Aptitude & Reasoning Handbook

Milestone - 1

Aptitude	Reasoning
LCM & HCF	Odd man out & Analogy
Ratio & Proportion	Number series
Problems on Ages	Coding & decoding
Mixture and Alligation	Direction sense
Percentage	
Profit and loss	
Simple Interest	
Compound Interest	
Progression (AP)	

ODD MAN OUT

Introduction:

In this, out of the given options, you have to choose, which one is different or odd one out, i.e. one which is not related to others .

Based on numbers :

1. 2, 5, 10, 17, 26, 37, 50, 64
   A) 50 B) 37 C) 26 D) 64
2. 56, 72, 90, 110, 132, 150
   A) 72 B) 110 C) 132 D) 150
3. 125, 127, 130, 135, 142, 153, 165
   A) 153 B) 165 C) 142 D) 127
4. 7 ,9 ,19 ,18 ,31, 29
   A) 31 B) 29 C) 18 D) 19
5. 331, 482, 551, 263, 383, 362, 284
   A) 263 B) 383 C) 331 D) 551
6. 582, 605, 588, 611, 634, 617, 600
   A) 634 B) 611 C) 605 D) 600
7. 8, 13, 21, 32, 47, 63, 83
   A) 47 B) 63 C) 32 D) 83
8. 1, 2, 6, 15, 31, 56, 91
   A) 31 B) 91 C) 56 D) 15
9. 52, 51, 48, 43, 34, 27, 16
   A) 27 B) 34 C) 43 D) 48
10. 125, 127, 130, 135, 142, 153, 165
    A)130 B) 142 C) 153 D) 165
11. 46080, 3840, 384, 48, 24, 2, 1
    A)1 B) 2 C) 24 D) 384
12. Find the one which does not belong to that group
    A)B4 B) E25 C) D16 D) I91
13. Find the one which does not belong to that group
    A)Baseball B) Boxing C) Chess D) Wrestling
14. Find the one which does not belong to that group
    A) PMS B) ROU C) GDJ D) KIM
15. Find the odd one which does not belong to the group
    A) BOQ B) EQV C) GIP D) KLR

ANALOGY

Introduction:

Analogy refers to the similarity in which we need to find similarities between the given entities and answer the unknown entity following this similarity.

Analogy Types:

Letter Based Analogy

In this type of analogy we have to move with letters. Where the letters where either forward or backward or they will be change in place etc.,

Example: EFG: HIJ : : PQR : ?

Number Based Analogy

In this type of analogy the problems were based on arithmetical operations like addition, subtraction, multiplication and division of numbers were used. Some of its examples are:

Examples: 4 : 8 :: 16 : ?

Words Based Analogy

Quantity and Unit Mass :Kilogram Force : Newton	**Individual and Group** Flowers : Bouquet Grapes : Bunch
Individual and Class Man : Mammal Ostrich : Bird	**Worker and Tool :** Carpenter : Saw Woodcutter : Axe
Worker and Place : Farmer : Field Warrior : Battlefield	**Animal &Young one :** Horse : Pony Cat : Kitten
Tool and Action : Knife : Cut Sword : Slaughter	**Male and Female :** Dog : Bitch Horse : Mare

QUESTIONS

1. Knife : Cut : : ? : Guard

   A)Dig B)Shield C)Oar D)Bore

2. Round : Earth : : ?

   A) Thin : Paper B) Height : Mountain

   C) Transparent : Glass D)Cube : Dice

3. Cube' is related to 'Square' in the same way as 'Square' is related to

   A)Plane B)Triangle C)Line D)Point

4. Foot : ? : : Hand : Wrist

   A)Length B)Shoe C)Ankle D)Leg

5. HCM : FAK :: SGD:?

   A) QIB B) ESQ C)GES D)QEB

6. CLOSE : DNRWJ : : OPEN : ?

   A) PRHR B) PRJQ C) RPJB D) RZWR

7. EGIK : LJHF :: SUWY : ?

   A)ZXVT B)LNPR C)MOQS D)TVXZ

8. GREAT : 25 : :NUMBER : ?

   A)36 B)38 C)27 D)24

9. NURTURE : ERUTRUN

   A) PRANK: KNARP B) PRANAK :KNPRA

   C) PRANK : NKARP D) PRANK : PNARK

10. NQ' is related to 'SV' in the same way as 'DG' is related to

    A) JM B) IK C) IL D) HK

11. 'MORE' is related to 'EORM' in the same way as 'SUIT' is related to

    A) TIUS B) IUST C) ISTU D) TUIS

12. 17 : 34 : : ? : 10

    A)11 B)8 C)5 D)15

13. 01 : 36 : : 2 : ?

    A)69 B)49 C)81 D)70

14. 41537 is related to 4 in the same way as 421 is related to

    A) 50 B)137 C)2 D)49

15. 12 : 30 : : 18 : ?

    A) 42 B) 44 C) 36 D) 45

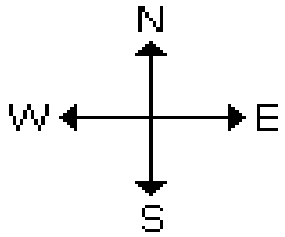
DIRECTIONS

What is direction?

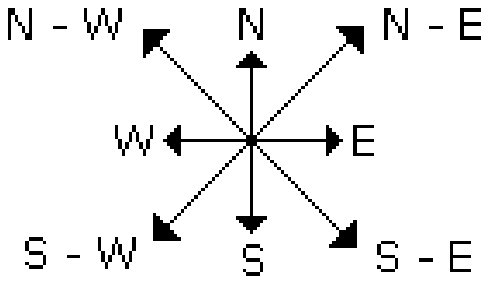
Direction is defined as the path that someone takes**.**

CONCEPT:

- There are four main directions - **East, West, North and South**



- There are four cardinal directions - **North-East (N-E), North-West (N-W), South-East (S-E), and South-West (S-W)**



- The direction does not depend on the person; it always remains the same.
- Left and right depend on the direction in which the person is facing.

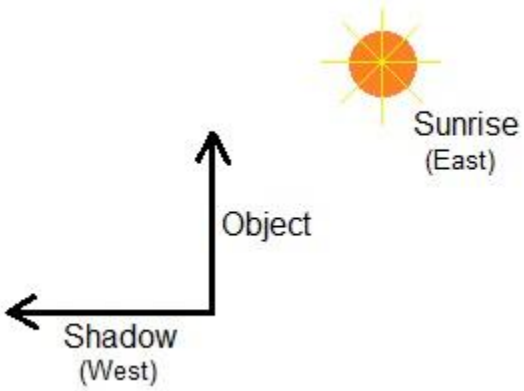
KEY POINTS:

Degree Concept:

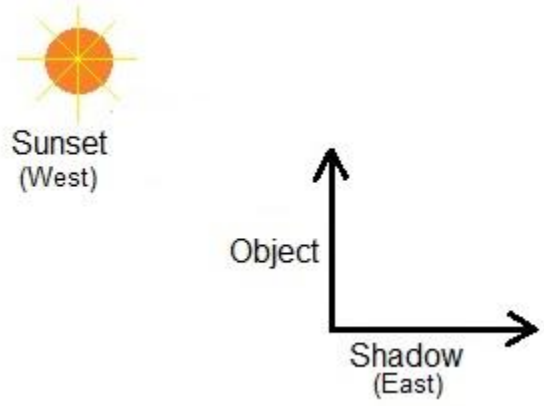
Clockwise	+
Anticlockwise (or) Counterclockwise	–

Shadow concept:

Shadow during the time of Sunrise: During the sunrise, the shadow of an object will always be towards the west.



Shadow during the time of Sunset: During the sunset, the shadow of an object will always be towards the east.



QUESTIONS

1. If South-East becomes North, North-East becomes West and so on. What will the West become?

   a) North-east b) North-west c) South-east d) South-west

2. Deepak starts walking straight towards the east. After walking 75 meters, he turns to the left and walks 25 meters straight. Again, he turns to the left and walks a distance of 40 meters straight. Again, he turns to the left and walks a distance of 25 meters. How far is he from the starting point?

   a) 35 meters b) 50 meters c) 115 meters d) 140 meters

3. If Rahim moves 20 meters in East direction, then turns to his left, then moves 15 meters, and then turns to his right and moves 25 meters, After this, he turns to his right and moves 15 meters. Now, how far is he from the starting point?

4. A man walks 1 km towards east, then turns to south and walks 5 km. Again, he turns to East and walks 2 km, after this, he turns to North and walks 9km. Now, how far is he from the starting point?

   a) 3 km b) 4 km c) 5 km d) 7 km

5. Radha moves towards the South-east a distance of 7 m, then she moves towards West and travels a distance of 14 m. From here, she moves towards North-west a distance of 7 m, and finally, she moves a distance of 4 m towards East and stands at that point. How far is the starting point from where she stood?

   a) 3 meters b) 4 meters c) 10 meters d) 11 meters

6. Sanjeev walks 10 meters towards the South. Turning to the left, he walks 20 meters and moves to his right. After moving a distance of 20 m, he turns to the right and walks 20 m. Finally, he turns to the right and moves a distance of 10 m. How far and in which direction is he from the starting point?

   a) 10 m, North b) 20 m, South c) 20 m, North d) 10 m, South

7. A man is facing south. He turns 135° in the anti-clockwise direction and then 180° in the clockwise direction. Which direction is he facing now?

   a) North - east b) North - west c) South - east d) South - west

8. A man is facing west and turns through 45° clockwise, again 180° clockwise, and then turns through 270° anticlockwise. In which direction is he facing now?

   a) West b) North-west c) South d) South-west

9. Facing the east, Rajesh turned left and walked 10 meters, then turned to his left again and walked 10 meters. He then turned 45° towards his right and went straight to cover 25 meters. In which direction from his starting point is he?

   a) South-west b) South-east c) North-west d) North-east

10. A watch reads 4.30 if the minute hand points east, in what direction does the hour hand point?

    a) North b) North-west c) South-east d) North-east

11. One morning, Udai and Vishal were talking to each other face to face at a crossing. If Vishal's shadow was exactly to the left of Udai, which direction was Udai facing?

12. Y is to the East of X which is to the North of Z. If P is in the South of Z, then in which direction of Y, is P?

Number Series

A number series is a sequential arrangement of numbers following a certain defined pattern.

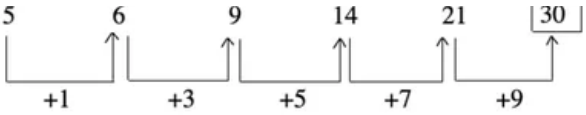
Different series based on certain patterns are discussed below.

I. Based on Addition/Subtraction of Numbers

These series follow the pattern of addition or subtraction of numbers.

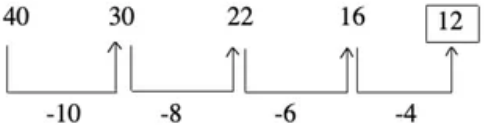
Example : 5, 6, 9, 14, 21, ?

Solution:



Example : 40, 30, 22, 16, ?

Solution:

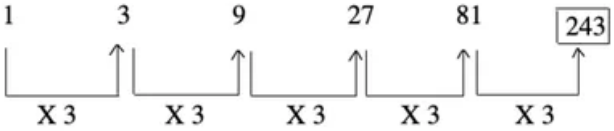


II. Based on Multiplication or Division of Numbers

These series follow the pattern based on multiplication and division of numbers.

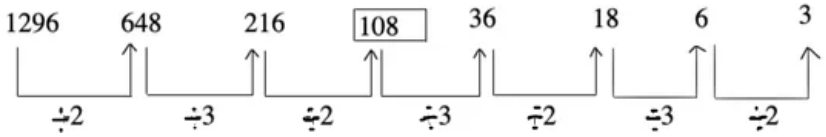
Example : 1, 3, 9, 27, 81, ?

Solution:



Example : 1296, 648, 216, ?, 36, 18, 6, 3

Solution:

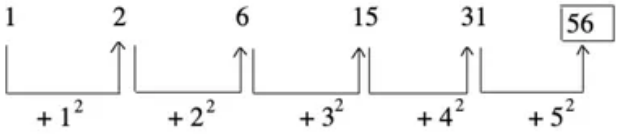


III. Based on Addition/Subtraction of Squares/ Cubes of Natural Numbers

These series follow the pattern based on addition/subtraction of squares and cubes of natural numbers.

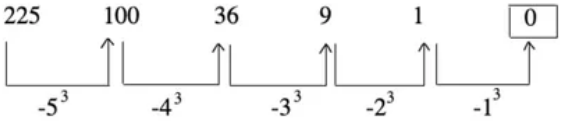
Example : **1, 2, 6, 15, 31, ?**

Solution :



Example : 225, 100, 36, 9, 1, ?

Solution :

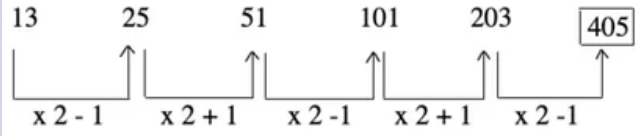


IV. Based on Multiple Operation

These series follow the pattern based on more than one mathematical operations.

Example : 13, 25, 51, 101, 203, ?

Solution

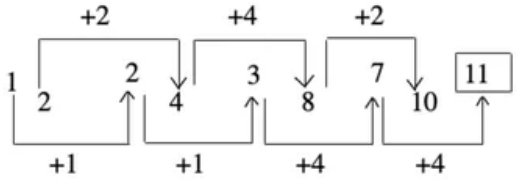


V. Based on Combination of Two or More Series

These series contains the combination of two or more series.

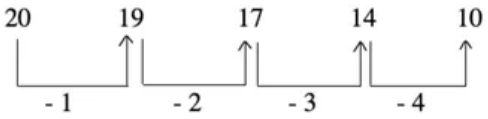
Example: 1, 2, 2, 4, 3, 8, 7, 10, ?

Solution :

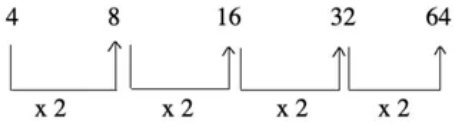


Some Tricks to Solve easily :

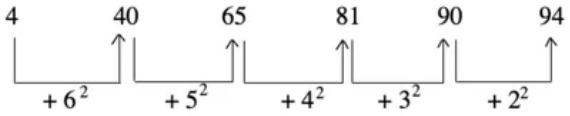
- If the change is slow or gradual, then it is a different series.



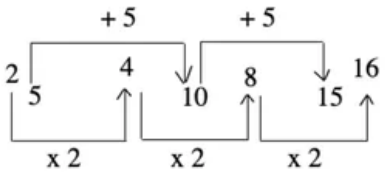
- If the change is equally sharp, then it is a ratio series.



- If the rise is sharp initially, but slows down later, then it is formed by adding squared, or cubed numbers.



- If the series is alternating, then it may be either a mixed series, or two different operations going on alternately.



Questions

Find the missing terms :

1. 57600, ?, 720, 120, 30, 15
2. 1.5, 2.5, 4, 6, ?, 11.5
3. 125, 148, 174, 203, 235, ?
4. 1, 12, 14, ?, 66, 142
5. 15, 120, ?, 5040, 25200, 100800
6. 13, 14, 26, 108, ? , 13712
7. 5 , 3 , 4, ? , 17, 45, 138
8. 8, 17, 34, 58, 88, ?
9. 200, 369, 513, 634, ?
10. 32, 36, 52, 88, 152, ?

Find the wrong terms:

1. 4, 2, 3.5, 7.5, 26.25, 118.125
2. 1, 3, 9, 31, 128, 651, 3913
3. 2, 3, 10, 40, 172, 885, 5346
4. 64, 96, 146, 216, 324
5. 25, 35, 50, 75, 110, 155, 210
6. 972, 484, 240, 118, 56, 26.5, 11.25
7. 900, 890, 879, 858, 830, 795, 753
8. 11, 13, 16, 33, 100, 356
9. 49, 60, 98, 102, 133,135
10. 2, 8, 12, 27, 58, 121`

CODING AND DECODING

What is Coding and Decoding?

Coding is a part of the logical reasoning section used to encrypt words, numbers in specific patterns or codes using particular rules and regulations.

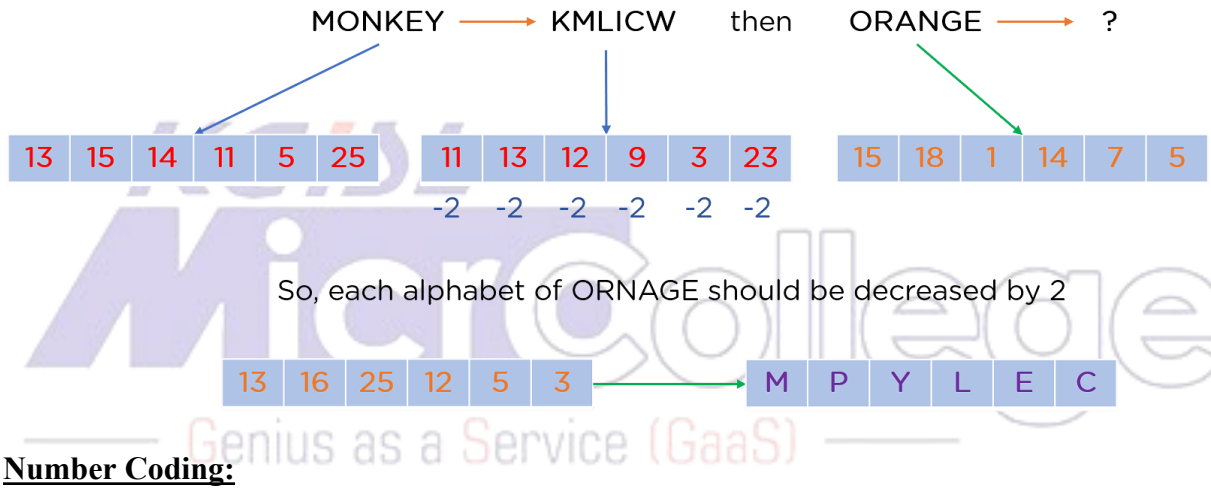
Decoding is the process that is used to decrypt the patterns into original forms from the given forms.

TYPES OF CODING AND DECODING WITH EXAMPLE

Letter Coding:

Letter Coding is a type in which the letters are replaced with other letters

Example:



Number Coding:

In the Number Coding section, once the parent code is known, the candidate will have to use this code to generate other numbers.

Example:

Explanation: The code of every letter is already specified in the question itself, so no need to use fixed codes of the letters.

Substitution Coding:

In substitution coding, it assigns particular objects to code names.

Example:

If 'white' is called 'red', and 'red' is called 'blue', 'blue' is called 'green', 'green' is called 'yellow', 'yellow' is called 'black', and what is the colour of blood?

Explanation:

As we know, the blood is red. So if you observe the above question, it is mentioned that white is called red and red is called blue. So blood is red by using the substitution method, the answer would be blue.

Mixed Letter Coding:

In this type of question, three or four complete messages are provided in the coded language, and the code for the particular word is asked. To analyze such codes, and if any two messages bearing the common word, are picked. The common code word will be that word.

Example:

In the code language,
1) 'Ha ka bow' means How are you
2) 'ka te ma' means where are they
3) 'se re tho' means good and bad
What does ‘are’ stand for?

Explanation:

If you observe the question, it is mentioned that both the 1st and 2nd statements are repeated.
So the common word in both these statements is KA. The rest of each word is different. So, "are" stands for ka.
So, according to mixed letter coding, "are" stands for "ka".

Mixed Number Coding:

In this mixed number-coding question, three or four complete messages are given in the coded language, and the code number for a particular word is asked.

Example:

If 'the monster hunter' is coded as 324,and 'will be the' is coded as 476, and 'they are in' is coded as 158. Which digit represents the?

Explanation:

If you observe the question in two statements, the is repeated, and in both the two statements, the only repeated letter is 4. So, as per mixed number coding, the exact code for "the" is "4".

QUESTIONS

Code Consists of Meaningful words

1. If 'sky' is called as 'star', 'star' is called as 'cloud', 'cloud' is called as 'earth', 'earth' is called as 'tree', and 'tree' is called as 'book', then where do the birds fly?
2. In certain code language blue is called black, black is called white, white is called red, red is called green. Green is called pink, pink is called yellow, then the color of human blood. Is?

Codes based on English Alphabets

3. If APPLE is coded as DSSOH then RABBIT will be coded as ?
4. If APTITUDE is coded as BRWMYAKM then REASONING is coded as ?
5. In a certain code of numbers GREEN is written as 209222213. How would YELLOW be written in that code?
6. If 'Development' is written as UOFNQPMFWFE. Then 'Evaluation' will be written as
7. In a code TIGER is written as SHFDQ, how shall HORSE be written in that code?
8. If 'COUNSEL' is to 'BITIRAK' so also 'GUIDANCE' is to
9. If BOMBAY is written as MYMYMY, how will TAMIL NADU be written in that code?
10. If SYMBOL is written as NZTMPC is a certain code. How is NUMBER will be coded?
11. If 'ORIENT' is coded as PQJDOS then what is the code for 'MOBILE'?
12. In a certain code language OFFICE is written as NGGHDF. How is DENOTE written in that code language?

Codes based on Numbers and Symbols

13. If UNIVERSITY is 1273948756, how can TRUSTY be written in that code?
14. In a certain code, RAID is written as %#*$, RIPE is written as % * @ ©. How is DEAR written up in that code?
15. In a certain code, MEAN is written as $57* and DOME is written as 93$5. How is MOAN written in that code?
16. In a certain code language, if the value of 28+14=50 and 36+43=63 then what is the code of 44+52=?

Codes based on Words

17. If B = 2, BAG = 10, then BOX = ?

18. If A = 2, M = 26, Z = 52, then RAT = ?
19. If D = 4 and READ is coded as 7, then what is HEAR coded as?
20. If ZOO is coded as 2, TAN is coded as 8, then what is the code for WAR?
21. If REASON is coded as 5 and BELIEVED as 7, then what is the code for GOVERNMENT?

Coded Sentence

22. In a certain code language, '743' means 'mangoes are good' ; '657' means 'eat good food' and '934' means 'mangoes are ripe'. Which digit means 'ripe' and ‘mangoes are’ in that language ?
23. In a certain code language,

    ‘kew xas huma deko’ means ‘she is eating apples’;

    ‘kew tepo qua’ means ‘she sells toys’ and

    ‘sul lim deko’ means ‘I like apples’

    Which word in that language means ‘she’ and ‘apples’?

24. ‘Worst Thing To Happen’ is coded as ‘ip tn bl rm’

    ‘Stay Close To Heart’ is coded as ‘pc ap ha bl’

    ‘Your Stay Was Worst’ is coded as ‘jr rm ha pi’

    ‘Thing Stay In Heart’ is coded as ‘ma pc ha tn’

    What does the code ‘jr’ stand for in the given code language?

    Which of the following is the code for ‘Worst Stay’ in the given code language?

25. "Music is natural medicine" is coded as "5#U 2^I 7&A 8*E“

    "Eating vegetable makes healthy" is coded as "6$E 9=E 5#A 7&E“

    "Health and Money balance" is coded as "6$E 3%A 5#O 7&A“

    "Life extra wonderful now" is coded as "4@I 5#E 9=O 3%O“

    1. What would be the code for "Weather"?
    2. What is the code for "Balanced diet"?

LCM AND HCF

LCM - LEAST COMMON MULTIPLE:

L.C.M. defines the least number that is exactly divisible by two or more numbers.

HCF- HIGHEST COMMON FACTOR:

The H.C.F. defines the greatest factor present between two or more numbers.

HCF AND LCM OF FRACTIONS :

$$\text{L.C.M of given fractions} = \frac{\text{L.C.M of numerators}}{\text{H.C.F of denominators}}$$

$$\text{H.C.F of given fractions} = \frac{\text{H.C.F of numerators}}{\text{L.C.M of denominators}}$$

PRODUCT OF TWO NUMBERS :

The product of two numbers (xy) = H.C.F x L.C.M

SAME AND DIFFERENT REMAINDER:

- The greatest number that will exactly divide a, b and c is **HCF(a, b, c)**.
- The greatest number that will divide a, b and c leaving remainder of x, y and z respectively is **HCF(a-x, b-y, c-z)**.
- The greatest remainder which when it divides a, b and c will leave the same remainder in each case is **HCF(a-b, b-c, c-a)**.
- The least number which is exactly divisible by a, b and c is **LCM(a, b, c)**.
- The least number which when divided by a, b and c leaves the same reminder r in each case is **LCM(a, b, c) + r**.
- The least number which when divided by a, b and c leaves the remainder x, y and z respectively is **LCM(a, b, c) – K**.
This is possible only if a-x = b-y = c-z = K.

QUESTIONS

Find LCM & HCF:

1. 12, 15, 18
2. 1/3 ,5/6 , 5/4, 10/7
3. 0.6, 9.6 and 0.36

Product of Numbers:

4. The LCM of two numbers is 2079, and their HCF is 27. If one of the numbers is 189, then what is the other number?
5. The H.C.F and L.C.M of two numbers are 11 and 385, respectively. If one number lies between 75 and 125 , then that number is
6. If the sum of two numbers is 55 and the H.C.F. and L.C.M. of these numbers are 5 and 120, respectively, then the sum of the reciprocals of the numbers is equal to:

Same & Different remainders - LCM

7. The least number that, when divided by 8, 12, and 16, leaves in each remainder 3, is
8. The least multiple of 7, which leaves a remainder of 4, when divided by 6, 9, 15, and 18, is:
9. Find the least number that, when divided by 10, 9, and 8 leaves remainders of 9, 8, and 7 respectively in each case.

Same & Different remainders - HCF

10. Find the Greatest Number that will divide 43, 91 and 183 so as to leave the same remainder in each case
11. The greatest number that will divide 148, 246, and 623 leaving remainders 4, 6, and 11, respectively, is

Least and Highest 3 or 4 digit Number (Only LCM)

12. Find the least number of 4 digits that is divisible by 4, 6, 8, and 10 and leaves no remainder.
13. Find the smallest 4 digit number such that, when divided by 12, 18, 21, 28, the remainder is 3 in each case.
14. Find the greatest number of three digits that, when divided by 2, 3, 4, and 5, leaves 1, 2, 3, and 4 as remainders, respectively.
15. Find the greatest 4 digit number that, when divided by 12, 15, 20 and 35 leaves no remainder.

Ratio based questions:

16. Three numbers are in the ratio of 3 : 4 : 5 and their L.C.M. is 2400. Their H.C.F. is:
17. The ratio of two numbers is 3 : 4 and their H.C.F is 4. Their L.C.M

Application based:

18. Three friends, J, K, and L, jog around a circular stadium and complete one round in 12, 18 and 20 seconds, respectively. In how many minutes will all three meet again at the starting point?
19. The traffic lights at three different road crossings change every 40 sec, 72 sec and 108 sec respectively. If they all change simultaneously at 5 : 20 : 00 hours, then find the time at which they will change simultaneously.
20. Six bells commence tolling together and toll at intervals of 2, 4, 6, 8 10 and 12 seconds, respectively. In 30 minutes, how many times do they toll together?
21. A merchant has three different types of milk: 25 liters, 55 liters, and 125 liters. Find the least number of casks of equal size required to store all the milk without mixing.

RATIO & PROPORTION

A ratio is a mathematical expression for comparing two similar or different quantities by division.

This expression can be expressed in ratio-to-percentage form by the conversion method.

It is denoted by the ':' symbol.

For example, 2:3

Finding Ratio:

1. If a:b = 2:3 and b:c = 4:5, then a:b:c =?
2. If a:b = 2:3 and b:c = 4:5 and c:d= 6:7 then a:b:c:d =?
3. If a:b = 1 ½ : 2 ¼ and b:c = 2:3 ½, then what is a:b:c equal to?
4. If 0.75 : x **::** 5 : 8, then x is equal to :

Divided into parts:

5. The sum of three numbers is 140. If the ratio of the first to the second is 2:3 and that of second to the third is 4:5 then what is the second number?
6. Find B's share in Rs. 6300 if A:B = 2:3, B:C = 4:5 and C:D = 3:7
7. The cost of making an article is divided between materials, labor, and overheads in the ratio of 3:4:1. If the material costs Rs. 234, then what is the labor cost?

Based on numbers:

8. The ratio of two numbers is 6:7 and the sum is 650. Find the first number?
9. 20% and 50% are two numbers, respectively, more than a third number. Find the ratios of two numbers?
10. In a school, the number of boys and the number of girls are in the respective ratio of 2:3. If the number of boys is increased by 20% and that of girls is increased by 10%, what will be the new ratio of the number of boys to the number of girls?
11. A sum of money is to be distributed among P, Q, R and S in the proportion 2:5:6:7. If S gets Rs. 500 more than R, What is P's share?
12. Rs 650 was divided among 3 children in the ratio 2 : 4 : 7. Had it been divided in the ratio 1/2 : 1/4 : 1/7. Who would have gained the most, and by how much?

Increase / Decrease:

13. The ratio between two numbers is 2:3. If each number is increased by 4, the ratio between them becomes 5:7, the difference between numbers.
14. What number has to be added to each term of 4 : 7 to make the ratio 5 : 6?
15. A, B, and C divide Rs 4200 among themselves in the ratio 7 : 8 : 6. If Rs 200 is added to each of their shares, what is the new ratio in which they will receive the money?
16. Salaries for Ravi and Sumit are in the ratio 2 : 3. If the salary of each is increased by Rs. 4000, the new ratio becomes 40 : 57. What is Sumit's salary?

Income / Expenditure

17. The income of Riya and Priya is in the ratio of 4:5 and their expenditure is in the ratio of 2:3. If each of them saves Rs. 2,000, then find their income.
18. If the ratio of income in two consecutive years is 2:3 respectively, the ratio of their expenditure is 5:9. The income for the 2nd year is Rs. 45,000, and expenditure for the 1st year is Rs. 25000. Find the savings in both years?

Coins:

19. A box contains 280 coins of one rupee, 50-paise and 25 paise. The value of each kind of coin is in the ratio of 8 : 4 : 3. Then the number of 50 paise coins is
20. David has Rs. 30 rupees in the denomination of 25 paisa, 10 paisa, and 5 paisa in ratio 1:2:3. Calculate how many 25 paise coins he has.

Partnership:

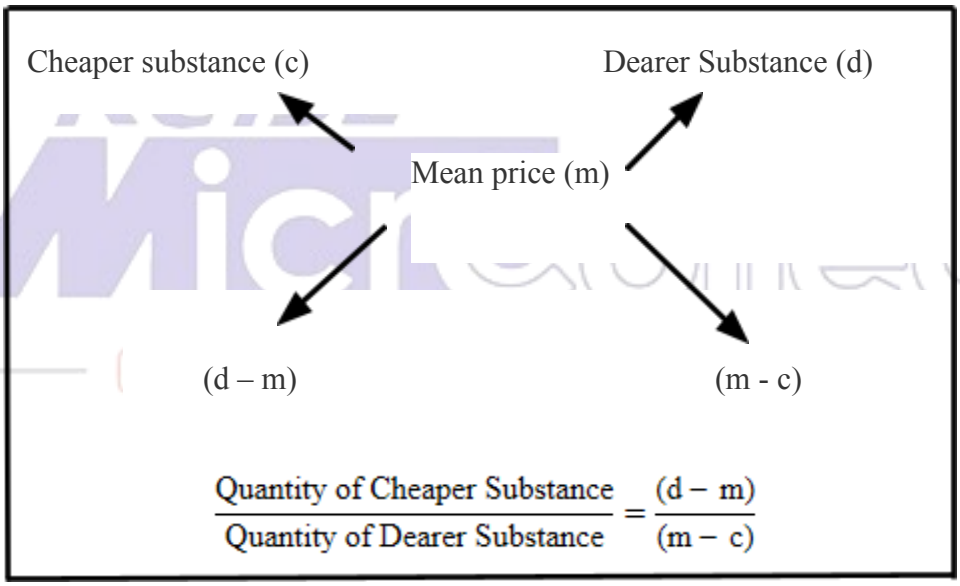
21. A starts business with Rs. 3500, and after 5 months, B joins with A as his partner. After a year, the profit is divided in the ratio 2 : 3. What is B's contribution to the capital?
22. A and B started a partnership business, investing some amount in the ratio of 3 : 5. C joined them after six months with an amount equal to that of B. In what proportion should the profit at the end of one year be distributed among A, B, and C?
23. A, B, and C rent a pasture. A puts 10 oxen for 7 months, B puts 12 oxen for 5 months, and C puts 15 oxen for 3 months for grazing. If the rent of the pasture is Rs. 175, how much must C pay as his share of rent?
24. A and B invest in a business in the ratio 3 : 2. If 5% of the total profit goes to charity and A's share is Rs. 855, the total profit is:

Mixture and Alligation

Mixture	Alligation
Mixture is a combination of two or more elements to form a third element.	Alligation is a rule that helps us solve problems related to mixtures.

1. **Mean Price:** The cost of a unit quantity of the mixture is called the mean price

2. Rule of Alligation:



$$\frac{\text{Quantity of Cheaper Substance}}{\text{Quantity of Dearer Substance}} = \frac{(d - m)}{(m - c)}$$

3. Removed / Replaced

Suppose a container contains 'I_Q' units of liquid from which 'x' units are taken out and replaced by water. After n operations,

The quantity of pure liquid $F_Q = I_Q \left[1 - \frac{x}{c}\right]^n$

F_Q, Final Quantity
I_Q, Initial Quantity
x, Quantity of Replacement
c, Capacity of the container
n, Number of Replacement

Questions

Alligation Rule:

1. In what ratio should two varieties of sugar of Rs.18 per kg and Rs.24 kg be mixed together to get a mixture whose cost is Rs.20 per kg?
2. Two vessels A and B contain spirit and water in the ratio 5: 2 and 7:6 respectively. Find the ratio in which this mixture be mixed to obtain a new mixture in the vessel C containing spirit and water in the ratio 8:5?
3. How many liters of oil at Rs.40 per liter should be mixed with 240 liters of a second variety of oil at Rs.60 per liter so as to get a mixture whose cost is Rs.52 per liter?
4. A dishonest milkman professes to sell his milk at cost price but he mixes it with water and thereby gains 25%. The percentage of water in the mixture is:

Quantity Added

5. In a 729 liter mixture of milk and water, the ratio of milk to water is 7 : 2. to get a new mixture containing milk and water in the ratio 7 : 3, the amount of water to be added is:
6. A beaker contains acid and water in the ratio 1 : x. When 300 ml of the mixture and 50 ml of water are mixed, the ratio of the acid and the water becomes 2 : 5. What is the value of x?

Based on replacement

7. A container contains 40 liters of milk. From this container 4 liters of milk was taken out and replaced by water. This process was repeated further two times. How much milk is now contained by the container?
8. A can contains a mixture of two liquids A and B is the ratio 7 : 5. When 9 liters of mixture is drawn off and the can is filled with B, the ratio of A and B becomes 7 : 9. How many liters of liquid A was contained by the can initially?
9. In a Jar, 120 Liters of Milk was mixed with 24 Liters of water. 12 Liters of this mixture was taken out and 3 liters of water was added. If 27 Liters of newly formed mixture is taken out, what will be the resultant quantity of water (in Liter) in the Jar?
10. A jar full of whisky contains 40% alcohol. A part of this whisky is replaced by another containing 19% alcohol and now the percentage of alcohol was found to be 26%. The quantity of whisky replaced is:
11. A mixture of alcohol and water comprises 60% alcohol. First, 20% of the mixture is replaced with water and then the volume of the resultant mixture is increased by 20% by adding only alcohol. What is approx. percentage of alcohol in the final mixture?
12. Three equal glasses are filled with mixture. The proportion of milk and water in each glass is as follows: In the first glass as 3: 1, in the second glass 5: 3 and in the third as9:7. The contents of the three glasses are emptied into a single vessel. What is the proportion of milk and water in it?

PERCENTAGE

What is Percentage ?

Percentage means per 100, i.e., p% means p / 100

CONCEPT

1. To convert a fraction to a percentage, we multiply by 100
2. To convert a percentage to a fraction, we simply divide by 100

PERCENTAGE CONVERSION TABLE

1/1	100
1/2	50
1/3	33.333
1/4	25
1/5	20
1/6	16.667
1/7	14.285
1/8	12.5
1/9	11.111
1/10	10
1/11	9.0909
1/12	8.333
1/13	7.692
1/14	7.142
1/15	6.66

PERCENTAGE INCREASE OR DECREASE

1. A is what percentage of B $= \frac{A}{B} \times 100$
2. A is what percentage more than B $= \frac{A-B}{B} \times 100$
3. B is what percentage less than A $= \frac{A-B}{A} \times 100$
4. Percentage increase/decrease $= \frac{Difference\ value}{Initial\ Value} \times 100$

NET CHANGE

Net Change = $\pm\ x\ \pm\ y\ +\ \frac{xy}{100}$

CONSUMPTION BASED

1. If consumption increased $\left[\frac{R}{(100 + R)} \times 100\right]\%$
2. If consumption decreased, $\left[\frac{R}{(100 - R)} \times 100\right]\%$

POPULATION BASED

1. Population after n years $= P\left(1 + \frac{r}{100}\right)^n$
2. Population before n years $= \frac{P}{\left(1 + \frac{r}{100}\right)^n}$

DEPRECIATION BASED

The decrease in value is known as depreciation

1. Depreciation after n years $= P\left(1 + \frac{R}{100}\right)^n$
2. Depreciation before n years $= \frac{P}{\left(1 + \frac{R}{100}\right)^n}$

Questions

Finding 100%

1. In an examination, 65% of students pass, and the number of failures is 420. Find the total strength?
2. A fruit seller had some mangoes. He sells 30% mangoes and still has 280 mangoes. Find the number of mangoes he had.

Percentage Increase/ Decrease

3. If the price of rice is 30% less than that of wheat, the price of wheat is how much percent more than that of rice?
4. If the salary of Vivek is 25% more than the salary of Nilesh, then by what percent is the salary of Nilesh less than Vivek?
5. Two numbers are less than a third number by 30% and 37% respectively. How much percent is the second number less than the first?
6. A student multiplied a number by 3/5 instead of 5/3. What is the percentage error?

Net change

7. Ramesh's salary was reduced by 10% and then the reduced salary was increased by 10%. What was his ultimate loss?
8. If one side of a rectangle is first increased by 20% and the other side is decreased by 12%, then what is the change in area in percent?

Salary

9. Radha spends 40% of her salary on food, 20% on house rent, 10% on entertainment, and 10% on conveyance. If her savings at the end of the month are Rs 1500, then what is her monthly salary?
10. Surya spends 20% of his monthly salary on food, 40% of the remaining on house rent, and the balance amount is spent on other items of routine expenses. What is his yearly salary if he spends Rs. 5760 per month on other items of routine expenses?

Election

11. In an election that was contested by 2 candidates, one candidate got 40% of total votes and yet lost by 1000 sc votes. What is the total number of votes cast in the election?
12. In a particular constituency, 75% of voters cast their votes, out of which 2% were rejected. The winning candidate received 75% of the valid votes and bagged a total of 9261 votes. What is the total number of voters in the constituency?

Mark based

13. Y has to score 40% to pass. He gets 20 marks and fails by 40 marks. What are the maximum marks for the exam?
14. Two students appeared at an examination. One of them secured 9 more marks than the other, and his marks were 56% of the sum of their marks. What are the marks obtained by both of them?
15. In a test, A scored 10% more than B and B scored 5% more then C. If C scored 300 marks out of 400,then what are A's marks?
16. In an examination, P scored 30% marks and failed by 15 marks. Q scored 40% marks and obtained 35 marks more than those required to pass. Find the pass percentage.

Consumption

17. The price of diesel increases by 50%. Find out by what percentage a truck owner must reduce his consumption in order to maintain the same budget?
18. The price of rice falls by 25%. By what percentage can a person increase the consumption of rice so that his overall budget does not change?

Population/Machine

19. The population of a city is 50,000 at present. It increases at a rate of 10% per year. What will be its population in 3 years from now?
20. The population of a city is 24,200 at present. It increases at a rate of 10% per year. What was its population 2 years ago from present?
21. The town had a population of 50,000 in 1988. In one year, i.e. by 1989 it increased by 25%. Next year, i.e. in 1990, it decreased by 30%. The next year, in 1991 there was an increase of 40%. What was the population at the end of 1991?
22. The value of the lathe machine depreciates at a rate of 10% per year. If the cost of the machine at present is Rs. 160,000, then what will be its worth after 2 years?
23. The value of the Xerox machine depreciates at a rate of 10 % per annum. If the cost of the machine at present is Rs. 81,000, then what was the value of the machine before 2 years?
24. In a class, 15% of the total number of students failed in science, 25% of the total number of students failed in math, and 10% of total number of students failed in both. How many students passed in both math and science?

Profit and Loss

Cost Price (CP)

The amount paid for a product or commodity to be purchased is called the cost price. Also denoted as CP.

Selling Price (SP)

The amount for which the product is sold is called the Selling Price. It is usually denoted as SP.

Profit(P)

The amount gained by selling a product for more than its cost price

Profit or Gain = Selling price – Cost Price

Loss(L)

The amount the seller incurs after selling the product less than its cost price is mentioned as a loss.

Loss = Cost Price – Selling Price

The formula for the profit and loss percentage is:

$$\textbf{Profit percentage (P\%)} = \frac{Profit}{Cost\ Price} \textbf{ x 100}$$

$$\textbf{Loss percentage (L\%)} = \frac{Loss}{Cost\ Price} \textbf{ x 100}$$

1. **For false weight, profit percentage will be P% = [(True weight – false weight)/ false weight] x 100.**
2. **If P% and L% are equal then, P = L and %loss = $P^2/100$**

Marked Price Formula (MP)

This is basically labelled by shopkeepers as offering a discount to customers in such a way that,

Discount = Marked price - Selling price

$$\textbf{Discount Percentage} = \frac{Discount}{Marked\ Price} \textbf{ x 100}$$

If the first discount is a% and the second discount is b%, then

$$\text{Total discount} = (a + b - \frac{ab}{100})\ \%$$

Questions

Finding Profit & Loss %

1. The Cost price of a mobile is Rs. 5,000, and it sold for Rs. 5500. Find the profit percentage.
2. Pavithra buys an old cycle for Rs. 800 and spends Rs. 400 on its repairs. If she sells the cycle for Rs. 1800, her gain percent is:
3. If the manufacturer gains 20%, the wholesale dealer 20%, and the retailer 25%, then find the cost of production of a table if the retail price was Rs 1800.
4. If the cost price of 16 pens is equal to the selling price of 12 pens, what is the gain percent?
5. A dishonest shopkeeper used a weightage of about 900 grams for 1 kg. Find his profit percentage.
6. Some articles were bought at 6 articles for Rs. 5 and sold at 5 articles for Rs. 6. Gain percent is:

Finding Cost Price & Selling Price

7. A chair is bought for Rs. 650 and sold at a loss of 8%. Find its S.P.
8. A man sold an article for Rs. 1980 & gained 10%. Find C.P.
9. A man sold an article per piece for Rs 1500; he loses 25 % , Find C.P.
10. By selling an article for Rs. 990, a shopkeeper makes a loss of 10%. At what price should he sell the article so as to make a profit of 10%?
11. A person sells 12 oranges per rupee and suffers a loss of 10%. Find how many oranges per rupee are to be sold to have a gain of 8%?
12. By selling an article for Rs 480 more, Prakash would have made 5% profit on his sale instead of a 11% loss. What was his cost price?

Profit = Loss

13. The profit earned after selling an article for Rs. 1256 is the same as the loss incurred after selling the article for Rs. 1044. What is the cost of the article?
14. The percentage profit earned by selling an article for Rs. 960 is equal to the percentage loss incurred by selling the same article for Rs. 640. At what price should the article be sold to make a 25% profit?

Same product C.P with different percentages:

15. Anusha bought two fans for Rs. 1800 each and sold one at a loss of 20% and other at a profit of 30%. What will be the total loss or profit percentage?
16. Kalaivani sells two flats at Rs. 250000 each, making a profit of 20% on the first flat and a loss of 20% on the second flat. Find the net profit or loss that she makes?

Discount:

17. Successive discounts of 20% and 10% are equivalent to a single discount of
18. A trader lists his article at 20% above cost price and allows a discount of 10% on cash payments. Find his profit percentage.
19. The marked price of a watch is Rs. 600. The seller allows a discount of 10% and gains 8%. If no discount is allowed, find his profit percentage.
20. The difference between the discount of 15% and two successive discounts of 10% each on a certain bill was Rs. 32. Find the billed amount?
21. A dealer marks his goods 40% above the cost price. He then allows a discount on it and makes a profit of 10%. Find the rate of discount.

Problems on Ages

Problems on ages basically consist of information about the ages of two or more persons and a relationship between their ages in the past/present/future.

BEFORE/AFTER ' n' YEARS:

Suppose if the present age of a person is x, then

after "n" years	The age of the person will be(x+n) years
before "n" years	The age of the person will be(x-n)years
n times the present age	The age of the person will be(x*n)years
$\frac{1}{n}$ of the age	The age of the person will be(x/n)years

Representation of Ratio

Sentence form	Ratio (A:B)
A is twice as B	2:1
A is five times of B	5:1
A is half of B	$\frac{1}{2}$:1⇒1:2
A is Two third of B	$\frac{2}{3}$:1⇒2:3
A is one fourth of B	$\frac{1}{4}$:1⇒1:4
A is $\frac{5}{2}$ times of B	$\frac{5}{2}$:1⇒5:2

Questions

Ratio Method

1. Five years ago, the ages of A and B were 1:2. At present the ratio is 3:4 . Find the present age of A?
2. One year ago, the ratio of Honey and Piyush ages was 2: 3 respectively. After five years from now, this ratio becomes 4: 5. How old is Piyush now?
3. Present ages of Sam and Anand are in the ratio of 5 : 4 respectively. Three years hence, the ratio of their ages will become 11 : 9 respectively. What is Anand's present age in years?
4. The ratio of the present ages of P and Q is 3 : 4. Five years ago, the ratio of their ages was 5 : 7. Find their present ages.

Thrice / Twice Method

5. The age of the father 3 years ago was 7 times the age of his son. At present, the father's age is five times that of his son. What are the present ages of the father and the son?
6. Ravi was thrice as old as Raghu 6 years back. Ravi will be 5/3 times as old as Raghu 6 years hence. How old is Raghu today?
7. Ten years ago, P was half of Q in age. If the ratio of their present ages is 3:4, what will be the total of their present ages?
8. Father is aged three times more than his son Ronit. After 8 years, he would be two and a half times of Ronit's age. After further 8 years, how many times would he be of Ronit's age?
9. Rajeev's age after 15 years will be 5 times his age 5 years back. What is the present age of Rajeev ?

Based on Addition/ Subtraction

10. Ratio between Rahul and Deepak is 4:3, After 6 Years Rahul's age will be 26 years. What is the present age of deepak?
11. The present ages of three persons are in proportions 4 : 7 : 9. Eight years ago, the sum of their ages was 56. Find the present age of brothers.

12. The ratio of father's age to son's age is 4:1. The product of their ages is 196. What will be the ratio of their ages after 5 years?
13. The total age of A and B is 12 years more than the total age of B and C. C is how many years younger than A.
14. The sum of the ages of a mother and her daughter is 50 yrs. Also 5 yrs ago, the mother's age was 7 times the age of the daughter. What are the present ages of the mother and the daughter?
15. A is two years older than B who is twice as old as C. If the total ages of A, B and C are 27, then how old is B?

Average

16. Ram and Shyam's average age is 65 years. The average age of Ram, Shyam and John is 53 years. What is the age of John?
17. Three years ago, the average age of Anita, Priya, and Varsha was 27 years. If five years ago, the average age of Priya and Varsha was 20 years, find the present age of Anita.
18. The average age of a couple at the time of marriage was 20 years. After 8 years they have a kid of 4 years old. Find the average age of the family when the baby was born?

SIMPLE INTEREST

Principal

Principal (or the sum) is the money borrowed or lent out for a certain period. It is denoted by P.

Amount

The Addition of Simple Interest and Principle is called the Amount.

Interest

Interest is the extra money paid by the borrower to the owner (lender) as a form of compensation for the use of the money borrowed calculated on the basis of Principle.

Time

This is the duration for which money is lent/borrowed. Rate of Interest It is the rate at which the interest is charged on principal.

Simple Interest :

Simple Interest (S.I.) is the method of calculating the interest amount for a particular principal amount of money at some rate of interest.

For example, when a person takes a loan of Rs. 5000, at a rate of 10 % p.a. for two years, the person's interest for two years will be S.I. on the borrowed money. That is, Rs.1000.

Formula :

To calculate Simple Interest,

$$S.I = \frac{P \times N \times R}{100}$$

Where,

P = principal (or) Sum , R = interest rate (in percentage) , N = time duration (in years)

From the above formula, we can derive the followings :

$$P = \frac{100 \times S.I}{N \times R}, N = \frac{100 \times S.I}{P \times R}, R = \frac{100 \times S.I}{P \times N}$$

In order to calculate the total amount, the following formula is used :

Amount (A) = Principal (P) + Interest (I)

Some Tricks to Solve easily :

- If a sum of money becomes “n” times in “T years” at simple interest, then the rate of interest per annum can be given be

$$P = \frac{100\,(n-1)}{T}$$

- A sum of money at simple interest N itself in T year. It will become n times of itself in t years (If Rate is constant),Then

$$\frac{T}{t} = \frac{(N-1)}{(n-1)}$$

QUESTIONS

Finding S.I:

1) Find S.I and an amount for Rs.20000 at 6% for 3 years.
2) The simple interest on a sum of money will be Rs.600 after 10 years. If the principal is tripled after 5 years what will be the total interest at the end of the tenth year?
3) Sonika deposited Rs.8000 which amounted to Rs.9200 after 3 years at simple interest. Had the interest been 2% more. She would get how much?

Finding Principal :

4) A sum of money at simple interest amounts to Rs. 815 in 3 years and to Rs. 854 in 4 years. The sum is?
5) A person lent a certain sum of money at 4% per annum at simple interest and in 8 years the interest amounted to Rs.340 less than the sum lent. What was the sum lent?
6) Rs.2500 is divided into two parts such that if one part is put out at 5% simple interest and the other at 6%, the yearly annual income may be Rs.140. How much was lent at 5%?
7) A sum of Rs.2600 is lent in two parts so that the interest on the first part for a period of 3 years at 5% may be equal to the interest on the second part for 6 years at 4%. The second part is equal to ?

Finding Rate of Interest

8) At what rate percent on simple interest will Rs.750 amount to Rs.900 in 5 years?
9) A certain sum amounts to Rs.1725 in 3 years and Rs.1875 in 5 years. Find the rate % per annum?

Finding Amount

10) If Rs.450 amounts to Rs.540 in 4 years, what will it amount to in 6 years at the same rate % per annum?
11) An amount of Rs. 3000 becomes Rs. 3600 in four years at simple interest. If the rate of interest was 1% more, then what was the total amount?

Finding Time Period:

12) In how many years does a sum of Rs. 5000 yield a simple interest of Rs. 16500 at 15% p.a.?
13) The simple interest on a sum of money is 4/9 of the principal and the number of years is equal to the rate percent. Find the rate and the time?
14) What will be the ratio of simple interest earned by a certain amount at the same rate of interest for 6 years and that for 9 years?

Doubles or Triples:

15) At what rate percent on simple interest will a sum of money four times itself in 10 years?
16) A sum of money becomes triple itself in 5 years at simple interest. How many years will it become six times at the same rate?

COMPOUND INTEREST

Compound Interest is interest based on the initial amount of principal and interest collected over a period of time.

The compound interest formula is given below:

When Compounded Annually,

$$Amount = P[1 + \frac{R}{100}]^{n}$$

When Compounded Half yearly,

$$Amount = P[1 + \frac{R/2}{100}]^{2n}$$

When Compounded Quaterly,

$$Amount = P[1 + \frac{R/4}{100}]^{4n}$$

Where,

A = amount , P = principal , r = rate of interest , n = time (In years)

And,

$$C.I. = Amount - Principal$$

Tricks to Solve :

- When time is fraction of a year, say $6\frac{3}{4}$ years, Then,

$$Amount = P[1 + \frac{R}{100}]^{6}[1 + \frac{\frac{3}{4}R}{100}]$$

- Difference of S.I. and C.I. is given for 2 years $= P[\frac{R}{100}]^{2}$
- Difference of S.I. and C.I. is given for 3 years $= P[\frac{R^3}{100} + 3\frac{R^2}{100}]$
- If a sum becomes X in N years,and it becomes Y in (N+1) years, Then

$$Rate\ of\ Interest = \frac{Difference\ between\ X\ and\ Y}{Lowest\ Value} \times 100$$

QUESTIONS

Finding C.I. & Amount:

1. Find the C.I. & amount for Rs. 5000 at 10% per annum for 2 years ?
2. Find the C.I. for Rs. 20000 at 20% for 1 yr 6 months which is compounded half-yearly ?
3. Find the C.I. for Rs.10000 at 12% for 9 months which is compounded quarterly?

Finding Rate of Interest:

4. An amount of Rs. 500 amounts to Rs. 583.20 in two years if compounded annually. Find the rate of interest per annum.
5. Compound interest earned on a sum for the second and the third years are Rs.1200 and Rs.1440 respectively. Find the rate of interest?

Finding Time:

6. Rs.8000 becomes Rs.9261 in a certain interval of time at the rate of 5% per annum of C.I. Find the time?
7. In what time will Rs 5400 amount to Rs 6773.76 at 12% per annum compounded annually?

Finding Principal:

8. A certain sum amounts to Rs. 2420 in 2 years and to Rs. 2662 in 3 years. Find the sum.
9. A certain sum amounts to Rs. 7000 in 2 years and to Rs. 8000 in 3 years. Find the sum

Doubles & Triples:

10. A sum of money doubles itself at compound interest in 10 years. In how many years will it be eight times?
11. A sum of money triples itself in 3 years at compound interest. In how many years will it become 9 times itself ?

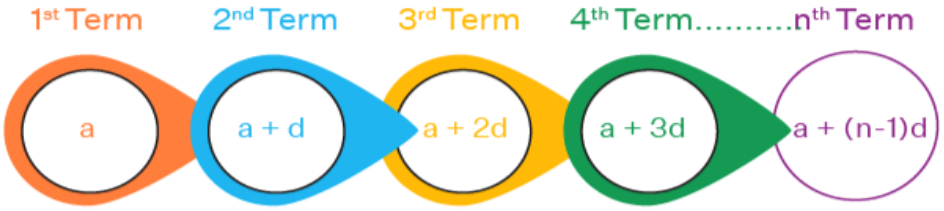
Difference b/w S.I & C.I

12. The difference between C.I. and S.I. a certain sum at 10 % per annum for 2 years is Rs. 530. Find the sum.
13. The difference between C.I. and S.I. accrued on an amount of Rs. 20,000 in 2 years was Rs. 392. Find the rate of interest per annum.

Arithmetic Progression

Introduction:

An arithmetic progression (AP) is a sequence of numbers in which each successive term is the sum of its preceding term and a fixed number. This fixed number is called the common difference



Here,

'a' is the first term and

'd' is the common difference (fixed number)

Arithmetic Progression

An arithmetic progression is a sequence of numbers such that the difference d between each consecutive term is a constant.

$a, a+d, a+2d, a+3d, \ldots\ldots$

The n^{th} term, $a_n = a + (n-1)d$

Sum of first n terms, $S_n = \frac{n}{2}[2a + (n-1)d]$

$= \frac{n}{2}[a + l]$

Some Special Series

1. $1 + 2 + 3 + 4 + \ldots\ldots + n = \frac{n(n+1)}{2}$
2. $1^2+2^2+3^2+4^2+\ldots+n^2 = \frac{[n(n+1)(2n+1)]}{6}$
3. $1^3+2^3+3^3+4^3+\ldots+n^3 = \frac{[n(n+1)]^2}{4}$

QUESTIONS

1. Find the nth term of AP: 1, 2, 3, 4, 5…., an, if the number of terms are 15.
2. Find the value of n, if a = 10, d = 5, an = 95.
3. Find the 20th term for the given AP:3, 5, 7, 9, ……
4. Find the sum of the natural numbers up to 15 numbers.
5. Find the sum of the first 30 multiples of 4.
6. Which term of the AP: 3,10,17,.. will be 84 more than its 13th term?
7. In an AP, the ratio of the 2nd term to the 7th term is 1/3. If the 5th term is 11, what is the 15th term?
8. How many 3-digit numbers are completely divisible by 6?
9. The 4th and 10th terms of an AP are 13 and 25 respectively. Find the first term and the common difference of the AP. Also, find its 17th term.
10. Discover three numbers in A.P. whose sum is 15 and it's multiple is 80.
11. Find the sum of the first 16 terms of an AP whose first term and third term are 5 and 15 respectively.
12. In an AP of 21 terms, the sum of the first 3 terms is -33, and that of the middle 3 is 75. What is the sum of the AP?