thus he spends total Rs. 350 on the rice and wheat per month. If the price of wheat is increased by 20% then what is the percentage reduction of rice consumption for the same expenditure of Rs. 350? Given that the price of rice and consumption of wheat is constant :
(a) 36% (b) 40%
(c) 25% (d) 24%

23. My friend Siddhartha Ghosh is working in the life insurance. Corporation of India (LIC). He was hired on the basis of commission and he got the bonus only on the first years commission. He got the policies of Rs. 2 lakh having maturity period of 10 year. His commission in the first second, third, fourth and for the rest of the years is 20%, 16% 12% 10% and 4% respectively. The bonus is 25% of the commission. If the annual premium is Rs. 20,000 then what is his total commission if the completion of the maturity of all the policies is mandatory :
(a) Rs. 174,00 (b) RS. 23, 600
(c) Rs. 15,000 (d) Rs. 15,500

Directions for question number 24 and 25: *DELL Computer has two branches : One in Ohio and second in Texas : The total no. of employees in Ohio office grew this year by 25% to 750 but the ratio of male to female employees is same as in the previous year. The no. of employees in the Texas office grew this year by 9.09% to 1200. The ratio of male to female employees last year in the Texas office was 5 : 6 and the no. of male employees in the Ohio office was 20% less than that of Texas office.*

24. The total no. of female employees this year in both the offices is :
(a) 654 (b) 546
(c) 950 (d) can't be determined

25. The total no. of employees in both the offices last year was :
(a) 1500 (b) 1700
(c) 1650 (d) can't be detemined

26. A shepherd had n goats in the year 2000. In 2001 the no. of goats increased by 40%. In 2002 the no. of goats declined to 70%. In 2003 the no. of goats grew by 30%. In 2004, he sold 10% goats, then he had only 34,398 goats. The percentage increase of the no. of goats in this duration was :
(a) 14.66% (b) 16.66%
(c) 20% (d) 33.33%

27. In the above question in which year the no. of goats was minimum?
(a) 2000 (b) 2001
(c) 2002 (d) 2004

Directions for questions number 28, 29 and 30: *In the IGNOU (Indira Gandhi National Open University) there are total 16,000 students pursuing MBA, which offers the specialization only in Finance, HR and Marketing. IGNOU accepts only Science, Commerce and Engineering students for the two years course of MBA. The number of science. students is 166.66% of the Commerce students. Number of Engineering students is equal to the number of Science and Commerce students together. Each student can specialize in only one of the marketing, HR and Finance. 20% of Science students opted the Finance, which is 16.66% less than the no. of Commerce students who opted Finance. The total Finance students is equal to 18% the total strength of the MBA students. 32% of Science students opted HR. Commerce students who opted HR is equal to 25% of total students specializing in Finance and Engineering students equal to 6.5% of the total strength of the MBA students opted HR.*

28. The number of Engineering students who opted marketing is :
(a) 7850 (b) 7500
(c) 8850 (d) none of these

29. The percentage of Commerce students who opted HR over the total strength of the MBA students is :
(a) 6.6% (b) 42.5%
(c) 4.5% (d) 62.5%

30. The most preferable course among the MBA students is :
(a) Finance (b) HR
(c) Marketing (d) I. T and systems

31. P% of the students of a class passed the exam. g% of the passed students are girls and b% of the fail students are boys. The percentage of passed boys over the failed girls is :
(a) $\left(\frac{bg}{p} \times 100\right)$ (b) $\frac{100(100-g).p}{(100-p)(100-b)}$
(c) $\frac{(100-g)(100-b)}{(100-p)}$ (d) none of these

32. In the Polo hospital some patients who were suffering from the Hepatites-B were admitted for the treatment , but 9% of the patients were died within half an hour. After treatment, the percentage of patients cured out of the remaining was only 80%. Out of these patients only 70% are completely cured out and the remaining were partially cured out which were equal to 153 patients. The no. of patients (approx.) who were admitted for the treatment for the same was :
(a) 400 (b) 678
(c) 560 (d) 700

33. The total cost of setting up a sugar cane factory is Rs. 1 crore, which produces 5000 ton per annum. Sugar is being sold at Rs. 18 per kg. Manufacturing cost including raw material is Rs. 3.2 per kg, labour and packing charges are Rs. 1.8 per kg. Maintenance and utilities expenses are Rs. 2 per kg and the general expenses (ie all the rest charges) are Rs. 3 per kg, 20% taxes are being paid of the gross annual earnings, then the net profit of the production of the factory per annum is :
(a) Rs. 4.2 crore (b) Rs. 3.2 crore
(c) 5.4 crore (d) none of these

34. A student appeard in the Mock CAT. The test paper contained 3 sections namely QA, DI and VA. The percentage marks in VA was equal to the average of the percentage marks in all the 3 sections. Coincidentally, if we reverse the digits of the percentage marks of QA we get the percentage marks of DI. The percentage marks in VA scored by the student could be :
(a) 48 (b) 66
(c) 69 (d) 81

35. The pressure of a definite mass of a gas is directly proportional to the temperature and inversely proportional to the volume under the given conditions. If temperature is increased by 40% and the volume is decreased by 20% then the new pressure will:
(a) be increased by 75% (b) reduce to 25%
(c) be increase by 20% (d) increase by 28%

36. A computer typist types a page with 20 lines in 10 minutes but he leaves 8% margin on the left side of the page. Now he has to type 23 pages with 40 lines on each page which he leaves 25% more margin than before. How much time is now required to type these 23 pages
(a) $7\frac{1}{2}$ hrs (b) $7\frac{2}{3}$ hrs
(c) $23\frac{1}{2}$ hrs (d) 3.916 hrs

37. A company made a cuboidal box of size $16 \times 12 \times 5$ to sell the ice cream, but later on it was found that the capacity of the box was 14.28% less than the required capacity while the height of the box was correct, which is 5 inches. As per the requirement he had to increase the length and breadth of the box in equal amount then the percentage increase in the area of the base of the box is
(a) 12.5% (b) 6.66%
(c) 16.66% (d) none of these

38. In Sabarmati Express, there are as many wagons as there are the no. of seats in each wagon and not more than one passanger can have the same berth (seat). If the middlemost compartment carrying 25 passangers is filled with 71.428% of its capacity, then find the maximum no. of passangers in the train that can be accommodated if it has minimum 20% seats always vacant
(a) 500 (b) 786
(c) 980 (d) can't be determined

39. The prepaid card of Reliance Infocom gives 19% less talktime than the prepaid card of Tata Indicom, having same price. Again the post-paid card of same price of Tata Indicom gives 10% less talktime than its prepaid card.
Similarly the post paid card of same price of Reliance gives 11.11% less talk time than its prepaid card. How much percent less talk time we get from the Reliance post paid card than the post paid card of Tata Indicom?
(a) 21.11% (b) 20%
(c) 30.11% (d) none of these

40. In the half yearly exam only 70% of the students were passed. Out of these (passed in half yearly) only 60% student are passed in annual exam. Out of those who did not pass the half yearly exam, 80% passed in annual exam. What per cent of the students passed the annual exam ?
(a) 42% (b) 56%
(c) 66% (d) none of these

41. The marks obtained by the students of a school is given below : maximum marks are 50.

Marks	Percentage of Students
< 10	15%
< 20	32%
< 30	40%
< 40	70%
< 50	100%

The ratio of no. of boys to no. of girls who passed the exam is 7 : 6. It is known that a student can pass the exam only when he obtained at least 20 marks in the exam. The total no. of students in the school if the no. of girls who are passed is 408 :
(a) 1100 (b) 1200
(c) 1300 (d) 1430

✍ ***Direction for question number 42 to 45:*** *After defeating Ravana, Ram and his family won a lot of valuable assets in the war. It consists of horses, chariots and some land of Ravans's kingdom. The cost of each horse and chariot was Rs. 20,000 and Rs. 8,000 respectively while the cost of 1 acre land was Rs. 5000. All the property was shared among the four persons in such a way that Ram and Sita got together the same wealth as Laxman and Urmila got together. Ram got more than Sita and Laxman got more than Urmila. Ram got* $\frac{1}{3}$ *rd horses and 20% chariots while Laxman received 50%chariots as the 50% of his total wealth. The no. of horses that Ram and Sita got together was 50% more than that of Laxman and Urmila together had. Sita got 8 horses and Urmila got 7 horses but the Ram and Sita got equal no. of Chariots and Urmila got 20 chariots less than that of Laxman. Urmila got twice the land than that of Sita but 20% less than Laxman.*

42. What is the difference between the wealth of Ram and wealth of Urmila?
(a) 1.2 lakh (b) 1 lakh
(c) 1.4 lakh (d) can't be determined

43. If Laxman wanted to exchange all his chariots with the horses, then who can exchange with his/her horses in terms of wealth :
(a) Ram (b) Sita
(c) Urmila (d) can't be determined

44. The wealth of Urmila is how many per cent less than that of Laxman :
(a) 42% (b) 45%
(c) 35% (d) none of these

45. The wealth due to land and chariot together is how much greater, in per cent, than the wealth due to horses.
(a) 25% (b) 20%
(c) 33.33% (d) none of these

46. A big cube is formed by rearranging the 160 coloured and 56 non-coloured similar cubes in such a way that the exposure of the coloured cubes to the outside is minimum. The percentage of exposed area that is coloured is:
(a) 25.9% (b) 44.44%
(c) 35% (d) none of these

47. Selection into IIMs (Indian Institutes of Management) is quite simple. In our coaching institute some students qualified CAT (The first stage of entrance into IIMs) but coincidentally the no. of boys who qualified the CAT was equal to the no. of girls. Besides these boys and girls got the calls from only IIM Ahamedabad and IIM Bangalore, but each of these from both the IIMs. 60% of the boys failed in the group discussion (the second phase of the selection process) and thus equal no of boys (but distinct) appeared for the personnel interview of IIM-A and IIM-B (interview is the third and final stage of selection of a candidate) but 20% of the boys who appeared for the interview of IIM-A and 60% of the boys who appeared for the interview of IIM-B failed. If it is possible that a candidate can receive the calls from more than one IIMs but he/ she can face the interview of only one IIM. Given that only 24 boys from our coaching institute were selected by the IIM-A and IIM-B also a candidate can appear for the next stage only if he/she qualifies the previous stage of the exam, then find the no. of girls who qualified the CAT (Common Admission Test).
(a) 100 (b) 250
(c) 300 (d) 600

48. In an office there were initially n employees. The HR manager first hired P% employees then after a month q% employees left the office, then there were finally n employees remained in the office, the value of $p-q$ is :
(a) pq (b) $\frac{pq}{100}$
(c) $\frac{p}{q}$ (d) none of these

49. In the Garbar Jhala, Aminabad a shopkeeper first raises the price of a Jewellery by x% then he decreases the new price by x%. After one such up down cycle, the price of a Jewellery decreased by Rs. 21025.After a second updown cycle the jewellery was sold for Rs. 484416. What was the original price of the jewellery.
(a) Rs. 5,00,000 (b) Rs. 6,00,625
(c) Rs. 525625 (d) RS. 5,26,000

50. The amount of work in a leather factory is increased by 50%. By what per cent is it necessary to increase the number of workers to complete the new amount of work in previously planned time, if the productivity of the new labour is 25% more.
(a) 60% (b) 66.66%
(c) 40% (d) 33.33%

Final Round

Directions for question number 1, 2 and 3: *The bar graph shown below reveals the data about the no. of students in different disciplines of MBA at a prominent Business School in India.*

1. The growth rate of Finance compared to that of marketing is:
(a) less (b) equal
(c) greater (d) none of these

2. Total no. of MBA students in the session of 2004-05 if the no. of students in 2004-2005 is increasing by 9.09% over the previous year :
(a) 555 (b) 600
(c) 777 (d) none of these

3. In the session of 2002-03 what percentage of MBA students are studying International Business?
(a) 13.33% (b) 25%
(c) 6.66% (d) 24%

Directions for question number 4 to 7: *The following table gives the sales details of the books for CAT written by Sarvesh.*

Year	Quant. Aptitude	Data Interpretation	Verbal Ability	Log. Reasoning
2000	4000	3750	4140	4350
2001	4200	3870	4260	4400
2002	4370	3990	4255	4500
2003	4268	3868	5371	4690
2004	4750	4900	5476	4710
2005	4800	5000	5500	4800

4. What is the growth rate of sales of Quantitative Aptitude from 2000 to 2005?
(a) 8% (b) 25%
(c) 20% (d) 40%

5. Which of the categories shows the lowest growth rate from 2000 to 2005?
(a) Q.A (b) DI
(c) VA (d) LR

6. Which category had the highest growth rate in the period?
(a) QA (b) DI
(c) VA (d) LR

7. Which of the categories had either a consistent growth or consistent decline in the period shown?
(a) QA (b) DI
(c) VA (d) LR

Directions for question number 8 to 10 : *In India there were only three bicycle making companies in the given period. The following table shows the production of units (in 000)*

Year	HERO	ATLAS	AVON
1990	2.97	1.75	3.77
91	4.22	2.48	4.55
92	5.95	3.14	4.5
93	6.28	3.01	4.76
94	6.33	4.12	4.74
95	8.50	4.21	4.26

UPTREND IN BICYCLES PRODUCTION IN INDIA

8. The simple average rate of growth of production of Hero cycles from 1990-95 :
(a) 37% (b) 42%
(c) 27% (d) 31.5%

9. Which of the following statements is/are correct ?
(i) Atlas cycles have recorded the fastest growth rate.
(ii) Total bicycles production was the highest in 1993
(iii) Hero cycles on an average account for 48% of total bicycles production
(a) I only (b) II only
(c) III only (d) none of these

10. Atlas cycles on an average account for what percentage of the total bicycles production :
(a) 15% (b) 23.4%
(c) 34.5% (d) 29%

Directions for question number 11 to 14 : *Answer the questions based on the following information, which gives data about certain butter producer companies in India.*

Name of the Company	Production ('000) tonnes	Capacity Utilisation (%)	Sales ('000) tonnes	Total sales value (in crore)
Amul	1.54	59.35	1.47	17.45
Nestle	1.64	64.80	1.26	15.25
Parag	2.48	71.20	2.03	26.75
Amrit	2.97	76.50	2.55	31.15
Total (including others)	11.60	61.30	10.67	132.80

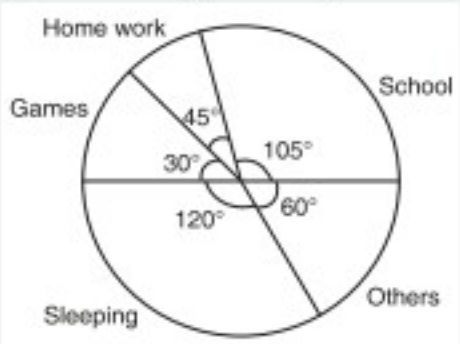
11. What is the maximum production capacity (in '000 tonnes) of Nestle for Butter?
(a) 2.53 (b) 2.07
(c) 2.84 (d) 2.97

12. Which company out of the four companies mentioned above has the maximum unutilised capacity in ('000 tonnes)?
(a) Amul (b) Nestle
(c) Parag (d) Amrit

13. What is the approximate total production capacity (in '000 tonnes) for butter in India?
(a) 7.8 (b) 18.9
(c) 11.60 (d) data insufficient

14. What per cent of the total market share (by sales value) is controlled by others?
(a) 32% (b) 83%
(c) 67% (d) data insufficient

Directions for (Q. no. 15 to 19): *The following pie chart shows the hourly distribution of all the major activities of a student.*



15. The percentage of time which he spends in school is :
(a) 38% (b) 30%
(c) 40% (d) 25%

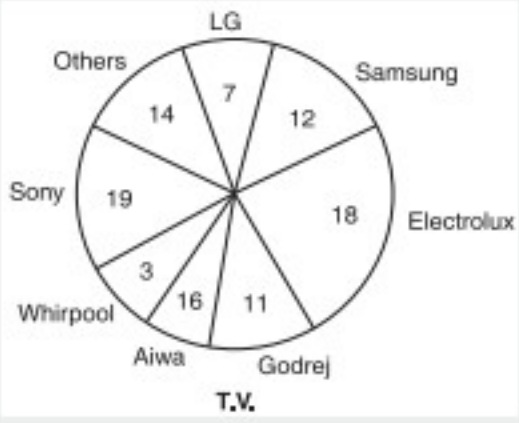
16. How much time (in per cent) he spends in games in comparison to sleeping?
(a) 30% (b) 40%
(c) 25% (d) none of these

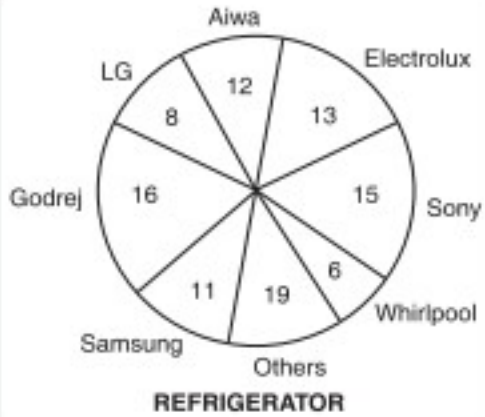
17. If he spends the time in games equal to the home work and remains constant in other activities, then the percentage decrease in time of sleeping :
(a) 15% (b) 12.5%
(c) 20% (d) none of these

18. What is the difference in time (in hours) spends in school and in home work :
(a) 2 (b) 3
(c) 4 (d) 8

19. If he spends $\frac{1}{3}$rd time of home work in Mathematics then the no. of hours spends in rest of the subjects in homework :
(a) 1 (b) 2
(c) 3 (d) 4

Directions for question number 20 to 23 : *The two pie charts show the market share of different companies which produces TV and Refrigerator (both) in the first quarter of 2005-06.*





NOTE The graph is not shown to scale.

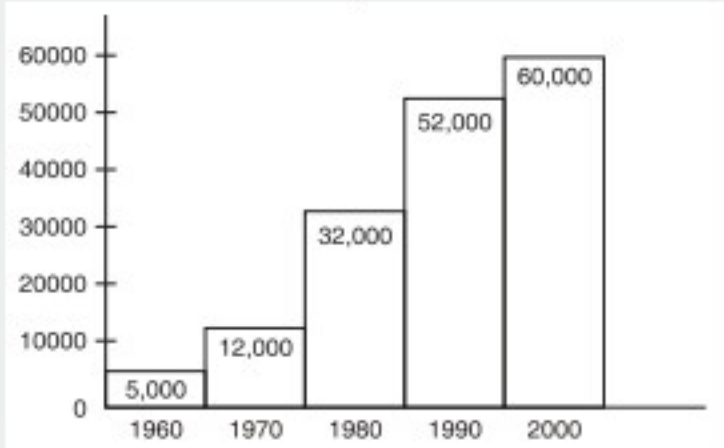
20. The difference in the angle subtended by Sony TV. and refrigerator is :
(a) 7.2° (b) 14.4°
(c) 21.6° (d) none of these

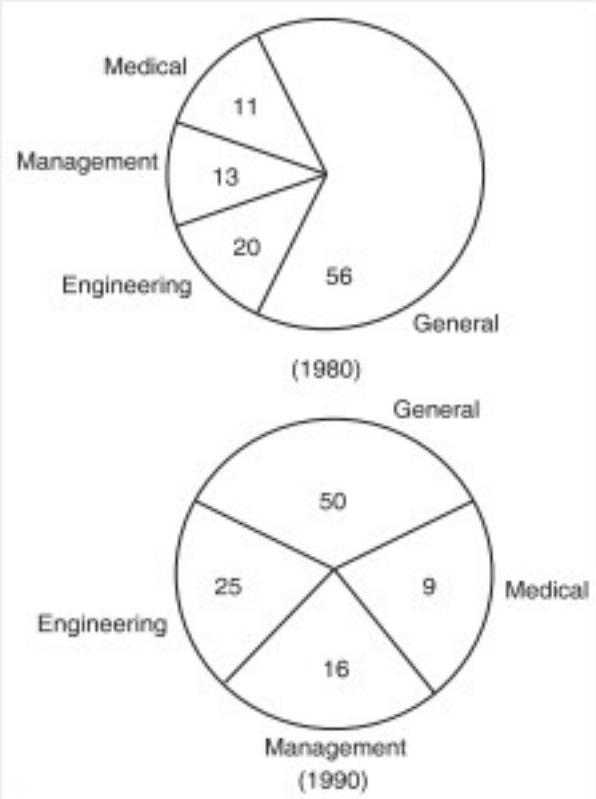
21. If the turn over of Samsung TV is Rs. 31 crores and of Samsung refrigerator is Rs. 9 crore, then what is the overall market share of Electrolux TV and refrigerater combined?
(a) 33.33% (b) 28%
(c) 16.7% (d) 65%

22. If the turnover in the first quarter of 2005-06 of Electrolux TV and Refrigerator is Rs. 42 crores and Rs. 6 crores respectively, then what is the average annual turnover of Godrej and Aiwa in both the product categories together?
(a) Rs. 304 crores
(b) Rs. 284 crores
(c) RS. 178 crores
(d) none of the above

23. Which of the following cann't be deduced from the given data :
(a) The angular difference between Samsung TV and Electrolux refrigerator is 3.6°.
(b) Sony is the market leader in the TV and Refrigerator segment combined.
(c) For every Rs. 100 turnover of Whirlpool Refrigerator, the difference in the turnover of Electrolux and Samsung Refrigerator is Rs. 33.34 crore
(d) none of the above

Directions for question number 24 to 28 : *Number of different colleges in India in different years is given in the graph below. Distribution of different colleges in the years 1980 and 1990 shown in the pie charts below :*





NOTE General courses include all the courses except Medical, Engineering and management

24. What is percentage increase in the number of colleges from 1960 to 1990?
(a) 1000% (b) 940%
(c) 1040% (d) 470%

25. The growth rate in no. of medical colleges in 1980 to 1990 is :
(a) 33% (b) 52%
(c) 36% (d) 39%

26. By what percentage did the no. of Engineering colleges go up from 1960 to 1970?
(a) 38% (b) 28%
(c) 42% (d) cann't of be determind

27. Till 1990 what was the highest increase in the number of colleges in any decade?
(a) 150% (b) 166.66%
(c) 200% (d) 140%

28. If the projected increase in the number of colleges in 2000 over 1990 is to be the same in all the categories of colleges, the percentage of Medical colleges in 2000 will be :
(a) 9% (b) 11%
(c) 7% (d) 13%

Directions for question number 29 to 33 : *Answer the questions based on the following information. The following table gives the tariff (in paise per kilo-litre) levied by the Lucknow jal Nigam in 2003-04 in four sectors and the region within them. (Each sector is divided in 5 regions). The table gives the percentage change in the tariff as compared to 2000-01.*

	Region 1		Region 2		Region 3		Region 4		Region 5	
	P/kl	%	P/kl	%	P/kl	%	P/kl	%	P/kl	%
Sector 1	1000	+ 25	400	+ 14.28	250	– 16.66	625	+ 4.166	720	+ 20%
Sector 2	800	+ 33.33	375	+ 7.14	350	– 12.5	750	+ 7.14	360	– 10
Sector 3	625	– 16.66	525	– 12.5	400	+ 14.28	240	– 4%	320	– 20
Sector 4	575	– 4.166	800	– 20%	500	– 16.66	360	+ 20%	400	– 11.11

29. If the amount of water consumed by the various regions in sector 1 is the same, then as compared to 2000-01 the net tariff in 2003-04 :
(a) increased by 20% (b) increased by 13%
(c) decreased by 12% (d) decreased by 20%

30. What was the approximate average tariff in region 2 in 2000-01?
(a) 450 (b) 675
(c) 575 (d) 525

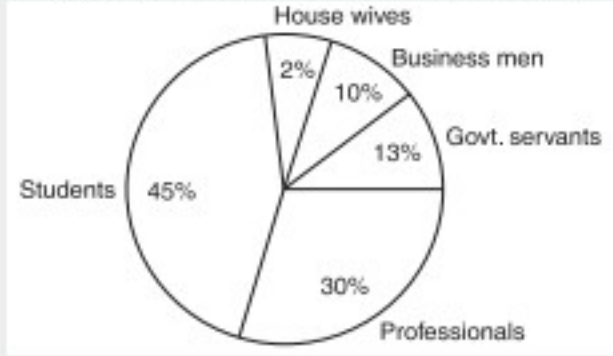
Additional direction for question 31-33 : *The Lucknow Jal Nigam supplies the water under four categories : Urban (25%) rural (15%) domestic (40%) industrial (20%). In 2003-04, the total water supplied by the Lucknow Jal Nigam was 20,000 kilo-litres.*

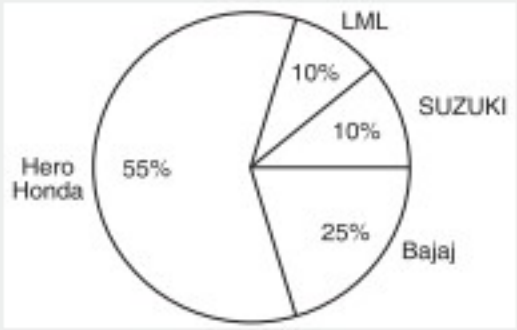
31. If in 2003-4, there was a 20% decrease in the domestic consumption of water as compared to that in 2000-01 what was the consumption of water in the industrial sector in 2000-01?
(a) 5,000 kl (b) 7500 kl
(c) 10,000 kl (d) 6000 kl

32. In the given two years, what is the total tariff paid by the Urban sector?
(a) Rs. 16,000 (b) Rs. 48,000
(c) Rs. 23,000 (d) can't be determined

33. Which of the following statements is true?
(a) The average tariff in region 2 is 625
(b) The average tariff in region 4 is greater than the average tariff in region 5
(c) In 2000-01 the industrial sector contributed about 30% of the total revenue from water supply
(d) none of the above

Directions for question 34-37 : *A marketing company conducted a survey among 10,000 person in Kanpur :*





It was observed that some people have more than one bike but from only one company i.e., a particular person can have more than one bike of HeroHonda, but not from bajaj etc. and vice versa. Thus there were total 12,000 bikes with 10,000 persons used for survey. There are only four companies operating in this market.

34. If each of Students, Govt. Servants and housewives use a Hero Honda bike (motorcycle), what per cent of the remaining people drive Hero Honda bike?
(a) 15% (b) 25%
(c) 20% (d) none of these

35. If the number of people who drive one, two and three bikes are in the ratio 15 : 3 : 1 what is the number of people in the survey who do not drive even a single bike?
(a) 750 (b) 400
(c) 600 (d) 500

36. If all the persons driving more than one bike drive only Hero Honda what is the number of people who drive single Hero Honda bike (the data can be used from previous question if necessary)?
(a) 2400 (b) 2100
(c) 4200 (d) 2600

37. If 20% of the persons who drive Bajaj's bike also drive another bike. What is the number of people who drive only Bajaj' bike ?
(a) 2400 (b) 2500
(c) 2660 (d) none of these

Directions for question 38-42 : *A table below shows the production and imports of crude oil (in '000 tonnes). Domestic production of crude oil is total of on-shore and off-shore production, which is supplemented by imports to meet the total demand of crude oil in the country.*

Year	2001	2002	2003
On shore	12,000	11,500	11,000
Off shore	11,000	19,000	16,000
Imports	21,000	24,000	30,000

(in '000 tonnes)

38. What was the percentage of domestic production of crude oil over imports in 2001?
(a) 80% (b) 140%
(c) 109.52% (d) none of these

39. What was the percentage change in domestic production of crude oil from 2001-2003 ?
(a) 14% (b) 27%
(c) 17.4% (d) – 10%

40. What is the average of total demand of crude oil over the period?
(a) 185 million tonnes (b) 52 million tonnes
(c) 18.5 million tonnes (d) 35 million tonnes

41. What was the approx-percentage increase in imports of crude oil from 2001 to 2003 :
(a) 49% (b) 65%
(c) 43% (d) none of these

42. If in the year 2004, off-shore production declines by 12.5% production on-shore remains the same and total demand increases by 2% what will be the imports of crude oil in 2004 ?
(a) 33.14 million tonnes (b) 63 million tonnes
(c) 39 million tonnes (d) 25 million tonnes.

Directions : *(Q. no. 43 to 50) Solve the following question on the basis of given data in the following table :*

Production of Rice in India

Year	Quantity (in tonnes)	Percentage change over the previous year
1920-21	1,34,300	+ 06.25%
1930-31	10,97,172	+ 12.50%
1940-41	2,64,280	+ 11.11%
1950-51	1,27,890	– 09.09%
1960-61	2,01,924	+ 20.00%
1970-71	1,12,325	– 16.66%
1980-81	2,13,465	– 25.00%
1990-91	1,69,368	+ 33.33%
2000-01	100,956	+ 50.00%
2010-11	23,800	– 83.33%

43. What is the production of rice in 1959-60?
(a) 1,84,250 (b) 1,68,270
(c) 242308.8 (d) none of these

44. What is the production of rice in 1949-50?
(a) 116263.6 3 (b) 1,23,460
(c) 1,40,679 (d) none of these

45. What is the total production of rice in 1919-20and 1929-30 and 1939-40 ?
(a) 13,26,400 (b) 13,39,516
(c) 1142693.75 (d) can't be determined

46. The production of rice in 2000-01 forms what percentage of total production out of the given years?
(a) 3.12% (b) 3.23%
(c) 4.128% (d) 6.45%

47. What is the difference in production of rice in 1969-70 and 1979-80 ?
(a) 149830 (b) 175752
(c) 53,890 (d) none of these

48. The percentage decrease in production of rice from 1929-30 to 1949-50
(a) 88.3% (b) 85.57%
(c) 66.66% (d) none of these

49. The production of rice in 1959-60 is what percentage of rice in 1960-61.
(a) 86.66% (b) 75.6%
(c) 83.33% (d) 16.66%

50. Out of the given years which year has shown least increase (in amount) over the previous year :
(a) 1940-41 (b) 1960-61
(c) 1920-21 (d) 2000-01

Answers

INTRODUCTORY EXERCISE-5.1

1. (i) 50, (ii) 54, (iii) 112.5, (iv) 400, (v) 2 quintal, (vi) 544.5, (vii) 88, (viii) 6 minutes, (ix) 200, (x) 2 lakh rupees
2. Rs. 4,500 **3.** 28 metres **4.** 750 **5.** 190 and 1520 **6.** 750 **7.** 102 km/hr **8.** Rs. 2200 **9.** 75 **10.** 750
11. 60000 **12.** 255

INTRODUCTORY EXERCISE-5.2

1. (i) 5%, (ii) 15.625, (iii) 33.33%, (iv) 24%, (v) 20%, (vi) 150%, (vii) 66.66%, (viii) 43.75%
2. (i) 4%, (ii) 75%, (iii) 6.25%, (iv) 33.33%, (v) 0.4166%, (vi) 7.5%
3. 85.33% **4.** 70% **5.** 97% **6.** 150% **7.** $33\frac{1}{3}\%$ **8.** 90% **9.** 12.5% **10.** 4%

INTRODUCTORY EXERCISE-5.3

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

LEVEL-1

1 (b)	**2.** (b)	**3.** (b)	**4.** (c)	**5.** (d)	**6.** (d)	**7.** (d)	**8.** (c)	**9.** (b)	**10.** (d)
11. (d)	**12.** (b)	**13.** (c)	**14.** (b)	**15.** (a)	**16.** (b)	**17.** (c)	**18.** (a)	**19.** (c)	**20.** (b)
21. (c)	**22.** (d)	**23.** (d)	**24.** (b)	**25.** (a)	**26.** (c)	**27.** (b)	**28.** (c)	**29.** (b)	**30.** (c)
31. (a)	**32.** (b)	**33.** (b)	**34.** (c)	**35.** (b)	**36.** (c)	**37.** (b)	**38.** (c)	**39.** (c)	**40.** (b)
41. (a)	**42.** (d)	**43.** (a)	**44.** (c)	**45.** (d)	**46.** (d)	**47.** (b)	**48.** (c)	**49.** (c)	**50.** (b)
51. (c)									

LEVEL-2

1 (d)	**2.** (c)	**3.** (a)	**4.** (d)	**5.** (d)	**6.** (d)	**7.** (a)	**8.** (d)	**9.** (b)	**10.** (d)
11. (c)	**12.** (c)	**13.** (a)	**14.** (c)	**15.** (a)	**16.** (d)	**17.** (c)	**18.** (b)	**19.** (b)	**20.** (c)
21. (b)	**22.** (a)	**23.** (a)	**24.** (d)	**25.** (b)	**26.** (a)	**27.** (c)	**28.** (d)	**29.** (c)	**30.** (c)
31. (b)	**32.** (d)	**33.** (b)	**34.** (b)	**35.** (a)	**36.** (a)	**37.** (c)	**38.** (c)	**39.** (b)	**40.** (c)
41. (c)	**42.** (a)	**43.** (a)	**44.** (c)	**45.** (b)	**46.** (b)	**47.** (a)	**48.** (b)	**49.** (c)	**50.** (c)

FINAL ROUND

1 (a)	**2.** (b)	**3.** (a)	**4.** (c)	**5.** (d)	**6.** (b)	**7.** (d)	**8.** (a)	**9.** (d)	**10.** (b)
11. (a)	**12.** (a)	**13.** (b)	**14.** (a)	**15.** (b)	**16.** (c)	**17.** (b)	**18.** (c)	**19.** (b)	**20.** (b)
21. (c)	**22.** (a)	**23.** (b)	**24.** (b)	**25.** (a)	**26.** (d)	**27.** (b)	**28.** (b)	**29.** (b)	**30.** (c)
31. (a)	**32.** (d)	**33.** (b)	**34.** (a)	**35.** (d)	**36.** (b)	**37.** (a)	**38.** (c)	**39.** (c)	**40.** (b)
41. (c)	**42.** (a)	**43.** (b)	**44.** (c)	**45.** (b)	**46.** (c)	**47.** (a)	**48.** (b)	**49.** (c)	**50.** (c)

Hints & Solutions

LEVEL 1

1.

F	M	
$60x$	$40x$	
$42x$	$20x$	(comp. lit.)

$62x$

$\therefore$ Female comp. literate $1600 \times \frac{42}{100} = 672$

2. $(10,00,000) \times 0.75 \times 0.80 \times 0.85 =$ Rs.5,10,000

3. $$2000 \times \frac{x}{100} + 4000 \times \frac{y}{100} = 320$$

and $$2000 \times \frac{x}{100} + 10,000 \times \frac{y}{100} = 680$$

$\therefore$ $x = 4$ and $y = 6$

$\therefore$ $x - y = -2$

4. Go through option $(40 \times 0.4) + (40)^2 = 1616$

$$\left(100 \times \frac{1616}{40} = 4040\right)$$

Alternatively: $(x \times 0.4) + x^2 = \frac{x \times 4040}{100}$

$\Rightarrow$ $x^2 = 40x \Rightarrow x = 40$

5. Can't be determined. We don't that whether there are some male employees who have exactly Rs. 8000 per month as their salary or not.

6.

	Physics	Chemistry
Failed	35%	45%
Passed	65%	55%

Passed in both = 22% of total student

Percentage of students who are passed in any of the Physics or Chemistry or both = (65 + 55) − 22 = 98%

So, the percentage of students who are failed in both = 2%

Therefore total failed (in both the subject) students = 12

7.

	History	Geography
Pass	$70x$	$50x$
Fail	$30x$	$50x$

both $20x$

$\therefore$ Total failed candidates $= (30x + 50x) - 20x = 60x$

Passed in both $= (100x - 60x) = 40x = 500$

Therefore total students $= 100x = 1250$ $\quad \because x = \frac{25}{2}$

8. My salary = 100

Salary of my brother = 110

Salary of my sister = 120

Salary of my wife $= 230 - \left(230 \times \frac{1300}{23 \times 100}\right) = 100$

$\because$ $56\frac{12}{23} = \frac{1300}{23}$

9. $\frac{60 \times 8 + 16 \times 30}{16 \times 60 \times 60} \times 100 = 1.66\%$

10. Total land of Sukhiya $= \frac{480x}{0.6} = 800x$

$\therefore$ Cultivated land of village $= 384000x$

$\therefore$ Required percentage $= \frac{800x}{384000} \times 100 = 0.20833$

11. Area $= l \times b$

$1 = 1 \times 1$

$1 = 0.8 \times 1.25$

So the area remained constant

12. Cost of fresh Mangoes + Packaging cost = Total cost

1	+	0.4	= 1.4
1.3	+	0.2	= 1.5

Percentage increase in cost $= \frac{0.1}{1.4} \times 100 = 7.14\%$

13. $$\frac{80}{100} + \frac{66}{100} + \frac{x}{200} = \frac{320}{400}$$

$\Rightarrow$ $x = 174 \Rightarrow 87\%$

14.

Male	Female
$55x$	$45x$

$\Rightarrow$ $10x = 72$

$x = 7.2$

$100x = 7.2 \times 100$

15. Let the total votes be x,

Polled votes $= 0.75x$

valid votes $= 0.70x$

$A + B + C = 0.70x$

$A \to 0.4x$, $B \to 1750$, $C \to 2450$

It means $B + C = 0.3x$ since given that $A = 0.4x$

Hence A is the winner.

16.

Bike	Car
x	$5x$
$1.2x$	$5.75x$

Initially total cost $= 25x + 10x = 35x$

Changed cost $= 28.75x + 12x = 40.75x$

Percentage change $= \frac{5.75}{35} \times 100 = 16\frac{3}{7}\%$

18. Go through option

S	K
15,000	18,000
12,000	16,000

Going in the reverse direction.

Hence, the presumed option is correct.

Alternatively:

	Sahid	Kareena
	$4x$	$\frac{48x}{9}$
25%	$5x$	$6x$

$\xrightarrow{+120\%}$

$\Rightarrow$ Initially $S : K = 4x : \frac{48x}{9} = 3 : 4$

$\Rightarrow$ Sahid's initial salary = 12,000

Sahid's changed salary = 15000

19. Let the smaller number be x and larger number be y

$$0.8x + 4 = 0.4y$$

$\Rightarrow$ $4y - 8x = 40$

and $y - x = 85$

$\Rightarrow$ $x = 75$ and $y = 160$

$\therefore$ $x + y = 235$

20. $\frac{x \times 220}{100} = 44$

$\Rightarrow$ $x = 20$ So $\frac{20 \times 44}{100} = 8.8$

21. Quantity × Rate = Price

$1 \times 1 = 1$

$0.7 \times 1.25 = 0.875$

$\therefore$ Decrease in price $= \frac{0.125}{1} \times 100 = 12.5\%$

22. Go through options

	P	Q	
In the Ist government	275 ←	225	Difference = 50
In the 2nd government	200 ←	300	Difference = 100

Hence, the presumed option (d) is correct

NOTE It can also be solved through the equation and variables

23. Passing marks are $0.6x$

So $0.3x + 30 = 0.6x \Rightarrow x = 100$

24. Go through options

Girls	Boys
800	1000

Now, $0.95 \times 800 + 1000 = 0.96 \times 1000 + 800$

Hence the presumed option is correct .

25.

H	E	U
$0.6x$	$0.24x$	$0.16x$
	↓	
	3600	2400

$(\because E : U = 24 : 16 = 3 : 2)$

26. Go through option

75

25 → 20, 50 → 30 (60%)

$\frac{50}{75} \times 100 = 66.66\%$

Hence, the presumed option is correct.

27.

Science	Commerce	Arts	Engineering
$\frac{x}{6}$ +	$\frac{x}{8}$ +	$\frac{x}{15}$	K

No. of Engineering student $= 1 - \left(\frac{x}{6} + \frac{x}{8} + \frac{x}{15}\right) = k = \frac{77x}{120}$

When $x = 120$ (the least possible number)

then the no of Engineering students = 77

28.

Copper	:	Aluminium	
7	:	4	
21 kg		12 kg	→ 33 kg

Required total alloy $= \frac{33}{0.88} = 37.5$ kg

29. $1.08x = 1404$

$x = 1300$

Therefore reduction in price = 1404 − 1300 = Rs. 104

$\left[\text{Since } 1300 + 1300 \times \frac{8}{100} = 1404\right]$

So you can solve it by using options.

30. Very fundamental question.

31. $8x + 9x + 10x = 810$

$\Rightarrow$ $x = 30$

Total marks in QA ⟶ 240

DI ⟶ 270

$\frac{VA}{RC}$ ⟶ 300

Now her score in QA ⟶ $\frac{240}{1.2} = 200$

Her score in DI $= \frac{270}{1.08} = 250$

Her score in $\frac{VA}{RC} = \frac{300}{1.0714} = 280$

Her total score = 200 + 250 + 280 = 730

32. Commission up to 10000 $= 10000 \times \frac{9}{100} = 900$

Again after 10000,

Commission	:	Bonus
9	:	3
$3x$	:	x

$\Rightarrow$

$\therefore$ Bonus $= (1380 - 900) \times \frac{1}{4} =$ Rs. 120

33.

Men	Women
$600x$	$400x$

Total Engineer = $480x$

Male Engineer $= 480x \times 0.66 = 320x$

$\therefore$ Women who are Engineers = $160x$

$\therefore$ Women who are not Engineers $= 400x - 160x = 240x$

Required percentage $= \frac{240}{400} \times 100 = 60\%$

34.

	Veer	Zara
In the last month	160	100
After the first change	200	75
After final change	120	120

35. Time × Rate = Total charges

$$1 \times 1 = 1$$

$$x \times 1.25 = 1.1$$

$$x = \frac{1.1}{1.25} \times 100 = 88\%$$

Thus decrease in time = 12%

36.

	Ambani	Sahara
Average earning	$4x$	$5x$
No. of family members	k	l
Total earning	$6y$	$5y$

Average earning × Number of family members = Total earning

$$l = \frac{5y}{5x} = \frac{y}{x}$$

$$k = \frac{6y}{4x}$$

$$\text{Required percentage} = \frac{l}{k} \times 100 = \frac{\frac{y}{x}}{\frac{6y}{4x}} \times 100$$

$$= \frac{4}{6} \times 100 = 66.66\%$$

Alternatively : After some steps you can use the options.

37.

Year	Value
2000	100
2001	110
2002	121
2003	133.1
2004	119.79
2005	107.811
2006	97.0299

HINT $(100) \times 1.1 \times 1.1 \times 1.1 \times 0.9 \times 0.9 \times 0.9 = 97.0299$

Now, $\frac{100 - 97.0299}{100} \times 100 \approx 3\%$

38. $30 \times 25 \times 35 = x \times 30 \times 28$

$\Rightarrow$ $x = 31.25$

It means 32 pages.

So, the percentages increase in the no. of pages

$$= \frac{2}{30} \times 100 = 6.66\%$$

39. Rate of increase of the price

= (rate of inflation + 2)% = 8 + 2 = 10%

Jan 2004	Jan 2005	Jan 2006	
20	20	22	24.2
	+2	+2.2	

Alternatively: Expected price after 2 years

$$= 20 \times 1.1 \times 1.1 = 24.2$$

40. Let the total number of people = x

then the amount donated by $0.6x$ people

$$= 600 \times 0.6x = 360\,x$$

Now since Rs. $360x$ is equal to 75% of the required amount. Hence we need only 25% more amount from the rest of the people *i.e.*, from $0.4x$ people

Hence average requirement $= \frac{120x}{0.4x} = 300$

Alternatively: $(600 \times 0.6 + k \times 0.4)\frac{3}{4} = 600 \times 0.6$

$\Rightarrow$ $k = 300$

41. By mistake $= \frac{x}{10}$

Actual value $= x \times 10$

$$\text{\% change} = \frac{10x - \frac{x}{10}}{10x} \times 100 = \frac{99}{100} \times 100$$

= 99% (negative)

Since actual value is greater than the wrong value

Alternatively :

Actual result = 10 × 10 = 100 (suppose $x = 10$)

wrong result $= \frac{10}{10} = 1$

$$\text{\% change} = \frac{100 - 1}{100} \times 100 = 99\%$$

NOTE Percentage error is always calculated on the basis of actual (*i.e.*, correct) value.

42. Use some different values for x then verify.

Let $x = 150$ then % error $= \frac{200 - 100}{100} \times 100 = 100\%$

Again if $x = 100$ then % error $= \frac{150 - 50}{50} \times 100 = 200\%$

Hence, we cannot determine.

43. Number of visitors × Rate = Revenue collected

	1	× 1	= 1
–20%	0.8	× 1.5	= 1.2
			+50%

Therefore percentage change in the revenue

$$= \frac{1.2 - 1}{1} \times 100 = 20\%$$

44.

	Bata	Woodland
M.P	100	100
S.P.	51	51

(Since the marked prices are same)

NOTE M.P. → Marked price, S.P. → Selling price
decreased by 49% = reduced to 51%

45. Selling price = cost price + profit

Shirt = $7y + x$

Coat = $12y + x$

Since, the profit is same, so the selling price of shirt will certainly be less than Rs. 2000 (which is half of the total value) as it is clear that cost price of shirt is less than the cost price of coat.

NOTE If selling price of shirt is equal to or greater than the selling price of coat then the C.P. of coat will be equal to or less than the C.P. of shirt which is wrong. Hence the only possible choice is (d).

46. Since we don't have sufficient data. Further any value is possible as the required income tax.

47. $2004 \longrightarrow 10000 \times x\% = k$

$2005 \longrightarrow 16000 \times \frac{5}{8} x\% = k$

but $\quad x - \frac{5}{8}x = 9 \Rightarrow x = 24\%$

So, the income tax = 2400.

48. Only (c) is correct since it is divisible by 4.

Let the original number of element be x then the new no. of elements will be

$$\frac{4x}{5} = K$$

So K must be divisible by 4

Since, $\quad x = \frac{K \times 5}{4}$

49. Go throught option

Boys	Girls	Total
14	11	25
56	44	100

(12)

Since out of 100 students no. of boys are greater than the no. of girls by 12 *i.e.*, 12% Hence correct.

Alternatively :

Let the no. of boys and girls be x and y respectively

then $\quad (x - y) = \frac{12 \times (x + y)}{100}$

$\Rightarrow \quad \frac{x}{y} = \frac{14}{11}$

50. Population after 2 years $= 5000\left(1 + \frac{2}{100}\right)^2$

$$5000 \times \frac{51}{50} \times \frac{51}{50} = 5202$$

51. Daily supply $= (100 - z)\%$ of $y = \frac{(100 - z)y}{100}$

$\therefore \quad$ Required no. of days $= \frac{x \times 100}{(100 - z)y}$

LEVEL 2

1.

Total Students (100)

- Boys (60)
  - Hockey (24)
  - Badminton (don't know about badminton)
- Girls (40)
  - Badminton (30)
  - Hockey (0)

Since we do not have information that whether the rest of the boys playing badminton or not. So we can not determine the total no. of students who are not playing any of the two games.

2. Go through option. Let us assume option (c)

$$10 = 2 \times 5 = 5 \times 2 = 1 \times 10 \times 10 \times 1$$

Consider the proper fraction $= \frac{2}{5}$

[Since the given percentage values are 25% and 20% that's why we have picked up option (c)].

$$\frac{2}{5} \rightarrow \frac{4}{25} \rightarrow \frac{5}{20}$$

To verify : $\quad \frac{2}{5} \times \frac{5}{8} = \frac{1}{4} = \frac{5}{20}$

Hence presumed option is correct

Alternatively: $\quad \frac{x}{y} \rightarrow \frac{x^2}{y^2} \rightarrow \frac{1.25\,x^2}{0.8\,y^2} = \frac{25}{16}\frac{x^2}{y^2}$

Now since $\quad \frac{25\,x^2}{16y^2} = \frac{5}{8}\left(\frac{x}{y}\right)$

$\Rightarrow \quad \frac{x}{y} = \frac{2}{5}$

3. Income = Expenditure + Savings

$$\begin{pmatrix} 8x = \\ 10x = \end{pmatrix} \begin{pmatrix} 5x + 3x \\ 8x + 2x \end{pmatrix} - x$$

Now $\quad$ the deficit $= (3x - 2x) = x = 3500$

and $\therefore \quad$ the new salary $= 10x = 35{,}000$

Alternatively : Go through options.

4. Go through options

$2457 - 2143 = 314 \qquad$ (True)

Again $(2457 + 2143) + 41 = 4641$

Now $\quad \frac{4641}{0.85} \rightarrow 5460$

Again $\quad \frac{5460 \times 45}{100} = 2457 \qquad$ (True)

Hence the presumed option is correct.

Alternatively: Let there be total x eligible voters, and the no. of votes goes to loser is k then

$$0.85x - 41 = 2k + 314 \qquad \ldots(1)$$

$$k + 314 = 0.45x \qquad \ldots(2)$$

Therefore $\quad x = 5460$

then, $\quad 5460 \times 0.85 = 4641$

Again $\quad 4641 - 41 = 4600$

Again $\quad k + (k + 314) = 4600$

$\Rightarrow \quad k = 2143 \qquad$ (loser)

and $\quad k + 314 = 2457 \qquad$ (winner)

5.

Income →	4	4.4	4.8	5.2]	18.4	lakh
Saving →	2	1.76	1.44	1.04]	6.24	lakh
Exp. →	2	2.64	3.36	4.16]	12.16	lakh

So, $\quad \frac{6.24}{12.16} \times 100 = 51\frac{6}{19}\%$

6. Let there be x voters and k votes goes to loser then

$$0.8x - 120 = k + (k + 200)$$

$$k + 200 = 0.41x$$

$\Rightarrow \quad k = 1440$

and $\quad (k + 200) = 1640$

Therefore $\quad \frac{1440}{3200} \times 100 = 45\%$

✍ ***Solutions for 7 – 9 :***

$$P + R = 30{,}000 \quad ...(1)$$
$$N = R - 8000 \quad ...(2)$$
$$(R + N) = 233.3\,(P)$$
$$\Rightarrow \quad 3\,(R + N) = 7P \quad ...(3)$$
$$\Rightarrow \quad 6R - 7P = 24{,}000 \quad ...(4)$$
$$\therefore \quad R = 18{,}000$$
$$\text{and} \quad P = 12{,}000$$
$$\text{and} \quad N = 10{,}000$$

7. $\dfrac{P + R + N}{3} = \dfrac{40{,}000}{3} = 1333.33$

8. Can't be determined

9. $\dfrac{8}{10} \times 100 = 80\%$

10. (Bonus) Commission $= \dfrac{20 \times 10{,}00{,}000}{100} = 2$ lakh

but total profit = net profit + $\dfrac{10}{100}$ × net profit

$\Rightarrow$ 1.32 lakh = 1.1 × net profit

$\Rightarrow$ net profit = 1.2 lakh = 1,20,000

$\therefore$ commission = total profit – net profit

= 1,32,000 – 1,20,000 = 12,000

hence total earning = 2,00,000 + 12,000 = 2,12,000

11. Let Mr. Scindia has x shares of 5.5%

$$x \times 92 = 32{,}200$$
$$\Rightarrow \quad x = 350 \text{ shares}$$
$$\text{Income} = 350 \times 5.5 = 1925$$

Now, after investment his income is

$$\left(\frac{1}{3} \times \frac{32200}{92} \times 4.5\right) + \left(\frac{2}{5} \times \frac{32200}{115} \times 5\right) + \left(\frac{4}{15} \times \frac{32{,}200}{56} \times 6\right)$$
$$= 525 + 560 + 920 = 2005$$
$$\text{Profit} = 2005 - 1925 = \text{Rs. } 80$$

12. The surface area of a cube $= 6a^2 = 6 \times (\text{side})^2$

New surface area $= 6 \times 1.44\,a^2$

$\therefore \quad \dfrac{0.44\,a^2}{a^2} \times 100 = 44\%$

✍ ***Solution for 13 and 14 :***

Pati → *Pt*, *Patni* → *Pn*, *Woh* → *W*

$$(Pt + Pn) = 2W \quad ...(i)$$
$$(Pn + W) = 4\,Pt \quad ...(ii)$$

Solving equation (i) and (ii) we get

$$\frac{Pn}{W} = \frac{7}{5} \quad \text{and} \quad \frac{Pt}{W} = \frac{3}{5}$$
$$\Rightarrow \quad Pt : Pn : W = 3 : 7 : 5$$
$$\text{Again} \quad (Pt + Pn) = 2W \quad ...(iii)$$
$$\text{and} \quad (Pn + W) \times 7 = 8 \times Pt \quad ...(iv)$$
$$\text{Therefore} \quad \frac{Pn}{W} = \frac{3}{5}, \quad \frac{Pt}{W} = \frac{7}{5}$$
$$\Rightarrow \quad Pt : Pn : W = 7 : 3 : 5$$

Gain of Pati $= 7x - 3x = 4x = 800$

$\Rightarrow \quad x = 200$

	Pati	*Patni*	*Woh*
Amount at the begining of Game =	600	1400	1000
Amount at the end of the game =	1400	600	1000

13. Only Patni has suffered the loss

14. $\dfrac{1400 - 600}{1400} \times 100 = 57.1428\%$

15. RM + MC = Total cost

Total cost + Profit = Sale price

70 + 30 = 100 100 + 10 = 110] + 80%

84 + 42 = 126 126 + 72 = 198

Therefore profit % $= \dfrac{72}{126} \times 100 = 57.14\%$

16.
$$A + B + C + D = 56$$
$$B + C + D = 4.6A$$
$$\Rightarrow \quad A + B + C + D = 5.6A \quad \text{(adding } A \text{ in both sides)}$$
$$56 \text{ lakh} = 5.6A$$
$$\Rightarrow \quad A = 10 \text{ lakh}$$
$$\text{Similarly} \quad A + C + D = \frac{11}{3}B$$
$$\Rightarrow \quad A + B + C + D = \frac{14}{3}B$$
$$\Rightarrow \quad B = 12 \text{ lakh}$$
$$\text{Similarly} \quad 4\,(A + B + D) = C$$
$$\Rightarrow \quad A + B + D = 2.5C$$
$$\Rightarrow \quad A + B + C + D = 3.5C$$
$$\Rightarrow \quad C = 16 \text{ lakh}$$

Therefore $D = (A + B + C + D) - (A + B + C) = 18$ lakh

17. Losing candidate = 0.3 x

$\therefore$ Other two candidates = 0.7 x

The share of winning candidate = 0.36 x

and the second ranker = 0.34 x

$\therefore$ Margin (min. possible) = 0.02 x

$\Rightarrow$ 2% of x

Let the minimum possible voters be 50 then

$$\frac{2 \times 50}{100} = 1$$

Hence the minimum possible margin of votes = 1

18.

Day	Initial amount	Sales	Remaining over night	Rotten	Stock for next day
I	x	$0.5x$	$0.5x$	$0.05x$	$0.45x$
II	$0.45x$	$0.225x$	$0.225x$	$0.0225x$	$0.2025x$
III	$0.2025x$	$0.10125x$	$0.10125x$	$0.010125x$	

$\therefore$ Total rotten amount $= 0.082625x = 1983$

$\Rightarrow \quad x = 24{,}000$

19. Check through option

Alternatively : Let the initial amount be x (with gambler), then

$$\left(\left(\left((x+100)\frac{1}{2}+100\right)\frac{1}{2}+100\right)\frac{1}{2}=\frac{x}{2}\right.$$

$$\Rightarrow \qquad x=\frac{700}{3}$$

20. Non-defective products

$$\frac{25\times 0.98+35\times 0.96+40\times 0.95}{100}\times 100=96.1$$

21.

No. of Machines	Output	Manf. cost	Est. cost	Total cost	Profit
12	48,000	24,000	10,000	34,000	14,000
11	44,000	22,000	10,000	32,000	12,000

Profit = out put − Total cost

= 44,000 − 32,000 = 12,000

Initial value of share holders $= 14{,}000\times\frac{10}{100}=1400$

Changed value of share holders $= 12{,}000\times\frac{10}{100}=1200$

$$\%\text{ decrease}=\frac{200}{1400}\times 100=14.28\%$$

22.

Rice	Wheat
25	9
$\times x$	$\times 5x$
$25x$	$45x$

$$70\,x=350$$

$$\Rightarrow \qquad x=5$$

Hence the price of Rice = Rs. 5 per kg

Price of wheat = Rs. 25 per kg

Now, the price of wheat = Rs. 30 per kg

Let the new amount of Rice be M kg, then

$$M\times 5+9\times 30=350$$

$$M=16$$

Hence decrease (in%) of amount of rice

$$=\frac{25-16}{25}\times 100=36\%$$

23.

Year	Rate of Commission	Commission in values
1	20%	$0.2\times 20{,}000=4000$
	25% (bonus)	$0.25\times 4000=1000$
2	16%	$0.16\times 20{,}000=3200$
3	12%	$0.12\times 20{,}000=2400$
4	10%	$0.1\times 20{,}000=2000$
5–10	4%	$6\times 0.04\times 20{,}000=4800$

Total commission

$= (4000+3200+2400+2000+48\,00)+(1000)=17{,}400$

Solution for 24-25

	OHIO	TEXAS
Last year :	$600 \leftarrow \overset{(M:F)}{(2:1)}$	$\overset{(M:F)}{(5:6)} \rightarrow 1100$
This year :	$750 \leftarrow (2:1)$	(unknown) $\rightarrow 1200$

24. Since we don't know the number of female employees in the Texas office this year so we can't determine

25. 1100 + 600 = 1700

26. There is no need to use the no. of goats *i.e.*, (34, 398) let initially there be 1000 goats then

$$1000\rightarrow 1400\rightarrow 980\rightarrow 1274\rightarrow 1146.6$$

Thus the % increase $=\frac{1146.6-1000}{1000}\times 100=14.66\%$

27. In 2002 (980 goats) as per the flow chart

Optional	Science	Commerce	Engi-neering	Total
	5000	3000	8000	16,000
Finance	1000	1200	680	2880
HR	1600	720	1040	3360
Marketing	2400	1080	6280	9760

28. 6280 Students of Engineering opted marketing

29. $\frac{720}{16{,}000}\times 100=4.5\%$

30. Marketing, since maximum students have opted marketing.

31. Consider some values and then verify the option.

32. Go through option :

700
↓
91% = (100 − 9)%
↓
637
↓
80%
↓
509.6 ≈ 510 persons
↓
70% (completely cured out)
↓
357
↓
(Partially cured) 153 = (510 − 357)

Hence, the presumed option is corret

33. Total expenditure per kg

= 3.2 + 1.8 + 2 + 3 = 10 = cost price

Selling price = Rs. 18 (per kg)

Gross profit = Rs. 8 per kg = (18 − 10)

Net profit $= 8\times\frac{80}{100}$ (since 20% is tax) = Rs. 6.4

Hence the net profit of the factory = 6.4 × 50,00,000

= Rs. 3,20,00,000 = Rs. 3.2 crore

34. Let the percentage marks in QA = $(10\,a+b)\%$

Let the percentage marks in DI = $(10\,b+a)\%$

Let the percentage marks in VA = $x\%$

then $\frac{(10\,a+b)+x+(10\,b+a)}{3}=x$

$$\Rightarrow \qquad 11a+11b+x=3x$$

$$\Rightarrow \qquad x=\frac{11}{2}(a+b)$$

Thus the percentage of the VA section is a multiple of 11.

35.
$$P_1 = k\frac{T}{V}$$
$$P_2 = k\frac{1.4T}{0.8} = K\frac{7T}{4V}$$
$$\frac{P_2 - P_1}{P_1} = \frac{\frac{7}{4}\frac{T}{V} - \frac{T}{V}}{\frac{T}{V}} = \frac{\frac{3}{4}\frac{T}{V}}{\frac{T}{V}} = \frac{3}{4}$$

Hence, the new pressure will be increased by 75%.

36. $20 \times 0.92 \Rightarrow$ 10 minutes.
$$\frac{23 \times 40 \times 0.90}{20 \times 0.92} = 45$$

Thus the required time is 45 times than the previous time

Hence, 450 minutes $= 7\frac{1}{2}$ hrs.

37. Original volume $= 16 \times 12 \times 5 = 960\ (\text{inch})^3$

Required capacity $= 1120\ (\text{inch})^3$

Increase in area $= \frac{1120}{5} - 16 \times 12$

$= 224 - 192 = 32\ (\text{inch})^2$

% increase $= \frac{32}{192} \times 100 = 16.66\%$

38. The total passengers in each compartment $= 25 \times \frac{7}{5} = 35$

Total no. of seats $= (35)^2 = 1225$

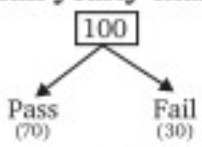
Maximum available capacity $= 1225 \times \frac{80}{100} = 980$ seats

39.

	Tata	Reliance
Prepaid	100	81
Postpaid	90	72

Thus the % decrease in talk time $= \frac{90 - 72}{90} \times 100 = 20\%$

40. **Half yearly exam**



Annual exam

$$\underbrace{70 \times 0.6}_{42} + \underbrace{30 \times 0.8}_{24}$$

$\therefore$ Total pass in annual exam $= 42 + 24 = 66$

41. Percentage of passed students $= 68\%$ $[100 - 32]\%$

Number of girls passed the exam = 408

Number of boys passed the exam = 476

Total passed students = 884

Therefore total no. of students $= \frac{884}{68} \times 100 = 1300$

Solution for 42- 45 :

Name	Horse	Chariot	Land	Total (in Rs.)
Ram	2 lakh (10)	80,000 (10)	20 acre = 1 lakh	3.8 lakh
Sita	1.6 lakh (8)	80,000 (10)	8 acre = 40,000	2.8 lakh
Laxman	1 lakh (5)	2 lakh (25)	20 acre = 1 lakh	4 lakh
Urmila	1.4 lakh (7)	40,000 (5)	16 acre = 80,000	2.6 lakh

1. $R + S = L + U$ *and* $R > S$ *and* $L > U$

2. Horses $\rightarrow (R + S) : (L + U) = 3x : 2x = 18x : 12x$

Again Ram have $\frac{1}{3}$ *rd horses*

Therefore $30x \times \frac{1}{3} = 10x$

Therefore the horse of Sita $= 18x - 10x = 8x$

$\Rightarrow$ $x = 1$

Therefore the horse of Ram $= 10$ *and Laxman* $= 5$

No. of chariots of Sita = No. of chariots of Ram $= \frac{K}{5}$

and *no. of chariots of Laxman* $= \frac{K}{2}$

Hence the no. of chariots of Urmila $= K - \left(\frac{K}{5} + \frac{K}{5} + \frac{K}{2}\right) = \frac{K}{10}$

Again $\frac{k}{2} - \frac{k}{10} = 20 \Rightarrow k = 50$ *chariots*

Now the 50% property of Laxman = 25 chariots = 2,00,000

Hence the total property of Laxman = 4,00,000

Thus the area of Land of Laxman $= \frac{2,00,000 - 5 \times 20,000}{5000}$

$= 20$ acre $= (1$ lakh$)$

Total property of Urmila

$= 1,40,000 + 40,000 + 80,000 = 2,60,000$

Thus the total property of Laxman and Urmila = 6.6 lakh

42. $3.8 - 2.6 = 1.2$ lakh

43. Value of chariots of Laxman = 2 lakh

Now since only Ram has the horses of worth Rs. 2 lakh. So only Ram can exchange with Laxman.

45. $\frac{7.2 - 6.0}{6.0} \times 100 = 20\%$

46. Total cubes $160 + 56 = 216$

Therefore the side of cube = 6 unit

No. of cubes without any exposure $= (6 - 2)^3 = 64$

Thus 64 cubes will be inside of the big cube

Now rest of the cubes $= 160 - 64 = 96$

Again the no. of cubes with one face outside

$= 6 \times (4 \times 4) = 96$

Hence the required percentage $= \frac{96}{216} \times 100 = 44.44\%$

47.

(Qualified CAT)
↓
x boys and x girls
↓
(Qualified G.D)
↓
$0.4x$ boys
↓
(Interview)

IIM-A	IIM-B	
[$0.2x$	$0.2x$]	appeared
↓	↓	
Qualified	Qualified	
↓	↓	
$0.8 \times 0.2x$	$0.4 \times 0.2x$	
$= 0.16x$	$= 0.08x$	

Total boys qualified the final stage = 0.24%

Thus $0.24x = 24$

$\Rightarrow$ $x = 100$

48. Go through option and consider some appropriate values

Alternatively : $\frac{p}{100+p} = \frac{q}{100}$

$\Rightarrow$ $100(p-q) = pq$

$\Rightarrow$ $(p-q) = \frac{pq}{100}$

49. Let the original price be P, then the decrease in value of P after one cycle

$$= P\left(\frac{x}{100}\right)^2 = 21025 \quad \ldots(i)$$

Again the final value after second cycle

$$\Rightarrow P\left(1+\frac{x}{100}\right)\left(1-\frac{x}{100}\right)\left(1+\frac{x}{100}\right)\left(1-\frac{x}{100}\right) = 484416$$

$$\Rightarrow P\left[1-\left(\frac{x}{100}\right)^2\right]^2 = 484416 \quad \ldots(ii)$$

Dividing equation (ii) by equation (i)

$$\frac{\left[1-\left(\frac{x}{100}\right)^2\right]^2}{\left(\frac{x}{100}\right)^2} = \frac{484416}{21025} = \frac{2304}{100}$$

$$\Rightarrow \frac{1-\left(\frac{x}{100}\right)^2}{\left(\frac{x}{100}\right)} = \sqrt{\frac{2304}{100}} = \frac{48}{10}$$

Let $\frac{x}{100} = k$, then

$$\frac{1-k^2}{k} = \frac{48}{10}$$

$\Rightarrow$ $10k^2 + 48k - 10 = 0$

$\Rightarrow$ $5k^2 - 24x - 5 = 0$

$\Rightarrow$ $k = 5$ or $k = -\frac{1}{5}$ (inadmissible value)

So $x = 20\%$

Hence, $P\left(\frac{x}{100}\right)^2 = 21025$

$\Rightarrow$ $P = 525625$

50. Men × Time = Work

100 × 1 = 100 unit

150 × 1 = 150 unit

Extra man power required = 50

but since new workers are $\frac{5}{4}$ times as efficient as existing workers.

$\therefore$ Actual no. of workers $= \frac{50}{5/4} = 40$ men

Hence, required percentage $= \frac{40}{100} \times 100 = 40\%$

Final Round

1. Growth rate of Finance

$$= \frac{125-75}{75} \times 100 = \frac{2}{3} \times 100 = 66.66\%$$

Growth rate of Marketing $= \frac{250-100}{100} \times 100 = 150\%$

2. Total no. of students in 2003-04 is

$$= (250 + 125 + 100 + 75) = 550$$

No. of student in 2004-05

$$= 550\left(1+\frac{1}{11}\right) = 600 \text{ students}$$

3. $\frac{50}{(150+100+75+50)} \times 100 = \frac{50}{375} \times 100 = 13.33\%$

4. $\frac{4800-4000}{4000} \times 100 = 20\%$

5. $\frac{450}{4350} \times 100 = 10.34\%$, which is lowest in comparison to others

Thus the growth rate of logical reasoning book is lowest.

6. DI $\rightarrow \frac{5000-3750}{3750} \times 100 = 33.33$

and VA $\rightarrow \frac{5500-4140}{4140} \times 100 = 32.85\%$

7. Only LR has consistent growth, others have been fluctuated (QA – 2003, DI – 2003, VA – 2002)

8. $\frac{\left[\frac{8.5-2.97}{2.97} \times 100\right]}{5} = 37.23\%$

9. Growth rate of Hero = 37.23%

Growth rate of Atlas = 28.1%

Avon is least which is clear from the data.

Total bicycle production is highest in 95 hence false

Hero cycle's share $= \frac{2.97 + 4.22 + \ldots 8.5}{79.84} = 43\%$

Hence, (d) since none of (a), (b) and (c) is correct.

10. $\frac{1.75 + 2.48 + \ldots 4.21}{79.84} = 23.4\%$

11. $\frac{1.64}{64.8} \times 100 = 2.53$

12. Amul has max. unutilised capacity

HINT $\left(\frac{1.54}{59.35} \times 100\right) - 1.54 = 1.05$

Similarly for others can also be find out

13. $\frac{11.6}{61.3} \times 100 \approx 18.9$

14. $\frac{42.20}{132.8} \times 100 = 31.81\%$

15. $\frac{105}{360} \times 100 = \frac{7}{24} \times 100 = 29.166\%$

16. $\frac{30}{120} \times 100 = 25\%$

17. $\frac{15}{120} \times 100 = 12.5\%$

18. $105 - 45 = 60° = 4$ hours

19. $15° = 1$ hour (Maths)

$30° = 2$ hour (other subjects)

20. Sony TV $\rightarrow$ 19%

Sony Refrigerator $\rightarrow$ 15%

difference = 4% = 14.4° (Since 1% = 3.6°)

21. $\begin{cases} 12\% \rightarrow \text{Samsung TV} = 31 \text{ crore} \\ 18\% \rightarrow \text{Electrolux TV} = 46.5 \text{ crore} \\ 100\% \rightarrow \text{Total market} = 258 \text{ crore} \end{cases}$

$\begin{cases} 11\% \rightarrow \text{Samsung Refrg.} = 9 \text{ crore} \\ 13\% \rightarrow \text{Electrolux Refrg.} = 10.6 \text{ crore} \\ 100\% \rightarrow \text{Total market} = 81.8 \text{ crore} \end{cases}$

$$\text{Market share} = \frac{46.5 + 10.6}{258 + 81.8} \approx 16.7\%$$

22. 18% = Rs. 42 crores, so 27% (= 16 + 11) = Rs. 63 crore

13% = Rs. 6 crore, so 28% (= 12 + 16) = Rs. 13 crore

Total Rs. 76 crores

$\therefore$ Annual approx. turnover = 4 × 76 = Rs. 304 crores

23. (a) $(13 - 12) = 1\% = 3.6$

(b) We don't know the turnover of TV and refrigerator market for each brand.

(c) 6% total refrigerator market = 100 crore

$\Rightarrow$ Total refrigerator market $\cong$ 1667 crore

$\therefore$ Difference = 2% of 1667 = 33.34 crore

Thus, (b) can't be inffered.

24. $\frac{52{,}000 - 5{,}000}{5000} \times 100 = 9.4 \times 100 = 940\%$

25. Medical college in 1980 $= \frac{11}{100} \times 32{,}000 = 3520$

$$1990 = \frac{9}{100} \times 52{,}000 = 4680$$

$$\therefore \quad \frac{4680 - 3520}{3520} \times 100 = 32.95$$

26. We don't have the information about the proportion (share) of Engineering colleges in the given years.

27. $\frac{32{,}000 - 12{,}000}{12{,}000} \times 100 = 166.66\%$

28. Number of medical colleges in 1990

$$= \frac{52{,}000 \times 9}{100} = 4680$$

Increase in the total no. of colleges

$$= 60{,}000 - 52000 = 8000$$

Increase in the no. of medical colleges $= \frac{8000}{4} = 2000$

Therefore, percentage of medical colleges in 2000

$$= \frac{4680 + 2000}{60{,}000} \times 100 = 11\%$$

29. If the amount of water consumed of sector 1 is the same then we can directly compare the tariffs to the two years.

	Tariff 2003–04	% change	Tariff 2000–01
Region 1	1000	+ 25%	800
Region 2	400	+ 14.28%	350
Region 3	250	–16.66%	300
Region 4	625	+ 4.166%	600
Region 5	720	+ 20%	600
	2995		**2650**

$$\frac{2995 - 2650}{2650} \times 100 = \frac{345}{2650} \times 100$$

$$= 13.01\%$$

30.

	Tariff 2003–04	% change over 2000-01	Tariff 2000–01
Sector 1	400	+ 14.28%	350
Sector 2	375	+ 7.14%	350
Sector 3	525	–12.5%	600
Sector 4	800	–20%	1000
	2100		**2300**

$$\text{Average tarrif} = \frac{2300}{4} = 575$$

31. In 2003-04 the water consumed by various secters out of 20,000 kilo-litres can be given as follow:

Category	Percentage	Consumption in 2003–04
Domestic	40	8,000
Urban	25	5,000
Rural	15	3,000
Industrial	20	4,000
		20,000

Since there was a 20% decrease in the domestic consumption in 2003-04 the domestic consumption in

2000-01 $= \frac{8{,}000}{0.8} = 10{,}000$

But this constitutes 40% of total water consumed in 2000-01 and the industrial consumption constitutes 20% of total water in 2000-01. Hence in 2000-01 the industrial consumption $= 10{,}000 \times \frac{20}{40} = 5{,}000$ kilo-liters

32. We do not know the category-wise break up of tariffs ie the rates of Urban sector is unknown.

33. The average of Region 2 $= \frac{400 + 375 + 525 + 800}{4} = 525$

Average tariff in region 4 $= \frac{62.5 + 750 + 240 + 360}{4} = 487.5$

Average tariff in region 5 $= \frac{220 + 360 + 320 + 400}{4} = 450$

Statements (c) can not be determined

34. Total number of people = 10,000

Business men	10%	1000
Govt. Servant	13%	1300
Professionals	30%	3000
Students	45%	4500
Housewives	2%	200

LML	1200
SUZUKI	1200
BAJAJ	3000
HERO HONDA	6600

The total number of Hero Honda bikes = 6600
Total numbers of Government servants housewives and students = 6000
Total no. of Businessmen and professional = 4000
∴ Percentage of remaining (*i.e.*, Businessmen and prof.) driving Hero Honda $= \frac{600}{4000} \times 100 = 15\%$

35. Let the no. of people who drive one two and three bikes be $15k$, $3k$ and k respectively.

Number of bikes which are being driven

$$= 15k + 2(3k) + 3(k) = 24k$$

Since LML and Suzuki can not be driven by same person and a person can drive maximum 3 bikes.
Total bikes which are being used to drive = 12,000

$$\therefore \quad 24k = 12{,}000 \Rightarrow k = 500$$

Total number of people driving the bikes

$$= 15k + 3k + k = 19k = 9500$$

∴ Number of people who do not drive any bike

$$= 10{,}000 - 9500 = 500$$

36. From the previous solution, number of people who drive more than 1 bike *i.e.*, 2 bikes and 3 bikes are 1500 and 500 respectively.
These people have total 4500 bikes

$$(= 1500 \times 2 + 500 \times 3)$$

Hence, the remaining Hero Honda bikes

$$= 6600 - 4500 = 2100$$

Thus, the number of persons who drive single Hero Honda

$$= 2100$$

37. Since 20% drive other bikes 80% drive only bajaj bike number of people who drive only Bajaj bike

$$= 0.8 \times 3000 = 2400$$

38. $\frac{11000 + 12000}{21{,}000} \times 100 = 109.52\%$

39. $\frac{27{,}000 - 23{,}000}{23{,}000} \times 100 = 17.4\%$

40. Demand = Domestic Production + Imports

Average demand $= \frac{44 + 54.5 + 57}{3} \approx 52$ million tonnes

41. (c) $\frac{30{,}000 - 21{,}000}{21{,}000} \times 100 \approx 43\%$

42. Offshore production in 2004 $= 16{,}000 \times 0.875$

$= 14{,}000$ thousand tonnes

Onshore production = 11,000 thousand tonnes

Demand in 2004 $= 57{,}000 \times 1.02 = 5814$ thousand tonnes

imports = 33.14 million tonnes $\quad (\because 1 \text{ million} = 10^6)$

43. $201924 \times \frac{5}{6} = 33654 \times 5 = 168270$

44. $127890 \times \frac{11}{10} = 140679$

45. $126400 + 975264 + 237852 = 1339516$

46. $\frac{100956}{2445480} \times 100 = 4.128\%$

Alternatively: $\frac{1}{24} \times 100 \approx 4.16\%$

47. $1969 - 70 \rightarrow 134790$
$1979 - 80 \rightarrow 284620$] 149830

48. $1929 - 30 \rightarrow 9{,}75{,}264$
$1949 - 50 \rightarrow 1{,}40{,}679$

% decrease $= \frac{975264 - 140679}{975264} \times 100 = 85.57\%$

49. $1959 - 60 \longrightarrow 1960 - 61$

$168020 \xrightarrow{+\,20\%} 201924$

Therefore $\frac{168020}{201924} \times 100 = 83.33\%$

Alternatively: From percentage charge graphic

Increase	Decrease
20%	16.66%
1/5	1/6

∴ The required value = 83.33% (100 − 16.66%)

Alternatively: $x \times \frac{6}{5} = k$

$$\Rightarrow \quad x = \frac{5k}{6}$$

$$(x)\% = \frac{5k}{6} \times 100 = 83.33\% \text{ of } k$$

50. Only 7,900 tonnes increase over the 1919 – 20.

4 RATIO, PROPORTION & VARIATION

The basic applications of the concepts involved in this chapter are comparisons of two or more quantities and changes in their magnitudes, *e.g.*, comparison of the ages, weights income, savings, heights, volume, density, temperature etc.

So this chapter is very useful in solving the problems of Data interpretation. Also each and every year one or two problems from this chapter is/are asked in CAT, either directly or application based for QA section. Last but not the least, the concepts of ratio, proportion and variations are very useful in solving the maximum arithmetic problems. That's why these problems are usually asked in most of the competitive exams like FMS, IIFT, MAT, SYMBIOSIS etc.

RATIO

The comparison between two quantities in terms of magnitude is called the ratio, *i.e.*, it tells us that the one quantity is how many times the other quantity.

For example, Amit has 5 pens and Sarita has 3 pens. It means the ratio of number of pens between Amit and Sarita is 5 is to 3. It can be expressed as '5 : 3'.

NOTE It should be noted that in a ratio, the order of the terms is very important. For example, in the above illustration the required ratio is 5 : 3 while 3 : 5 is wrong.

So the ratio of any two quantities is expressed as $\frac{a}{b}$ or $a : b$.

The numerator 'a' is called the **antecedent** and denominator 'b' is called as **consequent**.

Rule of Ratio

The comparison of two quantities is meaningless if they are not of the same kind or in the same units (of length, volume or currency etc). We do not compare 8 boys and 6 cows or 15 litres and 5 toys or 5 metres and 25 centimetres. Therefore, to find the ratio of two quantities (of the same kind), it is necessary to express them in same units.

NOTE

1. We do not compare 8 boys and 6 cows, but we can compare the number (8) of boys and number (6) of cows. Similarly, we cannot compare the number (15) of litres and the number (5) of toys etc.
2. Ratio has no units.

PROPERTIES OF RATIOS

1. The value of a ratio does not change when the numerator and denominator both are multiplied by same quantities *i.e.*,

$$\frac{a}{b} = \frac{ka}{kb} = \frac{la}{lb} = \frac{ma}{mb} \text{ etc.}$$

e.g., $\frac{3}{4} = \frac{6}{8} = \frac{9}{12}$ … etc. have the same ratio.

2. The value of a ratio does not alter (or change) when the numerator and denominator both are divided by same quantities *i.e.*,

$$\frac{a}{b} = \frac{a/k}{b/k} = \frac{a/l}{b/l} = \frac{a/m}{b/m} \text{ etc.}$$

e.g., $\frac{3}{4} = \frac{3/2}{4/2} = \frac{3/3}{4/3} = \frac{3/4}{4/4}$ … etc are same ratio.

3. The ratio of two fractions can be expressed in ratio of integers. *e.g.*,

$$\frac{3/4}{5/4} = \frac{3}{4} \times \frac{4}{5} = \frac{3}{5}$$

Since $\frac{a/b}{c/d} = \frac{a}{b} \times \frac{d}{c}$ (Refer to the **fractions** in Fundamentals)

4. When two or more than two ratios are multiplied with each other, then it is called as compounded ratio *e.g.*, $\frac{2}{3} \times \frac{4}{5} \times \frac{6}{7} = \frac{16}{35}$ is the compounded ratio of $\frac{2}{3}, \frac{4}{5}, \frac{6}{7}$

So, $\frac{a}{b} \times \frac{c}{d} \times \frac{e}{f} \ldots = \frac{k}{l}$ (compounded ratio)

5. When the ratio is compounded with itself, it is called as duplicate, triplicate ratios etc. *e.g.*,

$\frac{a}{b} \times \frac{a}{b} = \frac{a^2}{b^2} = \left(\frac{a}{b}\right)^2$ is called as duplicate ratio of $\frac{a}{b}$

and $\frac{a}{b} \times \frac{a}{b} \times \frac{a}{b} = \left(\frac{a}{b}\right)^3$ is called as triplicate ratio of $\frac{a}{b}$.

Similarly, $\sqrt{\left(\frac{a}{b}\right)} = \left(\frac{a}{b}\right)^{1/2}$ is called as sub-duplicate ratio and $\sqrt[3]{\left(\frac{a}{b}\right)} = \left(\frac{a}{b}\right)^{1/3}$ is called as sub-triplicate ratio of $\frac{a}{b}$.

6. $\frac{a}{b} = \frac{c+am}{d+bm}$ if and only if $\frac{c}{d} = \frac{a}{b}$

i.e., $\frac{30}{40} = \frac{30+3m}{40+4m} = \frac{33}{44} = \frac{36}{48} \ldots$ etc at $m = 1, 2, \ldots$

This property is very useful when we compare two fractions

e.g., to compare between $\frac{10}{20}$ and $\frac{12}{22}$

We see that $\frac{10}{20} = \frac{1}{2}$

Now if $\frac{10}{20}$ and $\frac{12}{22}$ are equal then $\frac{12}{22} = \frac{10+m}{22+2m}$

Now putting $m = 2$, we don't get the required fraction.

So $\frac{12}{22} \neq \frac{10}{20}$ for any value of m, $\frac{12}{22} \neq \frac{10}{20}$ (in terms of ratio)

7. $\frac{a+k}{b+k} < \frac{a}{b}$ if for every positive k, $\frac{a}{b} > 1$

and $\frac{a-k}{b-k} > \frac{a}{b}$

8. $\frac{a+k}{b+k} > \frac{a}{b}$ if for every positive k, $\frac{a}{b} < 1$ and $\frac{a-k}{b-k} < \frac{a}{b}$

9. $\frac{a+c}{b+d} > \frac{a}{b}$ if $\frac{c}{d} > \frac{a}{b}$

10. $\frac{a+c}{b+d} < \frac{a}{b}$ if $\frac{c}{d} < \frac{a}{b}$

11. If $\frac{a}{b} = \frac{c}{d} = \frac{e}{f} = \frac{g}{h} = \ldots = k$

then $\frac{a+c+e+g+\ldots}{b+d+f+h+\ldots} = k$

12. Let $\frac{a}{b}, \frac{c}{d}, \frac{e}{f}, \frac{g}{h} \ldots$ be some different ratios, then the value of $\left(\frac{a+c+e+g+\ldots}{b+d+f+h+\ldots}\right)$ must lies between the lowest and highest ratios.

13. If $a:b$ and $b:c$ are given, then

$$a:b:c = \begin{matrix} a & & b \\ \downarrow & \swarrow & \downarrow \\ b & & c \end{matrix} = (a \cdot b):(b \cdot b):(b \cdot c)$$

14. If the ratios between $a:b, b:c, c:d, d:e$ are given individually, then the combined ratio of $a:b:c:d:e$.

$$\begin{matrix} a & : & b \\ b & : & c \\ c & : & d \\ d & : & e \end{matrix} \quad \begin{matrix} a \\ b \\ c \\ d \end{matrix}\Big\downarrow \; : \; \begin{matrix} b \\ b \\ c \\ d \end{matrix}\Big\downarrow \; : \; \begin{matrix} b \\ c \\ c \\ d \end{matrix}\Big\downarrow \; : \; \begin{matrix} b \\ c \\ d \\ d \end{matrix}\Big\downarrow \; : \; \begin{matrix} b \\ c \\ d \\ e \end{matrix}\Big\downarrow$$

i.e., $a:b:c:d:e = (a.b.c.d):(b.b.c.d)$
$:(b.c.c.d):(b.c.d.d):(b.c.d.e)$

EXAMPLE 1 *Find the ratio of 25 to 40.*

SOLUTION $\frac{25}{40} = \frac{5 \times 5}{5 \times 8} = \frac{5}{8}$

NOTE To get the ratio, we rationalize the fractions by cancelling out the common factors of numerator and denominator.

EXAMPLE 2 *Find the ratio of 90 cm to 1.5 m.*

SOLUTION 1.5 m = 150 cm (units must be same)

So, the required ratio $= \frac{90}{150} = \frac{3}{5}$

EXAMPLE 3 *The number of boys and girls in a school are 576 and 480 respectively. Express the ratio of the number of boys to that of girls in the simplest form.*

SOLUTION Required ratio $= \frac{576}{480} = \frac{6}{5}$ $\left(\because \frac{576}{480} = \frac{96 \times 6}{96 \times 5}\right)$

EXAMPLE 4 *Shukla earns Rs. 14,000 per month and Mishra earns Rs. 18,000 per month. Find the ratio of Shukla's salary to Mishra's salary.*

SOLUTION Required ratio $= \frac{14{,}000}{18{,}000} = \frac{7}{9}$

EXAMPLE 5 *Out of 144 persons working in an office, 56 are men and the remaining are women. Find the ratio of number of women to number of men.*

SOLUTION Ratio $= \frac{88}{56} = \frac{11}{7}$ ($\because$ number of women = 144 – 56)

EXAMPLE 6 *In a club having 100 members, 20 play carrom, 24 play table-tennis and 16 play cricket and the remaining members do not play any game. No member plays more than one game. Find the ratio of the number of members who play.*

(a) Carrom to the number of those who play table-tennis.
(b) Cricket to the number of those who play carrom.
(c) Cricket to the number of those who do not play any game.
(d) Table-tennis to the number of those who do not play any game.
(e) Some game to the number of those who do not play any game.

SOLUTION Total members = 100
Carrom = 20
Table-tennis = 24
Cricket = 16
No any game = 40

(a) $\frac{20}{24} = \frac{5}{6}$ (b) $\frac{16}{20} = \frac{4}{5}$

(c) $\frac{16}{40} = \frac{2}{5}$ (d) $\frac{24}{40} = \frac{3}{5}$

(e) $\frac{60}{40} = \frac{3}{2}$

EXAMPLE 7 *A person earns Rs. 1200 per day and spends Rs. 800. Find the ratio of his savings to expenditure.*

SOLUTION $\frac{400}{800} = \frac{1}{2}$ (Savings = Income – Expenditure)

$= 1 : 2$

EXAMPLE 8 *Simplify the following ratios :*

(a) $\frac{1}{6} : \frac{1}{8}$ (b) $2\frac{1}{3} : 3\frac{1}{2}$ (c) $\frac{5}{6} : \frac{3}{8} : 3\frac{3}{4}$

SOLUTION (a) $\frac{1}{6} : \frac{1}{8} = \frac{1/6}{1/8} = \frac{1}{6} \times \frac{8}{1} = \frac{4}{3}$ or $4 : 3$

Alternatively: $\frac{1}{6} : \frac{1}{8} = \frac{48}{6} : \frac{48}{8}$ $\left(\text{or } \frac{24}{6} : \frac{24}{8}\right)$

$= 8 : 6 = 4 : 3$

NOTE In case of fractions, convert them to whole numbers by multiplying each term by the L.C.M. of their denominators.

(b) $2\frac{1}{3} : 3\frac{1}{2} = \frac{7}{3} : \frac{7}{2} = \frac{7/3}{7/2} = \frac{2}{3}$ or $2 : 3$

NOTE In case of two fractions if numerators are same, then the required ratio is the inverse ratio of the fractions.

(c) $\frac{5}{6} : \frac{3}{8} : 3\frac{3}{4} = \frac{5}{6} : \frac{3}{8} : \frac{15}{4} = \frac{5}{6} \times 24 : \frac{3}{8} \times 24 : \frac{15}{4} \times 24$

$= 20 : 9 : 90$ {∵ LCM of 6, 8 and 4 is 24}

EXAMPLE 9 *Divide 14 toffees among Ankita and Anshul in the ratio 5 : 2*

SOLUTION According to the question, if there are 7 toffees then Ankita will have 5 and Anshul will have 2 toffees but since there are 14 toffees, which is twice of 7. So Ankita will have 10 toffees and Anshul will have 4 toffees.

SHORTCUT

Ankita		Anshul
5	:	2
$14 \times \frac{5}{(5+2)}$	:	$14 \times \frac{2}{(5+2)}$
10	:	4

EXAMPLE 10 *Three boys are aged 2 years, 4 years and 8 years. They want to divide seventy rupees in the ratio of their ages. How much money would each get?*

SOLUTION The ratio of their ages = $A : B : C = 2 : 4 : 8 = 1 : 2 : 4$

A	:	B	:	C
1	:	2	:	4
$70 \times \frac{1}{1+2+4}$	:	$70 \times \frac{2}{1+2+4}$	:	$70 \times \frac{4}{1+2+4}$
10	:	20	:	40

So A gets Rs. 10, B gets Rs. 20 and C gets Rs. 40 if the ratio of their ages is $2 : 4 : 8$.

EXAMPLE 11 *An amount of Rs. 100 is being divided among two persons in the ratio $\frac{1}{10} : \frac{1}{15}$. How much money does each get?*

SOLUTION $\frac{1}{10} : \frac{1}{15} = \frac{1}{10} \times 30 : \frac{1}{15} \times 30 = 3 : 2$ (here 30 is the LCM of 10 and 15)

So, the ratio of amount of money $= \frac{3}{5} \times 100 : \frac{2}{5} \times 100$

$= 60$ and 40

EXAMPLE 12 *The lengths of sides of a triangle are in the ratio 2 : 3 : 4. If the perimeter of the triangle is 63 cm, find the lengths of the sides of the triangle.*

SOLUTION Let the sides of triangle be $2x$, $3x$ and $4x$, then $2x + 3x + 4x = 63$

$\Rightarrow \quad 9x = 63 \Rightarrow x = 7$

∴ The sides of triangle = $2x, 3x, 4x$ = 14, 21, 28

Alternatively:

$63 \times \frac{2}{(2+3+4)}$ and $63 \times \frac{3}{(2+3+4)}$ and $63 \times \frac{4}{(2+3+4)}$

$= 14, 21$ and 28.

EXAMPLE 13 *Divide 1224 into three parts such that first part be double that of second part and second part be $\frac{1}{3}$ of the third part.*

SOLUTION Let A, B, C be three parts respectively, then

$A : B = 2 : 1$

and $B : C = 1 : 3$

∴ $A : B : C = 2 : 1 : 3$

∴ $A = 1224 \times \frac{2}{6} = 408$

$B = 1224 \times \frac{1}{6} = 204$

$C = 1224 \times \frac{3}{6} = 612$

EXAMPLE 14 *If $A : B = 3 : 4$, $B : C = 5 : 2$ then find the value of $A : B : C$.*

SOLUTION $A : B = 3 : 4$

and $B : C = 5 : 2$

$A : B : C = (3 \times 5) : (4 \times 5) : (4 \times 2)$

or $A : B : C = 15 : 20 : 8$

EXAMPLE 15 *The ratio of $A : B = 1 : 3$, $B : C = 2 : 5$, $C : D = 2 : 3$. Find the value of $A : B : C : D$.*

SOLUTION $A : B = 1 : 3$

$B : C = 2 : 5$

$C : D = 2 : 3$

$A : B : C : D = (1 \times 2 \times 2) : (3 \times 2 \times 2) : (3 \times 5 \times 2) : (3 \times 5 \times 3)$

$A : B : C : D = 4 : 12 : 30 : 45$

EXAMPLE 16 *There are two types of mixtures of milk and water. In the first mixture, out of 12 litres of mixture, 5 litre is milk only and in the second mixture, 6 litre is milk and 12 litre is water. Which one mixture is better in terms of milk's strength?*

SOLUTION First Mixture Second Mixture

$\frac{5}{12}$ $\frac{6}{18}$ $(6 + 12 = 18)$

$\frac{5}{12} \times 36$ $\frac{6}{18} \times 36$ (milk + water = mixture)

15 12

So the first mixture has more milk in comparison to water.

EXAMPLE 17 *The ratio of salary of $A : B = 1 : 2$, $B : C = 3 : 4$, $C : D = 5 : 6$ and $D : E = 7 : 8$. What is the ratio of salary of A and E?*

SOLUTION

$A : B$ $1 : 2$

$B : C$ $3 : 4$

$C : D$ $5 : 6$

$D : E$ $7 : 8$

$A : B : C : D : E = (1 \times 3 \times 5 \times 7) : (2 \times 3 \times 5 \times 7)$
$: (2 \times 4 \times 5 \times 7) : (2 \times 4 \times 6 \times 7) : (2 \times 4 \times 6 \times 8)$

or $A : B : C : D : E = 105 : 210 : 280 : 336 : 384$

So the ratio of salary of $A : E = 105 : 384 = 35 : 128$

NOTE In every next step, we leave the left term and adopt right term.

EXAMPLE 18 *If $\frac{a}{b} = \frac{3}{4}$, then find the value of $7a - 4b : 3a + b$.*

(a) $7 : 1$ *(b)* $5 : 13$

(c) $12 : 1$ *(d) none of these*

SOLUTION Simply substitute the value of a and b as 3 and 4 in the given algebraic ratio

as $(7 \times 3 - 4 \times 4) : (3 \times 3 + 4) = 5 : 13$

EXAMPLE 19 *If $a : b = 3 : 2$ and $b : c = 6 : 5$ then $a : b : c$ is equal to*

(a) $9 : 6 : 5$ *(b)* $9 : 6 : 10$

(c) $3 : 3 : 5$ *(d)* $3 : 6 : 5$

SOLUTION

$a : b = 3 : 2$

$b : c = 6 : 5$

$a : b : c = (3 \times 6) : (2 \times 6) : (2 \times 5)$

$= 18 : 12 : 10 = 9 : 6 : 5$

EXAMPLE 20 *The sum of two natural numbers is 64. Which of the following can not be the ratio of these two numbers?*

(a) $3 : 5$ *(b)* $1 : 3$ *(c)* $7 : 9$ *(d)* $3 : 4$

SOLUTION Let the numbers be $3x$ and $5x$, then

$$3x + 5x = 64 \Rightarrow 8x = 64$$

$\Rightarrow$ $x = 8$, which is possible

The numbers are 24, 40.

Take another option:

$$x + 3x = 64 \Rightarrow x = 16$$

The numbers are 16 and 48.

Check for option (c) :

$$7x + 9x = 64 \Rightarrow 16x = 64$$

$\Rightarrow$ $x = 4$

The numbers are 28 and 36.

Check for option (d)

$$3x + 4x = 64 \Rightarrow 7x = 64$$

$$x = \frac{64}{7}$$

Numbers are $\frac{3 \times 64}{7}$ and $\frac{4 \times 64}{7}$ or $\frac{192}{7}$ and $\frac{256}{7}$

which are not the natural numbers.

Hence option (d) is the required answer.

EXAMPLE 21 *Monthly incomes of A and B are in the ratio of $4 : 3$ and their savings are in the ratio of $3 : 2$. If the expenditure of each will be Rs. 600, then the monthly incomes of each are :*

(a) 1800, 2400 *(b) 2400, 1600*

(c) 2400, 1800 *(d) 1600, 1200*

SOLUTION Income = Exp. + Savings

$A \to 4x = 3y + 600$

$B \to 3x = 2y + 600$

Therefore, $4x - 3y = 600$ and $3x - 2y = 600$

$\Rightarrow$ $4x - 3y = 3x - 2y \Rightarrow x = y$

$\therefore$ $4x - 3x = 600 \Rightarrow x = 600$

Then, the income of $A = 4 \times 600 = 2400$

and income of $B = 3 \times 600 = 1800$

Alternatively: Check the options. Consider (c)

	A		B	
Income	2400		1800	
	(4)	:	(3)	$\Rightarrow$ correct
Again,	2400		1800	
	− 600		− 600	
Savings	1800		1200	
	(3)	:	(2)	$\Rightarrow$ correct

Hence, option (c) is correct. If you check other options, the ratio will not match.

EXAMPLE 22 *A, B and C have 40, x and y balls with them respectively. If B gives 20 balls to A, he is left with half as many balls as C. If together they had 60 more balls, each of them would have had 100 balls on an average. What is value of $x : y$?*

(a) $3 : 2$ *(b)* $4 : 6$ *(c)* $2 : 1$ *(d)* $3 : 4$

SOLUTION From the last statement

$$\frac{100 + x + y}{3} = 100$$

$\Rightarrow$ $x + y = 200$ ...(1)

Again from first statement, $\frac{x - 20}{y} = \frac{1}{2}$

$\Rightarrow$ $2x - y = 40$ ...(2)

Solving equations (1) and (2), we get

$$x = 80 \text{ and } y = 120$$

Therefore, required ratio of $x : y = 2 : 3$

Hence, option (b) is correct.

Alternatively: After forming the equation (1), we can go through the options. Let us assume option (b).

$$x + y = 200$$

$\because$ $x : y = 4 : 6$

$\Rightarrow \quad x = 80$ and $y = 120$

Now from the first statement, $\frac{x-20}{y} = \frac{1}{2}$

So $\frac{80-20}{120} = \frac{1}{2}$ (verified)

hence option (b) is correct.

EXAMPLE 23 *The incomes of A, B, C are in the ratio of 12 : 9 : 7 and their spendings are in the ratio 15 : 9 : 8. If A saves 25% of his income. What is the ratio of the savings of A, B and C?*

SOLUTION Income = Expenditure + Saving

$A \rightarrow \quad 12x = 15y + 3x \quad (3x = 25\% \text{ of } 12x)$

$B \rightarrow \quad 9x = 9y + (9x - 9y)$

$C \rightarrow \quad 7x = 8y + (7x - 8y)$

Therefore, $12x - 3x = 15y$

$\Rightarrow \quad \frac{x}{y} = \frac{5}{3}$

$\Rightarrow \quad y = \frac{3x}{5}$

Therefore, savings = (income − expenditure)

$$A = 12x - 9x = 3x$$

$$B = 9x - \frac{27}{5}x = \frac{18}{5}x$$

$$C = 7x - \frac{24}{5}x = \frac{11}{5}x$$

i. e., the ratio of savings of $A : B : C = 3x : \frac{18}{5}x : \frac{11}{5}x$

$$= 15x : 18x : 11x$$

$$= 15 : 18 : 11$$

EXAMPLE 24 *There are total 100 coins consisting of 20 paise, 50 paise and Re 1 in the ratio of 7 : 8 : 5. What is the no. of coins of 50 paise if the difference between the amount yielded by 20 paise and Re. 1 coin is 18?*

(a) 32 (b) 40 (c) 26 (d) 56

SOLUTION $(20 \times 7x) - (100 \times 5x) = 1800$ (Rs. 18 = 1800 paise)

$(140x) - (500x) = 1800$

$\Rightarrow \quad 360x = 1800$

$\Rightarrow \quad x = 5$

Therefore, number of coins of 50 paise $= 8 \times 5 = 40$

Alternatively: Let there be 40 coins of 50 paise denomination, then

The no. of coins of $A, B, C = 7x : 8x : 5x = 35 : 40 : 25$

Therefore, the amount from 20 paise coins = 35 × 20 = Rs. 7

and amount from Re 1 coins = 1 × 25 = Rs. 25

Hence difference = Rs. 18 (25 − 7)

Thus the presumed option is correct.

EXAMPLE 25 *There are 43800 students in 4 schools of a city. If half of the first, two-third of the second, three-fourth of the third and four-fifth of the fourth are the same number of students, then find the ratio of number of students of A and D if A, B, C and D be the first, second, third and fourth schools respectively.*

SOLUTION $\frac{A}{2} = \frac{2B}{3} = \frac{3C}{4} = \frac{4D}{5}$

Therefore, $\frac{A}{B} = \frac{4}{3}$ and $\frac{B}{C} = \frac{9}{8}$ and $\frac{C}{D} = \frac{16}{15}$

$\therefore \quad A : B = 4 : 3$

$B : C = 9 : 8$

$C : D = 16 : 15$

$\therefore \quad A : B : C : D = (4 \times 9 \times 16) : (3 \times 9 \times 16) : (3 \times 8 \times 16) : (3 \times 8 \times 15)$

$A : B : C : D = 576 : 432 : 384 : 360$

Therefore, the ratio of number of students of A and $D = 576 : 360 = 8 : 5$

Alternatively: $\frac{A}{2} = \frac{2}{3}B = \frac{3}{4}C = \frac{4}{5}D = k$

then $A : B : C : D = 2k : \frac{3}{2}k : \frac{4}{3}k : \frac{5}{4}k$

$= 24k : 18k : 16k : 15k$

$\therefore \quad A : B : C : D = 24 : 18 : 16 : 15$

$\therefore \quad A : D = 24 : 15 = 8 : 5$

PROPORTION

An equality of two ratios is called a proportion and we say that the four numbers are in proportion.

i.e., if $\frac{a}{b} = \frac{c}{d}$, or $a : b = c : d$, then we say that a, b, c and d are in proportions and written as $a : b :: c : d$, where the symbol '::' indicates proportion and it is read as 'a is to b as c is to d'.

Here a and d are called **"extremes"** (or extreme terms) and b and c are called as **"means"** (or middle terms). Thus four numbers are said to be in proportion, if the ratio of the first to the second number is equal to the ratio of the third to the fourth number. *e.g.*, 2 : 3 :: 4 : 6. Some important results are derived from the discussion of proportion, which are very important for clear understanding.

Properties of Proportion

1. If four numbers (quantities) are in proportion then product of the extremes is equal to the product of the means and if these are not in proportion, then product of extremes is not equal to the product of the means.

   i.e., if $a : b :: c : d$,

   then $a \times d = b \times c$

   Thus it is clear that if three out of four terms of a proportion are given, then we can find the fourth term by dividing the product of means (or extremes) by the remaining term.

2. If a, b and c are three numbers such that $a : b = b : c$ then these numbers a, b, c are said to be in **continued proportion** or simply in proportion.

i.e., $a : b = b : c \Rightarrow b^2 = ac$

Here b is said to be the **mean proportional** between a and c, and c is said to be the **third proportional** to a and b. *e.g.,* $3 : 9 :: 9 : 27$

Here $9 \times 9 = 3 \times 27$ which are in continued proportion.

NOTE Sometimes the above idea is also expressed by saying that the three numbers are in the ratio 3 : 9 : 27. Thus if three quantities are proportionals, the first is to the third as the duplicate ratio of the first to the second.

i.e., if $a : b :: b : c$

then $a : c = a^2 : b^2$

$$\left[\because \frac{a}{b} = \frac{b}{c} \Rightarrow \frac{a^2}{b^2} = \frac{ab}{bc} \Rightarrow \frac{a^2}{b^2} = \frac{a}{c} \Rightarrow a : c = a^2 : b^2\right]$$

Some Facts about Proportion

(a) Invertendo: If $\frac{a}{b} = \frac{c}{d} \Rightarrow \frac{b}{a} = \frac{d}{c}$

(b) Alternando: If $\frac{a}{b} = \frac{c}{d} \Rightarrow \frac{a}{c} = \frac{b}{d}$

NOTE Each of the two results (a) and (b) can be obtained by cross product.

(c) Componendo: If $\frac{a}{b} = \frac{c}{d} \Rightarrow \left(\frac{a+b}{b}\right) = \left(\frac{c+d}{d}\right)$

(d) Dividendo: If $\frac{a}{b} = \frac{c}{d} \Rightarrow \left(\frac{a-b}{b}\right) = \left(\frac{c-d}{d}\right)$

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

$$\Rightarrow \left(\frac{a+b}{a-b}\right) = \left(\frac{c+d}{c-d}\right)$$

NOTE The result (e) can be obtained by dividing result (c) by result (d).

EXAMPLE 1 *The first, second and fourth terms of a proportion are 5, 15 and 90 respectively. Find the third term.*

SOLUTION Let the third term be x, then 5, 15, x, 90 are in proportion *i. e.*, $5 : 15 :: x : 90$

$\Rightarrow$ $5 \times 90 = 15 \times x$ (by the Ist property)

$\Rightarrow$ $x = 30$

EXAMPLE 2 *The ratio of length to width of a rectangular sheet of paper is 5 : 3. If the width of the sheet is 18 cm, find its length.*

SOLUTION Let the length of sheet of paper be x cm. Then the ratio of length to width = $x : 18$

Thus $x : 18 = 5 : 3$

$\Rightarrow$ $x \times 3 = 18 \times 5$

$\Rightarrow$ $x = 30$

Hence the length of paper = 30 cm.

EXAMPLE 3 *If 81, x, x, 256 are in proportion, find x.*

SOLUTION $81 : x :: x : 256$

$\Rightarrow$ $81 \times 256 = x \times x \Rightarrow x = 144$

EXAMPLE 4 *The ratio between the number of men and women in an office is 5 : 7. If the number of women working in the office is 56, find the number of men working in the office.*

SOLUTION $5 : 7 = x : 56$ (suppose number of men = x)

$\Rightarrow$ $x = 40$ (by the first property)

Therefore, number of men in the office = 40

EXAMPLE 5 *The age of Chandi and Radhika are in the ratio 5 : 3. If Chandi's age is 20 years, find the age of Radhika.*

SOLUTION $5 : 3 = 20 : x$

$\Rightarrow$ $x = \frac{3 \times 20}{5}$ (by the first property)

$\Rightarrow$ $x = 12$

Hence the age of Radhika is 12 years.

EXAMPLE 6 *The ratio of the number of boys to that of girls in a school is 9 : 11. If the number of girls in the school is 2035, find :*
(a) number of boys in school
(b) number of students in school.

SOLUTION (a) $9 : 11 = x : 2035$

$\Rightarrow$ $x = \frac{9 \times 2035}{11}$

$x = 1665$ (number of boys)

(b) number of students

= number of boys + number of girls = 3700

EXAMPLE 7 *What is the least possible number which must be subtracted from 16, 19 and 23 so that the resulting numbers are in continued proportion?*
(a) 2 (b) 4 (c) 6 (d) 7

SOLUTION Going through options, we find option (d) is correct.

Alternatively:

$(16 - x) : (19 - x) :: (19 - x) : (23 - x)$

$\Rightarrow$ $(19 - x)^2 = (16 - x)(23 - x)$

By solving the above equation, we get $x = 7$

EXAMPLE 8 *If $(a + b) : (a - b) = 15 : 1$, then the value of $a^2 - b^2$ is :*
(a) 56 (b) 15 (c) 112 (d) 8

SOLUTION $\frac{(a+b)}{(a-b)} = \frac{15}{1}$

$\Rightarrow$ $\frac{a}{b} = \frac{8}{7}$ (by componendo and dividendo)

therefore $a^2 - b^2 = 64 - 49 = 15$

EXAMPLE 9 *The mean proportional between 8 and 98 is :*
(a) 16 (b) 53 (c) 112 (d) 28

SOLUTION $8 : x :: x : 98$

$x^2 = 8 \times 98$

$\Rightarrow$ $x = 28$

Hence (d) is correct.

EXAMPLE 10 *The students in three classes are in the ratio of 2 : 3 : 4. If 40 students are added in each class, the ratio becomes 4 : 5 : 6. Find the total number of students in all the three classes is :*

(a) 270 (b) 180 (c) 126 (d) 135

SOLUTION

$$2x + 40 = 4y \quad \ldots(i)$$
$$3x + 40 = 5y \quad \ldots(ii)$$
$$4x + 40 = 6y \quad \ldots(iii)$$

Therefore $2x = 40$

$\Rightarrow$ $x = 20$

Hence, total number of students $= 2x + 3x + 4x = 9x$

$= 9 \times 20 = 180$

Alternatively: It can be solved through options also.

EXAMPLE 11 *The dimensions of a photograph are 4 and 1.8 cms. If the breadth of the enlarged photo is 4.5 cm and it was enlarged proportionally then what is the new length of new photograph?*

(a) 6 (b) 5.4 (c) 10 (d) 9

SOLUTION $4 : 1.8 = x : 4.5$

$\Rightarrow$ $x = 10$

Thus, the length of new photograph is 10 cm.

EXAMPLE 12 *Two equal containers are filled with the mixture of milk and water. The concentration of milk in each of the containers is 20% and 25% respectively. What is the ratio of water in both the containers respectively?*

(a) 15 : 16 *(b)* 16 : 15 *(c)* 4 : 5 *(d)* 5 : 4

SOLUTION

Milk	20%	25%
Water	80%	75%

Thereofre, required ratio $= \frac{80}{75} = \frac{16}{15}$ or 16 : 15

EXAMPLE 13 *A cat takes 7 steps for every 5 steps of a dog, but 5 steps of a dog are equal to 6 steps of cat. What is the ratio of speed of cat to that of dog?*

(a) 24 : 25 *(b)* 42 : 25 *(c)* 24 : 19 *(d)* 25 : 42

SOLUTION

	CAT	**DOG**
Given speed	7 steps	5 steps

but the length of 5 steps of dog = length of 6 steps of cat

it means the ratio of length covered by dog is to cat $= \frac{6}{5}$

Therefore, in each step a dog will cover $\frac{6}{5}$ times distance than that of a cat.

Thus the ratio of actual speed of cat is to dog

$$= 7 : 5 \times \frac{6}{5} = 7 : 6$$

SHORTCUT Actual speed of $A : B$

$$= \frac{\text{Given speed of } A}{\text{no. of steps of } A \text{ in terms of length}} : \frac{\text{Given speed of } B}{\text{no. of steps of } B \text{ in terms of length}}$$

$= \text{CAT} : \text{DOG}$

$= \frac{7}{6} : \frac{5}{5} = 7 : 6$

EXAMPLE 14 *A camel pursue an elephant and takes 5 leaps for every 7 leaps of the elephant, but 5 leaps of elephant are equal to 3 leaps of camel. What is the ratio of speeds of camel and elephant?*

SOLUTION Ratio of speed of camel and elephant

$$= \frac{5}{3} : \frac{7}{5} = \frac{5}{3} \times 15 : \frac{7}{5} \times 15$$

$= 25 : 21$

UNITARY METHOD

A method in which the value of a quantity is first obtained to find the value of any required quantity is called unitary method.

In solving problems based on unitary method.

Direct Proportion

Two quantities are said to be directly proportional if the increase (or decrease) in one quantity causes the increase (or decrease) in the other quantity by same proportion. *e.g.,*

(i) The cost of articles varies directly to the number of articles. More articles more cost, less articles less cost.

(ii) The work done varies directly to the number of men (work force) at work. More men at work, more work done in same time. Less men, less work done in same time.

Inverse Proportion

Two quantities are said to vary inversely if the increase (or decrease) in one quantity causes the decrease (or increase) in the other quantity by same proportion *e.g.,* The time taken to finish a work varies inversely to the number of men at work.

More men at work, less time taken to finish the same work. Less men at work, more time taken to finish the same work.

EXAMPLE 1 *If 6 note books cost Rs. 45, how much would 8 notebooks cost?*

SOLUTION More note books more cost; less note books, less cost

Note books	Cost
6	45
1	45/6
8	$\frac{8 \times 45}{6} = 60$

Hence 8 note books cost Rs. 60.

EXAMPLE 2 *If 45 students can consume a stock of food in 2 months, find for how many days the same stock of food will last for 27 students?*

SOLUTION More students, less days; less students, more days

Students	Days
45	60
1	60×45
27	$\frac{60 \times 45}{27} = 100$ days

EXAMPLE 3 *A man working 8 hours a day takes 5 days to complete a project. How many hours a day must he work to complete it in 4 days?*

SOLUTION 'More days, less hours; less days, more hours'

Days	Hours
5	8
1	5×8
4	$\frac{5 \times 8}{4} = 10$ hours a day

VARIATION

When two or more quantities are dependent upon each other and then if any one of them is changed, the other (dependent) quantity is also changed.

For example :

(i) When the salary of a person increases, then its savings/expenditure increases.

(ii) When the number of guests in a hotel/number of students in a hostel/number of employees changes, their respective expenses increases.

Basically, as it happens in direct proportion and inverse proportion, there are two types of variation :

(i) Direct variation (ii) Inverse variation

Direct Variation

A quantity A is said to vary directly if the increase (or decrease) in B yields increase (or decrease) in A but not in proportion. It is expressed as

$$A \propto B \Rightarrow A = KB,$$

where K is called proportionality constant

$$\Rightarrow \quad K = \frac{A}{B}$$

Inverse Variation

A quantity A is said to vary inversely if the increase (or decrease) in B yields decrease (or increase) in A but not in same proportion. It is expressed as

$$A \propto \frac{1}{B} \Rightarrow A = \frac{K}{B}$$

or $K = AB$, K is called as proportionality constant.

NOTE

1. If it is not mentioned that a particular quantity is inversely variable, then it means the given quantity is directly variable.
2. A quantity sometimes vary jointly *i.e.*, directly on any quantity and inversely on another quantity.

e.g., $A \propto B$ and $A \propto \frac{1}{C}$

It means $A \propto \frac{B}{C} \Rightarrow A = \frac{KB}{C}$

Here A varies directly as B but inversely as C.

Also it can vary as only directly or inversely as more than one quantities.

e.g., $A \propto BC \Rightarrow A = KBC$

and $A \propto \frac{1}{BC} \Rightarrow A = \frac{K}{BC}$

EXAMPLE 1 *A varies directly as B and inversely as C. A is 12 when B is 6 and C is 2. What is the value of A when B is 12 and C is 3?*

SOLUTION $A \propto B$ and $A \propto \frac{1}{C}$

$$\Rightarrow \quad A \propto \frac{B}{C} \Rightarrow A = K\frac{B}{C}$$

when $A = 12, B = 6, C = 2$, then

$$12 = K\frac{6}{2} \Rightarrow K = 4$$

Again $A = K\frac{B}{C} = 4 \times \frac{12}{3} = 16$

$$\Rightarrow \quad A = 16$$

EXAMPLE 2 *The value of a coin varies directly to the square of its radius, when its thickness is constant. The radius of a coin is 1.5 cm and its value is Rs. 2. What will be the radius of a coin if its value is Rs. 5?*

SOLUTION $V \propto r^2$

$$\Rightarrow \quad V = Kr^2$$

$$2 = K \times (1.5)^2$$

$$\Rightarrow \quad K = \frac{2}{2.25}$$

$$K = \frac{8}{9}$$

Again $5 = \frac{8}{9} \times r^2$

$$\Rightarrow \quad r^2 = \frac{5 \times 9}{8}$$

$$\therefore \quad r = \frac{3}{2} \times \sqrt{\frac{5}{2}}$$

$$= 1.5 \times \sqrt{2.5} = 1.5 \times 1.6$$

$$r \approx 2.4 \text{ cm}$$

Hence, required radius = 2.4 cm

PROBLEMS BASED ON AGES

This article is very suitable as an appendix of Ratio-proportion, since most of the questions based on ages involve the concept of ratio-proportion. *e.g.*, the age of Ravi is 16 years and the age of her mother is twice etc. or the ratio of the ages of the father and son at present is 3 : 1. 4 years, earlier the ratio was 4 : 1. What is the present ages of the father and son etc.

EXAMPLE 1 *The ratio of ages of Krishna and Balram is 3 : 4. Four years earlier the ratio was 5 : 7. Find the present ages of Krishna and Balram :*

(a) 15 years, 20 years *(b) 24 years, 32 years*
(c) 16 years, 20 years *(d) 32 years, 24 years*

SOLUTION Let the present age of Krishna and Balram be $3x$ and $4x$, then

four years ago their ages be $(3x - 4)$ and $(4x - 4)$

So $$\frac{(3x-4)}{(4x-4)} = \frac{5}{7}$$

$\Rightarrow$ $7(3x - 4) = 5(4x - 4)$

$\Rightarrow$ $21x - 28 = 20x - 20$

$\Rightarrow$ $x = 8$

$\therefore$ Present age of Krishna $= 3x = 24$ years

and age of Balram $= 4x = 32$ years

EXAMPLE 2 *The ratio of age of Aman and her mother is 3 : 11. The difference of their ages is 24 years. What will be the ratio of their ages after 3 years?*

SOLUTION Let the present age of Aman and her mother be $3x$ and $11x$ then 3 years later their ages will be $(3x + 3)$ and $(11x + 3)$ respectively.

Again $11x - 3x = 24$

$\Rightarrow$ $8x = 24 \Rightarrow x = 3$

Therefore the ratio of their ages 3 years after

$$= \frac{3x+3}{11x+3} = \frac{12}{36} = \frac{1}{3}$$

EXAMPLE 3 *The age of Sachin is 4 times that of his son. Five years ago Sachin was nine times as old as his son was at that time. The present age of the Sachin is :*

(a) 25 years *(b) 36 years*
(c) 32 years *(d) 48 years*

SOLUTION Let the age of son is x years, then the age of Sachin will be $4x$ years.

$\therefore$ $(4x - 5) = 9(x - 5) \Leftrightarrow x = 8$

$\therefore$ Age of Sachin is 32 years.

EXAMPLE 4 *The ratio of Varun's age and his mother's age is 5 : 11. The difference of their ages is 18 years. The ratio of their ages after 5 years will be :*

(a) 19 : 59 *(b)* 2 : 3 *(c)* 37 : 75 *(d)* 10 : 19

SOLUTION Let their ages be $5x$ and $11x$.

$11x - 5x = 18 \Leftrightarrow x = 3$

So their present ages are 15 and 33 years. Therefore, ratio of their ages after 5 years = 20 : 38 = 10 : 19.

PARTNERSHIP

When two or more than two people run a business jointly by investing their money/resources, then it is called a joint venture or the business in partnership.

All these people, who have invested their resources, are called as Partners.

Partners are basically of two types

(i) **Working partner:** A partner who is directly involved with day-to-day activities of business is called as working partner.

(ii) **Sleeping partner:** A partner who just invests his or her money is called as sleeping partner.

General rules of partnership :

(i) If the partners invest different amounts for the same period of time, then the profits of all the partners are shared in the ratio of their investments.

(ii) If the partners invest same amount for the different time periods, then the profits of all the partners are shared in the ratio of time periods for which their amounts were invested.

(iii) If the partners invest different amounts for different time periods, then their profits are shared in the ratio of products of respective investments with the time period for each partner, individually.

Thus gain or loss is divided in the ratio of 'money-time' capitals.

NOTE Sometimes different problems are solved on the basis of partnership to find the expenses.

EXAMPLE 1 *Bhanu and Shafeeq started a business by investing Rs. 36,000 and Rs. 63,000. Find the share of each, out of an annual profit of Rs. 5,500.*

SOLUTION Ratio of shares of Bhanu and Shafeeq

$= 36000 : 63{,}000 = 4 : 7$

$\therefore$ Share of Bhanu $= 5500 \times \frac{4}{11} =$ Rs. 2000

and Share of Shafeeq $= 5500 \times \frac{7}{11} = 3500$

EXAMPLE 2 *A starts some business with Rs. 50,000. After 3 months B joins him with Rs. 70,000. At the end of the year, in what ratio should they share the profits?*

SOLUTION Ratio of amount of A and B = 50,000 : 70,000

Ratio of time periods for A and B = 12 : 9

$\therefore$ Ratio of their money-time capital

Investments $= 50000 \times 12 : 70000 \times 9 = 20 : 21$

EXAMPLE 3 *Harsh Vardhan started a business by investing Rs. 36,000. After 4 months Gyan Vardhan joined him with some investment. At the end of the year, the total profit was divided between them in the ratio of 9 : 7. How much capital was invested by Gyan Vardhan in the business?*

SOLUTION $$\frac{36{,}000 \times 12}{x \times 8} = \frac{9}{7}$$

$\Rightarrow$ $x = 42{,}000$

$\therefore$ Gyan Vardhan invested Rs. 42,000 for 8 months only.

EXAMPLE 4 *A started some business with Rs. 26,000. After 3 months B joined him with Rs. 16,000. After some more time C joined them with Rs. 25,000. At the end of the year, out of a total profit of Rs. 15,453, C gets Rs. 3825 as his share. How many months after B joined the business did C join?*

SOLUTION Ratio (of share) of profits

$$= 26{,}000 \times 12 : 16000 \times 9 : 25000 \times C$$

$$= 312 : 144 : 25C$$

Now C's share $= \dfrac{25C}{456 + 25C} = \dfrac{3825}{15453}$

$\Rightarrow \quad C = 6$

Therefore C joined 3 months later than B joined.

EXAMPLE 5 *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 twice the amount as before while C withdrew $\frac{1}{4}$th of the their investments. Find the ratio of their profits at the end of the year.*

SOLUTION Let us assume their initial investments were x, $2x$ and $4x$ respectively.

Therefore, ratio of their investments during the whole year

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

$$= 15x : 36x : 42x$$

$$= 5x : 12x : 14x$$

$$= 5 : 12 : 14$$

$\therefore$ Ratio of their profits $= 5 : 12 : 14$

EXAMPLE 6 *A started a business with Rs. 52,000 and after 4 months B joined him with Rs. 39,000. At the end of the year, out of the total profits B received total Rs. 20,000 including 25% of the profits as commission for managing the business. What amount did A receive?*

SOLUTION Profit's share of A and B

$$= 52{,}000 \times 12 : 39{,}000 \times 8 = 2 : 1$$

Let the profit be Rs. x, then B receives 25% as commission for managing business, the remaining 75% of the total profit x is shared between A and B in the ratio 2 : 1. Hence B will get $\frac{1}{3}$rd part of this in addition to his commission. Hence his total earning

$$= 0.25x + \frac{1}{3} \times 0.75x$$

$$= 0.5x = 20{,}000$$

$\Rightarrow \quad x = 40{,}000$

So, the remaining profit goes to A, hence the profit of A is Rs. 20,000.

EXAMPLE 7 *A working partner gets 20% as his commission of the profit after his commission is paid. If the working partner's commission is Rs. 8000, then what is the total profit in the business?*

SOLUTION Let the total profit be Rs. x. The remaining profit after paying 20% working partner's commission $= (x - 8000)$. Again since 20% of this is working partner's commission,

therefore $\quad \dfrac{20}{100} \times (x - 8000) = 8000$

$\Rightarrow \quad x = 48{,}000$

$\therefore$ The total profit in the business is Rs. 48,000.

UNITARY METHOD

INTRODUCTORY EXERCISE-4.1

1. If 40 articles cost Rs. 180, the cost of 18 articles is :
   (a) Rs. 18 (b) Rs. 36
   (c) Rs. 81 (d) Rs. 40.5
2. If 20 persons can do a piece of work in 7 days, then the number of persons required to complete the work in 28 days :
   (a) 4 (b) 5
   (c) 14 (d) 10
3. If 20 men can reap a field in 38 days, in how many days will 19 men reap the field?
   (a) 21 days (b) 19 days
   (c) 76 days (d) 40 days
4. A rope makes 260 rounds of a cylinder with base radius 20 cm. How many times can it go round a cylinder with base radius 26 cm?
   (a) 130 (b) 300
   (c) 200 (d) 150
5. A garrison of 750 men has provision for 20 weeks. If at the end of 4 weeks they are reinforced by 450 men, how long will the remaining provision last?
   (a) 10 weeks (b) 11 weeks
   (c) 15 weeks (d) 16 weeks
6. 40 men can build a wall 20 m high in 15 days. The number of men required to build a similar wall 25 m high in 6 days will be :
   (a) 100 (b) 125
   (c) 150 (d) 200
7. Cost of erecting a fence round a square field of 625 hectares at 15 paise per metre is :
   (a) Rs. 500 (b) Rs. 750
   (c) Rs. 100 (d) Rs. 1500
8. 56 workers can reap a field in 8 days. If the work is to be completed in 7 days, the extra workers needed are :
   (a) 7 (b) 8
   (c) 14 (d) 16
9. If 5 persons weave 180 shawls in 12 days, how many shawls will 6 persons weave in 15 days?
   (a) 260 (b) 370
   (c) 270 (d) 360

10. 15 men take 42 days of 4 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) 15 (b) 22
(c) 25 (d) 30

11. 10 engines consume 80 litres diesel when each is running 9 hours a day., How much diesel will be required for 10 engines, each running 15 hours a day, whereas 6 engines of the former type consume as much as 5 engines of latter type?
(a) 160 litre (b) 75 litre
(c) 80 litre (d) $111\frac{1}{9}$ litre

12. If $\frac{3}{5}$th of a cistern is filled in 30 minutes, how much more time will be required to fill the rest of it?
(a) 50 minutes (b) 20 minutes
(c) 15 minutes (d) 45 minutes

AGE RELATED PROBLEMS

INTRODUCTORY EXERCISE-4.2

1. Amit is as much younger to Barkha as he is older to Charman. If the sum of the ages of Barkha and Charman is 48 years, what is the present age of Amit?
(a) 18 years (b) 36 years
(c) 24 years (d) 28 years

2. Bipin is 6 times old as Alok. Bipin's age will be twice of Chandan's age after 10 years. If Chandan's 7^{th}birthday was celebrated 3 years ago, what is Alok's present age?
(a) 15 years (b) 12 years
(c) 5 years (d) none of these

3. Renuka got married 8 years ago. Today her age is $1\frac{1}{3}$ times her age at the time of marriage. Her daughter's age is 1/8 times her age. Her daughter's age is :
(a) 3 years (b) 4 years
(c) 6 years (d) 8 years

4. Ten years ago *B* was twice of *A* in age. If the ratio of their present ages is 4 : 3, what is the sum of their present ages?
(a) 25 years (b) 30 years
(c) 40 years (d) 35 years

5. The sum of the ages of Aryabhatta and Shridhar is 45 years. Five years ago the product of their ages was 4 times the Aryabhatta's age at that time. The present ages of Aryabhatta and Shridhar respectively are :
(a) 25 and 20 (b) 35 and 10
(c) 36 and 9 (d) 40 and 5

PARTNERSHIP

INTRODUCTORY EXERCISE-4.3

1. A company make a profit of Rs. 9,00,000, 20% of which is paid as taxes. If the rest is divided among the partners *P*, *Q* and *R* in the ratio of $1:1\frac{1}{2}:2$, then the shares of *P*, *Q* and *R* are respectively :
(a) 2,40,000; 3,20,000; 1,60,000
(b) 3,20,000; 2,40,000; 1,60,000
(c) 1,60,000; 3,20,000; 2,40,000
(d) 1,60,000; 2,40,000; 3,20,000

2. We have to divide a sum of Rs. 13,950 among three persons *A*, *B* and *C*. *B* must get the double of *A*'s share and *C* must get Rs. 50 less than the double of *B*'s share. The share of *A* will be :
(a) Rs. 1950 (b) Rs. 1981.25
(c) Rs. 2000 (d) Rs. 2007.75

3. *A* started business with Rs. 45,000 and *B* joined afterward with Rs. 30,000. If the profits at the end of one year were divided in the ratio 2 : 1 respectively, then *B* would have joined *A* for business after :
(a) 1 month (b) 2 months
(c) 3 months (d) 4 months

4. *A* and *B* are partners in a business. They invest in the ratio 5 : 6, at the end of 8 months *A* withdraws. If they receive profits in the ratio of 5 : 9, find how long *B*'s investment was used?
(a) 12 months (b) 10 months
(c) 15 months (d) 14 months

5. Four milkmen rented a pasture. A put to graze 16 cows for 3 months, *B* 20 cows for 4 months, *C* 18 cows for 6 months and *D* 42 cows for 2 months. If *A*'s share of rent be Rs. 2400, the rent paid by *C* is :
(a) Rs. 3200 (b) Rs. 4200
(c) Rs. 4000 (d) Rs. 5400

6. *A*, *B* and *C* subscribe Rs. 47000 for a business. If a subscribes Rs. 7000 more than *B* and *B* Rs. 5000 more than *C*, then out of total profit of Rs. 4700, *C* receives :
(a) Rs. 1200 (b) Rs. 4500
(c) Rs. 1000 (d) none of these

RATIO AND PROPORTION

INTRODUCTORY EXERCISE-4.4

1. If $A : B = 4 : 5$, $B : C = 3 : 4$, $C : D = 7 : 11$, then $A : D$ is :
(a) 3 : 4 (b) 21 : 55
(c) 21 : 44 (d) 7 : 5

2. Mean proportional between 17 and 68 is :
(a) 51 (b) 24
(c) 4 (d) 34

3. Third proportional between 16 and 36 is :
(a) 64 (b) 144
(c) 81 (d) 49

4. If $a : b = 2 : 3$, then $(5a + b) : (3a + 2b)$ is :
(a) 13 : 12 (b) 15 : 17
(c) 12 : 13 (d) 13 : 11

5. $a = 2b = 3c = 4d$, then $a : b : c : d$ is :
(a) 12 : 3 : 6 : 4 (b) 3 : 4 : 6 : 12
(c) 6 : 12 : 4 : 3 (d) 12 : 6 : 4 : 3

6. The fourth proportional to 4, 7 and 20 is :
(a) 28 (b) 21
(c) 18 (d) 35

7. If $\sqrt{2} : (1 + \sqrt{3}) :: \sqrt{6} : x$, then x is equal to :
(a) $1 + \sqrt{3}$ (b) $\sqrt{3} - 1$
(c) $\sqrt{3} + 3$ (d) $2\sqrt{3}$

8. If $\frac{a}{3} = \frac{b}{4} = \frac{c}{5}$ then $\frac{a + b + c}{b} = ?$
(a) 2 (b) 3
(c) 4 (d) 5

9. If $\frac{a}{b} = \frac{c}{d}$, then :
(a) $\frac{a + b}{a - b} = \frac{c + d}{c - d}$ (b) $\frac{a + b}{a^2} = \frac{c + d}{d^2}$
(c) $\frac{a + b}{a^2} = \frac{c + d}{c^2}$ (d) $ac = bd$

10. If $a : b = b : c = c : d$ then $\frac{a}{b}, \frac{b}{c}, \frac{c}{d}$ are :
(a) in AP
(b) in continued proportion
(c) in GP
(d) both (b) and (c)

11. If $(a + b) : (a - b) = 3 : 2$, the $(a^2 - b^2) : (a^2 + b^2)$ equals :
(a) 5 : 13 (b) 12 : 13
(c) 9 : 4 (d) none of these

12. Two whole numbers, whose sum is 64, can not be in the ratio :
(a) 1 : 7 (b) 3 : 5
(c) 5 : 11 (d) 1 : 2

13. Two numbers are in the ratio 3 : 4. The difference between their squares is 28. Find the greater number :
(a) 12 (b) 8
(c) 24 (d) 16

14. If a, b, c, d, e, f, g are in continued proportion, then the value of $a.b.c.e.f.g$ is :
(a) d^3 (b) d^7
(c) d^6 (d) none of these

15. If A and B shared Rs. 1300 in the ratio 1 : 12, how much did A get?
(a) 120 (b) 1200
(c) 100 (d) 1000

16. Rs. 3960 are divided among A, B and C so that half of A's part, one-third of B's part and one-sixth of C's part are equal. Then C's part is :
(a) 720 (b) 2160
(c) 1080 (d) 810

17. A sum of Rs. 21000 is divided among A, B, C such that shares of A and B are in the ratio of 2 : 3 and those of B and C are in the ratio 4 : 5. The amount received by A is :
(a) Rs. 6000 (b) Rs. 4500
(c) Rs. 4800 (d) Rs. 8400

18. A certain amount was divided between A and B in the ratio 7 : 9. If B's share was Rs. 7200, the total amount was :
(a) Rs. 1280 (b) Rs. 6300
(c) Rs. 5600 (d) Rs. 12800

19. Rs. 11250 are divided among A, B and C so that A may receive one-half as much as B and C together receive and B receives one-fourth of what A and C together receive. The share of A is more than that of B by :
(a) Rs. 2500 (b) Rs. 1500
(c) Rs. 1800 (d) Rs. 650

20. A girl 1.2 metre tall casts a shadow 1.1 m at the time when a building casts a shadow 6.6 m long. The height of the building is :
(a) 2.7 m (b) 7.2 m
(c) 6.0 m (d) 5.5 m

21. The prices of Bajaj Scooter and Bajaj Pulser are in the ratio of 4 : 9. If the Bajaj Pulser costs Rs. 30,000 more than a Bajaj Scooter, the price of Bajaj Pulser is :
(a) Rs. 63,000 (b) Rs. 45,000
(c) Rs. 54,000 (d) Rs. 60,000

22. What is the ratio whose terms differ by 40 and the measure of which is 2/7?
(a) 16 : 56 (b) 14 : 49
(c) 15 : 36 (d) 16 : 72

23. Two numbers are in the ratio 3 : 5. If 9 be subtracted from each, then they are in the ratio of 12 : 23. The second number is :
(a) 53 (b) 54
(c) 55 (d) 52

24. Consider the following statements :
(1) If both the terms of a ratio are multiplied or divided by the same natural number, then the ratio remains unaltered.

(2) A statement which states that two ratios are equivalent is called proportion.
(3) If 4 quantities are in proportion, the product of extremes is not equal to the means.
(4) The mean proportion between any two numbers is equal to the square root of their product. The wrong one statements is/are :

(a) 1 (b) 3
(c) 3 and 4 (d) 1 and 4

25. In a mixture of 120 litres, the ratio of milk and water is 2 : 1. If the ratio of milk and water is 1 : 2, then the amount of water (in litres) is required to be added is :

(a) 20 (b) 40
(c) 80 (d) 120

26. A quantity x varies inversely as the square of y. Given that $x = 4$, when $y = 3$, the value of x when $y = 6$ is :

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

27. Suppose y varies as the sum of two quantities of which one varies directly as x and the other inversely as x. If $y = 6$ when $x = 4$ and $y = 3\frac{1}{3}$ when $x = 3$, then the relation between x and y is :

(a) $x = y + 4$ (b) $y = 2x + \frac{8}{x}$
(c) $y = 2x - \frac{8}{x}$ (d) $y = 2x - \frac{4}{x}$

28. The time period of a pendulum is proportional to the square root of the length of the pendulum. Consider the following statements :
(1) If the length of the pendulum is doubled, then the time period is also doubled.
(2) If the length is halved, then time period becomes one-fourth of the original time period.

The correct assertions are :

(a) 1 (b) 2
(c) neither 1 nor 2 (d) both 1 and 2

EXERCISE

LEVEL 1

1. Four numbers are in proportion. The sum of the squares of the four numbers is 50 and the sum of the means is 5. The ratio of first two terms is 1 : 3. What is the average of the four numbers?
(a) 2 (b) 3
(c) 5 (d) 6

2. A naughty student breaks the pencil in such a way that the ratio of two broken parts is same as that of the original length of the pencil to one of the larger part of the pencil. The ratio of the other part to the original length of pencil is :
(a) $1 : 2\sqrt{5}$ (b) $2 : (3 + \sqrt{5})$
(c) $2 : \sqrt{5}$ (d) can't be determined

3. If $\frac{x+y}{x-y} = \frac{5}{3}$ and $\frac{x}{(y+2)} = 2$, the value of (x, y) is :
(a) (4, 1) (b) (2, 8)
(c) (1, 4) (d) (8, 2)

4. If $a^3 + b^3 : a^3 - b^3 = 133 : 117$; find $a : b$:
(a) 2 : 3 (b) 5 : 4
(c) 5 : 2 (d) none of these

5. A student obtained equal marks in History and Sociology. The ratio of marks in Sociology and Geography is 2 : 3 and the ratio of marks in History and Philosophy is 1 : 2. If he has scored an aggregate of 55% marks. The maximum marks in each subject is same. In how many subjects did he score equal to or greater than 60% marks?
(a) 1 (b) 2
(c) 3 (d) none of these

6. The ratio of income of Anil and Mukesh is 2 : 3. The sum of their expenditure is Rs. 8000 and the amount of savings of Anil is equal to the amount of expenditure of Mukesh. What is the sum of their savings?
(a) 22,000 (b) 4,000
(c) 16,000 (d) 12,000

7. Hutch and Essar entered into a partnership just 5 months ago. The ratio of profit claimed by Hutch and Essar is 6 : 17. If Essar had just started his business 12 months ago with Rs. 1275, what is the amount contributed by Hutch?
(a) Rs. 980 (b) Rs. 1080
(c) Rs. 1200 (d) Rs. 998

8. A child has three different kinds of chocolates costing Rs. 2, Rs. 5 and Rs. 10. He spends total Rs. 120 on the chocolates. What is the minimum possible number of chocolates, he can buy, if there must be atleast one chocolate of each kind?
(a) 22 (b) 19
(c) 17 (d) 15

9. In the previous problem (no. 8) what is the maximum possible no. of chocolates?
(a) 52 (b) 53
(c) 55 (d) 60

10. Mr. Teremere and Mr. Meretere have 5 chocolates and 3 chocolates with them respectively. Meanwhile Mr. Khabbu Singh joined them and all 8 chocolates were distributed equally among all these three people. In turn Khabbu Singh gave Rs. 16 to Mr. Teremere and Mr. Meretere, since Khabbu Singh did not has any chocolate. What is the difference of amounts received by Teremere and Meretere? Given that the amount was shared in proportion of chocolates received by Khabbu Singh.
(a) Rs. 8 (b) Rs. 12
(c) Rs. 14 (d) Rs. 15

11. Rs. 4536 is divided among 4 men, 5 women and 2 boys. The ratio of share of a man, a woman and a boy is 7 : 4 : 3. What is the share of a woman?
(a) Rs. 336 (b) Rs. 498
(c) Rs. 166 (d) Rs. 256

12. The concentration of petrol in three different mixtures (petrol and kerosene) is $\frac{1}{2}, \frac{3}{5}$ and $\frac{4}{5}$ respectively. If 2 litres, 3 litres and 1 litre are taken from these three different vessels and mixed. What is the ratio of petrol and Kerosene in the new mixture?
(a) 4 : 5 (b) 3 : 2
(c) 3 : 5 (d) 2 : 3

13. Time period (T) of pendulum is directly proportional to the square root of length of string by which bob is attached to a fixed point and inversely proportional to the square root of gravitational constant 'g'. Time period of a bob is 3 seconds when the gravitational constant g is 4 m/sec^2 and length of string is 9 metre, what is the time period of a bob having a string of length 64 metre and gravitational constant 16 m/sec^2?
(a) 4 seconds (b) 12 seconds
(c) 16 seconds (d) 10 seconds

14. In a milk shoppe there are three varieties of milk, 'Pure', 'Cure' and 'Lure'. The 'Pure' milk has 100% concentration of milk. The ratio of milk is to water in the 'Cure' is 2 : 5 and in the Lure it is 3 : 8 respectively. Sonali purchased 14 litres of Cure and 22 litres of Lure milk and mixed them. If she wanted to make the concentration of milk in the mixture of purchased milk to 50%. How many litres of 'Pure' milk she is needed?
(a) 6 litres (b) 8 litres
(c) 16 litres (d) 18 litres

15. In the squadron of Indian Air Force the ratio of Sukhoi is to Mig and Jaguar together is 5 : 7 and the ratio of Jaguar is to Sukhoi and Mig together is 1 : 2. Find the ratio of Sukhoi and Mig :
(a) 2 : 7 (b) 3 : 5
(c) 3 : 1 (d) 5 : 3

16. During our campaign against child labour we have found that in three glass making factories A, B and C there were total 33 children aged below 18 were involved. The ratio of male to female in A, B and C was 4 : 3, 3 : 2 and 5 : 4 respectively. If the no. of female children working in the factories B and C be equal then find the no. of female children working in factory A :
(a) 5 (b) 2
(c) 8 (d) 6

17. The value of a diamond is directly proportional to the square of its weight. A diamond unfortunately breaks into three pieces with weights in the ratio of 3 : 4 : 5 thus a loss of Rs. 9.4 lakh is incurred. What is the actual value of diamond :
(a) 28.8 lakh (b) 13.5 lakh
(c) 14.4 lakh (d) 18.8 lakh

18. In the Ruchika's wallet there are only Rs. 16, consisting of 10 paise, 20 paise and Re. 1 coins. The ratio of no. of coins of 10 paise and 20 paise is 6 : 1. The minimum no. of Re 1 coin is :
(a) 5 (b) 12
(c) 4 (d) 8

19. There are two vessels containing the mixture of milk and water. In the first vessel the water is 2/3 of the milk and in the second vessel water is just 40% of the milk. In what ratio these are required to mix to make 24 litres mixture in which the ratio of water is to milk is 1 : 2 ?
(a) 4 : 3 (b) 5 : 7
(c) 5 : 2 (d) 7 : 5

20. Nehru Ji had 'n' chocolates. He distributed them among 4 children in the ratio of $\frac{1}{2} : \frac{1}{3} : \frac{1}{5} : \frac{1}{8}$. If he gave them each one a complete chocolate, the minimum no. of chocolates that he had :
(a) 139 (b) 240
(c) 278 (d) none of these

21. The ratio of working efficiency of A and B is 5 : 3 and the ratio of efficiency of B and C is 5 : 8. Who is the most efficient ?
(a) A (b) B
(c) C (d) can't be determined

22. If $4A = 5B$ and $3A = 2C$, the ratio of $B : C$ is :
(a) 4 : 3 (b) 5 : 8
(c) 8 : 15 (d) 10 : 15

23. Equal quantities of three mixtures of milk and water are mixed in the ratio of 1 : 2, 2 : 3 and 3 : 4. The ratio of water and milk in the mixture is :
(a) 193 : 122 (b) 122 : 193
(c) 61 : 97 (d) 137 : 178

24. The ratio of age of A and B is 8 : 9 and the age of B is 2/3 of C's age and age of C is $\frac{9}{13}$ times the age of D. If the age of B is 18 years then the age of C is :
(a) 36 years (b) 39 years
(c) 27 years (d) 54 years

25. A milk man has a mixture of milk in which ratio of milk and water is 5 : 3. He sells 40 litres of milk *i. e.*, mixture then he adds up 15 litres of pure water. Now the ratio of milk and water is 5 : 4. What is the new quantity of mixture?
(a) 72 litres (b) 270 litres
(c) 135 litres (d) data insufficient

26. A and B are two alloys of copper and tin prepared by mixing the respective metals in the ratio of 5 : 3 and 5 : 11 respectively. If the alloys A and B are mixed to form a third alloy C with an equal proportion of copper and tin, what is the ratio of alloys A and B in the new alloy C?
(a) 3 : 5 (b) 4 : 5
(c) 3 : 2 (d) 2 : 3

27. A hotel incurs two types of expenses, one which is fixed and others depend upon no. of guests. When there are 10 guests, total expenses of hotel are Rs. 6000. Also when there are 25 guests average expenses per guests are Rs. 360? What is the total expenses of hotel when there are 40 guests?
(a) Rs. 8,000 (b) Rs. 12,000
(c) Rs. 15,500 (d) none of these

28. The ratio of third proportional to 21 and 42 and mean proportional to 16 and 49 is :
(a) 3 : 1 (b) 2 : 3
(c) 4 : 3 (d) 1 : 3

29. The period of the pendulum is directly proportional to the square root of the length of the string. The period of such a pendulum with string of length 16 cm is 52 seconds. Find the length of the string if the period is 65 seconds :
(a) 4.5 cm (b) 5 cm
(c) 6 cm (d) none of these

30. For any two numbers m, n; $(m + n) : (m - n) : mn = 7 : 1 : 60$ Find the value of $\frac{1}{m} : \frac{1}{n}$
(a) 4 : 3 (b) 8 : 6
(c) 3 : 4 (d) 7 : 8

31. Rs. 960 were distributed among A, B, C and D in such a way that C and D together gets half of what A and B together gets and C gets one-third amount of B. Also D gets $\frac{5}{3}$ times as much as C. What is the amount of A?
(a) Rs. 240 (b) Rs. 280
(c) Rs. 320 (d) data insufficient

32. Find the value of $\frac{p^2 + q^2}{r^2 + s^2}$, if $p : q :: r : s$.
(a) $\frac{1}{4}$ (b) $\frac{1}{9}$
(c) $\frac{ps}{rq}$ (d) $\left(\frac{p-q}{r-s}\right)^2$

33. Find the value of $\frac{p^2 + q^2}{r^2 + s^2}$, if $p : q :: r : s$.
(a) $\frac{1}{4}$ (b) $\frac{pq}{rs}$
(c) $\left(\frac{p+q}{r+s}\right)^2$ (d) both (b) and (c)

34. The speeds of rickshaw, car and scooter are in the ratio of 3 : 5 : 6. What is the ratio of time taken by each one of them for the same distance?
(a) 6 : 5 : 3 (b) 10 : 6 : 5
(c) 12 : 7 : 6 (d) data insufficient

35. Divide Rs. 6940 in such a way that A gets $\frac{2}{3}$rd of what B gets and B gets $\frac{3}{5}$th of what C gets? What is the share of A and B together?
(a) Rs. 1982 (b) Rs. 1388
(c) Rs. 3470 (d) none of these

36. The ratio of age of A and B is $x : y$. If A's age is increased by 3 years and B's age is increased by 2 years then new ratio of their ages becomes 24 : 25. Given that the sum of their actual ages is 93 years. Find the actual ratio of their ages.
(a) 21 : 22 (b) 42 : 45
(c) 45 : 48 (d) can't be determined

37. $a : b = 4 : 9$ if 4 is added to both of the numbers then the new ratio becomes 21 : 46. What is the difference between a and b?
(a) 80 (b) 100
(c) 125 (d) 130

38. The ratio of ages of Rahul and Deepesh is 3 : 5. 10 years later this ratio becomes 5 : 7. What is the present age of Deepesh?
(a) 20 years (b) 50 years
(c) 25 years (d) 40 years

39. When 5 is added to the numerator and denominator both of a (positive) fraction, then the new ratio of numerator to denominator becomes 11 : 15. What is the original ratio?
(a) 17 : 25 (b) 3 : 5
(c) 28 : 40 (d) none of these

40. Five numbers a, b, c, d and e are in the ratio of 2 : 3 : 5 : 8 : 9 and their sum is 162. Find the average of all these numbers :
(a) 27 (b) 30
(c) 32.4 (d) can't be determined

41. 6 pumps of Kirlosker can fill a tank in 7 days and 2 similar pumps of USHA can fill the same tank in 18 days. What is the ratio of the efficiency of a Kirlosker pump and a USHA pump?
(a) 6 : 7 (b) 7 : 6
(c) 7 : 54 (d) can't be determined

42. 16 persons can reap $\frac{1}{5}$th field in 6 days. How many persons (with same efficiency) are required to reap rest of the field in 8 days?
(a) 27 (b) 54
(c) 48 (d) 64

43. The LCM of two numbers is 210 and their ratio is 2 : 3. The sum of these numbers is :
(a) 210 (b) 175
(c) 315 (d) can't be determined

44. What number must be subtracted from each of the numbers 53, 21, 41, 17 so that the remainders are in proportion?
(a) 1 (b) 3
(c) 5 (d) none of these

45. The angles of a triangle are in the ratio of 2 : 3 : 4. Find the measurement of greatest angle :
(a) 30° (b) 60°
(c) 100° (d) 80°

46. In a wallet the ratio of 25 paise, 50 paise and Re 1 coins are in the ratio of 12 : 4 : 3, which amounts to Rs. 600. Find the no. of coins of 25 paise :
(a) 200 (b) 225
(c) 275 (d) none of these

47. $(x-a):(x-b):(x-c) = 11 : 9 : 5$, where $x = \frac{a+b+c}{2}$.
What is the ratio of a, b, c?
(a) 10 : 8 : 7 (b) 3 : 5 : 9
(c) 7 : 8 : 10 (d) 6 : 5 : 3

48. Petrol is 7 times heavy than Kerosene and Castrol mobil is 18 times as heavy as Kerosene. What should be the ratio of petrol and mobil in the new mixture to get the mixture which must be 11 times as heavy as kerosene?
(a) 3 : 4 (b) 7 : 4
(c) 9 : 19 (d) 9 : 10

49. A girl buys 2 pigeons for Rs. 182. She sells one at a loss of 5% and another at a profit if 8%. But she neither gains nor loses on the whole. Find the price of pigeon which has sold at a profit :
(a) Rs. 112 (b) Rs. 85
(c) Rs. 70 (d) can't be determined

50. The ratio of prices of Cello and Rotomac pens in 2000 were in the ratio of 3 : 5. In 2005 the price of Cello pen trebles itself and the price of Rotomac pen is increased by Rs. 100, then the new ratio of prices of the same pens becomes 4 : 5. What was the original price of the Rotomac pen in 2000?
(a) Rs. 60 (b) Rs. 80
(c) Rs. 100 (d) Rs. 120

51. A goldsmith has 361 rings of gold. He sells some of them at a loss of 4% and rest at a profit of 15% making overall profit of 8%. Find the no. of rings sold at a profit of 15% :
(a) 171 (b) 133
(c) 218 (d) 228

52. Michel travelled from New York to New Jersey covering total distance of 250 miles in 8 hr. partly by car at 30 miles/hr. and rest by train at 35 miles/hr. The distance travelled by car is :
(a) 150 miles (b) 80 miles
(c) 220 miles (d) 180 miles

53. A rabit takes 22 leaps for every 17 leaps of cat and 22 leaps of a rabit are equal to 17 leaps of the cat. What is the ratio of the speeds of rabit and cat?
(a) 1 : 1 (b) 484 : 289
(c) 17 : 22 (d) none of these

54. Rs. 171 are divided among four friends in the ratio of $\frac{1}{3} : \frac{1}{4} : \frac{1}{5} : \frac{1}{6}$. What is the amount of the person who got the greatest share?
(a) 14 (b) 40
(c) 36 (d) 60

55. 10 years ago the age of Karishma was $\frac{1}{3}$rd of the age of Babita. 14 years hence the ratio of ages of Karishma and Babita will be 5 : 9. Find the ratio of their present ages :
(a) 13 : 29 (b) 11 : 27
(c) 29 : 17 (d) 13 : 25

56. The ratio of numerator to a denominator of a fraction is $\frac{1}{5}$ when x and $5x$ are added to the numerator and denominator respectively to the given fraction then the ratio of the new fraction will be :

(a) 1 : 1 (b) 1 : 25
(c) 1 : 5 (d) 2 : 7

57. x varies directly as y and x varies inversely as the square of z. When $y = 75$ and $x = 6$, then $z = 5$. Find the value of x when $y = 24$ and $z = 4$:

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

58. x varies directly as $(y^2 + z^2)$. At $y = 1$ and $z = 2$, the value of x is 15. Find the value of z, when $x = 39$ and $y = 2$:

(a) 2 (b) 3
(c) 4 (d) 6

59. Weight of a sumo is jointly varies as his height and his age. When height is 1.2 m and age is 20 years his weight is 48 kg. Find the weight of the sumo when his height is 1.5 metre and age is 30 years :

(a) 60 kg (b) 72 kg
(c) 90 kg (d) 58 kg

60. If $(a + b) : (b + c) : (c + a) = 5 : 6 : 9$ and $a + b + c = 10$. What is the value of c :

(a) 2 (b) 3
(c) 5 (d) 7

61. A, B, and C have amounts in the ratio of 3 : 4 : 5. First B gives $\frac{1}{4}$th to A and $\frac{1}{4}$th to C then C gives $\frac{1}{6}$th to A . Find the final ratio of amount of A, B and C, respectively :

(a) 4 : 3 : 5 (b) 5 : 4 : 3
(c) 6 : 4 : 2 (d) 5 : 2 : 5

LEVEL 2

1. A tin contains a mixture of Dew and Sprite in the ratio of 7 : 3 and another tin contains the Dew and Sprite in the ratio of 5 : 4. In what proportion should the solution of two tins be mixed to achieve a perfect proportion of 2 : 1 (in which Dew is 2 times that of sprite).

(a) 10 : 3 (b) 4 : 1
(c) 3 : 10 (d) 3 : 1

2. There are two containers A and B filled with mentha oil with different prices and their volumes are 140 litres and 60 litres respectively. Equal quantities are drawn from both A and B in such a manner that the oil drawn from A is poured into B and the oil drawn from B is poured into A. The price per litre becomes equal in both A and B. How much oil is drawn from each of A and B :

(a) 40 litre (b) 21 litre
(c) 42 litre (d) can't be determined

3. A three digit number is such that this number itself is divisible by the sum of its digits. The sum of hundreds and unit digit is 6 while the sum of the tens and unit digit is 5. What is the ratio of unit and tens digit :

(a) 1 : 2 (b) 2 : 3
(c) 3 : 4 (d) 2 : 7

4. Sachin bought 1.5 kg fresh grapes. The ratio of water is to pulp was 4 : 1. When his naughty child crushed these grapes, then some water get wasted. Now the ratio of water is to pulp is 3 : 2. What is the total amount of the crushed grapes?

(a) 0.5 kg (b) 1 kg
(c) 0.75 kg (d) none of these

5. A man bought 9 mangoes for a rupee and sold them at 6 mangoes for a rupee. What is the ratio of profit to the cost price?

(a) $\frac{3}{10}$ (b) $\frac{3}{2}$
(c) 1/2 (d) none of these

6. Half of the volume of Petrol and kerosene mixture of ratio 7 : 5 is converted into a mixture of ratio 3 : 1 by the substitution (or replacement) method. While the mixture of ratio 7 : 5 was formed from the mixture of 7 : 3 by adding the Kerosene in it. If 240 litres petrol is required in the replacement method, what is the total amount of Kerosene was added to prepare the mixture of 7 : 5?

(a) 100 litres (b) 400 litres
(c) 50 litres (d) 200 litres

7. Sometimes ago in a Cinema hall a blockbuster movie was being shown. Due to excessive demand of the show, manager of the Cinema hall increased the prices of tickets in all the three categories. 25% in first class, 12.5% in special class and 40% in balcony. If the collection of one show was Rs. 218925, then find the collection from the balcony only given that the ratio of price of ticket (increased price) for first class, special class and balcony is 5 : 9 : 14 :

(a) 109462.5 (b) 58800
(c) 14400 (d) data insufficient

8. In a mixture of petrol and Kerosene petrol is only 99 litres. if this same quantity of petrol would be presented in another mixture of petrol and Kerosene where total volume would be 198 litres less than the actual mixture then the concentration of petrol in the actual mixture would have been 13.33% point less than that of the new mixture. What is the concentration of petrol in actual mixture?

(a) 20% (b) 16.66%
(c) 26.66% (d) 8.33%

9. A drum of 20 litres is filled with milk. A milkman has only two measuring vessels of 3 litres and 5 litres without any calibration. He has to measure four litres of milk for a customer without using anyother vessel. Minimum how many operations are required for this work, where an operation is counted if the milk is transferred from one vessel to another vessel?

(a) 5 (b) 6
(c) 8 (d) 11

10. The ages of Vinay, Varsha, Veera and Vikram are in arithmetic progression, but not in order. The ratio of ages of Vinay and Varsha is 6 : 5 and Veera is to Vikram is 7 : 8. Two years later

the age of Varsha and Vikram will be 2 : 3. Find the ratio of ages of Vinay and Veera :

(a) 7 : 6 (b) 5 : 8
(c) 6 : 7 (d) 8 : 9

11. A container is filled with the mixture of milk and water. The ratio of milk and water is same. Bobby and Sunny increases the concentration to 60%. Bobby makes it by adding the milk and Sunny makes it by replacing the mixture with milk. What is the percentage of milk added by Bobby to that of milk replaced by Sunny :

(a) 100% (b) 120%
(c) 133.33% (d) none of these

12. There are two vessels A and B containing 25 litres each of pure milk and pure water respectively. 5 litres of milk from A is taken and poured into B, then 6 litres of mixture from B is taken and poured in A. What is the ratio of water in A and B respectively :

(a) 4 : 5 (b) 1 : 4
(c) 5 : 4 (d) 2 : 3

13. The ratio of age between A and B is 6 : 5 and the age of each C and D is $\frac{9}{10}$ times that of B. Age of F is less than A but greater than B. The ratio of ages between B and E is 2 : 3 also age of A is 3 years less than E. What is the ratio of ages of A and F if all the ages are in integers?

(a) 12 : 11 (b) 9 : 7
(c) 24 : 19 (d) 12 : 13

14. The ratio of students in a coaching preparing for B.Tech and MBA is 4 : 5, the ratio of fees collected from each of B. Tech and MBA student is 25 : 16. If the total amount collected from all the students is 1.62 lakh, what is the total amount collected from only MBA aspirants?

(a) Rs. 62,000 (b) Rs. 72,000
(c) Rs. 80,000 (d) none of these

15. The cost of the marble varies directly with square of its weight. Marble is broken into 3 parts whose weights are in the ratio 3 : 4 : 5. If marble had been broken into three equal parts by weight then there would have been a further loss of Rs. 1800. What is the actual cost of the original (or unbroken) marble?

(a) Rs. 3600 (b) Rs. 10,800
(c) Rs. 2160 (d) none of these

Directions for 16 and 17: *Four friends A, B, C and D have some money among them one day they decided to equate the money, so first A gave B what B had initially, then B gave C what C had initially. Again C gave D what D had initaily and finally D had doubled the money of A. Thus each of them had equal sum of Rs. 48.*

16. What was the initial amount of B?

(a) Rs. 36 (b) Rs. 54
(c) Rs. 45 (d) Rs. 42

17. What was the amount with C after second transaction?

(a) Rs. 45 (b) Rs. 69
(c) Rs. 72 (d) Rs. 84

18. Hari and Murli have 24 cows and 30 cows respectively. Both of them together hired a grazing field for the whole month of November. Initially Hari's cows used for grazing then for the remaining days of the month Murli's cows grazed it. If Hari has paid Rs. 3500 and Murli has paid Rs. 5000 for grazing then for how many days Hari used the grazing field :

(a) 14 (b) 16
(c) 21 (d) 20

19. The speeds of scooter, car and train are in the ratio of 1 : 4 : 16. If all of them covers equal distance then the ratio of time taken/velocity for the each of the vehicle is :

(a) 256 : 16 : 1 (b) 1 : 4 : 16
(c) 16 : 4 : 1 (d) 16 : 1 : 4

20. Radhika purchased one dozen bangles. One day she slipped on the floor fell down. What can not be the ratio of broken to unbroken bangles :

(a) 1 : 2 (b) 1 : 3
(c) 2 : 3 (d) 1 : 5

21. If $\frac{a}{b} = \frac{c}{d} = \frac{e}{f}$, then the value of $\left(\frac{a^n p + c^n q + e^n r}{b^n p + d^n q + f^n r}\right)^{1/n}$:

(a) $\frac{ad}{bc}$ (b) $\frac{af}{be}$
(c) $\frac{ck}{dk}$ (d) none of these

22. At a casino in Mumbai, there are 3 tables A, B and C. The pay-offs at A is 10 : 1, at B is 20 : 1 and at C is 30 : 1. If a man bets Rs. 200 at each table and win at two of the tables, what is the maximum and minimum difference between his earnings can be?

(a) Rs. 2500 (b) Rs. 2000
(c) Rs. 4000 (d) none of these

23. If $m = \frac{4pq}{p+q}$, then the value of $\frac{m+2p}{m-2p} + \frac{m+2q}{m-2q}$:

(a) 2 (b) 4
(c) $\frac{2mpq}{(p+q)}$ (d) none of these

24. The ratio of volumes of two cubes is 8 : 27. What is the ratio of surface area of these cubes respectively?

(a) 2 : 3 (b) 4 : 9
(c) 8 : 19 (d) 9 : 4

25. Dudheri Lal has two jars. Jar A is completely filled with milk and another jar B is totally empty. Before selling the milk in a town he transferred some milk in to the empty jar B then he fill the jar A with water. Once again he transferred the mixture of milk from A to B so that B is completely filled. Which one of the following is correct?

(a) Concentration of milk in B cannot be less than 75%
(b) Concentration of milk in B cannot be greater than 75%
(c) Concentration of milk is always 75%
(d) none of the above

26. In ABC corporation there are some management trainees. These trainees are divided into 3 groups A, B and C for 3 different projects in the ratio of 3 : 4 : 5 respectively, where P, Q, R are the projects-in-charge of A, B, C respectively. The difference between the no. of trainees in A and C is not greater than 3. Also P, Q, R belongs to the group of trainees. The no. of assistant of Q is less than the no. of assistance of R by :

(a) 33.33% (b) 20%
(c) 25% (d) 16.66%

27. If $\frac{a}{b}=\frac{b}{c}=\frac{c}{d}=\frac{d}{e}=\frac{e}{f}=\frac{1}{3}$, find the value of $\left(\frac{a+b+c+d+e}{b+c+d+e+f}\right)$:
(a) $\frac{1}{81}$ (b) $\frac{1}{27}$
(c) $\frac{1}{3}$ (d) 1

28. An engine can move at the speed of $\frac{20}{3}$ m/s without any wagon attached. Reduction in the speed of the train is directly proportional to the square root of the no. of wagons attached to the engine. When there are only four wagons attached its speed is $\left(\frac{50}{9}\right)$ m/s. The greatest no. of wagons with which the engine can move is :
(a) 144 (b) 143
(c) 12 (d) none of these

29. Mrs. Annapurna per day sells exactly four quintal sugar at Rs. 2000 per quintal getting the profit of Rs. 25%. Since she mixes two varities of sugar, one costs Rs. 14 per kg and another costs Rs. 22 per kg. One day due to huge demand in market she had only 3 quintal of the required mixture so she purchased the sugar costs Rs. 17 per kg at Rs. 18 per kg from the wholeseller on that day and then she mixed 300 kg mixture with 100 kg sugar costing Rs. 18 per kg to fullfill the demand of the market selling at the same price. How much percent less does she gain that she would have gained, if she had sufficient quantity of usual mixture of sugar?
(a) 12.5% (b) 18.18%
(c) 62.5% (d) can't be determined

30. Two vessels P and Q contain 'a' litres of petrol and 'b' litres of Kerosene respectively. 'c' litres of petrol and same quantity of Kerosene is taken out and then transferred to Q and P respectively. This process is repeated several times. If after the first operation the quantity of petrol or Kerosene in either of P and Q does not change. What is the value of 'c'?
(a) $\frac{ab}{(a-b)}$ (b) $\frac{2ab}{(a+b)}$
(c) $\frac{ab}{(a+b)}$ (d) $\left(\frac{a}{b}\right)^2$

31. Arvind Singh purchased a 40 seater bus. He started his services on route no. 2 (from Terhipuliya to Charbagh with route length of 50 km). His profit (P) from the bus depends upon the no. of passangers over a certain minimum number of passangers 'n' and upon the distance travelled by bus. His profit is Rs. 3600 with 29 passangers in the bus for a journey of 36 km and Rs. 6300 when there are 36 passengers. travelled for 42 km. What is the minimum no. of passangers are required so that he will not suffer any loss?
(a) 12 (b) 20
(c) 18 (d) 15

32. Three cats are roaming in a zoo in such a way that when cat A takes 5 steps, B takes 6 steps and cat C takes 7 steps. But the 6 steps of A are equal to the 7 steps of B and 8 steps of C. What is the ratio of their speeds :
(a) 140 : 144 : 147 (b) 40 : 44 : 47
(c) 15 : 21 : 28 (d) 252 : 245 : 240

33. In a family there were n people. The expenditure of rice per month in this family is directly proportional to the 5 times the square of no. of people in the family. If the elder son left the family to study in USA there was decrease in consumption of 95 kg rice per month. What is the value of n?
(a) 5 (b) 12
(c) 9 (d) 10

34. One day in summer I wanted to chill me out, I went to a cool corner. I gave him a note of Rs. 10 and asked for a coke costing Rs. 5 per jar and he did so, but he returned me Rs. 5, in the denomination of Re. 1, 50 paise and 25 paise. What could be the ratio of no. of coins of Re. 1, 50 paise and 25 paise respectively :
(a) 2 : 3 : 1 (b) 1 : 7 : 2
(c) 6 : 1 : 3 (d) 2 : 1 : 2

35. If $\frac{a}{b+c}=\frac{b}{c+a}=\frac{c}{a+b}$ and $a+b+c\neq 0$ then the value of $\frac{b}{a+b+c}$ is :
(a) $\frac{1}{2}$ (b) $\frac{1}{3}$
(c) $\frac{1}{4}$ (d) 1

36. The ratio of the density of 3 kinds of petrol P_1, P_2 and P_3 is 9 : 7 : 5. The density of P_1 is 18 gm/cc and P_1, P_2, P_3 are mixed in the ratio of 6 : 5 : 4 by weight. If a litre of P_3 cost Rs. 40, then find the cost of P_3 in 450 kg of mixture of P_1, P_2 and P_3 :
(a) Rs. 380 (b) Rs. 480
(c) Rs. 355 (d) Rs. 448

37. Three persons Amar, Akbar and Anthony agree to pay their hotel bills in the ratio of 3 : 4 : 5. Amar pays the first day's bill which amounts to Rs. 26.65, Akbar pays the second days bill which amounts to Rs. 42.75 and C pays the third day's bill which amounts to Rs. 53.00. When they settle their accounts, which of the following happens?
(a) Amar gives Rs. 3 to C
(b) Akbar gives Rs. 2 to Amar
(c) Amar gives Akbar Rs. 1.95 and Rs. 2 to Anthony
(d) none of the above

38. Find the value of x if $(14x-4):(8x-1)=(3x+8):(9x+5)$:
(a) 1 (b) 1/2
(c) 3/4 (d) none of these

39. Pooja, Shipra and Monika are three sisters. Pooja and Shipra are twins. The ratio of sum of the ages of Pooja and Shipra is same as that of Monika alone. Three years earlier the ratio of age of Pooja and Monika was 2 : 7. What will be the age of Shipra 3 years hence?
(a) 21 years (b) 16 years
(c) 8 years (d) 12 years

40. A couple got married 9 years ago when the age of wife was 20% less than her husband. 6 years from now the age of wife will be only 12.5% less than her husband. Now they have six

children including single, twins and triplets and the ratio of their ages is 2 : 3 : 4 respectively. What can be the maximum possible value for the present age of this family?

(a) 110 years (b) 103 years
(c) 105 years (d) 83 years

41. The price of a necklace varies directly as the no. of pearls in it. Also, it varies directly as the square root of radius of a pearl. The price of a necklace was Rs. 150. When it had 75 pearls each of radius 1 cm. Find the radius of the pearl of a necklace having 100 pearls whose cost is Rs. 600.

(a) 2 (b) 9
(c) 3 (d) 4

42. The price of a book varies directly as the no. of pages in it and inversely as the time periods in years that have elapsed since the date of purchasing. Two books cost the same, however, the no. of pages in the first book is triple of the second book. if the first book is sold on 18 years ago, how long ago was the second book sold?

(a) 54 years (b) 9 years
(c) 6 years (d) 3 years

43. Akbar and Birbal who purchased the shares for the cost of their basic salaries which are in the ratio of 5 : 6. later on company gave them 40 additional shares to each, due to which the ratio changed to 7 : 8. If the worth of each share is Rs. 75, what is the basic salary of the person who got less shares?

(a) Rs. 10500 (b) Rs. 7500
(c) Rs. 8800 (d) Rs. 9000

44. Distance covered by a train is directly proportional to the time taken and also it varies directly as the square root of fuel used and varies inversely as the no. of wagons attached to it. A train coveres 192 km journey in 20 hours when there are 10 wagons attached to it and total fuel consumption was 256 litre of diesel. Find the consumption of fuel per km when a train goes 200 km in 25 hours with 15 wagons attached to it :

(a) 1.5 l/km (b) 2 l/km
(c) 2.8 l/km (d) 20 l/km

45. At Sahara shopping centre, a person can purchase as much articles at a time as his or her age that is a person of n years age can purchase only n similar articles at a time. Amisha is younger to her elder brother who has just entered into his twenties. One day Amisha went to the Sahara shopping centre, she purchased same toffees at a particular rate on the ground floor. But when she reached on third floor she found that she could purchase double the no. of toffees with the same amount as she had spent on the ground floor. Also to purchase the same no. of toffees on the third floor she had to spend Rs. 2 less than that of on the first floor. How many toffees did she buy?

(a) 6 (b) 12
(c) 18 (d) 15

46. A contractor deployed some men to plant 1800 trees in a certain no. of days. But in $\frac{1}{3}$rd of the planned time 120 plants could be less planted so to ful fill the target for the rest of the days every day 20 more plants were planted. Thus it saved one day out of the initially planned no. of days. How many plants he planned to plant each day initially?

(a) 180 (b) 100
(c) 120 (d) 160

47. A and B have to write 810 and 900 pages respectively in the same time period. But A completes his work 3 days ahead of time and B completes 6 days ahead of time. How many pages did A write per hour if B wrote 21 pages more in each hour?

(a) 45 (b) 72
(c) 54 (d) 100

48. Three friends A, B and C decided to share the soda water with D, who had no soda water. A contributed 2 tumbler more than that of B and B contributed 1 tumbler more than that of C and then all of them had equal amount of soda water. In turn D paid money, which was divided among A, B and C in the ratio of their contribution to D. Thus A had gotten thrice as much money as B had gotten. The price of each tumbler of soda water was Rs. 15 and each transaction was integral in numbers either the sharing of money or contribution of soda water. What was the sum of money that B had gotten?

(a) Rs. 15 (b) Rs. 18
(c) Rs. 22.5 (d) none of these

49. In Maa Yatri Temple every devotee offers fruits to the orphans. Thus every orphan receives bananas, oranges and grapes in the ratio of 3 : 2 : 7 in terms of dozen. But the weight of a grape is 24 gm and weight of a banana and an orange are in the ratio of 4 : 5, while the weight of an orange is 150 gm. Find the ratio of all the three fruits in terms of weight, that an orphan gets :

(a) 90 : 75 : 42 (b) 180 : 150 : 82
(c) 75 : 42 : 90 (d) none of these

Final Round

1. In two alloys the ratio of Iron and copper is 4 : 3 and 6 : 1 respectively. If 14 kg of the first alloy and 42 kg of the second alloy are mixed together to form a new alloy, then what will be the ratio of copper to iron in the new alloy :

(a) 11 : 3 (b) 11 : 8
(c) 8 : 11 (d) none of these

2. In a zoo, there are rabbits and pigeons. If heads are counted, there are 340 heads and if legs are counted there are 1060 legs. How many pigeons are there?

(a) 120 (b) 150
(c) 180 (d) 170

3. 6 litre is taken out from a vessel full of Kerosene and substituted by pure petrol. This process is repeated two more times. Finally the ratio of petrol and Kerosene in the mixture becomes 1701 : 27. Find the volume of the original solution :

(a) 14 litre (b) 16 litre
(c) 8 litre (d) 42 litre

4. In three vessels, each of 25 litres capacity, mixture of milk and water is filled. The ratio of milk and water are 3 : 1, 2 : 3, 4 : 3 in the respective vessels. If all the three vessels are emptied into a single large vessel, then what will be the ratio of water to milk in the resultant mixture?
(a) 179 : 241 (b) 197 : 214
(c) 219 : 117 (d) 179 : 234

5. Two liquids are mixed in the ratio 4 : 3 and the mixture is sold at Rs. 20 with a profit of $33\frac{1}{3}$%. If the first liquid is costlier than the second by Rs. 7. Find the sum of costs of both the liquids :
(a) Rs. 11 (b) Rs. 29
(c) Rs. 35 (d) Rs. 70

6. Two alloys made up of copper and tin. The ratio of copper and tin in the first alloy is 1 : 3 and in the second alloy it is 2 : 5. In what ratio the two alloys should be mixed to obtain a new alloy in which the ratio of tin and copper be 8 : 3 ?
(a) 3 : 5 (b) 4 : 7
(c) 3 : 8 (d) 5 : 11

7. Three vessels having volumes in the ratio of 2 : 3 : 5 are full of a mixture of water and milk. In the first vessel ratio of water and milk is 1 : 3, in second 2 : 3 and in third vessel, 2 : 5. If all the three vessels were poured out in a large container, what is the resulting ratio of milk and water?
(a) 43 : 96 (b) 438 : 962
(c) 348 : 962 (d) 962 : 438

8. The number of oranges in three baskets are in the ratio of 3 : 4 : 5. In which ratio the no. of oranges in first two baskets must be increased so that the new ratio becomes 5 : 4 : 3 ?
(a) 1 : 3 (b) 2 : 1
(c) 3 : 4 (d) 2 : 3

9. A vessel of capacity 2 litre has 25% alcohol and another vessel of capacity 6 litre had 40% alcohol. The total liquid of 8 litre was poured out in a vessel of capacity 10 litre and thus the rest part of the vessel was filled with the water. What is the new concentration of mixture?
(a) 31% (b) 71%
(c) 49% (d) 29%

10. Alloy A contains 40% gold and 60% silver. Alloy B contains 35% gold and 40% silver and 25% copper. Alloys A and B are mixed in the ratio of 1 : 4. What is the ratio of gold and silver in the newly formed alloy is?
(a) 20% and 30% (b) 36% and 44%
(c) 25% and 35% (d) 49% and 36%

11. Dia and Urea are two chemical fertilizers. Dia is consists of N, P and K and Urea conists of only N and P. A mixture of Dia and Urea is prepared in which the ratio of N, P and K is 26%, 68% and 6% respectively. The ratio of N, P and K in Dia is 20%, 70% and 10% respectively. What is the ratio of N and P in the Urea?
(a) 27% and 63% (b) 33% and 67%
(c) 35% and 65% (d) 70% and 30%

12. The ratio of copper and nickel by weight in the two alloys X and Y are 2 : 7 and 5 : 4. How many kilogram of the alloy X and Y are required to make 42 kg of new alloy Z in which the ratio of copper and nickel is same?
(a) 6 kg and 36 kg (b) 10 kg and 32 kg
(c) 7 kg and 35 kg (d) none of these

13. There are two alloys made up of copper and aluminium. In the first alloy copper is half of the aluminium and in the second alloy copper is thrice as much as aluminium. How many times the second alloy must be mixed with first alloy to get the new alloy in which copper is twice as that of aluminium?
(a) 2 (b) 3
(c) 4 (d) 5

14. There are 90 litres castrol and 150 litres CRB mobil oils. The price of castrol is Rs. 80 per litre and price of CRB is Rs. 75 per litre. Equal amount of castrol and CRB is taken out and then CRB is poured out in the vessel of castrol and castrol is poured out in the vessel of CRB. Now the rate of both the mixtures is same. What is the amount of mobil oil taken out from each of the vessel?
(a) 45 litres (b) 56.25 litres
(c) 24.5 litres (d) 36 litres

15. There are two containers, the first contain, 1 litre pure water and the second contains 1 litre of pure milk. Now 5 cups of water from the first container is taken out is mixed well in the second container. Then, 5 cups of this mixture is taken out and is mixed in the first container. Let A denote the proportion of milk in the first container and B denote the proportion of water in the second container then :
(a) $A < B$ (b) $A = B$
(c) $A > B$ (d) can't be determined

16. Mitthu Bhai sells rasgulla (a favorite indian sweets) at Rs. 15 per kg. A rasgulla is madeup of flour and sugar in the ratio of 5 : 3. The ratio of price of sugar and flour is 7 : 3 (per kg). Thus he earns $66\frac{2}{3}$% profit. What is the cost price of sugar?
(a) Rs. 10/kg (b) Rs. 9/kg
(c) Rs. 18/kg (d) Rs. 14/kg

Answers

INTRODUCTORY EXERCISE-4.1

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

INTRODUCTORY EXERCISE-4.2

1 (c)	**2.** (c)	**3.** (b)	**4.** (d)	**5.** (c)					

INTRODUCTORY EXERCISE-4.3

1 (d)	**2.** (c)	**3.** (c)	**4.** (a)	**5.** (d)	**6.** (c)				

INTRODUCTORY EXERCISE-4.4

1 (b)	**2.** (d)	**3.** (c)	**4.** (a)	**5.** (d)	**6.** (d)	**7.** (c)	**8.** (b)	**9.** (a)	**10.** (d)
11. (b)	**12.** (d)	**13.** (b)	**14.** (c)	**15.** (c)	**16.** (b)	**17.** (c)	**18.** (d)	**19.** (b)	**20.** (b)
21. (c)	**22.** (a)	**23.** (c)	**24.** (b)	**25.** (d)	**26.** (a)	**27.** (c)	**28.** (c)		

LEVEL-1

1 (b)	**2.** (b)	**3.** (d)	**4.** (c)	**5.** (b)	**6.** (d)	**7.** (b)	**8.** (c)	**9.** (b)	**10.** (b)
11. (a)	**12.** (b)	**13.** (a)	**14.** (c)	**15.** (d)	**16.** (d)	**17.** (c)	**18.** (c)	**19.** (b)	**20.** (a)
21. (a)	**22.** (c)	**23.** (a)	**24.** (c)	**25.** (c)	**26.** (c)	**27.** (b)	**28.** (a)	**29.** (d)	**30.** (c)
31. (b)	**32.** (d)	**33.** (d)	**34.** (b)	**35.** (c)	**36.** (c)	**37.** (b)	**38.** (c)	**39.** (d)	**40.** (c)
41. (a)	**42.** (c)	**43.** (b)	**44.** (c)	**45.** (d)	**46.** (d)	**47.** (c)	**48.** (b)	**49.** (c)	**50.** (b)
51. (d)	**52.** (d)	**53.** (a)	**54.** (d)	**55.** (a)	**56.** (c)	**57.** (c)	**58.** (b)	**59.** (c)	**60.** (c)
61. (d)									

LEVEL-2

1 (a)	**2.** (c)	**3.** (b)	**4.** (c)	**5.** (c)	**6.** (d)	**7.** (d)	**8.** (a)	**9.** (c)	**10.** (c)
11. (d)	**12.** (b)	**13.** (a)	**14.** (b)	**15.** (d)	**16.** (c)	**17.** (d)	**18.** (a)	**19.** (a)	**20.** (c)
21. (c)	**22.** (c)	**23.** (a)	**24.** (b)	**25.** (a)	**26.** (c)	**27.** (c)	**28.** (b)	**29.** (a)	**30.** (c)
31. (d)	**32.** (a)	**33.** (d)	**34.** (b)	**35.** (b)	**36.** (b)	**37.** (c)	**38.** (b)	**39.** (c)	**40.** (b)
41. (b)	**42.** (c)	**43.** (b)	**44.** (b)	**45.** (b)	**46.** (b)	**47.** (c)	**48.** (a)	**49.** (a)	

FINAL ROUND

1 (d)	**2.** (b)	**3.** (c)	**4.** (a)	**5.** (b)	**6.** (b)	**7.** (d)	**8.** (b)	**9.** (d)	**10.** (b)
11. (c)	**12.** (c)	**13.** (c)	**14.** (b)	**15.** (b)	**16.** (d)				

Hints & Solutions

LEVEL 1

1. $a : b :: c : d$

$a^2 + b^2 + c^2 + d^2 = 50$

$b + c = 5$

and $a : b = 1 : 3$

If consider $a : b = 1 : 3$ as it is, then

$c = 2$ $(5 - 3 = 2)$

and $d = 6$ $(\because a : b :: c : d)$

$a^2 + b^2 + c^2 + d^2 = 1^2 + 3^2 + 2^2 + 6^2 = 50$

Hence, the presumed values are correct.

Thus, the average of a, b, c and $d = \dfrac{a + b + c + d}{4}$

$= \dfrac{1 + 3 + 2 + 6}{4} = 3$

Hence (b) is correct.

Alternatively: Assume option (b)

$\because$ $\dfrac{a + b + c + d}{4} = 3$

$\Rightarrow$ $a + b + c + d = 12$

Now $\because$ $b + c = 5$

$\Rightarrow$ $a + d = 7$

Again $a : b = 1 : 3$

$\Rightarrow$ $c : d = 2 : 6$

Now verify that $a^2 + b^2 + c^2 + d^2 = 50$. Since it is correct. Hence option (b) is correct.

NOTE It can also be solved by forming quadratic equations.

2. $\dfrac{a}{b} = \dfrac{a + b}{a}$

$\Rightarrow$ $a^2 = ab + b^2$

$\Rightarrow$ $a^2 - b^2 - ab = 0$

Let $b = 1$, then $a : b = a : 1$ (by putting $b = 1$)

$\therefore$ $a^2 - a - 1 = 0$

$\Rightarrow$ $a = \dfrac{1 \pm \sqrt{5}}{2}$ (Solving quadratic equation by Sridharacharya's formula)

$\therefore a = \dfrac{1 + \sqrt{5}}{2}$ (negative value can't be considered)

$a : b = \dfrac{1 + \sqrt{5}}{2} : 1$

or $a : b = (1 + \sqrt{5}) : 2$

Therefore, $\dfrac{b}{a + b} = \dfrac{2}{1 + \sqrt{5} + 2} = \dfrac{2}{3 + \sqrt{5}}$

Hence option (b) is correct.

3. The best way is to go through options

$\dfrac{x + y}{x - y} = \dfrac{8 + 2}{8 - 2} = \dfrac{10}{6} = \dfrac{5}{3}$ (verified)

Again $\dfrac{x}{y + 2} = \dfrac{8}{2 + 2} = 2$ (verified)

Hence option (d) is correct.

4. Best way is to go through options

and $\dfrac{a^3 + b^3}{a^3 - b^3} = \dfrac{5^3 + 2^3}{5^3 - 2^3} = \dfrac{125 + 8}{125 - 8} = \dfrac{133}{117}$

Hence option (c) is correct.

5. $H : S = 1 : 1$

and $S : G = 2 : 3$

$H : P = 1 : 2$

$\therefore$ $H : S : G : P = 2 : 2 : 3 : 4$

$= 2x : 2x : 3x : 4x$

Therefore $\dfrac{2x + 2x + 3x + 4x}{4} = \dfrac{11x}{4} = 55$

$\Rightarrow$ $x = 20$

Marks in History = 40

Sociology = 40

Geography = 60

Philosophy = 80

Hence, only in two subjects he scored 60% or above.

Hence option (b) is correct.

6. Let the incomes of A and M is $2x$ and $3x$

Let the savings of A be K, then the expenditure of M be K

Also expenditure of $A = 2x - K$

Given $(2x - K) + K = 8000 \Rightarrow x = 4000$

$\therefore$ Total income of

A and $B = 2x + 3x = 5x = 5 \times 4000 = 20000$

$\therefore$ Total savings of A and $B = 20{,}000 - 8000 =$ Rs. 12,000

7. $\dfrac{\text{Profit of Hutch}}{\text{Profit of Essar}} = \dfrac{\text{time period} \times \text{amount of Hutch invested}}{\text{time period} \times \text{amount of Essar invested}}$

$\dfrac{6}{17} = \dfrac{5 \times K}{12 \times 1275}$

$\Rightarrow$ $K = \dfrac{6 \times 12 \times 1275}{17 \times 5} = 1080$

8. Minimum number of chocolates are possible when he purchases maximum number of costliest chocolates.

Thus $2 \times 5 + 5 \times 2 =$ Rs. 20

Now Rs. 100 must be spend on 10 chocolates as $100 = 10 \times 10$.

Thus minimum number of chocolates $= 5 + 2 + 10 = 17$

9. Maximum number of chocolates are possible only when he purchases minimum number of costlier chocolates and maximum number of cheaper chocolates

$\therefore$ $2 \times 5 + 1 \times 10 =$ Rs. 20

Now Rs. 100 must be spend on 50 chocolates as $100 = 2 \times 50$.

Thus maximum number of possible chocolates

$= 2 + 1 + 50 = 53$

10. Meretere → M, Teremere → T and Khabbu Singh → K

$\frac{5+3}{3} = 2.66$ (since all the 8 chocolates were shared by 3)

It means M has given $5 - 2.66 = 2.33$ chocolates to K and T has given $3 - 2.66 = 0.33$ chocolates to K

Thus M and T will receive the amount in the ratio of donations (*i.e.*, share of chocolates)

M	:	T
2.33	:	0.33
$2\frac{1}{3}$	:	$\frac{1}{3}$
$\frac{7}{3}$	:	$\frac{1}{3}$
7	:	1

So the M receives Rs. 14 and T receives Rs. 2

Thus the difference = Rs. 12

11. Share of a man, a woman and a boy = $7x$, $4x$ and $3x$

then the share of 4 men = $4 \times 7x = 28x$

then the share of 5 women = $5 \times 4x = 20x$

then the share of 2 boys = $2 \times 3x = 6x$

Now, the share of all women $= \frac{20x}{(28x + 20x + 6x)} \times 4536$

$= \frac{20}{54} \times 4536 =$ Rs. 1680

Hence, the share of one woman $= \frac{1680}{5} = 336$

12. Concentration of petrol in

A	B	C
$\frac{1}{2}$	$\frac{3}{5}$	$\frac{4}{5}$

Quantity of petrol taken from $A = 1$ litre out of 2 litre

Quantity of petrol taken from $B = 1.8$ litre out of 3 litre

Quantity of petrol taken from $C = 0.8$ litre out of 1 litre

Therefore total petrol taken out from

A, B and $C = 1 + 1.8 + 0.8 = 3.6$ litre

So, the quantity of Kerosene $= (2 + 3 + 1) - (3.6) = 2.4$ litre

Thus, the ratio of petrol to Kerosene $= \frac{3.6}{2.4} = \frac{3}{2}$

13. $$T \propto \frac{\sqrt{l}}{\sqrt{g}} \Rightarrow T = k\sqrt{\frac{l}{g}}$$

Therefore, $3 = K\sqrt{\frac{9}{4}}$ or $3 = K\frac{3}{2} \Rightarrow K = 2$

Again $T = K\sqrt{\frac{l}{g}} = 2 \times \sqrt{\frac{64}{16}} = 4$

$T = 4$ seconds

14.

Pure	Cure	Lure
100%	40%	37.5%
$\frac{1}{1}$	$\frac{2}{5}$	$\frac{3}{8}$

	Milk	Water	Mixture
Cure	$4l$	$10l$	$14l$
Lure	$6l$	$16l$	$22l$
New mixture	Milk	Water	
	$10l$	$26l$	
⊕	$16l$		
	$26l$	$26l$	
Required mixture	1 :	1	

Since in the required mixture the ratio of milk and water is 1 : 1 so she has to add up 16 litre of more milk (pure) to get it, for the fixed quantity of water.

15. $S : (M + J) = 5 : 7 \Rightarrow 7S = 5M + 5J$ ...(1)

$J : (S + M) = 1 : 2 \Rightarrow 2J = S + M$ ...(2)

By solving equations (1) and (2), we get

$S : M : J = 5 : 3 : 4$

so $S : M = 5 : 3$

16.

	Male		Female
A	$4x$	:	$3x$
B	$3y$	:	$2y$
C	$5z$	:	$4z$

but $2y = 4z$

∴

	Male		Female
A	$4x$	:	$3x$
B	$6z$	:	$4z$
C	$5z$	:	$4z$

Therefore, $7x + 19z = 33$

but z can assume only one value *i.e.*, $z = 1$

Hence, $7x + 19 = 33 \Rightarrow x = 2$

Thus the no. of female children in factory $A = 3x = 6$.

17. The ratio of broken parts (by weight) $= 3x : 4x : 5x$

Therefore value of broken parts of diamond

$= (3x)^2 + (4x)^2 + (5x)^2 = 50x^2$

The value of original diamond $= (3x + 4x + 5x)^2 = 144x^2$

Therefore, loss in value $= 144x^2 - 50x^2 = 9.4$ lakh

$\Rightarrow 94x^2 = 9.4$ lakh

$\Rightarrow 94x^2 = 940000$

$\Rightarrow x^2 = 10000$

Hence, the actual value of the diamond $= 144x^2$

$= 144 \times 10000$

$= 14.4$ lakh

18. $10x + 20y + 100z = 1600$

Again since $x : y = 6 : 1$

∴ $60y + 20y + 100z = 1600$

$\Rightarrow 80y + 100z = 1600$

$\Rightarrow 4y + 5z = 80$

Putting $z = 1, 2, 3, 4, 5 \ldots$, we get at $z = 4$, $y = 15$ (an integer)

Hence, min. 4 coins of Re. 1 will be there

19. Concentration of water in first vessel $= \frac{2}{5} = 40\%$

concentration of water in second vessel $= \frac{2}{7} = 28.57\%$

By alligation

$\frac{2}{7}$ $\frac{2}{5}$

$\frac{1}{3}$

$\left(\frac{2}{5} - \frac{1}{3}\right)$ $\left(\frac{1}{3} - \frac{2}{7}\right)$

$\frac{1}{15}$	:	$\frac{1}{21}$
21	:	15
7	:	5

Therefore, ratio of first mixture to the second mixture = 5 : 7

20. LCM of 2, 3, 5, 8 = 120

Therefore, $\frac{1}{2} \times 120 = 60$

$\frac{1}{3} \times 120 = 40$

$\frac{1}{5} \times 120 = 24$

$\frac{1}{8} \times 120 = 15$

Therefore, minimum number of chocolates

$= 60 + 40 + 24 + 15 = 139$

21. $A : B = 5 : 3$

$B : C = 5 : 8$

$\therefore \quad A : B : C = 25 : 15 : 24$

So, A is the most efficient.

22. $A : B = 5 : 4 \Rightarrow 10 : 8$

$A : C = 2 : 3 \Rightarrow 10 : 15$

$\therefore \quad A : B : C = 10 : 8 : 15$

$\therefore \quad B : C = 8 : 15$

23.

	A		B		C
(Proportion of milk in mixture)	$\frac{1}{3}$	:	$\frac{2}{5}$	:	$\frac{3}{7}$
or	$\frac{35}{105}$	:	$\frac{42}{105}$	:	$\frac{45}{105}$

quantity of milk in new mixture $= 35 + 42 + 45 = 122l$

quantity of water in new mixture $= (105 \times 3) - 122 = 193l$

Therefore, ratio of water is to milk = 193 : 122

24. $A : B = 8 : 9$

$B : C = 2 : 3$

$C : D = 9 : 13$

$A : B : C : D = 144x : 162x : 243x : 351x$

But we need not to solve this, since we already know that

$B : C = 2x : 3x$

$\therefore \quad 2x : 3x :: 18 : k \Rightarrow k = 27$ years

25.

Milk		Water	
$5x$		$3x$	(initially)
$-25l$		$-15l$	
$5x - 25$		$3x - 15$	(after selling $40l$ mixture)
		$+15l$	
$5x - 25$		$3x$	(after adding $15l$ water)
5	:	4	

$\therefore \quad \frac{5x - 25}{3x} = \frac{5}{4} \Rightarrow x = 20$

$\therefore$ New quantity of mixture $= (5x - 25) + 3x = 135$ litre

26.

A	B
$C : T$	$C : T$
5 : 3	5 : 11

Concentration of copper in $A = \frac{5}{8}$

Concentration of copper in $B = \frac{5}{16}$

By alligation

$$\begin{array}{ccc} (B)\ \frac{5}{16} & & \frac{5}{8}\ (A) \\ & \frac{1}{2} & \\ \left(\frac{5}{8} - \frac{1}{2}\right) & & \left(\frac{1}{2} - \frac{5}{16}\right) \\ \frac{2}{16} & : & \frac{3}{16} \\ 2 & : & 3 \end{array}$$

So, the required ratio of $A : B = 3 : 2$ (Since $B : A = 2 : 3$)

27. $k + 10x = 6000$

$k + 25x = 9000 \quad (\because 25 \times 360 = 9000)$

$\Rightarrow \quad 15x = 3000$

$\Rightarrow \quad x = 200$ and $k = 4000$

$\therefore \quad k + 40x = 4000 + 40 \times 200 = 12{,}000$

where k is the fixed expenditure.

28. Third proportional of 21 and 42 is 84 and mean proportional to 16 and 49 is 28.

Therefore required ratio $= \frac{84}{28} = \frac{3}{1}$ or 3 : 1

29. $P \propto \sqrt{l} \Rightarrow P = k\sqrt{l}$

$\therefore \quad 52 = k\sqrt{16}$

$\Rightarrow \quad k = 13$

Again, $P = k\sqrt{l}$

$65 = 13\sqrt{l}$

$\Rightarrow \quad l = 25$ cm

30. $\frac{m + n}{m - n} = \frac{7x}{x} \Rightarrow \frac{m}{n} = \frac{4x}{3x}$

Again $mn = 4x \times 3x = 12x^2$

and $mn = 60x$

So $60x = 12x^2$

$\Rightarrow \quad x = 5$

$\therefore \quad m = 20$ and $n = 15$

Hence, $\frac{1}{m} : \frac{1}{n} = \frac{1}{20} : \frac{1}{15} = 3 : 4$

Alternatively: $\frac{m}{n} = \frac{4x}{3x}$

$\frac{1}{m} : \frac{1}{n} = 3 : 4$

31. $\underbrace{A + B}_{2} : \underbrace{C + D}_{1}$

and $\frac{B}{3} : \frac{C}{1}$ and $\frac{C}{3} : \frac{D}{5}$

$\Rightarrow \quad B : C : D$

$9 : 3 : 5$

Again $A + B : C + D$

$\underbrace{7 + 9}_{16} \quad \underbrace{3 + 5}_{8}$

Thus $A + B = 16 \Rightarrow A = 7$ when $B = 9$

$\therefore$ Therefore share of $A = \frac{7}{24} \times 9600 =$ Rs. 280

32. The best way is to consider some values in the proportion and verify the option, but care should be taken that in this type of question you are required to verify a possible correct option atleast with 2-3 times with different values.
Since, if you consider

$$p : q :: r : s \Rightarrow 1 : 2 :: 3 : 6$$

you will find answer (b) is also correct, but for only particular values. So it is not the general solution. Finally you will realize that option (d) is the most appropriate answer.

33. Solve by componendo and dividendo or as mentioned in the previous solution.

34. Since for the constant distance time is inversely proportional to the speed. So, the required ratio of time taken by each of the rickshaw, car and scooter is

$$\frac{1}{3} : \frac{1}{5} : \frac{1}{6} \Rightarrow 10 : 6 : 5$$

$$\left[\frac{1}{3} \times \frac{10}{10} : \frac{1}{5} \times \frac{6}{6} : \frac{1}{6} \times \frac{5}{5} = \frac{10}{30} : \frac{6}{30} : \frac{5}{30} = 10 : 6 : 5\right]$$

35. $A : B = 2 : 3$ and $B : C = 3 : 5$

$\Rightarrow$ $A : B : C = 2 : 3 : 5$

$\therefore$ $(A + B) : C = 5 : 5 = 1 : 1$

Hence, Share of $(A + B) = \frac{1}{2} \times 6940 = 3470$

36. $x + y = 93$ ...(1)

and $\frac{x + 3}{y + 2} = \frac{24}{25}$

$\Rightarrow$ $25x - 24y = (-27)$ ...(2)

From equations number (1) and (2)

$$x = 45 \text{ and } y = 48$$

Alternatively: Go through options.

37. $\frac{a}{b} = \frac{4x}{9x}$ and $\frac{a + 4}{b + 4} = \frac{21}{46}$

$\Rightarrow$ $a = 80$ and $b = 180$

$\therefore$ $b - a = 100$

38. $\frac{R}{D} = \frac{3x}{5x}$ and $\frac{R}{D} \Rightarrow \frac{3x + 10}{5x + 10} = \frac{5}{7}$

$\Rightarrow$ $x = 5$

Hence, $\frac{R}{D} = \frac{15}{25}$

Alternatively: Go through options.

39. Let the fraction be $\frac{x}{y}$ then

$$\frac{x + 5}{y + 5} = \frac{11}{15} \Rightarrow 11y - 15x = 20$$

Since, we have only one equation in two variables, so we cannot find the solution.

40. $\frac{2x + 3x + 5x + 8x + 9x}{5} = \frac{162}{5} = 32.4$

41. The number of days required by a single Kirlosker pump to fill the tank $= 6 \times 7 = 42$ days and the number of days required by a single USHA pump to fill the same tanks $= 2 \times 18 = 36$ days. Now, since efficiency is inversely proportional to the number of days. Hence,

$$\frac{\text{Efficiency of one K-pump}}{\text{Efficiency of U-pump}} = \frac{36}{42} = \frac{6}{7}$$

42. $\frac{1}{5}$th field can be reaped by 96 man days

$\therefore \frac{4}{5}$th field can be reaped by $96 \times 4 = 384$ man days

Now, since there are only 8 days so reqired

$$\text{number of men} = \frac{384}{8} = 48 \text{ men}$$

43. $210 = 2 \times 3 \times 5 \times 7$

Therefore, $\frac{N_1}{N_2} = \frac{2k \times 5 \times 7}{3k \times 5 \times 7}$

since, $N_1 : N_2 = 2 : 3$

Therefore, $N_1 = 70$ and $N_2 = 105$

$\therefore$ $N_1 + N_2 = 70 + 105 = 175$

44. $\frac{(53 - x)}{(21 - x)} = \frac{(41 - x)}{(17 - x)} \Rightarrow x = 5$

Alternatively : Go through options.

45. $2x + 3x + 4x = 180$

$\Rightarrow$ $x = 20 \therefore 4x = 80$

46. $(25 \times 12x) + (50 \times 4x) + (100 \times 3x) = 800x = 60000$

$\Rightarrow$ $x = 75$

$\therefore$ number of coins of 25 paise $= 12x = 12 \times 75 = 900$

Alternatively : Go through options, choices (a), (b) and (c) are eliminated since neither of 200, 225, 275 is divisible by 12. Hence choice (d) is correct.

47. Go through options.

Alternatively : $\frac{(x - a)}{11} = \frac{(x - b)}{9} = \frac{(x - c)}{5} = k$

$\Rightarrow$ $a = x - 11k$

$b = x - 9k$

$c = x - 5k$

$\therefore$ $x = \frac{(x - 11k) + (x - 9k) + (x - 5k)}{2}$

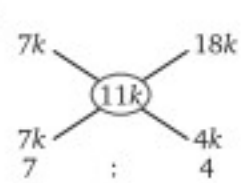
$2x = 3x - 25k \Rightarrow x = 25k$

$a = 14k \Rightarrow b = 16k$ and $c = 20k$

$\therefore$ $a : b : c = 14 : 16 : 20 = 7 : 8 : 10.$

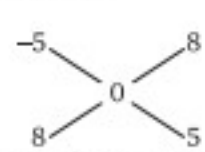
48. If the weight of kerosene be k kg/unit volume, then
weight of petrol $= 7k$/unit volume
weight of castrol $= 18k$/unit volume
required weight of the mixture $= 11k$/unit volume

By Alligation



The required ratio is 7 : 4.

49. **By Alligation**



The ratio of price of pigeons sold at loss and profit respectively are in the ratio of 8 : 5

$\therefore$ Cost price of profitable pigeon $= \frac{5}{8 + 5} \times 182 =$ Rs. 70.

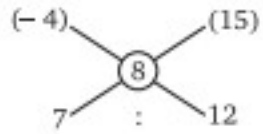
50. $\frac{C}{R} = \frac{3x}{5x}$

Again $\frac{C}{R} = \frac{(3x)\,3}{(5x + 100)} = \frac{4}{5}$

$\Rightarrow$ $x = 16$

$\therefore$ Price of Rotomac pen in 2000 was Rs. 80.

51. By Alligation



Now, we get the ratio of no. of rings sold at a loss and profit is 7 : 12

$\therefore$ Number of rings sold at profit $= \frac{12}{19} \times 361 = 228$

Alternatively : Go through options.

52. Best way is to go through options.
consider option (d)

$$\frac{180}{30} + \frac{70}{35} = 6 + 2 = 8 \text{ hrs}$$

Hence, (d) is correct.

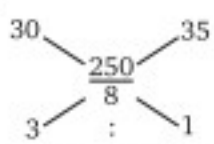
Alternatively : $\frac{x}{30} + \frac{250 - x}{35} = 8$

$\Rightarrow$ $x = 180$ miles

Alternatively : Since the Average Speed

$$= \frac{\text{Total Distance}}{\text{Total Time}} = \frac{250}{8} \text{ miles/hr}$$

$\therefore$ **By Alligation**



Therefore, the ratio of time taken @ 30 m/hr and @ 35 m/hr is in the ratio of 3 : 1. It means he has travelled @ 30 m/hr for 6 hr.
Therefore, the distance travelled by car is 180.
($\because$ Distance = Speed $\times$ Time).

53. $\frac{22}{22} : \frac{17}{17} = 1 : 1$

54. $\frac{1}{3} : \frac{1}{4} : \frac{1}{5} : \frac{1}{6}$

$\Rightarrow$ $\frac{20}{60} : \frac{15}{16} : \frac{12}{60} : \frac{10}{60}$ (by taking LCM)

$\Rightarrow$ $20 : 15 : 12 : 10$

$\therefore$ Largest share $= \frac{20}{(20 + 15 + 12 + 10)} \times 171$

$= \frac{20}{57} \times 171 = 60.$

55. Let the present age of Karishma and Babita be x and y then,

$$\frac{x - 10}{y - 10} = \frac{1}{3} \quad \ldots(1)$$

Again $\frac{x + 14}{y + 14} = \frac{5}{9}$ ...(2)

By solving (1) and (2) we get $x = 26$ and $y = 58$

56. Let the fraction be $\frac{k}{5k}$

then, $\frac{k + x}{5k + 5x} = \frac{(k + x)}{5(k + x)} = \frac{1}{5}$

57. $x \propto y$ and $x \propto \frac{1}{z^2}$

$x \propto \frac{y}{z^2} \Rightarrow x = k\frac{y}{z^2}$

$6 = k \times \frac{75}{(5)^2} \Rightarrow k = 2$

Again $x = 2 \times \frac{24}{(4)^2} \Rightarrow x = 3$

58. $x \propto (y^2 + z^2) \Rightarrow x = k(y^2 + z^2)$

$15 = k(1^2 + 2^2) \Rightarrow k = 3$

again $39 = 3 \times (2^2 + z^2)$

$\Rightarrow$ $13 = (4 + z^2) \Rightarrow z = 3$

59. $W \propto HA \Rightarrow W = K \times H \times A$

Now, $48 = K \times 1.2 \times 20 \Rightarrow K = 2$

Again $W = 2 \times 1.5 \times 30$

$\therefore$ $W = 90$

60. $(a + b) : (b + c) : (c + a) = 5x : 6x : 9x$

and $a + b + c = 10$

$\Rightarrow$ $(a + b) + (b + c) + (c + a) = 20x$

$\Rightarrow$ $a + b + c = 10x$

$\Rightarrow$ $a + b + c = 10$ ($\because x = 1$)

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

or $c = 10 - 5 = 5$

61.

A	B	C	
$3x$	$4x$	$5x$	
$(3x + x)$	$2x$	$(5x + x)$	(B gives $\frac{1}{4}$ to A and $\frac{1}{4}$ to C)
$= 4x$	$2x$	$6x$	
$(4x + x)$	$2x$	$(5x)$	(C gives $\frac{1}{6}$ to A)
$5x$	$2x$	$5x$	
5 :	2 :	5	

LEVEL 2

1.

M_1	M_2
$D : S$	$D : S$
$7 : 3$	$5 : 4$

New Mixture

D		S
2	:	1

proportion of Dew in $M_1 = \frac{7}{10}$

proportion of Dew in $M_2 = \frac{5}{9}$

proportion of new mixture $= \frac{2}{3}$ (required)

By alligation rule

$$\begin{array}{ccc} \frac{7}{10} & & \frac{5}{9} \\ & \frac{2}{3} & \\ \left(\frac{2}{3}-\frac{5}{9}\right) & & \left(\frac{7}{10}-\frac{2}{3}\right) \\ \frac{3}{27} & & \frac{1}{30} \end{array}$$

or $\frac{1}{9} : \frac{1}{30}$

or $10 : 3$

2. The ratio of quantities $= 140 : 60 = 7 : 3$

$\therefore$ The quantity to be exchanged $= \frac{(140 \times 3) + (60 \times 7)}{2(7+3)}$

$= 42$ litre

NOTE In this question individual prices are not required. You can solve it by forming equation.

Alternatively : Go through options by assuming some prices.

3. Let the number be $100x + 10y + z$, then

$$x + z = 6 \quad \text{and} \quad y + z = 5$$

Also, from the given options only option (b) is suitable

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

or $3 + 2 = 5$

4.

Water	Pulp
$4x$	x
$3y$	$2y$

but $x = 2y$ since pulp remains contant

	Water	Pulp
$5y$ = loss in water →	$8y$	$2y$
	$3y$	$2y$

but $10y\ (= 8y + 2y) = 1.5$ kg

$\therefore$ $5y\ (= 3y + 2y) = 0.75$ kg

5.

Cost price	:	Selling price
$\frac{1}{9}$	:	$\frac{1}{6}$
or 2	:	3

CP : SP = 2 : 3

since profit = SP − CP

$\therefore$ Profit = 3 − 2 = 1

$\therefore$ Profit : CP = 1 : 2

6. Flow Chart :

$P : K$

$7x : 3x$ → + Kerosene by addition

Step 1 → $7x : 5x$

Step 2 → $3x : x$

by replacement

By the replacement formula from alligation chapter

$$\frac{1}{4} = \frac{5}{12}\left(1 - \frac{240}{12x}\right)$$

$$\Rightarrow \quad \frac{3}{5} = \left(1 - \frac{240}{12x}\right)$$

$$\Rightarrow \quad \frac{2}{5} = \frac{20}{x}$$

$$\Rightarrow \quad x = 50$$

Therefore, half of the initial amount $= (350 + 150)$ litres then, the required amount of kerosene

$= 5x - 3x = 2x = 100$ litres

But for the whole amount required kerosene to be added $= 200$ litres

7. Data insufficient. Since we don't know that how many persons bought ticket of all the categories individually

i.e., $5x + 9y + 14z = 213925$

but we don't know anything about x, y and z

8.

Petrol	Kerosene	Total Mixture
99	x	$99 + x$
99	$(x - 198)$	$(x - 99)$

Again $\frac{99}{(x-99)} \times 100 - \frac{99}{(x+99)} \times 100 = 13.33$

or $9900\left(\frac{x + 99 - x + 99}{x^2 - 99^2}\right) = 13.33$

or $\frac{9900\ (198)}{x^2 - 99^2} = \frac{40}{3}$

$\Rightarrow \quad x^2 - 99^2 = 99^2 \times 15$

$\Rightarrow \quad x^2 = (99)^2 \times (16)$

$\Rightarrow \quad x = 99 \times 4 = 396$ litres

Therefore the actual concentration of petrol

$= \frac{99}{(99 + 396)} = 20\%$

9. Do it yourself.

10. Varsha : Vinay = 5 : 6 = $5x : 6x$

Veera : Vikram = 7 : 8 = $7y : 8y$

But their ages are in A.P.

Therefore, $6x - 5x = 8y - 7y$

$\Rightarrow \quad x = y$

Again, $\dfrac{5x+2}{8y+2} = \dfrac{2}{3}$

$\Rightarrow \quad \dfrac{5x+2}{8x+2} = \dfrac{2}{3}$

$\Rightarrow \quad x = 2$

Therefore, the ages of Varsha, Vinay, Veera and Vikram are 10, 12, 14 and 16 years respectively.

Therefore, the ratio of ages of Vinay and Veera = 6 : 7

11.

Bobby			Sunny		
Milk		Water	Milk		Water
1	:	1	1	:	1
50%		50%	50%		50%
2		2			
60%		40%			
3	:	2			

It means bobby will add up 1 litre of milk, in 4 litre of initial mixture, to prepare 5 litres mixture in the ratio of 3 : 2.

By replacement method

$\dfrac{2}{5} = \dfrac{2}{4}\left(1 - \dfrac{k}{4}\right)$

$\Rightarrow \quad \dfrac{4}{5} = \left(1 - \dfrac{k}{4}\right)$

$\Rightarrow \quad \dfrac{1}{5} = \dfrac{k}{4}$

$\Rightarrow \quad k = \dfrac{4}{5}$

It means Sunny will replace $\dfrac{4}{5}$ litre of initial mixture by the same quantity of pure milk.

Hence, the percentage of milk added by Bobby to that of replaced by Sunny $= \dfrac{1}{4/5} \times 100 = 125\%$

12.

	A			B	
	Milk	Water		Milk	Water
After first operation	25l	0		0	25l
	20l	0	→	5l	25l
				1 : 5	
After second operation	21l	5l	←	4l	20l

Therefore, the ratio of water in A and B is 1 : 4

13. $B = \dfrac{5}{6}A$ ...(i)

and $C = D = \dfrac{9}{10}B$ ...(ii)

also $B = \dfrac{2}{3}E$ ...(iii)

and $E - A = 3$ ...(iv)

From (i) and (iii) $\dfrac{A}{E} = \dfrac{4}{5}$ or $E = \dfrac{5}{4}A$ ...(v)

$\therefore \quad E - A = \dfrac{5A}{4} - A = 3$ from (iv) and (v)

$\Rightarrow \quad A = 12$ and $E = 15$ and $B = 10$

Also $C = D = 9$ and $F = 11$, since $B < F < A$ and F is integer

$\therefore \quad A : F = 12 : 11$

14. The ratio of fees collected from B.Tech : MBA

$= 4x \times 25y : 5x \times 16y$

$= 100xy : 80xy$

$= 5xy : 4xy = 5k : 4k$

The amount collected only from MBA students

$= \dfrac{4}{9} \times 1.62$ lakh

= Rs. 72,000

15. $C \propto (W)^2$

$W_1 : W_2 : W_3 = 3 : 4 : 5$

cost $= (3x)^2 + (4x)^2 + (5x)^2 = 50\,(x)^2$

Again $W_1 : W_2 : W_3 = 4 : 4 : 4$ (when weights are equal)

cost $= (4x)^2 + (4x)^2 + (4x)^2 = 48x^2$

loss $= 50x^2 - 48x^2 = 2x^2$

$1800 = 2x^2$

$x = 30$

$\therefore$ Actual cost of unbroken marble $= (4x + 4x + 4x)^2$

$= (12x)^2 = 144x^2$

$= 144 \times x^2$

$= 144 \times 900 = 129600$

Solutions for 16 and 17 :

	A	B	C	D
Initially	69	45	42	36
$A \to B$	24	90	42	36
$B \to C$	24	48	84	36
$C \to D$	24	48	48	72
$D \to A$	48	48	48	48

Solve it in reverse order (*i.e.,* from the result side)

18. Ratio of price paid by Hari and Murli = 7 : 10

or $(24 \times x) : 30 \times (30 - x) = 7 : 10$

$\Rightarrow \quad x = 14$

or go through options.

19. Since distance is constant. Therefore ratio of speeds of scooter, car and train = 1 : 4 : 16

and therefore, ratio of time taken = 16 : 4 : 1

Therefore, required ratio $= \dfrac{16}{1} : \dfrac{4}{4} : \dfrac{1}{16}$

$= 16 : 1 : \dfrac{1}{16} = 256 : 16 : 1$

20. Since there are 12 bangles, then the no. of broken to unbroken bangles can not be 2 : 3, since $5x = (2x + 3x)$ can not divide 12 for any integral value of x *i.e.,* all the sum of ratios which are the factors of 12 can possibly be the ratio of broken to unbroken.

21. $$\frac{a}{b}=\frac{c}{d}=\frac{e}{f}=k$$

$$\Rightarrow \quad \frac{a^n}{b^n}=\frac{c^n}{d^n}=\frac{e^n}{f^n}=k^n$$

$$\Rightarrow \quad \frac{a^n p}{b^n p}=\frac{c^n q}{d^n q}=\frac{e^n r}{f^n r}=k^n$$

$$\therefore \quad \frac{a^n p+c^n q+e^n r}{b^n p+d^n q+f^n r}=(k^n)$$

$$\therefore \quad \left(\frac{a^n p+c^n q+e^n r}{b^n p+c^n q+f^n r}\right)^{\frac{1}{n}}=(k^n)^{1/n}$$

$$\therefore \quad \left(\frac{a^n p+c^n q+e^n r}{b^n p+d^n q+f^n r}\right)^{1/n}=k=\frac{a}{b}=\frac{c}{d}=\frac{e}{f}$$

Hence (c) is the possible answer.

22. Maximum earning will be only when he will won on the maximum yielding table.

$$A \to 10:1$$
$$B \to 20:1$$
$$C \to 30:1$$

i.e., he won on B and C but lost on A

$$20 \times 200 + 30 \times 200 - 1 \times 200 = 9800$$

minimum earning will be when he won on table A and B and lose on that table 3.

$$\therefore \quad 10 \times 200 + 20 \times 200 - 1 \times 200$$
$$6000 - 200 = 5800$$

Therefore, difference = 9800 − 5800 = 4000

Alternatively the difference

$$= [(30 + 20 - 1) - (10 + 20 - 1)] \times 200$$
$$= 20 \times 200 = \text{Rs. } 4000.$$

23. $\frac{m+2p}{m-2p}+\frac{m+2q}{m-2q}$

$=\frac{m}{2p}+\frac{m}{2q}$ (by componendo and dividendo)

$=m\left(\frac{p+q}{2pq}\right)$

$=\left(\frac{4pq}{p+q}\right)\left(\frac{p+q}{2pq}\right)$ substituting the value of $m=\frac{4pq}{p+q}=2$

24. Volume of a cube = $(\text{side})^3 = (a)^3$

surface area of a cube = $6(a)^2$ ($a \to$ side)

$$a_1^3 : a_2^3 = 8 : 27$$
$$\Rightarrow \quad a_1 : a_2 = 2 : 3$$
$$\Rightarrow \quad a_1^2 : a_2^2 = 4 : 9$$
$$\Rightarrow \quad 6a_1^2 : 6a_2^2 = 4 : 9$$

25. Clearly it can not be less than 75%. For clarification of concept consider some values and then verify it.

26. $$A : B : C = 3x : 4x : 5x$$

but $\quad C - A = 5x - 3x \le 3$

or $\quad C - A = 2x \le 3 \Rightarrow x = 1$

$\Rightarrow \quad C - A = 2$

$\therefore \quad A : B : C = 3 : 4 : 5$

Therefore, number of assistant trainee (except project in charge) of $Q = 3$ and assistant trainee of $R = 4$

Therefore, required percentage $=\frac{4-3}{4}\times 100$

$$=\frac{1}{4}\times 100 = 25\%$$

27. $b = 3a$

$c = 3b = 9a$

$d = 3c = 9b = 27a$

$e = 3d = 9c = 27b = 81a$ and $f = 3e = 243a$

put the values and simplify.

or $\quad$ we know that $\frac{a}{b}=\frac{c}{d}=\frac{e}{f}\ldots=\frac{a+c+e}{b+d+f}$

28. Let w be the number of wagons and s be the speed of engine without wagon $=\frac{20}{3}$ m/s = 24 km/hr.

then speed of the train $= s - k\sqrt{w}$

$\therefore \quad 20 = 24 - k\sqrt{4} \qquad [\because \frac{50}{9}\text{ m/s} = 20\text{ km/hr}]$

$\therefore \quad k = 2$

when train will stop its speed becomes zero

$$0 = 24 - 2\sqrt{w} \qquad (\because k = 2)$$

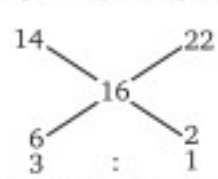
$\Rightarrow \quad w = 144$

since at 144 wagons train will stop, so at 143 wagons train just can move with its least possible speed having maximum possible wagons.

29. Cost of 1 kg (mixture) of sugar = Rs. 16/kg

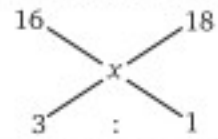
since selling price is Rs. 20/kg

Therefore, ratio of quantity of sugar costing Rs. 14 and Rs. 22 per kg = 3 : 1



So, the available stock of mixture costing Rs. 16 = 3 quintal and the required stock of sugar costing Rs. 18 = 1 quintal

Therefore, the new price of mixture costing 3 quintal of sugar @ Rs. 16/kg and 1 quintal of sugar @ Rs. 18 per kg



$\therefore \quad x = \text{Rs. } 16.5$ per kg

New price = Rs. 16.5 per kg

Now, $\quad$ original profit = 20 − 16 = Rs. 4 per kg

New profit = 20 − 16.5 = Rs. 3.5 per kg

$\therefore$ Percentage reduction in profit $=\frac{4-3.5}{4}\times 100 = 12.5\%$

30.

	P	Q
Initial amounts	a (petrol)	b (kerosene)
After one operation	$a - c$ (petrol) c (kerosene)	$b - c$ (kerosene) c (petrol)

Since there is no change in concentration in the second, third... etc operations.

In the vessel *P*;

The fraction of kerosene in P is $\frac{c}{a}$

In the vessel *Q* ;

The fraction of kerosene in Q is $\left(\frac{b-c}{b}\right)$

$\therefore \quad \left(\frac{b-c}{b}\right) = \frac{c}{a}$

$\Rightarrow \quad c(a+b) = ab$

$\Rightarrow \quad c = \frac{ab}{a+b}$, Hence (c)

Since at this moment the concentration in both vessels is same.

31. The minimum number of passengers n, at which there is no loss and number of passengers travelling $= m$ and let the distance travelled is d, then

$$P \propto (m-n)d$$

or $\quad p = k(m-n)d$; k is a constant.

when $P = 3600$, $m = 29$ and $d = 36$, then

$$3600 = k(29-n) \times 36 \quad \ldots(1)$$

Again, when $p = 6300$, $m = 36$, $d = 42$ km

$$6300 = k(36-n) \times 42 \quad \ldots(2)$$

Dividing equation (2) by (1)

$$\frac{6300}{3600} = \frac{k}{k}\frac{(36-n)\times 42}{(29-n)\times 36}$$

$\Rightarrow \quad \frac{(36-n)}{(29-n)} = \frac{9}{6}$

$\Rightarrow \quad 3n = 45 \Rightarrow n = 15$

Hence to avoid loss, minimum number of 15 passengers are required.

32. Frequency of step of $A : B : C = 5 : 6 : 7$

but it terms of size of step, $6A = 7B = 8C$

$\therefore$ Ratio of speeds of A, B and $C = \frac{5}{6} : \frac{6}{7} : \frac{7}{8}$

$= 280 : 288 : 294$

$= 140 : 144 : 147$

33. Expenditure = 5 (no. of family members)^2

$\Rightarrow \quad E_1 = 5(n)^2 \quad \ldots(1)$

again $\quad E_2 = 5(n-1)^2 \quad \ldots(2)$

but $\quad E_1 - E_2 = 95$

$\therefore \quad 5[n^2 - (n-1)^2] = 95$

$5[n^2 - (n^2 + 1 - 2n)] = 95$

$n^2 - n^2 - 1 + 2n = 19$

$\Rightarrow \quad 2n = 20 \Rightarrow n = 10$

34. Finally I have Rs. 5

Consider option (a)

$$2 \times 100 + 3 \times 50 + 1 \times 25 = 375 \text{ paise}$$

Its integer multiple can not give the value equals to 500. So can not be true.

Consider option (b)

$1 \times 100 + 7 \times 50 + 2 \times 25 = 500$ paise, can be true

but we also check the option (c) and (d) now when you check the choices (c) and (d) you will find wrong as choice (a). So, only choice be could be the best answer.

35. By componendo and dividendo :

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

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

$\Rightarrow \quad a - b - c = b - c - a$

$\Rightarrow \quad a = b$

similarily $\quad a = b = c$

$\therefore \quad \frac{b}{a+b+c} = \frac{1}{3}$

36. Density of P_1, P_2 and P_3 are 18, 14 and 10 gm/cc

again since volume $= \frac{\text{weight}}{\text{density}}$

now the weight of P_3 in 450 kg mixture $= \frac{450 \times 4}{15} = 120$ kg

now the volume of $P_3 = \frac{120}{10} = 12$ litre

$\therefore$ The cost of 12 litre P_3 petrol $= 12 \times 40 =$ Rs. 480

37. $26.65 + 42.75 + 53 = 122.40$

Proportionate amount of Amar, Akbar and Anthony in the ratio of 3 : 4 : 5 is Rs. 30.60, Rs. 40.80 and Rs. 51 respectively.

Now	Amar	Akbar	Anthony
	30.60	40.80	51.00
	26.65	42.75	53.00

So, Amar pays Rs. 1.95 to Akbar and Rs. 2 to Anthony.

38. The best way is to go through options

Alternatively: Solve by cross product rule and componendo.

39. Since Pooja and Shipra are twins so their ages be same. Let their ages be x and age of Monika be y, then,

$$x + x = y \quad \ldots(1)$$

and $\quad \frac{(x-3)}{(y-3)} = \frac{2}{7}$

$\Rightarrow \quad 7x - 2y = 15$

Now, from equation (1),

$$7x - 4x = 15 \Rightarrow x = 5$$

So the age of Shipra 3 years hence will be $5 + 3 = 8$ years.

40. $\frac{H-9}{W-9} = \frac{5}{4}$ and $\frac{H+6}{W+6} = \frac{8}{7}$

$\therefore$ Thus the present age of Husband is 34 and present age of his wife is 29 years.

Now, the maximum age of any child must be less than 9 years. Hence their ages can be 2, 3 and 4 years or 4, 6 and 8 years. So the max. possible sum of age of this family

$= 34 + 29 + (1 \times 4 + 2 \times 6 + 3 \times 8)$

$= 103$ years

41. $P \propto n\sqrt{r} \Rightarrow P = kn\sqrt{r}$

where P is the price of necklace, n is number of pearls and r is the radius of a pearl.

Now $150 = k \times 75 \times \sqrt{1}$

$\Rightarrow$ $k = 2$

again $600 = 2 \times 100 \times \sqrt{r}$

$\Rightarrow$ $\sqrt{r} = 3 \Rightarrow r = 9$ cm

42. $P \propto \frac{N}{T} \Rightarrow P = K\frac{N}{T}$

$P \to$ Price of a book, $N \to$ Number of Pages, $T \to$ Time period

$$P_1 = P_2$$

$$\therefore \quad K\frac{N_1}{T_1} = K\frac{N_2}{T_2}$$

$$\Rightarrow \quad \frac{3N}{18} = \frac{N}{T}$$

$$T = 6 \text{ years}$$

43. $\frac{5x + 40}{6x + 40} = \frac{7}{8} \Rightarrow \frac{\text{Akbar}}{\text{Birbal}}$

$\Rightarrow$ $x = 20$

$\therefore$ The actual number of shares of less salaried person

$= 100$ $\quad \because (5 \times 20 = 100)$

$\therefore$ The salary of Akbar $= 100 \times 75 = 7500$

44. $D \propto \frac{\sqrt{F} \times T}{W}$, $D \to$ Distance, $F \to$ Fuel, $T \to$ Time, $W \to$ No. of wagons

$$D = k\frac{\sqrt{F} \times T}{W}$$

$$192 = k\frac{\sqrt{256} \times 20}{10}$$

$\Rightarrow$ $k = 6$

again $200 = \frac{6 \times \sqrt{F} \times 25}{15}$

$\Rightarrow$ $\sqrt{F} = 20 \Rightarrow F = 400$ litre

$\therefore$ fuel used per km $= \frac{400}{200} = 2\,l/\text{km}$

45. Just go through option and factorize the product into two factors such that the given conditions must satisfy.

e.g., $6 = 1 \times 6$

2×3

3×2

6×1

It is not true.

Again consider option (b)

$12 = 1 \times 12$

2×6

$3 \times 4 \to 3 \times 4 = 12$

4×3

$6 \times 2 \to 6 \times 2 = 12$

12×1

Now you can see that the rate is being half from 4 to 2 so she can purchase double number of toffees as she was already purchasing on the ground floor. Again to purchase the same number of toffees she had to spend Rs. 2 less than the spending on the ground floor :

Rate		Number of toffee/Re		Total Number of toffee
4	×	3	=	12
2	×	6	=	12

and if you check other options (c) and (d) they will not satisfy the given conditions.

46. Go through options.

	Total no. of plants		No. of plants	Days
Previous scheme $\Rightarrow$	1800	=	100	× 18

Again after $\frac{1}{3}$rd days, remaining plants

$$= \frac{1800 \times 2}{3} + 120 = 1320$$

$$1320 = (100 + 20) \times 11$$

This shows that in the second case 1 day was saved than the planned no. of day.

47. Go through options.

$$\frac{810}{54} - \frac{900}{75} = 3 = (6 - 3 = 3)$$

$$15 - 12 = 3$$

$$3 = 3$$

Hence choice (c) is correct.

i.e., if A writes 54 page, then B writes 75 (= 54 + 21) pages per hour.

48.

	A	B	C	D
Initial amount of soda water	$(x + 3)$	$(x + 1)$	(x)	0
final amount of soda water	$\left(\frac{3x}{4} + 1\right)$	$\left(\frac{3x}{4} + 1\right)$	$\left(\frac{3x}{4} + 1\right)$	$\left(\frac{3x}{4} + 1\right)$

Therefore to be the integral value x must be $4m$; $m = 1, 2, 3\ldots$

So at $m = 1$

Hence option (a) is correct since B had contributed 1 tumbler.

	A	B	C	D
Initial amount	7	5	4	0
Final amount	4	4	4	4
	3	1	0	
	2	1		

49. Ratio of fruits (by dozen) = 3 : 2 : 7

Ratio of fruits by weight = 120 : 150 : 24

$\therefore$ Ratio of fruits (combined) by weight

$= 3 \times 120 : 2 \times 150 : 7 \times 24$

$= 30 : 25 : 14$

Final Round

1.

	1st Alloy		2nd Alloy	
	Iron	Copper	Iron	Copper
	4	3	6	1
Proportion of iron in the alloys	$\frac{4}{7} \Downarrow \frac{8}{14}$ (×2)		$\frac{6}{7} \Downarrow \frac{36}{42}$ (×6)	

So in the new alloy total iron will be 44 kg and copper will be 12 kg.

$\because$ Iron = 8 + 36 = 44

and Copper = (14 + 42) − (8 + 36) = 12

$\therefore$ Ratio of copper to iron = 12 : 44 = 3 : 11, hence (d)

2. Suppose there are all the pigeons then total no. of heads are 340 and total no. of legs are 680. Now since 380 (= 1060 − 680) legs are extra, it means there will be $190\left(=\frac{380}{2}\right)$ rabbits. As we know a rabbit has 2 extra legs than that of a pigeon who has only two legs.

Therefore, number of rabbits = 190

and number of pigeons = 340 − 190 = 150

Alternatively : go through options and consider choice (b)

	Pigeons	Rabbits
Heads (340)	150 (×2)	190] 340 (×4)
Legs (1060)	300	760] 1060

Alternatively : $P + R = 340$ ...(1)

and $2P + 4R = 1060$ ...(2)

Solve these two equations and you will get the answer.

Alternatively : It can be solved through alligation rule.

3. By the replacement formula

Decreased amount

$$= \text{Original amount}\left(1 - \frac{\text{replacing amount}}{\text{original amount}}\right)^{\text{no. of times } (n)}$$

Now, since the ratio of petrol and kerosene is 1701 and 27 it means initially there was (1701 + 27) = 1728 unit of kerosene and the decreased amount of kerosene is 27 unit.

$$\therefore \quad 27 = 1728\left(1 - \frac{6}{k}\right)^3 \Rightarrow k = 8 \text{ litre}$$

NOTE Here 27 : 1728 just show the ratio not the exact amount.

4. The ratio of milk in 3 vessels

$$= \frac{3}{4} \times \frac{5\times7}{5\times7} : \frac{2}{5} \times \frac{4\times7}{4\times7} : \frac{4}{7} \times \frac{4\times5}{4\times5}$$

$$= \frac{105}{140} : \frac{56}{140} : \frac{80}{140}$$

Remember, The value of 25 litre does not matter, the basic thing is that the amount of mixture in all the three quantities is same.

So the total quantity of milk in mixture = 105 + 56 + 80 = 241

So the total amount of water in mixture

$$= [(3 \times 140) - 241] = 179 \text{ litre}$$

Therefore ratio of water to milk in the new mixture

= 179 : 241

5. $\because$ Profit = $33\frac{1}{3}$%, it means cost price = Rs. 15

Now, by alligation

$$\frac{(x+7)-15}{(15-x)} = \frac{3}{4}$$

$$\Rightarrow \quad x = 11$$

$\therefore$ $x = 11$ and $(x + 7) = 18$

Thus the total value of both the prices = 11 + 18 = 29

6.

A_1		A_2	
C	T	C	T
1	3	2	5

Copper → $\frac{1}{4}$ Copper → $\frac{2}{7}$

Required copper → = $\frac{3}{11}$

So, the required ratio is 4 : 7

Since it is clear from the above values

(1 + 2 → 3 and 4 + 7 → 11)

Alternatively : By Alligation

$$\frac{1}{4} \quad \frac{2}{7} \quad 3 \quad 11 \quad \left(\frac{2}{7} - \frac{3}{11}\right) \quad \left(\frac{3}{11} - \frac{1}{4}\right)$$

$$\frac{1}{77} : \frac{1}{44}$$

$$\Rightarrow \quad \frac{1}{7} : \frac{1}{4}$$

$$4 : 7$$

7. Ratio of $W_1 : M_1$ = 1 : 3, $W_2 : M_2$ = 2 : 3, $W_3 : M_3$ = 2 : 5

Proportion of water $\frac{1}{4} : \frac{2}{5} : \frac{2}{7}$

$$\Rightarrow \quad \frac{1}{4} \times \frac{5\times7}{5\times7} : \frac{2}{5} \times \frac{4\times7}{4\times7} : \frac{2}{7} \times \frac{4\times5}{4\times5}$$

$$\Rightarrow \quad \frac{35}{140} : \frac{56}{140} : \frac{40}{140}$$

Now since all these three mixtures are mixed in the ratio of 2 : 3 : 5

Therefore new ratio $= \frac{35}{140} \times \frac{2}{2} : \frac{56 \times 3}{140 \times 3} : \frac{40 \times 5}{140 \times 5}$

$$= \frac{70}{280}, \frac{168}{420}, \frac{200}{700}$$

Now, the amount of water = 70 + 168 + 200 = 438

$\therefore$ The amount of milk = (280 + 420 + 700) − 438 = 962

$\therefore$ Ratio of milk to water = 962 : 438

8. $B_1 : B_2 : B_3 = 3x : 4x : 5x$

again $B_1 : B_2 : B_3 = 5y : 4y : 3y$

Since there is increase in no. of oranges in first two basket only, it means the no. of oranges remains constant in the third basket

$\therefore$ $5x = 3y$

Hence $3x : 4x : 5x$

$\Rightarrow$ $\frac{9y}{5} : \frac{12y}{5} : \frac{15y}{5} = 9y : 12y : 15y$

and $5y : 4y : 3y \Rightarrow 25y : 20y : 15y$

Therefore, increase in first basket = 16

and increase in second basket = 8

$\therefore$ the required ratio = 2 : 1

9. Amount of alcohol in first vessel = $0.25 \times 2 = 0.5$ litre
amount of alcohol in second vessel = $0.4 \times 6 = 2.4$ litre
Total amount of alcohol out of 10 litres of mixture is $0.5 + 2.4 = 2.9$ litre

Hence, the concetration of the mixture is 29% $\left(= \frac{2.9}{10} \times 100\right)$

10. Assume the weight of Alloy A is 100 kg
$\therefore$ The weight of Alloy B is 400 kg

$\therefore$		Gold	Silver	Copper
	A	40 kg	60 kg	0 kg
	B	140 kg	160 kg	100 kg
$\therefore$	total $\rightarrow$	180 kg	220 kg	100 kg

$\therefore$ Ratio of Gold and Silver in new alloy $= \frac{180}{500} : \frac{200}{500}$

$= 36\% : 44\%$

11.

Urea			Dia		
N	P	K	N	P	K
x	y	0	20%	70%	10%

Mixture

N	P	K
26%	68%	6%

This 6% of K is obtained only from Dia.

$\therefore$

Urea			Dia		
N	P	K	N	P	K
x	y	0	120	420	60

Mixture

N	P	K
260	680	60

$N_U + N_D = N_M \Rightarrow N_U + 120 = 260$

$N \rightarrow$ Nitrogen, $P \rightarrow$ Phosphorus

and $P_U + P_D = P_M \Rightarrow P_U + 420 = 680$

$U, D, M \rightarrow$ Urea, Dia and mixture

$\therefore$ Amount of Nitrogen in Urea = 140

and amount of Phosphorus in Dia = 260

$\therefore$ Ratio of $N : P = 7 : 13 \Rightarrow 35 : 65$

12.

X		Y	
C	N	C	N
2	7	5	4

Copper $\rightarrow \frac{2}{9} = \frac{4}{18}$ Copper $\rightarrow \frac{5}{9} = \frac{10}{18}$

$\therefore$ **By alligation**

$\frac{4}{18}$ $\frac{10}{18}$

$\frac{9}{18}$

1 : 5

$\therefore$ amount of $X = \frac{1}{6} \times 42 = 7$ kg

and amount of $Y = \frac{5}{6} \times 42 = 35$ kg

13.

First	Alloy	Second	Alloy
C	Al	C	Al
1	2	3	1

$\therefore$

Required	alloy
C	Al
2	1

$\therefore$ Copper in first alloy $= \frac{1}{3}$

copper in second alloy $= \frac{3}{4}$

copper in required alloy (mixture) $= \frac{2}{3}$

Now, **by alligation**

$\frac{1}{3}$ $\frac{3}{4}$

$\frac{2}{3}$

$\left(\frac{3}{4} - \frac{2}{3}\right)$ $\left(\frac{2}{3} - \frac{1}{3}\right)$

$\frac{1}{12} : \frac{1}{3}$

$\Rightarrow$ 1 : 4

Therefore, second alloy be mixed 4 times the first alloy.

14. Note in this type of question individual prices does not matter. To prove this solve it algebrically.

$$\text{Exchanged amount} = \frac{3 \times 150 + 5 \times 90}{2(3+5)}$$

$$= \frac{450}{8} = 56.25 \text{ litre}$$

Here 3 and 5 are obtained from the ratio of amounts *i.e.*, from 90 and 150.

15. Here the ratio of mixtures (*i.e.*, milk, water) does not matter. But the important point is that whether the total amount (either pure or mixture) being transferred is equal or not. Since the total amount (*i.e.*, 5 cups) being transferred from each one to another, hence $A = B$.

HINT You can verify it very easly by considering a simple example.

16. CP. of rasgulla = Rs. 9 (since profit is 66.66%)
Now by alligation

(Flour) $3x$ $7x$ (Sugar)

9

5 3

$\frac{(9-3x)}{(7x-9)} = \frac{3}{5} \Rightarrow x = 2$

$\therefore$ Price of sugar $= 7x =$ Rs. 14 per kg.