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1- Number System

(Types of Numbers)

1. **Natural Numbers –** The numbers 1, 2, 3, 4, 5……..are called natural numbers or positive numbers.

   Example: 1, 2, 3, 4, 5……..

2. **Whole Numbers –**The numbers including "0" and all natural numbers are called the while numbers.

   Example: 0, 1, 2, 3, 4, 5……..

3. **Integers –** The numbers including 0 and all the positive and negative of the natural numbers are called integers.

   Example: ……-3, -2, -1, 0, 1, 2, 3……

4. **Rational Numbers –** A number in the form of p/q where p and q are integers and q≠0.

   Example:$\frac{17}{4} = 4.25, \frac{2}{5} = 0.4$

   Note: Rational numbers are either terminating or non-terminating periodic fractions.

   Example: $\frac{16}{3} = 5.333333 \ldots, \frac{20}{6} = 3.33333333 \ldots, 9.2323232323 \ldots, 9.\overline{23}$

5. **Irrational Numbers –** Fractions which cannot be expressed in the form of a proper fraction p/q, where q≠0.

   Example: $\sqrt{2}, \sqrt{5}, \pi$ etc.

   Note: Irrational numbers have non-terminating and non-periodic (or repeated) digits after decimal.

   Example: $\pi = \frac{22}{7} = 3.142857142 \ldots \ldots \ldots \ldots \ldots$

6. **Real numbers –** The set of natural numbers, integers, whole numbers, rational numbers, and irrational numbers constitute the set of real numbers.

7. **Even Numbers –** The numbers that are divisible by 2 are called even numbers.

   Example: 2, 4, 6, 8, 16, 32 etc.

8. **Odd Numbers –** The numbers that are not divisible by 2 are called odd numbers.

   Example: 3, 5, 7, 9, 15 etc.

9. **Prime Numbers –** Those numbers which are divisible by themselves and 1 are called prime numbers or a number which has only two factors 1 and itself is called a prime number.

   Example: 2, 3, 5, 7 etc.

10. **Twin Primes –** A pair of prime numbers when they differ by 2 are called twin prime numbers.

Example: (3, 5), (5, 7), (11, 13), (17, 19) etc.

11. **Co-prime Numbers –** A pair of two natural numbers are said to be co-prime if their G.C.D. or H.C.F. is 1.

Example: H.C.F. (3, 4) = 1, H.C.F. (13, 15) = 1 then (3, 4) and (13, 15) are co-prime numbers.

12. **Composite Numbers –** The natural numbers which are not prime are called composite numbers OR numbers that have factors other than itself and 1, are called composite numbers.

Example: 4, 6, 9, 16, 25 etc.

Note: 1 is neither a composite number nor a prime number.

13. **Perfect Numbers –** If the addition of all the factors of a number excluding the number itself happens to be equal to the number, it is called a perfect number.

First perfect number is 6.

Factors of 6 are 1, 2, 3, 6.

Now add all the factors excluding 6.

1+2+3 = 6, hence 6 is a perfect number.

Example: 28, 496 and 8128.

14. **Complex Numbers –** The number which have real and imaginary component is called a complex number.

Example: 3+4i, 5+6i, where $i = \sqrt{-1} = a\ imaginary\ number$

15. **Face Value** of a digit in a number is its own value.

Example: 6728, Face Value ⇒ 6 = 6, 7 = 7, 2 = 2 and 8 = 8

16. **Place Value** of a digit is given by multiplying it with value of place where it is placed.

Example: 6729

Place Value of 9 ⇒ 9 x 1 = 9

Place Value of 2 ⇒ 2 x 10 = 20

Place Value of 7 ⇒ 7 x 100 = 700

Place Value of 6 ⇒ 6 x 1000 = 6000

17. **Fractions**: A fraction is a quantity which expresses a part of the whole, eg: ¼ means one fourth of the whole

Types of Fractions:

- A **Proper Fraction** is one whose numerator is less than its denominator
  Example: 2/3 is proper fraction, as 2<3
- An **Improper Fraction** is one whose numerator is equal to or greater than its denominator

Example: 3/2 is an improper fraction, as 3>2 ; 3/3 is an improper fraction, as 3=3

Divisibility Rules

Divisibility by	Criteria
2	A number is divisible by 2 when its units place is 0 or divisible by 2. Example: 130, 128 etc.
3	A number is divisible by 3 when the sum of its digits is divisible by 3. Example: 6561 ⇒ 6+5+6+1 = 18 is divisible by 3 17281 ⇒ 1+7+2+8+1 = 19 is not divisible by 3
4	When the last two digits of the number are 0's or divisible by 4. Example: 17400, 132, 12348 etc.
5	If the unit digit is 5 or 0, the number is divisible by 5. Example: 895, 100, 125, 625, 400 etc.
6	A number is divisible by 6, if it is divisible by both 2 and 3.
7	A number is divisible by 7, if and only if the number of tens added to 5 times the number of units, is divisible by 7 Example: 105 is divisible by 7, since 10+5*5= 10+25=35, which is divisible by 7.
8	If the last three digits of the number are 0's or divisible by 8, the number is divisible by 8. Example: 125128, 135000 etc.
9	If sum of digits is divisible by 9, the number is also divisible by 9. Example: 729 ⇒ 7+2+9 = 18 is divisible by 9. 46377 ⇒ 4+6+3+7+7 = 27 is divisible by 9.
10	A number is divisible by 10 if and only if the unit place digit is 0. Example: 100, 23450, 1100 etc.
11	When difference between sum of digits at odd places and sum of digits at even places is either 0 or 11, the number is divisible by 11. Example: 65967 ⇒ (6+9+7) – (5+6) = 22 – 11 = 11 is divisible by 11.

Simplification

1. $18265 + 2736 + 41328 = ?$

1. 61329 2. 62239 3. 62319 4. 62329

2. $7845 - ? = 8461 - 3569$

1. 2593 2. 2773 3. 3569 4. None of these

3. 46917 X 9999 =?

1. 4586970843 2. 469123083 3. 4691100843 4. 584649125

4. Which of the following has fractions in ascending order?

1. $\frac{1}{3}, \frac{2}{5}, \frac{4}{7}, \frac{3}{5}, \frac{5}{6}, \frac{6}{7}$ 2. $\frac{1}{3}, \frac{2}{5}, \frac{3}{5}, \frac{4}{7}, \frac{5}{6}, \frac{6}{7}$ 3. $\frac{1}{3}, \frac{2}{5}, \frac{3}{5}, \frac{5}{6}, \frac{4}{7}, \frac{6}{7}$ 4. $\frac{2}{5}, \frac{3}{5}, \frac{1}{3}, \frac{4}{7}, \frac{5}{6}, \frac{6}{7}$

5. Which of the following are in descending order or their value?

1. $\frac{5}{9}, \frac{7}{11}, \frac{8}{15}, \frac{11}{17}$ 2. $\frac{5}{9}, \frac{8}{15}, \frac{11}{17}, \frac{7}{11}$ 3. $\frac{11}{17}, \frac{7}{11}, \frac{8}{15}, \frac{5}{9}$ 4. $\frac{11}{17}, \frac{7}{11}, \frac{5}{9}, \frac{8}{15}$

6. When $0.\overline{47}$ is converted into a fraction, the result is:

1. $\frac{46}{90}$ 2. $\frac{46}{99}$ 3. $\frac{47}{90}$ 4. $\frac{47}{99}$

7. The value of $0.\overline{57}$ is:

1. $\frac{57}{10}$ 2. $\frac{57}{99}$ 3. $\frac{26}{45}$ 4. $\frac{52}{9}$

8. The value of $4.1\overline{2}$ is:

1. $4\frac{11}{90}$ 2. $4\frac{11}{99}$ 3. $\frac{371}{900}$ 4. None of these

9. The value of $2.1\overline{36}$ is:

1. $\frac{47}{220}$ 2. $\frac{68}{495}$ 3. $2\frac{3}{22}$ 4. None of these

10. $3.\overline{87} - 2.\overline{59} = ?$

1. 1.20 2. $1.\overline{2}$ 3. $1.\overline{27}$ 4. $1.\overline{28}$

11. Given $168 \times 32 = 5376$, then $5.376 \div 16.8$ is equal to:

1. 0.032 2. 0.32 3. 3.2 4. 32

12. $\frac{5 \times 1.6 - 2 \times 1.4}{1.3} = ?$

1. 0.4 2. 1.2 3. 1.4 4. 4

13. Evaluate: $\frac{(2.39)^2 - (1.61)^2}{2.39 - 1.61}$

1. 2 2. 4 3. 6 4. 8

14. $\left(\frac{1.49 \times 14.9 - 0.51 \times 5.1}{14.9 - 5.1}\right)$ is equal to:

1. 0.20 2. 2.00 3. 20 4.22

15. The Value of

$$\left(\frac{0.1 \times 0.1 \times 0.1 + 0.02 \times 0.02 \times 0.02}{0.2 \times 0.2 \times 0.2 + 0.04 \times 0.04 \times 0.04}\right)$$

1. 0.0125 2. 0.125 3. 0.25 4. 0.5

16. $1260 \div 15 \div 7 = ?$

1. 12 2. 58 3. 122 4. 588

17. $2 - [2 - \{2 - 2(2 + 2)\}] = ?$

1. – 4 2. 4 3. 6 4. None of these

18. Simplify

$25 - 5[2 + 3\{2 - 2(5 - 3) + 5\} - 10] \div 4$ is

1. 5 2. 23.25 3. 23.75 4. 25

19. $\frac{4 + 4 \times 18 - 6 - 8}{123 \times 6 - 146 \times 5} = ?$

1. 1 2. 2 3. 6.65 4. 7.75

20. Simplify $18 - [5 - \{6 + 2(7 - \overline{8 - 5})\}]$

1. 13 2. 15 3. 27 4. 32

21. Simplify

$$\frac{\frac{1}{3} + \frac{3}{4}\left(\frac{2}{5} - \frac{1}{3}\right)}{1\frac{2}{3} of \frac{3}{4} - \frac{1}{4} of \frac{4}{5}}$$

1. $\frac{1}{63}$ 2. $\frac{23}{40}$ 3. $\frac{23}{55}$ 4. $\frac{23}{63}$

22. The value of

$$\frac{\frac{1}{3}\div\frac{1}{3}\times\frac{1}{3}}{\frac{1}{3}\div\frac{1}{3}of\frac{1}{3}}-\frac{1}{9}\text{is}$$

1. 0 2. $\frac{1}{9}$ 3. $\frac{1}{3}$ 4. 1

23. Find the value of

$$\frac{\frac{1}{2}\div\frac{1}{2}of\frac{1}{2}}{\frac{1}{2}+\frac{1}{2}of\frac{1}{2}}$$

1. 1 2. $1\frac{1}{3}$ 3. $2\frac{2}{3}$ 4. 3

24. The value of

$$\frac{1}{2+\frac{1}{2+\frac{1}{2-\frac{1}{2}}}}\text{is}$$

1. $\frac{3}{8}$ 2. $\frac{19}{8}$ 3. $\frac{8}{3}$ 4. $\frac{8}{19}$

25. $\text{If}\frac{2+\frac{1}{3\frac{4}{5}}}{2+\frac{1}{3+\frac{1}{1+\frac{1}{4}}}}=x$, then the value of x is

1. $\frac{1}{7}$ 2. $\frac{3}{7}$ 3. 1 4. $\frac{8}{7}$

26. The value of $\sqrt{10+\sqrt{25+\sqrt{108+\sqrt{154+\sqrt{225}}}}}$ is

1. 4 2. 6 3. 8 4.10

27. $\left(\frac{\sqrt{625}}{11}\times\frac{14}{\sqrt{25}}\times\frac{11}{\sqrt{196}}\right)$ is equal to

1. 5 2. 6 3. 8 4. 11

28. $\sqrt{\frac{25}{81}-\frac{1}{9}}=?$

1. $\frac{2}{3}$ 2. $\frac{4}{9}$ 3. $\frac{16}{81}$ 4. $\frac{25}{81}$

29. $\text{If}\frac{52}{x}=\sqrt{\frac{169}{289}}$, the value of x is:

1. 52 2. 58 3. 62 4. 68

30. If $\sqrt{1\frac{55}{729}} = 1 + \frac{x}{27}$, then the value of x is:

1. 1 2. 3 3. 5 4. 7

31. $\left(\sqrt{2} + \frac{1}{\sqrt{2}}\right)^2$ is equal to:

1. $2\frac{1}{2}$ 2. $3\frac{1}{2}$ 3. $4\frac{1}{2}$ 4. $5\frac{1}{2}$

32. If $\sqrt{5} = 2.236$, then the value of $\frac{1}{\sqrt{5}}$is:

1. 0.367 2. 0.447 3. 0.745 4. None of these

33. Free notebooks were distributed equally among children of the class. The number of notebooks each child got was one-eighth of the number of children. Had been the number of children been half, each child would have got 16 notebooks. Total how many notebooks were distributed?

1. 256 2. 432 3. 512 4. 640

34. A classroom has equal number of boys and girls. Eight girls left to play Kho-Kho, leaving twice as many boys as girls in the classroom. What was the total number of girls and boys present initially?

1. 16 2. 24 3. 32 4. None of these

35. A sum of R312 was divided among 100 boys and girls in such a way that each boy gets R3.60 and each girl R2.40. The number of girls is:

1. 35 2. 40 3. 60 4. 65

36. In an examination, a student scores 4 marks for every correct answer and loses 1 mark for every wrong answer. If he attempts in all 60 questions and secures 130 marks, the number of questions he attempts correctly. Is

1. 35 2. 38 3. 40 4. 42

37. A cricket team won 3 matches more than they lost. If a win gives them 2 points and loss (-1) point, how many matches. In all have they played if their score is 23?

1. 17 2. 20 3. 37 4. 40

38. On Children Day, sweets were to be equally distributed among 175 children in a school. Actually on the Children's Day, 35 children were absent and therefore each child got 4 sweets extra. Total how many sweets were available for distribution?

1. 2400 2. 2480 3. 2600 4. None of these

39. A certain number of tennis balls were purchased for R450. Five more balls could have been purchased in the same amount if each ball was cheaper by R15. The number of balls purchased was:

1. 10 2. 15 3. 20 4. 25

40. There are two examinations rooms A and B. If 1o students are sent from A to B, then the number of students in each room is the same. If 20 students are sent from B to A, then number of students in A is double the number of students in B. the number of students in room A is

1. 20 2. 80 3. 100 4. 200

Problems on Numbers

1. The difference between a number and its three-fifth is 50. What is the number?

   1. 75 2. 100 3. 125 4. None of these

2. A number is doubled and 9 is added. If the resultant is trebled, it becomes 75. What is that number?

   1. 3.5 2. 6 3. 8 4. None of these

3. Three-fourth of a number is 60 more than its one-third. The number is:

   1. 84 2. 108 4. 144 5. None of these

4. A number whose fifth part is increased by 4 is equal to its fourth part diminished by 10, is:

   1. 240 2. 260 3. 270 4. 280

5. The difference of two numbers is 20% of the larger number. If the smaller number is 12, the larger one is:

   1. 15 2. 16 3. 18 4. 20

6. If the sum of a number and its square is 182, what is the number?

   1. 15 2. 26 3. 28 4. None of these

7. Thrice the square of a natural number decreased by 4 times the number is equal to 50 more than the number. The number is:

   1. 4 2. 5 3. 6 4. 10

8. The sum of a number and its reciprocal is one-eighth of 34. What is the product of the number and its square root?

   1. 8 2. 27 3. 32 4. None of these

9. Find a positive number which when increased by 17 is equal to 60 times the reciprocal of a number.

   1. 3 2. 10 3. 17 4. 20

10. Two numbers are such that the ratio between them is 4:7. If each is increased by 4, the ratio becomes 3:5. The larger number is:

    1. 36 2. 48 3. 56 4. 64

11. The sum of three numbers is 264. If the first number be twice the second and third number be one-third of the first. Then the second number is:

1. 48 2. 54 3. 72 4. 84

12. The sum of two numbers is 25 and their difference is 13. Find their product.

1. 104 2. 114 3. 315 4. 325

13. If the sum of two numbers is 33 and their difference is 15, the smaller number is:

1. 9 2. 12 3. 15 4. 18

14. The sum of two numbers is 40 and their product is 375. What will be the sum of their reciprocals?

1. $\frac{1}{40}$ 2. $\frac{8}{75}$ 3. $\frac{75}{4}$ 4. $\frac{75}{8}$

15. The sum of squares of two numbers is 3341 and the difference of their squares is 891. The numbers are:

1. 25, 36 2. 25, 46 3. 35, 46 4. None of these

16. The sum of four consecutive even integers is 1284. The greatest of them is:

1. 320 2. 322 3. 324 4. 326

17. The sum of the digits of a two-digit number is 15 and the difference between the digits is 3. What is the two-digit number?

1. 69 2. 78 3. Cannot be determined 4. None of these

18. In a two-digit number, if it is known that its unit's digit exceeds its ten's digit by 2 and that the product of the given number and the sum of its digits is equal to 144, then the number is:

1. 24 2. 26 3. 42 4. 46

19. The difference between a two-digit number and the number obtained by interchanging the positions of its digits is 36. What is the difference between the two digits of that number?

1. 3 2. 4 3. Cannot be determined 4. None of these

20. The sum of the numerator and denominator of a fraction is 11. If 1 is added to the numerator and 2 is subtracted from the denominator, it becomes $\frac{2}{3}$. The fraction is:

1. $\frac{5}{6}$ 2. $\frac{6}{5}$ 3. $\frac{3}{8}$ 4. $\frac{8}{3}$

21. Find the least value of * for which 5967*13 becomes divisible by 3.

1. 1 2. 2 3. 3 4. 4

22. Find the least value of * for which 7*5462 is divisible by 9.

1. 3 2. 6 3. 9 4. None of these

23. Find the least value of * for which 4832*18 is divisible by 11.

1. 5 2. 3 3. 7 4. 11

24. Is 52563744 divisible by 24?

1. Yes 2. No 3. Cannot be determined 4. None of these

25. What least number must be subtracted from 1672 to obtain a number which is completely divisible by 17?

1. 5 2. 7 3. 3 4. 6

26. What least number must be added to 2010 to obtain a number which is completely divisible by 19?

1. 5 2. 4 3. 19 4. None of these

27. On dividing 12401 by a certain number, we get 76 as quotient and 13 as remainder. What is the divisor?

1. 163 2. 173 3. 183 4. None of these

28. On dividing a certain number by 342, we get 47 as reminder. If the same number is divided by 18, what will be the remainder?

1. 7 2. 9 3. 11 4. 13

29. What is the unit digit in the product (684 x 759 x 413 x 676)?

1. 6 2. 8 3. 2 4. None of these

30. What is the unit digit in the product $(3547)^{153} \times (251)^{72}$?

1. 1 2. 3 3. 7 4. None of these

31. What is the unit digit in $\{(264)^{102} + (264)^{103}\}$?

1. 0 2. 1 2. 2 3. 4

32. Find the total number of prime factors in the product $\{(4)^{11} \times (7)^5 \times (11)^2\}$.

1. 31 2. 10 3. 11 4. 29

33. Find the remainder when 2^{31} is divided by 5.

1. 1 2. 2 3. 3 4. 4

34. A number when successively divide by 3, 5 and 8 leaves remainders 1, 4 and 7 respectively. Find the respective remainders if the order of divisors be reversed.

1. 5, 4, 2 2. 6, 4, 2 3. 1, 1, 3 4. None of these

2-HCF and LCM

Factors and Multiples: If a number a divides another number$b$ exactly, we say that a is a ***factor***of$b$. In this case, b is called a ***multiple***of a.

Highest Common Factor (H.C.F.) or Greatest Common Measure (G.C.M.) or Greatest Common Divisor (G.C.D.): The H.C.F. of two or more than two numbers is the greatest number that divides each of them exactly.

Least Common Multiple: The least number which is exactly divisible by each one of the give numbers is called their L.C.M.

H.C.F. and L.C.M. of Fractions:

$$\text{H.C.F.} = \frac{\text{H.C.F.of Numerators}}{\text{L.C.M.of Denominators}}$$

$$\text{L.C.M.} = \frac{\text{L.C.M.of Numerators}}{\text{H.C.F.of Denominator}s}$$

Example 1: ***Find the HCF of 24, 30 and 42.***

Solution:

2	24	2	30	2	42
2	12	3	15	3	21
2	6	5	5	7	7
3	3		1		1
	1				

$\therefore$ Factors of $24 = 2 \text{ X } 2 \text{ X } 2 \text{ X } 3 = (2^3 \text{ X } 3^1)$

Factors of $30 = 2 \text{ X } 3 \text{ X } 5 = (2^1 \text{ X } 3^1 \text{ X } 5^1)$

Factors of $42 = 2 \text{ X } 3 \text{ X } 7 = (2^1 \text{ X } 3^1 \text{ X } 7^1)$

$\therefore$ The product of common prime factors with the least powers $= 2^1 \text{ X } 3^1 = 6$

Example 2: ***Find the HCF of 26 and 455.***

Solution:

$$\begin{array}{r} 26\overline{)455}(17 \\ \underline{26} \\ 195 \\ \underline{182} \\ 13\overline{)26}(2 \\ \underline{26} \\ X \end{array}$$

∴ Required HCF = 13.

Example 3: ***What will be the HCF of 1785, 1995 and 3381?***

Solution: At the 1st step, use any two of three numbers.

$$
\begin{array}{r}
1785\overline{)1995}(1 \\
1785 \\
\hline
210\overline{)1785}(8 \\
1680 \\
\hline
105\overline{)\ 210}\ (2 \\
210 \\
\hline
\text{X}
\end{array}
$$

∴ HCF for 1785 and 1995 = 105

At the 2nd step, use obtained HCF 105 and the 3rd given number 3381.

$$
\begin{array}{r}
105\overline{)\ 3381}\ (3 \\
315 \\
\hline
231 \\
210 \\
\hline
21\ \overline{)\ 105}\ (5 \\
105 \\
\hline
\text{X}
\end{array}
$$

Example 4: ***Find the HCF of $\mathbf{\frac{36}{51}}$ and $\mathbf{3\frac{9}{17}}$.***

Solution: Here, $\frac{36}{51} = \frac{12}{17}$ and $3\frac{9}{17} = \frac{60}{17}$

Now, we have to find the HCF of $\frac{12}{17}$ and $\frac{60}{17}$.

According to the formula,

HCF of fractions $= \frac{HCF\ of\ Numerators}{LCM\ of\ Denominators} = \frac{HCF\ of\ 12\ and\ 60}{LCM\ of\ 17\ and\ 17} = \frac{12}{17}$.

Example 5: ***Calculate the LCM of $\mathbf{\frac{72}{250}, \frac{126}{75}}$ and $\mathbf{\frac{162}{165}}$.***

Solution: Here, $\frac{72}{250} = \frac{36}{125}, \frac{126}{75} = \frac{42}{25}$ and $\frac{162}{165} = \frac{54}{55}$

According to the formula,

Required LCM $= \frac{LCM\ of\ 36{,}42\ and\ 54}{HCF\ of\ 125{,}25\ and\ 55} = \frac{756}{5} = 151\frac{1}{5}$

Exercise

1. Reduce $\frac{391}{667}$ to lowest terms.

   1. $\frac{17}{29}$ 2. $\frac{11}{23}$ 3. $\frac{13}{25}$ 4. $\frac{14}{27}$

2. Find the HCF of 2^3 x 3^2 x 5 x 7^5; 2^2 x 5^2 x 7^3 and 2^3 x 5^3 x 7^2.

   1. 940 2. 980 3. 930 4. 925

3. HCF of 2^2 x 3^2 x 5^3 x 7, 2^3 x 3^3 x 5^4 x 7^2 and 3 x 5 x 7 x 11^2

   1. 105 2. 1155 3. 2310 4. 27720

4. Find the highest common factor of (34, 85)

   1. 4 2. 12 3. 17 4. 19

5. The LCM of (198, 252, 308) is:

   1. 2072 2. 2772 3. 2727 4. 2770

6. Which of the following is a pair of co-primes?

   1. (16, 62) 2. (18, 24) 3. (20, 27) 4. (23, 92)

7. The HCF of $\left(\frac{3}{4}, \frac{5}{6}, \frac{6}{7}\right)$is

   1. $\frac{2}{93}$ 2. $\frac{1}{84}$ 3. $\frac{1}{83}$ 4. $\frac{3}{91}$

8. HCF of $\left(\frac{9}{25}, \frac{12}{35}, \frac{18}{10}, \frac{21}{40}\right)$is:

   1. $\frac{3}{5}$ 2. $\frac{252}{5}$ 3. $\frac{3}{1400}$ 4. $\frac{63}{700}$

9. Find the lowest common multiple of (20, 32, 36).

   1. 1200 2. 1240 3. 1360 4. 1440

10. LCM of $\left(\frac{3}{7}, \frac{2}{5}, \frac{4}{3}, \frac{9}{13}\right)$is:

1. 36 2. $\frac{1}{36}$ 3. $\frac{1}{1365}$ 4. $\frac{12}{455}$

11. The ratio of two number is 4:5 and HCF is 4; their LCM is:

1. 48 2. 24 3. 80 4. 60

12. Three numbers are in the ratio of 1:2:3 and their HCF is 13, the numbers are:

1. 9, 8, 12 2. 13, 26, 39 3. 10, 20, 30 4. 12, 24, 36

13. The sum of two numbers is 243 and their HCF is 27. The numbers are:

1. (81, 189) 2. (122, 121) 3. (27, 216) 4. (81, 152)

14. The HCF of two numbers is 14 and their difference is 14. The numbers are:

1. 64, 78 2. 72, 86 3. 70, 84 4. 98, 122

15. The product of two numbers is 5476. If the HCF of these numbers is 37. The greater number is:

1. 107 2. 111 3. 148 4. 185

16. The product of two numbers is 2028 and their HCF is 13. How many pairs of such numbers are possible?

1. 1 2. 2 3. 3 4. 4

17. The HCF of two numbers is 11 and thei LCM is 7700. One number is 308, the other number is:

1. 280 2. 238 3. 275 4. 318

18. Product of two co-prime numbers is 143, their LCM should be:

1. 1 2. 143 3. equal to HCF 4. Cannot be determined

19. Two number, both greater than 29, have GCD $= 29$ and LCM $= 4147$. The sum of the numbers is:

1. 669 2. 696 3. 766 4. 767

20. The greatest possible length which can be used to measure exactly the lengths: 20 m 6 cm, 11m 90 cm and 14 m 45 cm is:

1. 17 2. 18 3. 19 4. 121

21. What is the maximum number of students among whom 1095 pens and 1168 pencils can be distributed in such a way that each students gets equal number of pens and equal number of pencils.

1. 71 2. 73 3. 63 4. 65

22. Find the greatest number that will divide 48, 97 and 188 and leaves the reminder 6 in each case.

1. 4 2. 7 3. 2 4. 6

23. The greatest number, which when divides 1358, 1870, and 2766 leaves the same remainder 14 in each case, is:

1. 124 2. 64 3. 156 4. 260

24. What will be the least number which when doubled becomes exactly divisible by 9, 15, 21, and 30?

1. 196 2. 189 3. 630 4. 315

25. The least five digit number which is exactly divisible by 12, 18, and 21 is:

1. 10010 2. 10015 3. 10080 4. 10020

26. The greatest four digit number which is divisible by 18, 25, 30, and 48 is:

1. 9000 2. 9200 3. 9279 4. 9729

27. The smallest number which when diminished by 5 becomes divisible by 12, 16, 18, 21, and 28

1. 1015 2. 1013 3. 1022 3. 1017

28. The least number which when increased by 7 becomes divisible by 24, 32, 36, and 54

1. 427 2. 854 3. 857 4. 859

29. Find the least multiple of 23 which when divided by 24, 21, and 18 leaves the remainders 13, 10, and 7 respectively.

1. 3004 2. 3024 3. 3013 4. 3026

30. The least number which when divided by 5, 6, 7, and 8 leaves the remainder 3. But when divided by 9 leaves no remainder, is:

1. 1766 2. 1683 3. 2327 4. 1895

31. Four different devices beep after every half hour, 60 min, 1 and half hours, and 135 min respectively. All the devices beeped together at 12 noon. They will beep together again at:

1. 12 midnight 2. 6 AM 3. 9 AM 4. 7:30 AM

32. X, Y, Z start at the same time in the same direction to run around a circular stadium. X completes a round in 63 seconds, Y in 105 seconds and Z in 210 seconds. If they start at the same time, then at what time will they meet again at the starting point?

1. 9 min 9 seconds 2. 10 min 3 seconds 3. 10 min 6 seconds 4. 8 min 4 seconds

3-Average

$$\text{Average} = \frac{\text{Sum of Observations}}{\text{Number of Observations}}$$

Suppose a man covers a certain distance at $x$kmph and an equal distance at $y$kmph. Then the average speed during the whole journey is $\left(\frac{2xy}{x+y}\right)$kmph.

Example 1: ***Find out the average of 308, 125, 45, 120 and 102.***

Solution: Required average $= \frac{Sum\ of\ given\ observations}{No.of\ Observations} = \frac{308+125+45+120+102}{5} = \frac{700}{5} = 140$

Example 2: ***If the weight of A is 60 kg, weight of B is 45 kg and weight of C is 54 kg, what is the averageweightof three persons?***

Solution: Required average $= \frac{60+45+54}{3} = \frac{159}{3} = 53$ kg.

Example 3: ***The average expenditure of Chandan in four days is R 90. If his expenditure for the first three days is R 100, R 125 and R 85, respectively, what is the expenditure of Chandan for the fourth day?***

Solution: Let, the expenditure for the fourth day = R x

Then, average expenditure $= \frac{Sum\ of\ the\ expenditure\ of\ four\ days}{4}$

$90 = \frac{100+125+85+x}{4} \Rightarrow 310 + x = 360\ or\ x = 360 - 310 = R50$

Example 4: ***What will be the average of numbers from 1 to 51?***

Solution: According to the formula

The average of $1^{st}{}'n'$ natural numbers $= \frac{n+1}{2}$

Where $n = 51$

$\therefore$ Required average $= \frac{51+1}{2} = \frac{52}{2} = 26$

Example 5: ***Find out the average of 2, 4, 6, 8, 10, 12 and 14.***

Solution: As we know that average of $1^{st}{}'n'$ even numbers $= (n + 1)$

$\therefore$ Required average $= (7 + 1) = 8$

Example 6: ***Calculate the average of 1, 3, 5, 7, 9, 11, 13, 15 and 17.***

Solution: As we know, average of 1^{st} $'n'$ odd numbers $= n$

$\therefore$ Required average $= 9$

Example 7: ***What will be the average of 1, 2, 3, 4……51, 52, 53?***

Solution: As we know, average of consecutive numbers $= \frac{First\ Number + Last\ Number}{2}$

Where first number $= 1$ and last number $= 53$

$\therefore$ Required average $= \frac{1+53}{2} = \frac{54}{2} = 27$

Example 8: ***Calculate the average of the squares of natural numbers from 1 to 25.***

Solution: According to the formula, average of squares of first $'n'$ natural numbers $= \frac{(n+1)(2n+1)}{6}$

Where $n = 25$.

$\therefore$ Required average $= \frac{(25+1)(2\times25+1)}{6} = \frac{26\times51}{6} = \frac{1326}{6} = 221$

Exercise

1. The average of first five prime number is:

   1. 4.5 2. 5 3. 5.6 4. 7.5

2. The average of first five multiples of 3 is:

   1. 3 2. 9 3. 12 4. 15

3. The average height of 30 boys out of a class of 50 is 160 cm. If the average height of the remaining boys is 165 cm, the average height of the whole class (in cm) is:

   1. 161 2. 162 3. 163 4. 164

4. The average of three numbers is 20. If the two numbers are 16 and 22, the third number is:

   1. 22 2. 20 3. 19 4. 18

5. The average of five results is 46 and that of the first four is 45. The fifth result is:

   1. 1 2. 10 3. 12.5 4. 50

6. The average of Radhika's marks in 7 subjects is 75. His average in six subjects excluding science is 72. How many marks did he get in Science?

1. 72 2. 90 3. 93 4. None of these

7. The average of eight numbers is 14.. The average of six of these numbers is 16. The average of the remaining two numbers is:

1. 4 2. 8 3. 16 4. Data inadequate

8. The average price of three items of furniture is R 15000. If their prices are in the ratio 3:5:7, the price of the cheapest item is:

1. R9000 2. R15000 3. R18000 4. R21000

9. Of three numbers, second is twice the first and is also thrice the third. If the average of the three numbers is 44, the largest number is:

1. 24 2. 36 3. 72 4. 108

10. The average of ten numbers is 7. If each number is multiplied by 12, then the average of new set of numbers is:

1. 7 2. 19 3. 82 4. 84

11. The average age of 30 students of a class is 12 years. The average age of a group of 5 of the students is 10 years and that of another group of 5 of them is 14 years. What is the average age of the remaining students?

1. 8 years 2. 10 years 3. 12 years 4. 14 years

12. The average of 50 numbers is 38. If two numbers 45 and 55 are discarded, the average of the remaining numbers is:

1. 36.5 2. 37 3. 37.5 4. 37.52

13. The mean of 100 observations was calculated as 40. It was found later on that one of the observations was misread as 83 instead of 53. The correct mean is:

1. 39 2. 39.7 3. 40.3 4. 42.7

14. The average of six numbers is 30. If the average of first four is 25 and that of last three is 35, the fourth number is:

1. 25 2. 30 3. 35 4. 40

15. The average of 11 observations is 60. If the average of first five observations is 58 and that of the last five is 56, the sixth observation is:

1. 90 2. 110 3. 85 4. 100

16. Harish has twice as much money as Rohan and Rohan has 50% more money than what Anita has. If the average money with them is R110, then Harish has:

1. R55 2. R60 3. R90 4. R180

17. A motorist has travels to a place 150 km away at an average speed of 50 km per hour and returns at 30 km per hour. His average speed for whole journey in km per hour is

1. 35 2. 37 3. 37.5 4. 40

18. The average of 5 numbers is 7. When 3 new numbers are added, the average of the eight numbers is 8.5. The average of three new numbers is:

1. 11 2. 7.75 3. 8.5 4. 7

19. The average age of 30 students is 9 years. If the age of their teacher is included, it becomes 10 years. The age of the teacher (in years) is:

1. 27 2. 31 3. 35 4. 40

20. The average age of 24 boys and the teacher is 15 years. When the teacher's age is excluded, the average decreases by 1. What is the age of the teacher?

1. 38 years 2. 39 years 3. 40 years 4. Data inadequate

21. The average salary per month of 30 employees in a company is R4000. If the manager's salary is added, the average salary increases to R4300, what is the salary of the manager?

1. R10000 2. R13000 3. R12000 4. R13300

22. The average age of 40 students of a class is 15 years. When 10 new students are admitted, the average is increased by 0.2 years. The average age of new students is:

1. 15.2 years 2. 16 years 3. 16.2 years 4. 16.4 years

23. The average weight of 8 men is increased by 1.5 kg when one of the men who weighs 65 kg is replaced by a new man. The weight of the new man is:

1. 76 kg 2. 76.5 kg 3. 76.7 kg 4. 77 kg

24. The average weight of 6 men decreases by 3 kg when one of them weighing 80 kg is replaced by a new man. The weight of the new man is:

1. 56 kg 2. 58 kg 3. 62 kg 4. 76 kg

25. The average age of a committee of eight members is 40 years. A member aged 55 years retired and his place was taken by another member aged 39 years. The average age of the present committee is:

1. 39 years 2. 38 years 3. 36 years 4. 35 years

26. A cricketer has a certain average for 9 innings. In the tenth innings, the score is 100 runs, thereby increasing his average by 8 runs. His new average is:

1. 20 runs 2. 24 runs 3. 28 runs 4. 32 runs

27. A man whose bowling average is 12.4 takes 5 wickets for 26 runs and thereby decreases his average by 0.4. The number of wickets, taken by him before his last match is:

1. 85 2. 78 3. 72 4. 64

28. The mean temperature of Monday to Wednesday was 37^0C and of Tuesday to Thursday was 34^0C. If the temperature on Thursday was 4/5 that of Monday, the temperature on Thursday was:

1. 36.5^0C 2. 36^0C 3. 35.5^0C 34^0C

29. The average weight of 3 men, X, Y and Z is 84 kg. Another man T joins the group and the average now becomes 80 kg. If another man S, whose weight is 3 kg more than that of T, replaces X than the average weight of Y, Z, T and S becomes 79 kg. The weight of X is:

1. 70 kg 2. 72 kg 3. 75 kg 4. 80 kg

30. Three years ago, the average age of X, Y and Z was 27 years and that of Y and Z, 5 years ago was 20 years. X's present age is:

1. 30 years 2. 35 years 3. 40 years 4. 48 years

31. Three years ago, the average age of a family of 5 members was 17 years. A baby having been born, the average age of the family is the same today. The present age of the baby is:

1. 2 years 2. 2.4 years 3. 3 years 4. 1.5 years

4-Ages

When solving age problems, you need to represent the following in terms of variables:

- The present age of the people or things involved
- The age, at the other specified time, of the people or things involved

Example 1. Mohan's age after 15 years will be 5 times his age 5 years back. What is his present age?
Solution: Let Mohan's present age be x years, then
His age after 15 years = (x+15) years
His age 5 years back = (x - 5) years
x+15 = 5(x-5)
hence, x=10 years

Example 2. The ages of 2 persons differ by 16 years. If, 6 years ago, the elder one be 3 times as old as younger one, find their present ages.
Solution: Let the age of younger person be x years
Then, age of elder person = (x+16) years
3x – 6 = (x+16) – 6
We get, x=14
Thus, the present ages are 14 years & 30 years

Exercise

1. The sum of the ages of a son and father in 56 years. After four years, the age of the father will be three times that of the son. Their ages respectively are:

   1. 12 years, 44 years 2. 16 years, 42 years 3. 16 years, 48 years 4. 18 years, 36 years

2. The sum of the ages of a mother and a daughter is 50 years. Also 5 years ago, the mother's age was 7 times the age of the daughter. The present ages of the mother and the daughter respectively are

   1. 35 years, 15 years 2. 38 years, 12 years 3. 40 years, 10 years 4. 42 years, 8 years

3. Mr. Natwarlal is 4 times as old as his son. Four years hence the sum of their ages will be 43 years The present age of son is?

   1. 5 years 2. 7 years 3. 8 years 4. 10 years

4. Arjun's age is 3 times that of Sameer. In 12 years, Arjun's age will be double the age of Sameer. Arjun's present age is?

   1. 27 years 2. 32 years 3. 36 years 4. 40 years

5. The age of a man is 4 times that of his son. Five years ago, the man was nine times as old as his son was at that time. The present age of the man is?

1. 28 years 2. 32 years 3. 40 years 4. 44 years

6. The age of Harish's father is 4 times his age. If 5 years ago, father's age was 7 times of the age of his sone at that time, what is Harish's father's present age?

1. 35 years 2. 40 years 3. 70 years 4. 84 years

7. The ratio of Mansi's age to the age of her mother is 3:11. The difference of their ages is 24. The ratio of their ages after 3 years will be?

1. 1:3 2. 2:3 3. 3:5 4. None of these

8. Ratio of Ashok's age to Anuj's age is equal to 4:3. Ashok will be 26 years old after 6 years. How old is Anuj now?

1. 12 years 2. 15 years 3. 19½ 4. 21 years

9. The difference between the ages of two persons is 10 years. 15 years ago, the elder one was twice as old as the younger one. The present age of the elder person is:

1. 25 years 2. 35 years 3. 45 years 4. 55 years

10. 10 years ago, Divya's mother was 4 times older than her daughter. After 10 years, the mother will be twice older than the daughter. The present age of Divya is

1. 5 years 2. 10 years 3. 20 years 4. 30 years

11. The age of a father 10 years ago was thrice the age of his son. Ten years hence, the father's age will be twice that of his son. The ratio of their present ages is?

1. 8:5 2. 7:3 3. 5:2 4. 9:5

12. After 5 years the age of a father will be thrice the age of his son, whereas five years ago, he was seven times as old as his son was. What is father's present age?

1. 35 years 2. 40 years 3. 45 years 4. 50 years

13. Five years ago Arun's age was one third of the age of Ajay and now Arun's age is 17 years. What is the present age of Ajay?

1. 9 years 2. 36 years 3. 41 years 4. 51 years

14. The sum of the ages of a father and son is 45 years. Five years ago the product of their ages was 4 times the father's age at that time. The present ages of the father and son, respectively are:

1. 25 years, 10 years 2. 36 years, 9 years 3. 39 years, 6 years 4. None of these

15. Radha is twice as old as Radhika was two years ago. If the difference between their ages be 2 years, how old is Radha today?

1. 6 years 2. 8 years 3. 10 years 4. 12 years

16. In 10 years, Amit will be twice as old as Mohit was 10 years ago. If Amit is now 9 years older than Mohit, the present age of Mohit is:

1. 19 years 2. 29 years 3. 39 years 4. 49 years

5-Percentage

Concept of Percentage: by a certain percent, we mean that many hundredths. Thus, x percent means x hundredths, written as $x\%$.

To express $x\%$ as a fraction: We have,$x\% = \frac{x}{100}$.

Thus, $20\% = \frac{20}{100} = \frac{1}{6}$; $48\% = \frac{48}{100} = \frac{12}{25}$, etc.

To express $\frac{a}{b}$ as a percent: We have, $\frac{a}{b} = \left(\frac{a}{b} \times 100\right)\%$

Thus, $\frac{1}{4} = \left(\frac{1}{4} \times 100\right)\% = 25\%; 0.6 = \frac{6}{10} = \frac{3}{5} = \left(\frac{3}{5} \times 100\right)\% = 60\%$

If the price of a commodity increases by $R\%$, then the reduction in consumption so as not to increase the expenditure is

$$\left[\frac{R}{(100+R)} \times 100\right]\%$$

If the price of a commodity decreases by $R\%$, then the increase in consumption so as not to decrease the expenditure is

$$\left[\frac{R}{100-R} \times 100\right]\%$$

Results on Population: Let the population of a town be P now and suppose it increases at the rate of $R\%$ per annum, then:

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

Results on Depreciation: Let the present value of a machine be P. Suppose it depreciates at the rate of $R\%$ per annum. Then:

1. Value of the machine after n years = $P\left(1-\frac{R}{100}\right)^n$
2. Value of the machine n years ago = $\frac{P}{\left(1-\frac{R}{100}\right)^n}$

If A is $R\%$ more than B, then B is less than A by

$$\left[\frac{R}{(100+R)} \times 100\right]\%$$

If A is $R\%$ more than B, then B is less than A by

$$\left[\frac{R}{(100-R)} \times 100\right]\%$$

Example 1: ***60 kg is what percent of 240 kg?***

Solution: According to the formula,

$$\text{Required percentage} = \frac{60}{240} \text{ X } 100\% = \frac{100}{4} = 25\%$$

Example 2: ***The monthly income of a person is R 8000. If his income is increased by 20%, what will be his new monthly income?***

Solution: Given that $x = \text{R } 8000$

$y = 20\%$

According to the formula,

$$\text{New income} = \frac{100+20}{100} \text{ X } 8000 \qquad [+ \text{ sign as increase takes place}]$$

$$= \frac{120}{100} \text{ X } 8000 = \text{R } 9600$$

Example 3: ***The price of a computer is R20000. What will, be the price of computer after reduction of 25%?***

Solution: Given that $x = 20000$

$y = 25\%$

According to the formula,

$$\text{New price} = \frac{100-25}{100} \text{ X } 20000$$

$$= \frac{75}{100} \text{ X } 20000 = 75 \text{ X } 200$$

$$= \text{R } 15000$$

Example 4: ***If income of Ravi is 20% more than that of Ram, then income of Ram is how much percent less than that of Ravi?***

Solution: Given that $a = 20\%$

According to the formula,

$$\text{Required percentage} = \left(\frac{20}{100+20} \times 100\right)\%$$

$$= \frac{50}{3}\% = 16\frac{2}{3}\%$$

Exercise

1. X is 75% of Y. The percentage of Y to X is:

   a. 25% b. $33\frac{1}{3}\%$ c. 125% d. $133\frac{1}{3}\%$

2. X is 80% of y. The percentage of y to y - x is:

   a. 120% b. 400% c. 500% d. None of these

3. Verma gets 10% more than Akbar, then Akbar gets

   a. 10% less than Verma b. 9% less than Verma c. $9\frac{1}{11}\%$ less than Verma d. 10% more than Verma

4. The price of sugar having risen. By 50% by what fraction must a householder reduce his consumption of sugar so as not to increase his expenditure?

   a. ¼ b. ⅓ c. ½ d. ⅔

5. The population of a town is 12000, if the number of males be increased by 6% and that of females by 8%, the population would be increased to 12800. Find the strength of females in the town.

   a. 3500 b. 4000 c. 4500 d. 5000

6. Adding $x\%$ of y is the same as multiplying Y by

   a. $\frac{x}{100}$ b. $\frac{x}{100} + x$ c. $\frac{x}{100} + 1$ d. None of these

7. 300 gm of sugar solution has 30% sugar in it. How much sugar should be added to make it 60% in the solution?

   a. 90 gm b. 180 gm c. 225 gm d. 315 gm

8. A man spent 6.25% of what he had. If his expenditure amounted toR75, what amount he had?

   a. R 1000 b. R 1200 c. R 1600 d. R 1100

9. An Engineering student has to secure 40% marks to pass. He get 80 marks and fails by 40 marks. Find his maximum marks.

   a. 200 b. 300 c. 250 d. 400

10. The population of a town increased from 70000 to 71050. Find the increase percent.

    a. 1.5% b. 1.75% c. 1.25% d. 2%

11. If the income tax be reduced from 3½% to 3⅓% what difference does it make to a man whose annual income in R 8400?

    a. R 7 b. R 28 c. R 21 d. R 14

12. A man spent 12.50% of his money and after spending 75% of the remainder, he had R175 left. How much had he at first?

    a. R800 b. R1200 c. R1600 d. None of these

13. Two numbers are respectively 20% and 50% more than a third number. What percentage is the first of the second?

a. 60% b. 70% c. 80% d. 40%

14. Candidate who gets 30% of the marks in an examination fails by 50 marks. Another candidate who gets 320 marks fails by 30 marks. Find the maximum number of marks.

a. 800 b. 900 c. 1000 d. None of these

15. In an examination paper is set to 2500 pupils of whom 'one fifth are girls and the rest boys. 5% of the boys fail and 40% of the girls fail. What percent of the whole passed?

a. 82% b. 75% c. 80% d. 88%

16. The population of a town increase by 5% annually frails present population is 64000. What will it be in 3 years' time?

a. 72044 b. 74088 c. 75042 d. None of these

17. The population of a town increases at the rate of 5% per year. The present population is 8000. When will it have 9261 inhabitants?

a. 2 years b. 2.5 years c. 3 years d. 4 years

18. During the first year, the population of town increased by 4% and during the second year it 'diminished by 4%. If at the end of the second year its population was 24960, what was its population at the beginning of the first year?

a. 24960 b. 25200 c. 24000 d. 25000

19. If 97% of the students are present in a class and 18 students are absent, find the total number of students in the class.

a. 800 b. 600 c. 700 d. 575

20. A man saves 20% of his monthly salary. If on account of dearness of things he is to increase his monthly expenses by 20% he is only able to save Rs. 20 per month. What is the monthly salary?

a. 400 b. 200 c. 500 d. 600

21. If a tape recorder is sold at R972, then there is a profit of 8%. If it is sold at Rs. 872, then there is a loss of

a. R 7 b. R 14 c. R 21 d. R 28

22. A man gains 12% when he sells his goods for R36. Find the cost price of the goods.

a. R 30 b. R 32 c. R 28 d. R 24

23. A shopkeeper purchase 11 knives with Rs 10 and sells them at the rate of 10 knives for Rs 11. He earns a profit of

a. 11% b. 15% c. 20% d. 21%

24. A buys a house for R100000 and sells it to B at a profit of 10%. B sells it back to A at a loss of 10%. Then in the deal

a. A neither loses nor gains. b. A makes R1000 c. A makes R11000 d. A loses R1000

25. A refrigerator is marked for sale at R6400. If two successive discounts of 20% and 15% are offered, what is the price at which it is sold?

a. R 2048 b. R 2240 c. R 4160 d. R 4352

26. An article is marked at R1000. If a discount of 20%, 10% and 10% is allowed, then its sale price is:

a. R846 b. R684 c. R648 d. R600

27. The difference between a discount of 40% and two successive discounts of 25% and 15% on a bill of R 12000 is:

a. No difference b. R 420 c. R 450 d. R480

28. A shopkeeper sells a badminton racket marked 30 Rs at 15% discount and gives I shuttle cock costing R 1.50 free with each racket. He then makes a profit of 20%. His cost price per racket is

a. R 15 b. R 16 c. R 18 d. R 20

29. A mixture of milk and water measures 70 liters. It contains 10% water. How much water should be mixed with it so that the water may be 25% in the new mixture?

a. 10 liters b. 12 liters c. 14 liters d. 15 liters

30. The tax on a commodity is diminished by 15% and its consumption increased by 10%. Find the decrease percent in the revenue derived from it.

a. 6.5% b. 8.33% c. 9.11% d. 5.2%

6-Profit & Loss

Cost Price: The price, at which an article is purchased, is called its ***cost price***, abbreviated as C.P.

Selling Price: The price, at which an article is sold, is called its ***selling price***, abbreviated as S.P.

Profit or Gain: If S.P. is greater than C.P., the seller is said to have a ***profit*** or ***gain***.

Loss: If S.P. is less than C.P., then the seller is said to have incurred a ***loss***.

1. Gain = (S.P.) – (C.P.)
2. Loss = (C.P.) – (S.P.)
3. Loss of gain is always reckoned on C.P.

4. Gain% = $\left(\frac{\text{Gain}\times 100}{\text{C.P.}}\right)$

5. Loss% = $\left(\frac{\text{Loss}\times 100}{\text{C.P.}}\right)$

6. S.P. = $\frac{(100+\text{Gain}\%)}{100}\times \text{C. P.}$

7. S.P. = $\frac{(100-\text{Loss}\%)}{100}\times \text{C. P.}$

8. C.P. = $\frac{100}{(100+\text{Gain}\%)}\times \text{S. P.}$

9. C.P. = $\frac{100}{(100-\text{Loss}\%)}\times \text{S. P.}$

10. If an article is sold at a gain of say, 35%, then S.P. = 135% of C.P.
11. If an article is sold at a loss of say, 35%, then S.P. = 65% of C.P.
12. When a person sells two similar items, one at a gain of say, $x\%$, and the other at a loss of $x\%$, then the seller always incurs a loss given by:

$$\text{Loss}\% = \left(\frac{\text{Common Loss and Gain}\%}{10}\right)^2 = \left(\frac{x}{10}\right)^2$$

13. If a trader professes to sell his goods at a cost price, but uses false weights, then

$$\text{Gain\%} = \left[\frac{\text{Error}}{(\text{True Value}) - (\text{Error})} \times 100\right]\%$$

Example 1: ***Raman purchased a car for R 5 lac and sold it for R4 lac. Find profit/loss in this transaction.***

Solution: Here SP < CP

∴ Loss is incurred in this case.

According to the formula,

Loss = CP – SP

∴ Loss = R 5 lac – R 4 lac = R 1 lac

Example 2: ***A person buys a toy for R 50 and sells it for R 75. What will be his gain percent?***

Solution: Given that CP = R 50, SP = R 75

Profit = SP – CP = R (75 – 50) = R 25

According to the formula,

$$\text{Gain \%} = \frac{\text{Profit}}{\text{CP}} \text{ X } 100\% = \frac{25}{50} \text{ X } 100\% = 50\%$$

Example 3: ***A person buys a cycle for R 450 but because of certain urgency, he sells it for R 350. Find his loss percent.***

Solution: Given that CP = R 450, SP = R 350

Loss = CP – SP = R (450 – 350) = R 100

According to the formula,

$$\text{Loss \%} = \frac{\text{Loss}}{\text{CP}} \text{X} 100\% = \frac{100}{450} \text{ X } 100\% = \frac{200}{9}\% = 22\frac{2}{9}\%$$

Example 4: ***Find the SP when CP is R 80 and gain is 20%.***

Solution: SP = 120% of CP

$= 120\%$ of $80 = \frac{120}{100}$ X 80

= 6 X 16

= R 96

Example 5: ***Find the CP when SP is R40 and gain is 15%.***

Solution: CP $= \frac{100}{115}$ of SP $= \frac{100}{115}$ X 40 = R 34.78

Example 6: ***Find the CP when SP is R 200 and loss is 35%.***

Solution: CP $= \frac{100}{65}$ of SP $= \frac{100}{65}$ X 200 = R 307.6

Example 7: ***A vendor sells apples at 10 for a rupee gaining 40%. How many apples did he buy for a rupee?***

Solution: SP of 10 apples = R 1, gain = 40%

CP of 10 apples $= 1 \text{ X} \frac{100}{140} = \frac{5}{7}$

$\because$ $R\frac{5}{7}$ yields 10 apples

$\therefore$ R 1 will yield $10 \text{ X} \frac{7}{5} = 14$ apples

Exercise

1. When commodity is sold for R34.80, there is a loss of 25%. What is the cost price of the commodity?

   a. 46.40 b. 26.10 c. 43 d. 43.20

2. A bag marked at R80 is sold for R68. The rate of discount is:

   a. 20% b. $17\frac{11}{17}\%$ c. 15% d. 12%

3. If the cost price of 12 tables is equal to the selling price of 16 tables, the loss percent is:

   a. 15% b. 20% c. 25% d. 30%

4. A man sold 250 chairs and had a gain equal to selling price of 50 chairs. His profit percent is:

   a. 5% b. 10% c. 25% d. 50%

5. A man buys oranges at R5 a dozen and an equal number at R4 dozen. He sells them at R5.50 a dozen and makes a profit of R50. How many oranges did he buy?

   a. 30 dozens b. 40 dozens c. 50 dozens d. 60 dozens

6. Two mixers and one T.V. cost R7000, while two T.V.s and a mixer cost R9800. The value of one T.V. is:

   a. R2800 b. R2100 c. R4200 d. R8400

7. A horse and a cow were sold for R12000 each. The horse was sold at a loss of 20% and the cow at a gain of 20%. The entire transaction resulted in:

   a. No loss or gain b. Loss of R1000 c. Gain R1000 d. Gain of R2000

8. Hemant sold 10 sarees for a total profit of R460 and 12 sarees for a total profit of R144. At what profit per saree should he sell the remaining 20 sarees so that he gets an average profit of Rs. 18

per saree?

a. 7.40 b. 7.60 c. 7.80 d. 8.00

9. If an article is sold at 5% gain instead of 5% loss, the seller gets R6.72 more. The C.P. of the article is:

a. R67.20 b. R120 c. R134.40 d. R240

10. A man bought an article and sold it at a gain of 5%. If he had bought it at 5% less and sold it for R 1 less, he would have made a profit of 10%. The C.P. of the article was:

a. R100 b. R150 c. R200 d. R500

11. The sale price of an article including the sales tax is R616. The rate of sales tax is 10%. If the shopkeeper has made a profit of 12%, then the cost price of the article is :

a. R500 b. R515 c. R550 d. R600

12. At what profit percent must an article be sold so that by selling at half that price, there may be a loss of 30%?

a. 25% b. 36% c. 40% d. 42%

13. Jacob bought a scooter for certain sum of money. He spent 10% of the cost on repairs and sold the scooter for a profit of R1100. How much did he spend on repairs if he made a profit of 20%?

a. R400 b. R440 c. R500 d. R550

14. A man gains 20% by selling an article for a certain price. If he sells it at double the price, the percentage of profit will be:

a. 40% b. 100% c. 120% d. 140%

15. The ratio between the sale price and the cost price of an article is 7 : 5., What is the ratio between the profit and the cost price of that article?

a. 2 : 7 b. 5 : 2 c. 7 : 2 d. None

16. By selling an article, Michael earned a profit equal to one-fourth of the price he bought it. If he sold it for R375, what was the cost price?

a. R281.75 b. R300 c. R312.50 d. R350

17. In a certain store, the profit is 320% of the cost. If the cost increase by 25% but the selling price remains constant, approximately what percentage of the selling price is the profit?

a. 30% b. 70% c. 100% d. 250%

18. Oranges are bought at the rate of 9 for R1 and sold at the rate of 8 for R1. The profit is:

a. $9\frac{1}{11}$ % b. 10% c. $11\frac{1}{9}$ % d. $12\frac{1}{2}$ %

19. By selling an article, Ram earned a profit equal to one-fifth of the price he bought it. If he sold it for R360, what was the cost price?

a. R281.75 b. R300 c. R312.50 d. R350

20. If SP of 10 articles is equal to cost price of 8 articles, find Profit or Loss Percentage

a. 25% Profit b. 25% loss c. 20% Profit d. 20% loss

21. A shopkeeper sells one transistor for R840 at a gain of 20% and another for R960 at a loss of 4%. His total gain or loss percent is:

a. $5\frac{15}{17}$ % loss b. $5\frac{15}{17}$ % gain c. $6\frac{2}{3}$ % gain d. None

22. Nandlal purchased 20 dozen notebooks at R48 per dozen. He sold 8 dozen at 10% profit and the remaining 12 dozen with 20% profit. What is his profit percentage in this transaction?

a. 15% b. 16% c. 7.68% d. 19.2%

23. An article when sold for R840 earns a profit which is double the amount of loss when the same article is sold for R600, what is the C.P. of the article?

a. R500 b. R680 c. R720 d. Data inadequate

24. A table is offered for R300 with 20% and 10% off. If in addition, a discount of 5% is offered on cash payment, then the cash price of the table is:

a. R240 b. R216 c. R210 d. R205.20

25. The difference between a discount of 40% on R500 and two successive discounts of 36% and 4% on the same amount is:

a. Nil b. R2 c. R7.20 d. R1.93

26. A dealer marks his goods 20% above C.P. he then allows some discount on it and makes a profit of 8%. The rate of discount is:

a. 4% b. 6% c. 10% d. 12%

27. What price should a shopkeeper mark on an article, costing him R153, to gain 20% after allowing a discount of 15%?

a. R224 b. R216 c. R184 d. R162

28. The profit earned by selling an article for Rs. 800 is double the loss incurred when the same article is sold for R500. What is the cost price?

a. R750 b. R600 c. R800 d. Data inadequate

7-Ratio and Proportions

Ratio: The ratio of two quantities a and b in the same units, is the fraction $\frac{a}{b}$ and we write it as $a : b$.
In the ratio $a : b$, we call a as the ***first term*** or ***antecedent*** and b, the ***secondterm*** or ***consequent***.

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

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

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

Proportion: The equality of two ratios is called proportion.
If $a : b = c : d$, we write, $a : b :: c : d$ and we say that a, b, c, d are in proportion.
Here a and b are called ***extremes***, while b and c are called ***mean terms***.
Product of means = Product of extremes
Thus, $a : b :: c : d \Leftrightarrow (b \times c) = (a \times d)$

Fourth Proportional: If $a : b = c : d$, then d is called the fourth proportional top a, b, c.
Third Proportional: If $a : b = b : c$, then c is called the third proportional to a, b.
Mean Proportional: Mean proportional between a and $b$is $\sqrt{ab}$.

Comparison of Ratios:

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

Compound Ratio:

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

Duplicate Ratio of $(a : b)$is $(a^2 : b^2)$.

Sub – Duplicate Ratio of $(a : b)$ is $(\sqrt{a} : \sqrt{b})$

Triplicate Ratio of $(a : b)$ is $(a^3 : b^3)$

Sub – Triplicate Ratio of $(a : b)$ is $\left(a^{\frac{1}{3}} : b^{\frac{1}{3}}\right)$

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

Example 1: Divide 2324 in the ratio of 35 : 28 : 20.

Solution: 1^{st} part $= \frac{35}{83} \times 2324 = 35 \times 28 = 980$

2^{nd} part $= \frac{28}{83} \times 2324 = 28 \times 28 = 784$

3^{rd} part $= \frac{20}{83} \times 2324 = 20 \times 28 = 560$

Example 2: ***Shantanu has 50 p, 25 p and 10 p coins in the ratio of 5 : 9 : 4, amounting to R412. Find the number of coins of each type.***

Solution: Let Number of 50 p coins $= 5x$
Number of 25 p coins $= 9x$
Number of 10 p coins $= 4x$

Then, Value of 50 p coins $= \frac{5x}{2}$

Value of 25 p coins $= \frac{9x}{4}$

Value of 10 p coins $= \frac{4x}{10}$

And total amount = R412

$\therefore \quad \frac{5x}{2} + \frac{9x}{4} + \frac{4x}{10} = 412$

$\Rightarrow \quad 50x + 45x + 8x = 412 \times 20$

$\Rightarrow \quad 103x = 412 \times 20$

$\therefore \quad x = 80$

Number of 50 p coins = 5 X 80 = 400
Number of 25 p coins = 9 X 80 = 720
Number of 10 p coins = 4 X 80 = 320

Example 3: ***Sum of two numbers is 1664 and their ratio is 5 : 3. Find the numbers.***

Solution: Let 1^{st} number $= 5x$ and 2^{nd} number $= 3x$

According to the question

$5x + 3x = 1664 \quad \Rightarrow \quad 8x = 1664$

$\therefore \quad x = 208$

Hence, 1^{st} number $= 5x = 5$ X 208 = 1040
2^{nd} number $= 3x = 3$ X 208 = 624

Alter

1^{st} number $= \frac{5}{5+3} \times 1664 = \frac{5}{8} \times 1664 = 5$ X 208 = 1040

2^{nd} number = 1664 – 1040 = 624

Example 4: ***Difference between two numbers is 372 and their ratio is 7 : 4. Find the number.***

Solution: Let 1^{st} number $= 7x$ and 2^{nd} number $= 4x$

According to the question,

$7x - 4x = 372 \Rightarrow \quad 3x = 372$

$\therefore \quad x = 124$

Hence, 1st number $= 7x = 7$ X $124 = 868$

2nd number $= 4x = 4$ X $124 = 496$

Exercise

1. If A:B=7:9 & B:C= 3:5, then A:B:C is

   a. 7:9:5 b. 21:35:45 c. 7:9:15 d. 7:3:15

2. Some money is divided among A,B,C in such a way that 5 times A's share, 3 times B's share & 2 times C's share are all equal, then ratio b/w shares of A,B,C is

   a. 5:3:2 b. 2:2:5 c. 15:10:6 d. 6:10:15

3. The proportion of zinc & copper in brass piece is 13:7. How much zinc will be there in 100 kg of such piece

   a. 20kg b. 35kg c. 55kg d. 65kg

4. The prices of a scooter & a television are in the ratio 3:2. If a scooter costs R6000 more than the television set, the price of the television is

   a. R6000 b. R10000 c. R12000 d. R18000

5. A certain amount was divided b/w Kavita & Reena in ratio of 4:3. If Reena's share was R2400, then amount is

   a. R5600 b. R3200 c. R9600 d. None

6. The ratio of father's age to son's age is 4:1. The product of their ages is 196. The ratio of their ages after 5 years will be

   a. 3:1 b. 10:3 c. 11:4 d. 14:5

7. An alloy contains copper and zinc in the ratio 7 : 3. If the alloy contains 10.5 kg zinc, then the quantity of copper in the alloy is:

   a. 17.35 kg b. 24.5 kg c. 28.2 kg d. 31.5 kg

8. R675 was divided between A, B and C. If each of them had received R5 less, their shares would have been in the ratio 1: 2: 3. How much did B receive?

   a. R112.50 b. R215 c. R220 d. R225

9. Divide the number 217 into three parts proportional to 1 / 2, 1 / 3, 1 / 5.

a. 105, 70, 42 b. 115, 80, 50 c. 110, 75, 50 d. 120, 80, 50

10. Two numbers are in the ratio of 3 : 5. If 9 be subtracted from each, then they are in the ratio of 9 : 17. Find the second number.

a. 42 b. 48 c. 55 d. 60

11. If R391 is divided into three parts proportional to the fractions 1 / 2 :2 / 3 : 3 /4. What is the first part?

a. 102 b. 112 c. 92 d. 82

12. If R1540 be divided amongst A, B, C in such a way that the share of B is equal to 3 / 11 of what A and C together receives. What is B's share?

a. 300 b. 330 c. 360 d. 390

13. A certain sum of money is divided among three brothers john, Paul and Tommy such that if John has one rupee, Paul has 65 paise and Tommy 40 paise. If Tommy has R8, what is the total money divided amongst three brothers?

a. 40 b. 41 c. 45 d. 47

14. A bag contains 25 paise, 10 paise& 5 paise coins in the ratio 1:2:3, if their total value is R30, the no of 5 paise coins is

a. 50 b. 100 c. 150 d. 200

15. 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. 11:14 b. 14:11 c. 25:28 d. 28:25

16. The students in three classes are in the ratio 2:3:5. If 20 students are increased in each class, the ratio changes to 4:5:7. The no of students before the increase were

a. 10. b. 90 c. 100 d. None

17. A & B are two alloys of gold & copper prepared by mixing metal in the proportion 7:2 & 7:11 respectively. If equal quantities of the alloy are melted to form a 3rd alloy C, the proportion of gold & copper in C will

a. 5:9 b. 5:7 c. 7:5 d. 9:5

18. The equal glasses are respectively 1/3 & ¼ full of milk. They are then filled up with water & the contents mixed in a tumbler. The ratio of milk & water in tumbler is

a. 7:5 b. 7:17 c. 3:7 d. 11:23

19. 15 liter of mixture contains 20% alcohol & rest of the water. If 3 ltr of water be mixed in it, the %age of alcohol in new mixture is

a. 17 b. 50/3 c. 37/2 d. 15

20. A man has some hens & cows. If the no of heads be 48 & no of feet is 140, the no of hens will be

a. 22 b. 23 c. 24 d. 26

8-Partnership

Partnership: When two or more than two persons run a business jointly, they are called partners and the deal is known as partnership.

Example 1: ***A and B invested R 24000 and R 8000 for a period of 2 years. After 2 years, they earned R 48000. What will be the shares of A and B out of this earning?***

Solution: A's share : B's share = A's investment : B's investment = 24000 : 8000 = 3 : 1

Now, let A's share $= 3x$

B's share $= x$

According to the equation, $3x + x = 48000$

$\Rightarrow$ $4x = 48000$

$\therefore$ $x = 12000$

Clearly, share of B $= x =$ R 12000 and share of A $= 3x = 3$ X 12000 = R 36000

Alter

A's share : B's share = A's investment : B's investment = 24000 : 8000 = 3 : 1

Now A's share $= \frac{3}{3+1}$ X 48000 = 3 X 12000 = R 36000

B's share $= \frac{1}{3+1}$ X 48000 = 1 X 12000 = R 12000

Example 2: ***A and B jointly start a business. The investment of A is equal to three times investment of B. Find the share of A in the annual profit of R 52000.***

Solution: Let the investment of B = 1

Then, investment of A = 1 X 3 = 3

Clearly, A : B = 3 : 1

Now, let the share of A $= 3x$

And the share of B $= x$

According to the question,

$3x + x = 52000$

$\Rightarrow$ $4x = 52000$

$\therefore$ $x = 13000$

Clearly, A's share $= 3x = 3$ X 13000 = R 39000

Example 3: ***A starts a business with R 2000 and B joins him after 3 months with R 8000. Find the ratio of their profits at the end of the year.***

Solution: A's share : B's share = 2000 X 12 : 8000 X (12 – 3) = 2 X 12 : 8 X 9 = 1 : 3

Note: *Here, A invested for a year (12 months) and B invested 3 months later. It does not mean B invested for (12 – 3) or 9 months.*

Example 4: ***A starts a business with R 4000 and B joins the business 4 months later with an investment of R 5000. After a year, they earn a profit of R 22000. Find the shares of A and B.***

Solution: A's share : B's share = 4000 X 12 : 5000 X (12 – 4) = 4 X 12 : 5 X 8 = 6 : 5

Now, let the share of A $= 6x$

And the share of B $= 5x$

According to the question, $6x + 5x = 22000 \quad \Rightarrow \quad 11x = 22000$

$\therefore \quad x = \text{R } 2000$

$\therefore$ Share of A $= 6x = 6$ X 2000 $=$ R 12000

And share of B $= 5x = 5$ X 2000 $=$ R 10000

Shares of A and B could be determined by the following method also.

A's share $= \frac{6}{6+5}$ X 22000 $=$ R 12000 and B's share $= \frac{5}{6+5}$ X 22000 $=$ R 10000

Exercise

1. The partners A, B, C invests R26000, R34000 &R10000 respectively in a business. Out of a profit of R3500, B's share is

   a. R1300 b. R1700 c. R500 d. R1500

2. Pooja invests R30000 for one year in a shop. How much her partner Neha should invest in order that the profit after one year may be 2:3

   a. R20000 b. R40000 c. R45000 d. R18000

3. R700 is divided among A,B, and C so that A receives half as much as B and B half as much as C. Then C's share is

   a. R200 b. R300 c. R400 d. R600

4. Manoj got R6000 as his share out of a total profit of R9000 which he and Ramesh earned at the end of one year. If Manoj invested R20000 for 6 months, whereas Ramesh invested his amount for the whole year, what was the amount invested by Ramesh?

   a. R3000 b. R3000 c. R1000 d. R5000

5. A and B enter into partnership. A invests R16000 for 8 months and B remains in the business for 4 months. Out of a total profit, B claims 2/7 of the profit, B contributed.

   a. R11900 b. R10500 c. R13600 d. R12800

6. A and B start a business with initial investments in the ratio 12:11 and their annual profits were in the ratio 4:1. If A invested the money for 11 months, B invested the money for

   a. 3 months b. 11/3 months c. 4 months d. 6 months

7. A, B and C are partners in a business. If twice the investment of A is equal to thrice the capital of B and the capital of B is four times the capital of C, out a total profit of R5940, the share of C is

   a. R700 b. R900 c. R740 d. R540

8. A and B are centered into partnership investing R16000 and R12000 respectively. After 3 months, A withdrew R5000 while B investedR5000 more. After 3 more months C joins the Business with a capital of R21000. The Share of B exceeds that of C, out of a total profit of R26400 after one year,

by

a. R1200 b. R2400 c. R3600 d. R4800

9. A, B and C enter in partnership and their capital are in the proportion of 1/3, ¼, 1/5. A withdraws half his capital at the end of 4 months. Out of a total annual profit of R847, A's share is

a. R252 b. R280 c. R315 d. R412

10. In a partnership, A invests (1/6) of the capital for (1/6) of the time, B invests (1/3) of the capital for (1/3) of the time and C, the rest of the capital for the whole time. Out of a profit of R4600, B's share is

a. R800 b. R1000 c. R650 d. R960

11. Four milkmen rented a pasture. A grazed 18 cows for 4 months, B 25 cows for 2 months, C 28 cows for 5 months & D 21 cows for 3 months. If A's share is R360, the total rent of field is

a. R1500 b. R1600 c. R1625 d. R1650

9-Time and Work

If A can do a piece of work in n days, then A's 1 day's work = $\frac{1}{n}$.

If A's day's work = $\frac{1}{n}$, then A can finish the work in n days.

If A is thrice as good as a workman as B, then:
Ratio of work done by A and B = 3 : 1
Ratio of times taken by A and B to finish a work = 1 : 3

Example 1: ***Vandana completes a work in 35 days. What work will she do in 1 day?***

Solution: As we know that if a person can do a piece of work in n days, then person's 1 day's work $= \frac{1}{n}$

Here $n = 35$

$\therefore$ Required work done $= \frac{1}{35}$

Example 2: ***Kavi does $\frac{1}{13}$ part of certain work in 1 day. In how many days will be complete the whole work?***

Solution: As we know that if a person's 1 day's work $= \frac{1}{n}$, then the person will complete the while work in n days.

Here, $\frac{1}{n} = \frac{1}{13}$

$\therefore$ Required number of days $= 13$

Example 3: ***Shantanu can do a piece of work in 4 days. In how many days will he complete 3 works of the same type?***

Solution: We know that work and time are directly proportional, *i. e.*,
More Work, More Time (days)

$\because$ A piece of work can be done in 4 days.

$\therefore$ 3 works of same type will be done in 4 X 3 = 12 days.

Example 4: ***16 men can do a piece of work in 10 days. How many men are needed to complete the work in 20 days?***

Solution: Here, $M_1 = 16, D_1 = 10, W_1 = W_1 = 1, D_2 = 20, M_2 = ?$
According to the formula,

$$M_1D_1W_2 = M_2D_2W_1$$
$$16 \text{ X } 10 \text{ X } 1 = M_2 \text{ X } 20 \text{ X } 1$$

$\therefore$ $M_2 = \frac{16\times10}{20} = \frac{160}{20} = 8$ men

Example 5: ***10 men can make 20 toys in 12 days working 12 hours a day. Then, in how many days can 24 persons make 32 toys working 16 hours a day?***

Solution: Given that $M_1 = 10, M_2 = 24, D_1 = 12, D_2 = ?, T_1 = 16, W_1 = 20, W_2 = 32$

According to the formula

$$M_1D_1T_1W_2 = M_2D_2T_2W_1$$

$\Rightarrow$ $10 \text{ X } 12 \text{ X } 12 \text{ X } 32 = 24 \text{ X } D_2 \text{ X } 16 \text{ X } 20$

$\therefore$ $D_2 = \frac{10\times12\times12\times32}{24\times16\times20} = \frac{12}{2} = 6$ days

Example 6: ***10 men can do a piece of work in 4 days, 14 women can do the same work in 6 days while 18 boys can do this work in 8 days. In how many days will 1 man, 1 woman and 1 boy complete the whole work?***

Solution: Time taken by 10 men to complete the work = 4 days

$\therefore$ Time taken by 1 man to complete the work $= 10 \text{ X } 4 = 40$ days

$\therefore$ 1 day's work of a man $= \frac{1}{40}$

Similarly, 1 day's work of a woman $= \frac{1}{14\times6} = \frac{1}{84}$

And 1 day's work of a boy $= \frac{1}{18\times8} = \frac{1}{144}$

$\therefore$ (1 man + 1 woman + 1 boy)'s 1 day's work $= \frac{1}{40} + \frac{1}{84} + \frac{1}{144}$

$$= \frac{126+60+35}{5040} = \frac{221}{5040}$$

$\therefore$ (1 man + 1 woman + 1 boy) complete the whole work in $\frac{5040}{221}$ days.

Example 7: ***Gagan can finish a work in 5 days working 4 hours a day while Kavi can finish the same work in 10 days working 5 hours a day. Working together, how long will they take to complete the work, if they work 10 hours a day?***

Solution: Time taken by Gagan to finish the work working 4 hours a day = 5 days

$\therefore$ Time taken by Gagan to finish the work working 1 hour a day $= 4 \text{ X } 5 = 20$ days

$\therefore$ Gagan's 1 day's work working 1 hour a day $= \frac{1}{20}$

Similarly, Kavi's 1 day's work working 1 hour a day $= \frac{1}{50}$

$\therefore$ (Gagan + Kavi)'s work working 1 hour a day $= \frac{1}{20} + \frac{1}{50} = \frac{5+2}{100} = \frac{7}{100}$

$\therefore$ (Gagan + Kavi) complete the work working 1 hour a day in $\frac{100}{7}$ days.

$\therefore$ Time taken by both working 1 hour a day $= \frac{100}{7\times10} = \frac{10}{7} = 1\frac{3}{7}$ days.

Exercise

1. A can do a piece of work in 30 days while B can do it in 40 days. In how many days can A and B working together do it?

   a. 70 days b. $42\frac{3}{4}$ days c. $27\frac{1}{7}$ days d. $17\frac{1}{7}$ days

2. A and B can together do a piece of work in 15 days. B alone can do it in 20 days. In how many days can A alone do it?

   a. 30 days b. 40 days c. 45 days d. 60 days

3. A and B can do a piece of work in 6 days and A alone can do it in 9 days. The time taken by B alone to do the work is:

   a. 18 days b. 15 days c. 12 days d. $7\frac{1}{2}$ days

4. A can do a piece of work in 20 days while B can do in 12 days. B worked at it for 9 days. A can finish the remaining work in

   a. 3 days b. 5 days c. 7 days d. 11 days

5. A can do a piece of work in 80 days. He works at it for 10 days and then B alone finishes the work in 42 days. The two together could complete the work in

   a. 24 days b. 25 days c. 30 days d. 35 days

6. A can do a certain hob in 25 days which B alone can do in 20 days. A started the work and was joined by B after 10 days. The work lasted for:

   a. $12\frac{1}{2}$ days b. $14\frac{2}{9}$ days c. 15 days d. $16\frac{2}{3}$ days

7. A can do a piece of work in 10 days and B can do the same piece of work in 20 days. They start the work together but after 5 days, A leaves off. B will do the remaining piece of work in:

   a. 5 days b. 6 days c. 8 days d. 7 days

8. A and B can together finish a work in 30 days. They worked for it for 20 days and then B left. The remaining work was done by A alone in 20 more days. A alone can finish the work in

   a. 48 days b. 50 days c. 54 days d. 60 days

9. A can do a piece of work in 14 days which B can do in 21 days. They begin together but 3 days before the completion of the work, A leaves off. The total number of days to complete the work is

   a. $6\frac{3}{5}$ days b. $8\frac{1}{2}$ days c. $10\frac{1}{5}$ days d. $13\frac{1}{2}$ days

10. A is twice as good a workman as B and together they finish a piece of work in 14 days. A alone can finish the work in:

a. 11 days b. 21 days c. 28 days d. 42 days

11. A is thrice as good a workman as B and takes 10 days less to do a piece of work than B takes. B can do the work in:

a. 12 days b. 15 days c. 20 days d. 30 days

12. A can do a certain job in 12 days. B is 60% more efficient than A. the number of days, it takes B to do the same piece of work is:

a. 6 b. $6\frac{1}{4}$ c. $7\frac{1}{2}$ d. 8

13. If 1 man or 2 women or 3 boys can do a piece of work in 44 days, then the same piece of work will be done by 1 man, 1 woman and 1 boy in:

a. 21 days b. 24 days c. 26 days d. 33 days

14. if 5 men or 9 women can finish a piece of work in 19 days, 3 men and 6 women will do the same work in:

a. 10 days b. 12 days c. 13 days d. 15 days

15. 3 men and 4 boys do a piece of work in 8 days, while 4 men and 4 boys finish it in 6 days. 2 men and 4 boys will finish it in:

a. 9 b. 10 c. 12 d. 14

16. If 15 toys cost R234, what do 35 toys cost?

a. R550 b. R546 c. R600 d. R530

17. If the 36 men can do a piece of work in 25hours, in how many hours will 15 men do it?

a. 50hrs b. 60hrs c. 70hrs d. 80hrs

18. If the wages of 6 men for 15 days be R2100, the find the wages of 9 men for 12 days?

a. R2500 b. R2520 c. 2 R600 d. R2225

19. If 20 men can build a wall 56m long in 6 days, what length of a similar wall can be built by 35 men in 3 days?

a. 47 b. 48. c. 49 d. 46

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

a. 10 b. 15 c. 20 d. 25

21. A garrison of 3300 men had provision for 32 days, when given at the rate 850gm per head. At the end of seven days, reinforcement arrives and it was found that the provisions will last 17 days more, when given at the rate of 825 gm per head. What is the strength of the reinforcement?

a. 1700 b. 1600 c. 1700 d. 1800

10-Pipes & Cisterns

Inlet: A pipe connected with a tank or a cistern or a reservoir, that fills it, is known as an inlet.
Outlet:A pipe connected with a tank or a cistern or a reservoir, emptying it, is known as an outlet.

If a pipe can fill a tank in x hours, then: part filled in 1 hour = $\frac{1}{x}$

If a pipe can empty a full tank in y hours, then: part emptied in 1 hour = $\frac{1}{y}$

If a pipe can fill a tank in x hours and another pipe can empty the full tank in y hours (where $y > x$), then on opening both the pipes, the net part filled in 1 hour is:

$$\frac{1}{x} - \frac{1}{y}$$

If a pipe can fill a tank in x hours and another pipe can empty the full tank in y hours (where $x > y$), then on opening both the pipes, the net part emptied in 1 hour is:

$$\frac{1}{y} - \frac{1}{x}$$

Example 1: ***If a pipe can fill a tank in 2 hours and another pipe can fill the same tank in 6 hours, then what part of tank will be filled by both the pipes in 1 hour, if they are opened simultaneously?***

Solution: In 1 hour, part filled by 1st pipe $= \frac{1}{m} = \frac{1}{2}$

In 1 hour, part filled by 2nd pipe $= \frac{1}{n} = \frac{1}{6}$

$\therefore$ in 1 hour, part filled by both the pipes together $= \left(\frac{1}{m} + \frac{1}{n}\right) = \frac{1}{2} + \frac{1}{6} = \frac{3+1}{6} = \frac{2}{3}$ part

Example 2: ***A pipe can fill a tank in 15 hours. Another pipe can empty the full tank in 20 hours. Find the net part filled in 1 hour, when both, the pipes are opened.***

Solution: According to the formula

Part filled by 1st pipe in 1 hour $= \frac{1}{15}$

Part filled by 2nd pipe in 1 hour $= \frac{1}{20}$

$\therefore$ Part filled when both the pipes are opened $= \frac{1}{15} - \frac{1}{20} = \frac{4-1}{60} = \frac{1}{60}$

Exercise

1. Two pipes A & B can fill a tank in 36 hours and 45 hours respectively. If both the pipes are opened simultaneously. How much time is taken to fill the tank?

   a. 10 b. 5. c. 20 d. 25

2. Two pipes can fill a tank in 10 hours and 12 hours respectively while a third pipe empties the full tank in 20 hours. If all the pipes operates simultaneously, in how much time will the tank be filled?

   a. 6hrs b. 8hrs c. 7hrs 3omin d. 9hrs

3. A tap can fill a tank in 6 hours. After half the tank is filled; three more similar taps are opened. What is the total time taken to fill the tank completely?

   a. 3 hrs 45 min b. 3 hrs 15min c. 4 hrs d. None of these

4. A water tank is two fifth full. Pipe A can fill the tank in 10 min and pipe B can empty it in 6 min. If both pipes are open, how long will it take to empty or fill the tank completely?

   a. 6min to empty b. 6min to fill c. 9min to fill d. None of these

5. Two pipes can fill a cistern in 14 hrs and 16 hrs respectively. The pipes are opened are opened simultaneously and it is found that due to leakage in the bottom it took 32 min more to fill the cistern. When the cistern is full, in what time will the leak empty it?

   a. 110hours b. 112 hours c. 115hours d. 120hours

6. Two pipes A and B can fill a tank in 36min and 45 min respectively. A water pipe C can empty the tank in 30min. First A and B are opened. After 7 min, C is also opened. In how much the tank is full?

   a. 38min b. 39min c. 46min d. 45min

7. Two pipes A and B can fill a tank in 24min and 32min respectively. If both the pipes are opened simultaneously, after how much time B should be closed so that the tank is full in 18min?

   a. 8min b. 10min c. 12min d. 14min

8. A leak in the bottom of a tank can empty the full tank in 8 hours. An inlet pipe fills water at the rate of 6litres a min. When the tank is full, the inlet is opened and due to the leak the tank is empty in 12hrs, how many litres does the cistern hold?

   a. 7580 b. 7960 c. 8290 d. 8640

9. Two pipes can fill the tank in 20 and24 min respectively and the waste pipe can empty 3 gallons per min. All the three pipes working all together to fill the tank in 15min. The capacity of the tank is?

   1. 60gallons 2. 100gallons 3. 120gallons 4. 180gallons

10. Three pipes A, B and C can fill a tank in 6 hours . After working at it together for 2 hours , C is closed and A and B can fill the remaining part in 7 hours. The number of hours taken by C alone to fill the tank is?

    a. 10 b. 12 c. 14 d. 16

11-Speed, Time & Distance

$\text{Speed} = \left(\frac{\text{Distance}}{\text{Time}}\right)$, $\text{Time} = \left(\frac{\text{Distance}}{\text{Speed}}\right)$, $\text{Distance} = (\text{Speed} \times \text{Time})$

$x\ km/hr = \left(x \times \frac{5}{18}\right)\ m/sec$

$x\ m/sec = \left(x \times \frac{18}{5}\right)\ km/hr$

If the ratio of the speeds A and $B$is $a : b$, then the ratio of the times taken by them to cover the same distance is $\frac{1}{a} : \frac{1}{b}$ or $b : a$.

Suppose a man covers a certain distance at $x\ km/hr$ and an equal distance at $y\ km/hr$. Then the average speed during the whole journey is $\left(\frac{2xy}{x+y}\right)\ km/hr$.

Example 1: ***Convert 72 km/h into m/s.***

Solution: We know that

$$a\text{km/h} = \left(a \times \tfrac{5}{18}\right) \text{m/s}$$

$$\therefore \quad 72 \text{ km/h} = \left(72 \times \tfrac{5}{18}\right) \text{m/s} = 20 \text{ m/s}$$

Example 2: ***Convert 25 m/s to km/h.***

Solution: We know that

$$a\text{m/s} = \left(a \times \tfrac{18}{5}\right) \text{km/h}$$

$$\therefore \quad 25 \text{ m/s} = \left(25 \times \tfrac{18}{5}\right) \text{km/h} = 90 \text{ km/h}$$

Example 3: ***A train covers a distance of 200 km with a speed of 10 km/h. What time is taken by the train to cover this distance?***

Solution: As we know that

$$\text{Speed} = \frac{\text{Distance}}{\text{TIme}}$$

Where speed $= 10$ km/h and distance $= 200$ km

$$\therefore \quad 10 = \frac{200}{\text{Time}}$$

$\therefore$ Required time $= 20$ hours.

Example 4: ***A bike crosses a bridge with a speed of 108 km/h. What will be the length of the bridge if the bike takes 8 minutes to cross the bridge?***

Solution: Here, length of the bridge = Distance travelled by bike in 8 minutes
= Speed X Time

Given that speed $= 108$ km/h $= 108$ X $\frac{5}{18}$ m/s $= 30$ m/s

Time $= 8$ minutes $= 8$ X $60 = 481$ seconds
$\therefore$ Length of the bridge $= 30$ X $480 = 14400$ m

Example 5: ***Two persons are moving in the direction opposite to each other. The speeds of both the persons are 5 km/h and 3 km/h respectively. Find the relative speed of the two persons with respect to each other.***

Solution: As we know that the two speeds will be added if the motions of two objects are in opposite directions.
$\therefore$ Required relative speed $= 5 + 3 = 8$ km/h

Example 6: ***A person covers a certain distance with a speed of 18 km/h in 8 minutes. IF he wants to cover the same distance in 6 minutes, what should be his speed?***

Solution: As we know that,

$$\text{Speed} = \frac{\text{Distance}}{\text{TIme}}$$

$$18 = \frac{\text{Distance} \times 60}{8}$$

$$\text{Distance} = \frac{18 \times 8}{60} = \frac{12}{5} \text{ km}$$

$\therefore$ Speed to cover $\frac{12}{5}$ km in 6 minutes $= \frac{\frac{12}{5}}{\frac{1}{10}} = \frac{12}{5}$ X $10 = 12$ X $2 = 24$ km/h

Exercise

1. A car takes 6 hours to cover a journey at a speed of 45 kmph. At what speed must it travel in order to complete the journey in 5 hours?

   a. 55 km/hr b. 54 km/hr c. 53 km/hr d. 52 km/hr

2. If a man running at 15 kmph crosses a bridge in 5 min then the length of the bridge is:

   a. 1333.33 m b. 1000 m c. 7500 m d. 1250 m

3. If a student walks from his house to school at 5 kmph, he is late by 30 min. However, if he walks at 6 kmph, he is late by 5 min only. The distance of his school from his house is:

a. 2.5 km b. 3.6 km c. 5.5 km d. 12.5 km

4. A car travels a distance of 715 km at a uniform speed. If the speed of the car is 10 kmph more, it takes 2 hours less to cover the same distance. The original speed was:

a. 45 kmph b. 55 kmph c. 60 kmph d. 65 kmph

5. Two cyclists start from the same place in opposite directions. One goes towards north at 18 kmph and the other goes towards south at 20 kmph. What time will they take to be 47.5 km apart?

a. $2\frac{1}{4}$ hrs b. $1\frac{1}{4}$ hrs c. 2 hrs 23 min d. $23\frac{1}{4}$hrs

6. Two trains starting at the same time from two stations 200 km apart and going in opposite directions cross each other at a distance of 110 km from one of the stations. What is the ratio of their speeds?

a. 11 : 20 b. 9: 20 c. 11 : 9 d. None

7. A thief steals a car at 9 am and drive at the rate of 20 km/h. The theft is discovered and police starts chasing him at 9.30 am., in a jeep at the speed of 40 km/h. The thief will be caught at :

a. 10 am b. 10.30 am c. 11 am d. None

8. Two cyclists A and B starts from same place at the same time, one going towards east at a rate of 20 km/h and another towards west at a rate of 10 km/h. What time will they take to be 75 km apart?

a. 3 hr b. 2.5 hr c. 2 hr d. None

9. A person covers half of his journey at 30 km/hr and the remaining half at 20 km/hr. The average speed for the whole journey is

a. 24 km/hr b. 28 km/hr c. 32 km/hr d. None

10. A and B are two towns. A car goes from A to B at a speed of 64 km/hr and return to A at a slower speed. If its average speed for the whole journey is 56 km/hr, it returned with speed

a. 52.54 km/hr b. 47.52 km/hr c. 49.78 km/hr d. None

11. A train does a journey without stopping in 8 hours. If it had travelled 5 km an hour faster, it would have done the journey in 6 hours 40 min. What is its slower speed?

a. 35 km/hr b. 25 km/hr c. 40 km/hr d. None

12. Excluding stoppages, the speed of a train is 45 kmph and including stoppages, it is 36 kmph. For how many min does the train stop per hour?

a. 10 min b. 12 min c. 15 min d. 18 min

13. A bullock cart has to cover a distance of 80 km in 10 hours. If it covers half of the journey in $3/5^{th}$ time, what should be its speed to cover the remaining distance in the time left?

a. 8 km/hr b. 6.4 km/hr c. 10 km/hr d. 20 km/hr

14. The ratio between the rates of walking of A and B is 3 : 4. If the time taken by B to cover a distance is 24 min, the time taken by A to covet that much distance is:

a. 18 min b. 32 min c. $10\frac{6}{7}$ min d. $13\frac{5}{7}$ min

15. Bombay Express left Delhi for Bombay at 14:30 hrs, travelling at a speed of 60 kmph and Rajdhani Express left Delhi for Bombay on the same day at 16:30 hrs, travelling at a speed of 80 kmph. How far away from Delhi will the two trains meet?

a. 120 km b. 360 km c. 480 km d. 500 km

12-Problems on Trains

1. Time taken by a train of length $l$meters to pass a pole or a standing man or a signal post is equal to the time taken by the train to cover l meters.
2. Time taken by a train of length l meters to pass a stationary object of length b meters is the time taken by the train to cover $(l + b)$ meters.
3. Suppose two trains of two bodies are moving in the same direction at $u\ m/s$and $v\ m/s$, where $u > v$, then their relative speeds $= (u - v)\ m/s$.
4. Suppose two trains of two bodies are moving in the opposite direction at $u\ m/s$and $v\ m/s$, where $u > v$, then their relative speeds $= (u + v)\ m/s$.
5. If two trains of length a meters and b meters are moving in opposite directions at $u\ m/s$and $v\ m/s$, then the time taken by the trains to cross each other $= \frac{(a+b)}{(u+v)}\ sec$.
6. If two trains of length a meters and b meters are moving in the same direction at $u\ m/s$and $v\ m/s$, then the time taken by faster train to cross the slower train $= \frac{(a+b)}{(u-v)}\ sec$.
7. If two trains (or bodies), start at the same time from points A and B towards each other and after crossing they take a and $b\ sec$ in reaching B and A respectively, then:
   $(A's$speed) : ($B's$ speed) = $\left(\sqrt{b} : \sqrt{a}\right)$

Example 1: ***A train covers 85 m in passing a signal post. What is the length of the train?***

Solution: We know that the distance covered by a train in passing a pole or standing man or a signal post or any other object (of negligible length) is equal to the length of the train. So, in this case train covers 85 m to pass a signal post.

∴ Length of the train = 85 m

Example 2: ***A 29 m long train passes a platform which is 100 m long. Find the distance covered by the train in passing the platform.***

Solution: We know that when a train passes a stationary object having some length, then the distance covered by train is equal to the sum of the lengths of train and that particular stationary object. In this case, stationary object is 100 m long platform.

∴ Required distance = Length of train + Length of platform = 29 + 100 = 129 m

Example 3: ***Two trains are moving in opposite directions with speed of 4 m/s and 8 m/s, respectively. Find their relative speed.***

Solution: When two trains are moving in opposite direction, then their relative speed = sum of the speds of both the trains.

∴ Required relative speed = 4 m/s + 8 m/s = 12 m/s

Example 4: ***Two trains are moving in the same direction with speeds of 19 km/h and 25 km/h, respectively. What will be the relative speed of the train running at 25 km/h with respect to the train running at 19 km/h?***

Solution: We know that when two trains are running in the same direction, then the relative speed is equal to the difference of speeds both the trains.

∴ Required relative speed = 25 km/h – 19 km/h = 6 km/h

Example 5: ***Two trains of lengths 80 m and 90 m are moving in opposite directions at 10 m/s and 7 m/s, respectively. Find the time taken by the trains to cross each other.***

Solution: According to the formula.

$$\text{Required time} = \frac{x+y}{u+v}$$

Where $x = 80$ m, $y = 90$ m, $u = 10$ m/s, $v = 7$ m/s

$$\therefore \quad \text{required time} = \left(\frac{80+90}{10+7}\right) = \frac{170}{14} = 10 \text{ s}$$

Exercise

1. A train moves with a speed of 108 kmph. Its speed in m/s is

   a. 10.8 b. 18 c. 30 d. 38.8

2. A speed of 14mps is same as :

   a. 28kmph b. 46.6kmph c. 50.4kmph d. 70kmph

3. In what time will a train 100 mtr long cross an electric pole, if its speed be 144kmph?

   a. 2.5sec b. 4.25sec c. 5sec d. 12.5sec

4. A train covers a distance of 12km in 10 min. If it takes 6 sec to pass a telegraph post, the length of train is:

   a. 90m b. 100m c. 120m d. 140m

5. The length of the train & that of a platform are equal. If with a speed of 90kmph, the train crosses the platform in 1 min, then the length of train in mtr is:

   a. 500 b. 600 c. 750 d. 800

6. A train passes a station platform in 36 sec & a man standing on the platform in 20 sec. If the speed of the train is 54kmph, length of platform is:

   a. 120 b. 240 c. 300 d. 350

7. A train speeds past a pole in 15 sec & a platform 100 mtr long in 25 sec, its length is:

   a. 50 b. 150 c. 200 d. Data inadequate

8. A train 108 mtr long moving at a speed of 50kmph crosses a train 112mtr long coming from opposite direction in 6 sec, then the speed of 2nd train is:

   a. 48kmph b. 54kmph c. 66kmph d. 82kmph

9. A train X speeding with 120kmph crosses another train Y running in same direction in 2 min. If the length of the trains X & Y be 100m & 200 m resp. What is the speed of train Y?

a. 111kmph b. 123kmph c. 127kmph d. 129kmph

10. Two trains travel in opposite directions at 36kmph & 45kmph & a man sitting in slower train passes the faster train in 8 sec. The length of the faster train is:

a. 80m b. 100m c. 120m d. 180m

11. Two stations A & B are 110 km apart. One train starts from A at 7 a.m. & travels towards B at 20kmph. Another train starts from B at 8 a.m. & travels towards A at speed of 25kmph. At what time will they meet?

a. 9 a.m. b. 10 a.m. c. 10:30 a.m. d. 11 a.m.

12. A train X starts from Delhi at 4 p.m. & reaches Mumbai at 5 p.m. while another train Y starts from Mumbai at 4 p.m. & reaches Delhi at 5:30 p.m. The two trains will cross each other at:

a. 4:36 p.m. b. 4:42 p.m. c. 4:48 p.m. d. 4:50 p.m.

13-Boats & Streams

1. In water, the direction along the stream is called downstream. And, the direction against the stream is called upstream.
2. If the speed of a boat in still water is $u\ km/hr$ and the speed of the stream is $v\ km/hr$, then:
   Speed downstream $= (u + v)\ km/hr$
   Speed upstream $= (u - v)\ km/hr$
3. If the speed downstream is $a\ km/hr$ and the speed upstream is $b\ km/hr$, then:

   Speed in still water $= \frac{1}{2}(a + b)\ km/hr$

   Rate of stream$= \frac{1}{2}(a - b)\ km/hr$

Example 1: ***If the speed of a boat in still water is 8 km/h and the rate of stream is 4 km/h, find upstream speed of the boat.***

Solution: Given that

Speed of boat $= x = 8$ km/h

Speed of stream $= y = 4$ km/h

$\therefore$ Speed of upstream $= (x - y) = 8 - 4 = 4$ km/h

Example 2: ***A man can row with a speed of 6 km/h in still water. What will be his speed with the stream, if the speed of the stream is 2 km/h?***

Solution: Given that

Speed of man $= x = 6$ km/h

Speed of stream $= y = 2$ km/h

$\therefore$ Speed downstream $= (x + y) = 6 + 2 = 8$ km/h

Example 3: ***Shantanu can row upstream at 10 km/h and downstream at 18 km/h. Find the man's rate in still water and the rate of the current.***

Solution: According to the formula,

Man's rate in still water $= \frac{1}{2}$ (Speed downstream + Speed upstream)

$= \frac{1}{2}(18 + 10) = \frac{28}{2}$

$= 14$ km/h

Speed of current $= \frac{1}{2}$ (Speed downstream – Speed upstream)

$= \frac{1}{2}(18 - 10) = \frac{8}{2}$

$= 4$ km/h

Example 4: ***Raman can row 30 km downstream and 18 km upstream, taking 10 hours each time. What is the velocity of the current?***

Solution: Speed downstream $= \frac{\text{Distance}}{\text{Time}} = \frac{30}{10} = 3$ km/h

Speed upstream $= \frac{\text{Distance}}{\text{Time}} = \frac{18}{10} = 1.8$ km/h

Velocity of the current $= \frac{1}{2}$ (Speed downstream – Speed upstream)

$= \frac{1}{2}(3 - 1.8) = \frac{1.2}{2}$

$= 0.6$ km/h

Exercise

1. In one hour, a boat goes 11km along stream & 5km against the stream. The speed of boat in still water in kmph is:

   a. 3 b. 5 c. 8 d. 9

2. A man can row upstream at 8 kmph& downstream at 13kmph. The speed of stream is (kmph)

   a. 2.5 b. 4.2 c. 5 d. 10.5

3. A man rows downstream 13km & 14km upstream. If he takes 6 hr to cover each distance. The the velocity of current is:

   a. 0.5 kmph b. 1 kmph c. 1.5 kmph d. 2 kmph

4. A boat running downstream covers a distance of 16km in 2 hr & upstream in 4 hr. What is the speed of boat in still water

   a. 4 kmph b. 6 kmph c. 8 kmph d. 10 kmph

5. A boatman goes 2 km against the current in 1 hr & goes 1 km along the current in 10 min. How long will it take to go 5km in still water?

   a. 40min b. 60min c. 75min b. 90min

6. A man takes twice as long to row a distance against the stream as to row the same distance in favour of stream. The ratio of speed of boat in still water and the steam is:

   a. 2:1 b. 3:1 c. 2:3 d. 3:2

7. A boat running upstream takes 8 hr 48 min to cover a certain distance, while it takes 4 hrs to cover the same distance running downstream. What is the ratio b/w speed of boat & speed of water current?

a. 2:1 b. 3:2 c. 8:3 d. None

8. If a boat goes 7km upstream in 42 min & speed of stream is 3kmph. Then what is the speed of boat in still water?

a. 4.2 kmph b. 9 kmph c. 13 kmph d. 21 kmph

9. A man can row at 5 kmph in still water. If the velocity of current is 1 kmph& it takes him 1 hr to row to a place & come back, how far is the place

a. 2.4 km b. 2.5 km c. 3 km d. 3.6 km

10. A boat takes 19 hr to travel downstream from A to B & coming back to C, mid-way b/w A & B. If the velocity of stream is 4 kmph& speed of boat in still water is 14 kmph. What is the distance b/w A & B?

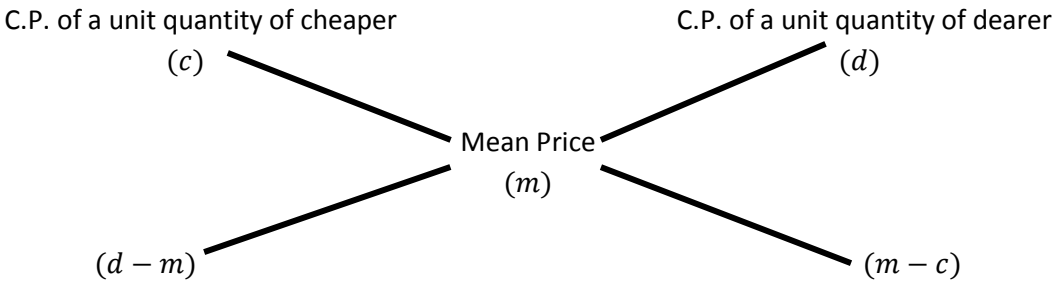
a. 160 km b. 180 km c. 220 km d. 220 km

14-Alligation & Mixtures

Alligation: It is the rule that enables us to find the ratio in which two or more ingredients at the given price must be mixed to produce a mixture of a desired price.
Mean price: The cost price of a unit quantity of the mixture is called the mean price.
Rule of Alligation: If two ingredients are mixed, then:

$$\left(\frac{\text{Quantity of cheaper}}{\text{Quantity of dearer}}\right) = \frac{(\text{C. P. of dearer}) - (\text{Mean Price})}{(\text{Mean Price}) - (\text{C. P. of cheaper})}$$

We present as under:

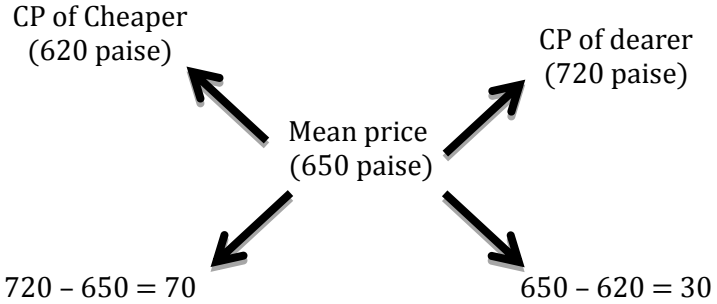


∴ (Cheaper Quantity) : (Dearer Quantity) $= (d-m) : (m-c)$.

Suppose a container contains x units liquid from which y units are taken out and replaced by water. After n operations, the quantity of pure liquid $= \left[x\left(1-\frac{y}{x}\right)^n\right]$ units.

Example 1: ***In what proportion must wheat at R6.20 per kg must be mixed with wheat at R 7.20 per kg so that the mixture is worth R 6.50?***

Solution: According to the rule of mixture/alligation,



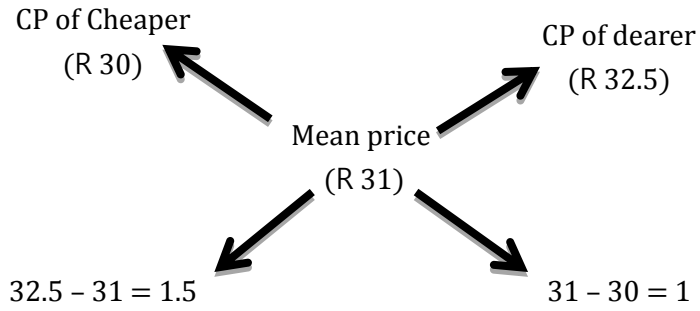
∴ Required ratio $= 70 : 30 = 7 : 3$

Example 2: ***In what ratio must a grocer mix rice worth R 30 per kg and R 32.5 per kg so that by selling the mixture at R 34.10 per kg, he may gain 10%?***

Solution: SP of 1 kg mixture = R 34.10, gain = 10%

$$\text{CP of 1 kg of mixture} = \frac{100}{110} \times 34.10 = \text{R } 31$$

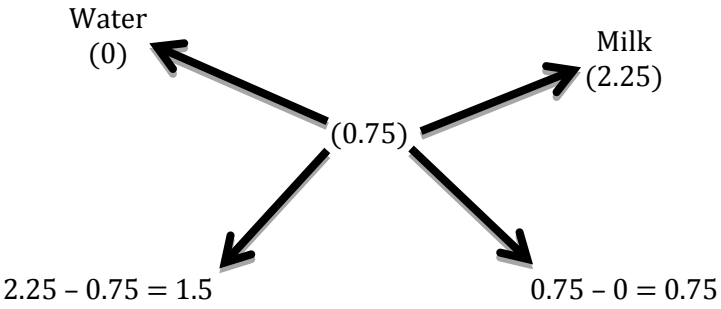
According to the rule of mixture/alligation,



∴ Required ratio = 1.5 : 1 = 3 : 2

Example 3: ***A mixture of certain quantity of milk with 16 L of water is worth R 0.75 per litre. If pure milk be is worth R 2.25 per litre, how much milk is there in the mixture?***

Solution: According the rule of mixture/alligation,



∴ Water : Milk = 1.5 : 0.75 = 2 : 1

Clearly, quantity of milk = ½ of water = ½ X 16 = 8 L

Exercise

1. In what ratio must rice at R9.30 per kg be mixed with rice at R10.80 per kg so that the mixture be

worth R10 per kg?

a. 8:7 b. 7:9 c. 5:9 d. 7:5

2. How much water must be added to 60 litres of milk at 3/3 litres for R20 so as to have a mixture worth R32/3 a litre?

a. 12 L b. 15 L c. 18 L d. 20 L

3. How many kg of wheat costing R8 must be mixed with 36 kg of rice costing R5.40 per kg so that 20% gain may be obtained by selling the mixture at R7.20 per kg?

a. 10kg b. 12kg c. 9.8kg d. 10.8kg

4. The milk & water in two vessels A & B are in the ratio 4:3 & 2:3 resp. In what ratio, the liquids in both the vessels are mixed to obtain a new mixture in vessel C containing half milk & half water?

a. 7:5 b. 7:9 c. 5:9 d. 3:7

5. In what ratio must a grocer mix two varieties of pulses costing R15 &R20 per kg respectively so as to get a mixture worth R16.50 per kg?

a. 3:7 b. 5:7 c. 7:3 d. 7:5

6. Find the ratio in which rice at R7.20 a kg be mixed with the rice at R5.70 a kg to produce a mixture worth R6.30 a kg

a. 1:3 b. 2:3 c. 3:4 d. 4:5

7. The cost of A chocolate is R14 per kg & B chocolate is R20 per kg. If both A & B are mixed in the ratio 2:3, then the price per kg of the mixed variety of chocolate is:

a. R18 b. R18.50 c. R19 d. R19.50

8. In what ratio must a grocer mix two varieties of tea worth R60 a kg &R65 a kg so that by selling a mixture at R68.20 a kg, he may gain 10%?

a. 3:2 b. 3:4 c. 3:5 d. 4:5

9. Two vessels A & B contain spirit & water mixed in the ratio 5:2 & 7:6 respectively. Find the ratio in which these mixture be mixed to obtain a new mixture in vessel C containing spirit & water in the ratio 8:5?

a. 4:3 b. 3:4 c. 5:6 d. 7:9

10. A container contains 40L of milk. From this container 4 L of milk was taken out & replaced by water. This process was repeated further 4 times. How much milk is now contained in the container?

a. 26.34L b. 27.36L c. 28L d. 29.16L

11. A vessel is filled with liquid, 3 parts of which are water & 5 parts syrup. How much of the mixture

must be drawn off & replaced with water so that the mixture may be half & half syrup?

a. 1/3 b. 1/4 c. 1/5 d. 1/7

15-Simple & Compound Interest

Simple Interest

Principal: The money borrowed or lent out for a certain period is called the principal or the sum.
Interest: Extra money paid for using other's money is called interest.
Simple Interest (S.I.): If the interest on a sum borrowed for a certain period is reckoned uniformly, then it is called simple interest.
Let principal = P, Rate = $R\%$ per annum (p.a.) and Time = T years. Then,

S.I.$= \left(\frac{P \times R \times T}{100}\right)$

Compound Interest

Let principal = P, Rate = $R\%$ per annum (p.a.) and Time = T years. Then,

1. When interest is compounded Annually: Amount $= P\left(1+\frac{R}{100}\right)^n$
2. When interest is compounded Half – yarely: Amount $= P\left(1+\frac{R/2}{100}\right)^{2n}$
3. When interest is compounded Quarterly: Amount $= P\left(1+\frac{R/4}{100}\right)^{4n}$
4. When the interest is compounded Annually but time is in fraction, say $3\frac{2}{5}$ years.

   Amount $= P\left(1+\frac{R}{100}\right)^3 \times \left(1+\frac{\frac{2}{5}R}{100}\right)$
5. When Rates are different for different years, say $R_1\%$, $R_2\%$, $R_3\%$ for 1st, 2nd and 3rd year respectively.

   Then, Amount$= P\left(1+\frac{R_1}{100}\right)\left(1+\frac{R_2}{100}\right)\left(1+\frac{R_3}{100}\right)$
6. Present worth of x due n years hence is given by:

   Present Worth $= \frac{x}{\left(1+\frac{R}{100}\right)^n}$

Example 1: ***Find the simple interest on ₹200 for 5 years at 6% per annum.***

Solution: Here P $=$ ₹ 200, T $= 5$ years, R $= 6\%$

$$\therefore \quad SI = \frac{P \times R \times T}{100} = \frac{200 \times 5 \times 6}{100} = R\ 60$$

Example 2: ***In what time, 1200 will become ₹1450 when annual rate of interest is 20%?***

Solution: Here $P = R\ 1200$, $A = 1450$, $R = 20\%$

As we know, $A = P + SI$

$\Rightarrow \quad 1450 = 1200 + SI$

$\Rightarrow \quad SI = 1450 - 1200 = R\ 250$

Again, $SI = \frac{P \times R \times T}{100}$

Or $250 = \frac{1200 \times 20 \times T}{100} = 240T$

$\therefore \quad T = \frac{25}{24} = 1\frac{1}{24}$ years

Example 3: ***A sum at simple interest of 4% per annum amounts to ₹3120 in 5 years. Find the sum.***

Solution: According to the question, $T = 5$ years, $R = 4\%$, $A = R\ 3120$

As we know, $P = \frac{100 \times A}{100 + RT} = \frac{100 \times 3120}{100 + 4 \times 5} = \frac{100 \times 3120}{120} = R\ 2600$

Example 4: ***Find the compound interest on ₹8000 at 4% per annum for 2 years compounded annually.***

Solution: Here, $P = R\ 8000$, $R = 4\%$, Time $= 2$ years

Now, according to the formula,

$$\text{Amount} = P\left(1 + \frac{R}{100}\right)^n = 8000\left(1 + \frac{4}{100}\right)^2 = 8000\ X\ \frac{26}{25}\ X\ \frac{26}{25} = R\ 8652.80$$

$\therefore \quad CI = R\ (8652.80 - 8000) = R\ 652.80$

Example 5: ***Ruchi invested ₹1600 at the rate of compound interest for 2 years. She got ₹1764 after the specified period. Find the rate of interest.***

Solution: Here, $P = R\ 1600$, $n = 2$ years, $A = R\ 1764$

Now, according to the formula,

$$\text{Amount} = P\left(1 + \frac{R}{100}\right)^n$$

$$1764 = 1600\left(1 + \frac{R}{100}\right)^2$$

$$\Rightarrow \quad \frac{1764}{1600} = \left(\frac{100+R}{100}\right)^2 \quad \Rightarrow \quad \left(\frac{21}{20}\right)^2 = \left(\frac{100+R}{100}\right)^2$$

$$\Rightarrow \quad \frac{100+R}{100} = \frac{21}{20} \quad \Rightarrow \quad 100 + R = \frac{21}{20} X\ 100$$

$$\Rightarrow \quad 100 + R = 105$$

$$\therefore \quad R = 105 - 100 = 5\%$$

Example 6: ***Find the compound interest on R 5000 in 2 years at 4% per annum, the interest being compounded half yearly.***

Solution: Here, Principal P = R 5000

Rate R = 4% pa

Time $n = 2$ years

Now according to the formula,

$$\text{Amount} = P\left(1 + \frac{R}{2\times100}\right)^{2n} = 5000\left(1 + \frac{4}{200}\right)^4$$

$$= \left(5000 \times \frac{51}{50} \times \frac{51}{50} \times \frac{51}{50} \times \frac{51}{50}\right) = \left(\frac{51\times51\times51\times51}{1250}\right)$$

$$= R\ 5412.16$$

$\therefore$ Compound Interest = R (5412.16 – 5000) = R 412.16

Example 7: ***Find the compound interest on R 8000 at 20% per annum for 9 months, compounded quarterly.***

Solution: Here, P = R 8000, n = 9 months = ¾ years, R = 20%

According to the formula,

$$\text{Amount} = P\left(1 + \frac{R}{4\times100}\right)^{4n}$$

$$= 8000\left(1 + \frac{20}{400}\right)^{¾\times4} = 8000\left(1 + \frac{5}{100}\right)^3$$

$$= 8000\ X\frac{21}{20}X\frac{21}{20}X\frac{21}{20} = R\ 9261$$

CI = (9261 – 8000) = R 1261

Exercise

1. A sum of money will be double itself in 16 years at S.I with yearly rate of:

a. 10% b. 25/4% c. 8% d. 16%

2. At S.I, a sum doubles after 20 years. The rate of interest per annum is:

a. 5% b. 10% c. 12% d. Data inadequate

3. A sum of money at S.I amounts to R2200 in 2 years & R2500 in 5 years. The sum is

a. R1880 b. R2000 c. R2120 d. Data inadequate

4. If the amount of R360 in 3 years is R511.20, what will be amount of R700 in 5 years

a. R1190 b. R1230 c. R1060 d. R1225

5. A lent R600 to B for 2 years &R150 to C for 4 years & received all together from both R90 as S.I. Then the rate of interest is

a. 4% b. 5% c. 10% d. 12%

6. R800 amounts to R920 in 3 years at S.I. If the rate is increased by 3%, that would amount to?

a. R1056 b. R1112 c. R1182 d. R992

7. Find the rate when R1763 earns an interest of R370.23 in 3 years.

a. 6% b. 7% c. 8% d. 4.5%

8. The amount of R7500 at C.I at 4% p.a. for 2 years is

a. R7800 b. R8100 c. R8112 d. R8082

9. If the S.I on a sum of money at 5% p.a. for 3 years is R1200, The C.I on same sum for same period at same rate is:

a. R1260 b. R1261 c. R1264 d. R1265

10. If the difference b/w C.I compounded half yearly & S.I on a sum at 10% p.a. for 1 year is R25, the sum is:

a. R9000 b. R9500 c. R10000 d. R10500

11. The C.I on a certain sum at 5% p.a. for 2 years is R328. The S.I for that sum at same rate for same period will be:

a. R320 b. R322 c. R325 d. R326

12. The difference b/w S.I & C.I on R1200 for 1 year at 10% p.a., reckoned half-yearly is

a. Nil b. R13.20 c. R8.80 d. R3

13. The sum of money at C.I amounts to R578.40 in 2 years & R614.55 in 3 years. The rate of interest per annum is

a. 4% b. 5% c. 25/4% d. 25/3%

14. A sum of money placed at C.I doubles itself in 5 years. It will amount to 8 times itself in

a. 10 yr b. 12yr c. 15yr d. 20yr

15. A sum of money at C.I amounts to thrice itself in 3 years. In how many years will it be 9 times itself

a. 12 b. 9 c. 6 d. 8

16. A sum of R12000 deposited at C.I becomes double After 5 yrs. After 20 yrs, it will become

a. R120000 b. R192000 c. R124000 d. R96000

17. A loan was repaid in two annual installments of R121 each. If the rate of interest be 10% per annum, compounded annually, the sum borrowed was:

a. R200 b. R210 c. R217.80 d. R216

18. A sum of Rs. 1100 was taken as a loan. This is to be repaid in two equal installments. If the rate of interest be 20% compounded annually, then the value of each installment is:

a. R842 b. R792 c. R720 d. R700

19. What is the principal amount which earns R132 as compound interest for the second year at 10% per annum?

a. R1000 b. R1200 c. R1320 d. R1188

20. A man had R 1600, part of which was lent at 4% and the rest at 4.5%. The whole amount of interest received was R 67. How much did he lend at 4%?

a. R 600 b. R 800 c. R 1000 d. R 1250

16-Area, Volume and Surface Area

Shape	Formula	Explanation
Area of a triangle	$\frac{1}{2} \times b \times h$	$b = base, h = height$
Area of a triangle (Heron's formula)	$\sqrt{s(s-a)(s-b)(s-c)}$	$s = semi\ perimeter, a, b, c = sides$
Area of trapezium	$\frac{1}{2}(sum\ of\ parallel\ sides) \times h$	$h = height$
Area of rhombus	$\frac{1}{2} \times product\ of\ diagonals$	
Area of quadrilateral	$\frac{1}{2} \times diagonal \times sum\ of\ the\ offsets$	
Area of a square	a^2	$a = side$
Area of a rectangle	$l \times b$	$l = length, b = breadth$
Area of regular hexagon	$\frac{3\sqrt{3}}{2}a^2$	$a = side$
Area of regular octagon	$2\left(1+\sqrt{2}\right)a^2$	$a = side$
Circumference of a circle	$2\pi r$	$r = radius$
Area of a circle	πr^2	$r = radius$
Length of arc of a circle	$\frac{\theta}{360} \times 2\pi r$	$\theta = angle\ of\ arc, r = radius$
Area of sector of a circle	$\frac{\theta}{360} \times \pi r^2$	$\theta = angle\ of\ arc, r = radius$
Area of segment of a circle	$Area\ of\ corresponding\ sector$ $- Area\ of\ corresponding\ triangle$	
Slant height of cone	$l = \sqrt{r^2 + h^2}$	$r = radius, h = height$
Slant height of frustum	$l = \sqrt{h^2 + (R-r)^2}$	$h = height, R, r = radii\ of\ the\ ends$
Surface area of a cuboid	$2(lb + bh + hl)$	$l = length, b = breadth, h = height$

Surface area of a cube	$6a^2$	$a = side$
Curved surface area of a cylinder	$2\pi rh$	$r = radius\ of\ base, h = height$
Total surface area of a cylinder	$2\pi r(r + h)$	$r = radius\ of\ base, h = height$
Curved surface area of a cone	πrl	$r = radius\ of\ base, l = slant\ height$
Total surface area of a right circular cone	$\pi r(l + r)$	$r = radius\ of\ base, l = slant\ height$
Surface area of a sphere	$4\pi r^2$	$r = radius$
Curved surface area of a hemisphere	$2\pi r^2$	$r = radius$
Total surface area of a hemisphere	$3\pi r^2$	$r = radius$
Volume of a cuboid	$l \times b \times h$	$l = length, b = breadth, h = height$
Volume of a cube	a^3	$a = side$
Volume of a cylinder	$\pi r^2 h$	$r = radius\ of\ base, h = height$
Volume of a cone	$\frac{1}{3}\pi r^2 h$	$r = radius\ of\ base, h = height$
Volume of a sphere	$\frac{4}{3}\pi r^3$	$r = radius$
Volume of a hemisphere	$\frac{2}{3}\pi r^3$	$r = radius$
Volume of frustum of cone	$\frac{1}{3}\pi h(R^2 + r^2 + Rr)$	$h = height, R, r = radii\ of\ the\ ends$
Curved surface area of a frustum of cone	$\pi(R + r)l$	$R, r = radii\ of\ the\ ends, l = slant\ height$
Total surface area of a frustum of cone	$\pi l(R + r) + \pi R^2 + \pi r^2$	$R, r = radii\ of\ the\ ends, l = slant\ height$

Exercise

1. The perimeter of rectangular field is 480 meters and the ratio between the length and breadth is 5 : 3. The area of the field is:

   a. 7200 b. 1500 c. 13500 d. 5400

2. If the ratio of the area of two squares is 9 : 1, the ratio of their perimeters is:

   a. 9 : 1 b. 3 : 1 c. 1 : 3 d. 3 : 4

3. If the side of a square is increased by 5 cm, the area increases by 165 sq. cm. the side of the square is:

   a. 13 cm b. 14 cm c. 15 cm d. 12 cm

4. The area of a square is 0.5 hectare. Its diagonal is:

   a. 50 m b. 100 m c. 250 m d. $50\sqrt{2}$ m

5. If the area of a rhombus is 15 sq. cm and the length of one of its diagonals is 5 cm, then the length of the other diagonal is:

   a. 3 cm b. 5 cm c. 6 cm d. 7 cm

6. If the circumference of a circle is 352 meters, then its area (in sq. m) is:

   a. 5986 b. 6589 c. 8956 d. 9856

7. The two parallel sides of a trapezium are 1.5 m and 2.5 m respectively. If the perpendicular distance between them is 6.5 meters, the area of the trapezium is:

   a. 26 m^2 b. 13 m^2 c. 20 m^2 d. 10 m^2

8. If each side of a square is increased by 25%, its area is increased by:

   a. 100 b. 150 c. 225 d. 56.25

9. If the length and breadth of a rectangular plot are increased by 50% and 20% respectively, then the new area is how many times the original area?

   a. 5/9 b. 10 c. 9/5 d. None of these

10. The length of the rectangle is increased by 60%. By what percent would the width have to be decreased to maintain the same area?

    a. 37.5% b. 60% c. 75% d. 120%

11. A hall 20 m long and 15 m broad is surrounded by a verandah of uniform width of 2.5 m. the cost of flooring the verandah at R3.50 per square meter is:

a. R500 b. R600 c. R700 d. R800

12. If the diagonal of a rectangle is 17 cm long and the perimeter of the rectangle is 46 cm, then the area of the rectangle is:

a. 112 cm^2 b. 120 cm^2 c. 132 cm^2 d. 289 cm^2

13. If the perimeter of a rectangular and a square, each is equal to 80 cm and the difference of their areas is 100 sq. cm, the sides of the rectangle are:

a. 35 cm, 15 cm b. 30 cm, 10 cm c. 28 cm, 12 cm d. 25 cm, 15 cm

14. The circumferences of two concentric circles forming a ring are 88 cm and 66 cm respectively. The width of the ring is:

a. 3.5 cm b. 10.5 cm c. 7 cm d. 14 cm

15. The radius of a wheel is 7 cm. How many revolutions will it make in moving 44 km?

a. 2000 b. 10000 c. 70000 d. 100000

16. A toothed wheel of diameter 50 cm is attached to a smaller wheel of diameter 30 cm. How many revolutions will the smaller wheel make when the larger one makes 15 revolutions?

a. 18 b. 20 c. 25 d. 30

17. The area of the largest circle that can be drawn inside a square of side 14 cm in length is:

a. 154 cm^2 b. 84 cm^2 c. 204 cm^2 d. None of these

18. The area of a circle inscribed in an equilateral triangle of side 24 cm is:

a. 18π cm^2 b. 24π cm^2 c. 36π cm^2 d. $48\ \pi$ cm^2

19. The area of a circle inscribed in an equilateral triangle is 462π cm^2. The perimeter of the triangle is:

a. $42\sqrt{3}$ cm b. 126 cm c. 72.6 cm d. 168 cm

20. The length of the longest rod that can be placed in a room 30 m long, 24 m board and 18 m high is:

a. 30 m b. $15\sqrt{2}$ m c. $30\sqrt{2}$ m d. 60 m

21. A wooden box of dimensions 8 m X 7 m X 6 m is to carry rectangular boxes of dimensions 8 cm X 7 cm X 6 cm. the maximum number of boxes that can carried in the wooden box is:

a. 9800000 b. 7500000 c. 1000000 d. 1200000

22. The area of the card board needed to make a box of size 24 cm X 12 cm X 5 cm is:

a. 1440 cm^2 b. 468 cm^2 c. 936 cm^2 d. 720 cm^2

23. A cube of side 6 cm is cut into a number of cubes, each of side 2 cm. The number of cubes will be:

a. 6 b. 9 c. 12 d. 27

24. The total surface area of cuboid is 63200 sq. cm and its length, breadth and height are in the ratio of 8:5:3. The length, breadth and height (in cm) of the cuboid are respectively:

a. 120, 75, 45 b. 128, 80, 48 c. 160, 100, 60 d. 144, 90, 54

25. If the diameter of a cylinder is 28 cm and its height is 20 cm, then total surface area is:

a. 2993 cm^2 b. 2992 cm^2 c. 2292 cm^2 d. 2229 cm^2

26. The radii of two cylinders are in the ratio of 2:3 and their heights are in the ratio 5:3. The ratio of their volumes is

a. 4:9 b. 9:4 c. 20:27 d. 27:20

27. The sum of the radius of the base and the height of a solid cylinder is 37 meters. If the total surface area of the cylinder be 1628 sq. meters, its volume is:

a. 5240 m^3 b. 4620 m^3 c. 3180 m^3 d. None of these

28. If the surface areas of two spheres are in the ratio of 4:25, then the ratio of their volumes is

a. 4:25 b. 25:4 c. 125:8 d. 8:125

29. If the volumes of two cones are in the ratio of 1:4 and their diameters are in the ratio of 4:5, then the ratio of their heights is:

a. 1:5 b. 5:4 c. 5:16 d. 25:64

30. Two cubes have their volumes in the ratio 8:27. The ratio of their surface area is:

a. 2:3 b. 3:2 c. 4:9 d. 64:729

31. A copper sphere of radius 3 cm is beaten and drawn into a wire of diameter 0.2 cm. the length of the wire is:

a. 9 m b. 12 m c. 18 m d. 36 m

32. A cylindrical vessel 60 cm in diameter is partially filled with water. A sphere 30 cm in diameter is dropped into it. The increase in the level of water in the vessel is:

a. 2 cm b. 3 cm c. 4 cm d. 5 cm

33. How many bullets can be made out of a cube of lead whose edge measures 22 cm, each bullet being 2 cm in diameter?

a. 5324 b. 2662 c. 1347 d. 2541

34. The material of a cone is converted into the shape of a cylinder of equal radius. If the height of the cylinder is 6 cm, the height of the cone is:

a. 2 cm b. 6 cm c. 18 cm d. 36 cm

35. A tank 4 m long, 2.5 m wide and 1.5 m deep is dug in a field 31 m long and 10 m wide. If each dug out is evenly spread out over the field, the rise in level of the field is:

a. 3.1 cm b. 6.2 cm c. 5 cm d. 4.8 cm

17-Logarithms

Logarithm: If a is a positive real number, other than 1 and $a^m = x$, then we write: $m = \log_a x$ and we say that the value of $\log x$ to the base a is m.
Example:

1. $10^3 = 1000 \Rightarrow \log_{10} 1000 = 3$
2. $3^4 = 81 \Rightarrow \log_3 81 = 4$
3. $2^{-3} = \frac{1}{8} \Rightarrow \log_2 \frac{1}{8} = -3$
4. $(.1)^2 = .01 \Rightarrow \log_{.1} .01 = 2$

Properties of Logarithms:

1. $\log_a(xy) = \log_a x + \log_a y$
2. $\log_a \frac{x}{y} = \log_a x - \log_a y$
3. $\log_x x = 1$
4. $\log_a 1 = 0$
5. $\log_a x^p = p \log_a x$
6. $\log_a x = \frac{1}{\log_x a}$
7. $\log_a x = \frac{\log_b x}{\log_b a} = \frac{\log x}{\log a}$

Remember: When base is not mentioned, it is taken as 10.

Exercise

1. If $\log_x 4 = 0.4$, then the value of x is:

   a. 1 b. 4 c. 16 d. 32

2. If $\log_{10000} x = -\frac{1}{4}$, then x is equal to:

a. $\frac{1}{10}$ b. $\frac{1}{100}$ c. $\frac{1}{1000}$ d. $\frac{1}{10000}$

3. If $\log_x 4 = \frac{1}{4}$, then x is equal to:

a. 16 b. 64 c. 128 d. 256

4. If $\log_x 0.1 = -\frac{1}{3}$, then the value of x is:

a. 10 b. 100 c. 1000 d. $\frac{1}{1000}$

5. If $\log_{32} x = 0.8$, then x is equal to:

a. 25.6 b. 16 c. 10 d. 12.8

6. If $\log_x y = 100$ and $\log_2 x = 10$, then the value of y is:

a. 2^{10} b. 2^{100} c. 2^{1000} d. 2^{10000}

7. The value of $\log_{\frac{-1}{3}} 81$ is equal to:

a. -27 b. -4 c. 4 d. 27

8. $\log 2 = 0.3010$ and $\log 3 = 0.4771$, the value of log5 512 is:

a. 2.870 b. 2.967 c. 3.876 d. 3.912

9. $(\log\sqrt{8})/\log 8$ is equal to:

a. 1/8 b. 1/4 c. 1/2 d. 1/8

10. If $\log 27 = 1.431$, then the value of log 9 is:

a. 0.934 b. 0.954 c. 0.945 d. 0.958

11. If $\log a/b + \log b/a = \log (a + b)$, then

a. a+b=1 b. a-b=1 c. a=b d. $a^2 - b^2 = 1$

12. If $\log 2 = 0.30103$, the number of digits in 2^64 is:

a. 18 b. 19 c. 20 d. 21

13. The value of $\log_{2\sqrt{3}} 1728$ is:

a. 3 b. 5 c. 6 d. 9

14. $\frac{\log\sqrt{8}}{\log 8}$ is equal to:

a. $\frac{1}{\sqrt{8}}$ b. $\frac{1}{4}$ c. $\frac{1}{2}$ d. $\frac{1}{8}$

15. Which of the following statements is not correct?

a. $\log_{10} 10 = 1$ b. $\log(2 + 3) = \log 2 \times 3$ c. $\log_{10} 1 = 0$ d. $\log(1 + 2 + 3 = \log 1 + \log 2 + \log 3$

16. The value of $\log_2(\log_5 625)$ is:

a. 2 b. 5 c. 10 d. 15

17. If $\log_2[\log_3 (\log_2 x)] = 1$, then x is equal to:

a. 0 b. 12 c. 128 d. 512

18. The value of $\log_2 \log_2 \log_3 \log_3 27^3$ is

a. 0 b. 1 c. 2 d. 3

19. If $a^x = b^y$, then:

a. $\log \frac{a}{b} = \frac{x}{y}$ b. $\frac{\log a}{\log b} = \frac{x}{y}$ c. $\frac{\log a}{\log b} = \frac{y}{x}$ d. None of these

20. $\log 360$ is equal to:

a. $2 \log 2 + 3 \log 3$ b. $3 \log 2 + 2 \log 3$ c. $3 \log 2 + 2 \log 3 - \log 5$ d. $3 \log 2 + 2 \log 3 + \log 5$

18-Clocks

The face or dial of a watch is a circle whose circumference is divided into 60 equal parts, called minute spaces.

A clock has two hands; the smaller one is called the *hour hand* or *short hand* while the larger one is called the *minute hand* or *long hand*.

1. In 60 seconds, the minute hand gains 55 minutes on the hour hand.
2. In every hour, both the hands coincide once.
3. The hands are in the same straight line when they are coincident or opposite to each other.
4. When the two hands are at right angles, they are 15 minutes spaces apart.
5. When the hands are in opposite directions, they are 30 minutes spaces apart.
6. Angle traced by hour hand in 12 hours = 360°.
7. Angle traced by minute hand in 60 minutes = 360°.

Example 1: ***At what time between 4 o'clock and 5 o'clock, will the hands of a clock be together?***

Solution: Here, $n = 4(n + 1) = 5$

Then, according to the formula,

The two hands will coincide at $\frac{60n}{11}$ minutes past n.

Or $\frac{60\times4}{11}$ minute past 4 or $21\frac{9}{11}$ minute past 4.

Example 2: ***At what time between 1 o'clock and 2 o'clock, will the hands of a clock be together?***

Solution: Here, $n = 1(n + 1) = 2$

$\therefore$ The two hands will coincide at $\frac{60n}{11}$ minutes past 2.

Or $\frac{60\times1}{11}$ minute past 2 or $5\frac{5}{11}$ minutes past 2

Exercise

1. An accurate clock shows 8 o'clock in the morning. Through how many degrees will the hour hand rotate when the clock shows 2 o'clock in the afternoon?

   a. 144° b. 150° c. 168° d. 180°

2. At what angle the hands of a clock are inclined at 15 minutes past 5?

   a. $58\frac{1^\circ}{2}$ b. 64° c. $67\frac{1^\circ}{2}$ d. 72°

3. The reflex angle between the hands of a clock at 10.25 is:

a. $180°$ b. $192\frac{1^{\circ}}{2}$ c. $195°$ d. $197\frac{1^{\circ}}{2}$

4. How many times in a day, are the hands of a clock in straight line but opposite in direction?

a. 20 b. 22 c. 24 d. 48

5. At what time, in minutes, between 3 0'clock, both the needles will coincide each other?

a. $5\frac{1}{11}$ b. $12\frac{4}{11}$ c. $13\frac{1}{11}$ d. $16\frac{4}{11}$

6. At what time between 7 and 8 o'clock will the hands of a clock be in the same straight line but, not together?

a. 5 min. past 7 b. $5\frac{2}{11}$ min. past 7 c. $5\frac{3}{11}$ min. past 7 d. $5\frac{5}{11}$ min. past 7

7. A watch which gains uniformly is 2 minutes low at noon on Monday and is 4 min. 48 sec fast at 2 p.m. on the following Monday. When was it correct?

a. 2 p.m. on Tue b. 2 p.m. on Wed c. 3 p.m. on Thur d. 1 p.m. on Fri

8. A watch which gains 5 seconds in 3 minutes was set right at 7 a.m. In the afternoon of the same day, when the watch indicated quarter past 4 o'clock, the true time is:

a. $59\frac{7}{12}$ min. past 3 b. 4 p.m. c. $58\frac{7}{11}$ min. past 3 d. 3 p.m.

19-Permutation & Combination

Factorial Notation: Let n be a positive integer. Then, factorial n, denoted by $n!$ Is defined as:

$$n! = n(n-1)(n-2) \dots \dots \dots 3.2.1$$

Permutation: The different arrangements of a given number of things by taking some or all at a time, are called permutations.

Number of Permutations: Number of all permutations of n things, taken r at a time, is given by

$$^{n}P_r = n(n-1)(n-2) \dots \dots (n-r+1) = \frac{n!}{(n-r)!}$$

Combination: Each of the different groups or selections which can be formed by taking some of all of a number of objects is called a combination.

Number of Combinations: The number of combinations of n things, taken r at a time is:

$$^{n}C_r = \frac{n!}{(r!)(n-r)!} = \frac{n(n-1)(n-2) \dots \dots to\ r\ factors}{r!}$$

Note that: $^{n}C_n = 1$ and $^{n}C_0 = 1$

An important result: $^{n}C_r = {}^{n}C_{n-r}$

Exercise

1. How many words with or without meaning, can be formed by using all the letters of the word 'Delhi', using each letter exactly once?

   a. 10 b. 25 c. 60 d. 120

2. In how many ways can the letters of the word 'Apple' be arranged?

   a. 720 b. 120 c. 60 d. 180

3. In how many ways can the letters of the word 'Leader' be arranged?

   a. 72 b. 144 c. 360 d. 720

4. How many words can be formed by using all the letters of the word 'Allahabad'?

a. 3780 b. 1890 c. 7560 d. 2520

5. In how many ways can the letters of the word 'Optical' be arranged so that the vowels always come together?

a. 120 b. 720 c. 4320 d. 2160

6. In how many ways can the letters of the word 'Software' be arranged so that the vowels always come together?

a. 120 b. 360 c. 4320 d. 720

7. In how many ways can the letters of the word 'Detail' be arranged so that the vowels occupy only odd positions?

a. 32 b. 48 c. 36 d. 60

8. In how many ways can a group of 5 men & 2 women be made out of 7 men & 3 women?

a. 63 b. 90 c. 126 d. 45

9. In how many ways a committee, consisting of 5 men & 6 women can be formed out of 8 men & 10 women?

a. 266 b. 5040 c. 11760 d. 86400

10. From a group of 7 men & 6 women, 5 persons are to be selected to form a committee so that at least 3 men are there on the committee. In how many ways can it be done?

a. 564 b. 645 c. 735 d. 756

11. In a group of 6 boys & 4 girls, 4 children are to be selected. In how many ways can they be selected such that at least one boy should be there?

a. 159 b. 194 c. 205 d. 209

12. A box contains 2 white balls, 3 black balls & 4 red balls. In how many ways can 3 balls be drawn from the box, if at least one black ball is to be included in the draw?

a. 32 b. 48 c. 64 d. 96

13. How many 3-digit numbers can be formed from the digits 2, 3, 5, 6, 7, 9, which are divisible by 5 & none of the digits is repeated?

a. 5 b. 10 c. 15 d. 20

14. In how many ways can 21 books on English & 19 books on Hindi be placed in a row on a shelf so that two books on Hindi may not be together?

a. 3990 b. 1540 c. 1995 d. 3672

15. Out of 7 consonants & 4 vowels, how many words of 3 consonants & 2 vowels can be formed?

a. 210 b. 1050 c. 25200 d. 21400

16. Find the number of ways in which 4 Boys and 4 Girls be seated around a table so that no two girls

are together.

a. 144 b. 196 c. 224 d. 159

17. Find the number of ways in which 5 Indians and 5 Englishmen be seated along a circle so that they are alternate.

a. 1990 b. 2880 c. 2140 d. 3004

18. In meeting b/w 2 countries, each country has 12 delegates. All the delegates of one country shake hands with all delegates of other country. Find the number of possible handshakes.

a. 72 b. 144 c. 256 d. 276

19. In how many ways, cricket team of 11 players can be made from 15 players if a particular player is always chosen.

a. 1001 b. 1835 c. 1635 d. 1365

20. In how many ways, cricket team of 11 players can be made from 15 players if a particular player is never chosen.

a. 364 b. 480 c. 1365 d. 770

21. How many straight lines can be drawn from 15 non-collinear points?

a. 105 b. 120 c. 110 d. 115

22. There is a polygon of 12 sides. How many triangles can be drawn using the vertices of polygon?

a. 200 b. 220 c. 240 d. 260

20-Probability

Experiment: An operation which can produce some well – defined outcomes is called an experiment.
Random Experiment: An experiment in which all possible outcomes are known and the exact output cannot be predicted in advanced, is called a random experiment.

Details:

1. When we throw a coin, then either a Head (H) or a Tail (T) appears.
2. A die is a solid cube, having 6 faces, marked 1, 2, 3, 4, 5, 6. When we throw a die, the outcome is the number that appears on its upper face.
3. A pack of cards has 52 cards.
    a. It has 13 cards of each suit, namely, Spades, Clubs, Hearts and Diamonds.
    b. Cards of spades and clubs are black cards.
    c. Cards of hearts and diamonds are read cards.
    d. There are 4 honors of each suit. These are Aces, Kings, Queens and Jacks. These are called face cards.

Sample Space: When we perform an experiment, then the set S of all possible outcomes is called the Sample Space.
Event: Any subset of a sample space is called an event.
Probability of Occurrence of an Event:
Let S be the sample space and let E be an event.
Then $E \subseteq S$

$\therefore \quad P(E) = \frac{n(E)}{n(S)}$

Exercise

1. In a simultaneous throw of 2 coins, the probability of getting at least one head is:
    a. ½ b. 1/3 c. 2/3 d. 3/4
2. Three unbiased coins are tossed. What is the probability of getting at least 2 heads:
    a. ¼ b. ½ c. 1/3 d. 1/8
3. Three unbiased coins are tossed. What is the probability of getting at most 2 heads:
    a. 7/8 b. ½ c. ¾ d. 1/3
4. In a simultaneous throw of 2 dice. What is the probability of getting a total of 7?
    a. 1/6 b. ¼ c. 2/3 d. 3/4
5. In a simultaneous throw of 2 dice. What is the probability of getting a total of 10 or 11?
    a. 1/4 b. 5/36 c. 7/36 d. 1/8

6. In a simultaneous throw of 2 dice. What is the probability of getting two numbers whose product is even?
   a. 1/4 b. 1/6 c. 7/12 d. 3/4

7. Tickets numbers 1-20 are mixed up & then a ticket is drawn at random. What is the probability that the ticket drawn has a number which is a multiple of 3 or 5?
   a. 1/2 b. 2/5 c. 8/15 d. 9/20

8. One card is drawn at random from a deck of 52 cards. What is the probability that the card drawn is a face card?
   a. 4/13 b. 3/13 c. 1/52 d. 1/26

9. A card is drawn from a pack of 52 cards. What is the probability of a getting a queen of club or king of heart?
   a. 1/13 b. 2/13 c. 1/26 d. 1/52

10. One card is drawn from a pack of 52 cards. What is the probability that the card drawn is either red or a king?
   a. 1/2 b. 6/13 c. 7/13 d. 27/52

11. One card is drawn from a pack of 52 cards. What is the probability that the card drawn is 10 or spade?
   a. 4/13 b. 7/13 c. 2/13 d. 3/4

12. From a pack of 52 cards, 2 cards are drawn at random. What is the probability that both cards being king?
   a. 7/13 b. 13/26 c. 63/221 d. 1/221

13. A bag contains 6 black & 8 white balls. One ball is drawn at random. What is the probability the ball drawn is white?
   a. 3/4 b. 4/7 c. 1/8 d. 3/7

14. A box contains 5 green, 4 yellow & 3 white marbles. 3 marbles are drawn at random. What is the probability that they are not of the same color?
   a. 3/44 b. 3/55 c. 52/55 d. 41/44

15. A bag contains 6 white & 4 red balls. 3 balls are drawn at random. What is the probability that one ball is red & other two are white?
   a. 1/2 b. 1/12 c. 3/10 d. 7/12

16. A bag contains 2 red, 3 green & 2 blue balls. 2 balls are drawn at random. What is the probability that none of the ball drawn is blue?
   a. 10/21 b. 11/21 c. 2/7 d. 5/7

17. In a box, there are 8 red, 7 blue & 6 green balls. 1 ball is drawn at random. What is the probability that it is neither red nor green?
   a. 1/3 b. 3/4 c. 7/19 d. 8/21

18. A box contains 4 red balls, 5 green & 6 white balls. A ball is drawn at random. What is the probability that the ball drawn is either red or green?
   a. 2/5 b. 3/5 c. 1/5 d. 7/15

19. In a class, there are 15 boys & 10 girls. 3 students are selected at random. What is the probability that one girl & 2 boys are selected?
   a. 21/46 b. 25/117 c. 1/50 d. 3/25

20. 4 persons are chosen at random from a group of 3 men, 2 women & 4 children. The chance that exactly 2 of them are children is
   a. 1/9 b. 1/5 c. 1/12 d. 10/21

21. A box contains 20 electric bulbs. Out of which 4 are defective. 2 bulbs are chosen at random. What is the probability that at least one of these is defective?
    a. 4/19 b. 7/19 c. 12/19 d. 21/95

22. In a class, 30% students offered English, 20% Hindi & 10% both. If a student is selected at random, What is the probability that he has offered English or Hindi?
    a. 2/5 b. 3/4 c. 3/5 d. 3/10

23. Two dice are tossed. What is the probability that the total score is prime number?
    a. 1/6 b. 5/12 c. ½ d. 7/9

24. A speaks truth in 75% cases & B in 80% cases. In what % of cases are they likely to contradict each other, narrating the same incident?
    a. 5% b. 15% c. 35% d. 45%

25. A man & his wife appear in an interview for 2 vacancies at the same post. The probability of Husband's selection is(1/7) & of wife's selection is (1/5). What is the probability that only one of them is selected?
    a. 4/5 b. 2/7 c. 8/15 d. 4/7

21-Data Interpretation

Ques. (1-5): ***The following table gives the sales of batteries manufactured by a company over the years. Study the table and answer the questions that follow*****:**

NUMBER OF DIFFERENT TYPES OF BATTERIES SOLD BY A COMPANY OVER THE YEARS (NUMBERS IN THOUSANDS)

Year	TYPES OF BATTERIES					
	4AH	7AH	32AH	35AH	55AH	Total
1992	75	144	114	102	108	543
1993	90	126	102	84	126	528
1994	96	114	75	105	135	525
1995	105	90	150	90	75	510
1996	90	75	135	75	90	465
1997	105	60	165	45	120	495
1998	115	85	160	100	145	605

1. The total sales of all the seven years are the maximum for which battery?

   a. 4AH b. 7AH c. 32AH d. 35AH e. 55AH

2. What is the difference in the number of 35AH batteries sold in 1993 and 1997?

   a. 24000 b. 28000 c. 35000 d. 39000 e. 42000

3. The percentage of 4AH batteries sold to the total number of batteries sold was maximum in the year:

   a. 1994 b. 1995 c. 1996 d. 1997 e. 1998

4. In the case of which battery there was a continuous decrease in sales from 1992 to 1997?

   a. 4AH b. 7AH c. 32AH d. 35AH e. 55AH

5. What was the approximate percentage increase in the sales of 55AH batteries in 1998 compared to that in 1992?

   a. 25% b. 31% c. 33% d. 34% e. 37%

Ques. (6-11): Study the following table carefully and answer these questions:

NUMBER OF CANDIDATES APPEARED AND QUALIFIED IN A COMPETITIVE EXAMINATION FROM DIFFERENT STATES OVER THE YEARS

Year / State	1997		1998		1999		2000		2001	
	App.	Qual.	App.	Qual.	App.	Qual.	App.	Qual.	App.	Qual.
M	5200	720	8500	980	7400	850	6800	775	9500	1125
N	7500	840	9200	1050	8450	920	9200	980	8800	1020
P	6400	780	8800	1020	7800	890	8750	1010	9750	1250
Q	8100	950	9500	1240	8700	980	9700	1200	8950	995
R	7800	870	7600	940	9800	1350	7600	945	7990	885

6. Combining the states P and Q together in 1998, what is the percentage of the candidates qualified to that of the candidates appeared?

   a. 10.87% b. 11.49% c. 12.35%

   d. 12.54% e. 13.05%

7. The percentage of the total number of qualified candidates to the total number of appeared candidates among all the five states in 1999 is:

   a. 11.49% b. 11.84% c. 12.21%

   d. 12.57% e. 12.73%

8. What is the percentage of candidates qualified from State N for all the years together, over the candidates appeared from State N during all the years together?

   a. 12.36% b. 12.16% c. 11.47%

   d. 11.15% e. None of these

9. What is the average of candidates who appeared from State Q during the given year?

   a. 8700 b. 8760 c. 8810

   d. 8920 e. 8990

10. In which of the given years the number of candidates appeared from State P has maximum percentage of qualified candidates?

    a. 1997 b. 1998 c. 1999

    d. 2000 e. 2001

11. Total number of candidates qualified from all the states together in 1997 is approximately what percentage of the total number of candidates qualified from all the states together in 1998?

    a. 72% b. 77% c. 80%

    d. 2000 e. 2001

Ques. (12-16): The following table gives the percentage of marks obtained by seven students in six different subjects in an examination. Study the table and answer the questions based on it. The numbers in the brackets give the maximum marks in each subject.

Subjects (Max. Marks/Student	Maths (150)	Chemistry (130)	Physics (120)	Geography (100)	History (60)	Computer Science (40)
Ayush	90	50	90	60	70	80
Aman	100	80	80	40	80	70
Sajal	90	60	70	70	90	70
Rohit	80	65	80	80	60	60
Muskan	80	65	85	95	50	90
Tanvi	70	75	65	85	40	60
Tarun	65	35	50	77	80	80

12. What was the aggregate of marks obtained by Sajal in all the six subjects?

    a. 409 b. 419 c. 429

    d. 439 e. 449

13. What is the overall percentage of Tarun?

    a. 52.5% b. 55% c. 60%

    d. 63% e. 64.5%

14. What are the average marks obtained by all the seven students in Physics? (rounded off to two digits after decimal)

    a. 77.26 b. 89.14 c. 91.37

    d. 96.11 e. 103.21

15. The number of students who obtained 60% and above marks in all the subjects is:

    a. 1 b. 2 c. 3

    d. 4 e. None of these

16. In which subject is the overall percentage the best?

    a. History b. Math c. Physics

    d. Chemistry e. Geography

Ques. (17-21): Study the following table carefully and answer the questions given below:

CLASSIFICATION OF 100 STUDENTS BASED ON THE MARKS OBTAINED BY THEM IN PHYSICS AND CHEMISTRY IN AN EXAMINIATION

Marks out of 50 / Subject	40 and above	30 and above	20 and above	10 and above	0 and above
Physics	9	32	80	92	100
Chemistry	4	21	66	81	100
(Aggregate) Average	7	27	73	87	100

17. The number of students scoring less than 40% marks in aggregate is:

    a. 13 b. 19 c. 20

    d. 27 e. 34

18. If at least 60% marks in physics are required for pursuing higher studies in Physics, how many students will be eligible to purse higher studies in Physics?

    a. 27 b. 32 c. 34

    d. 41 e. 68

19. What is the difference between the number of students passed with 30 as cut-off marks in Chemistry and those passed with 30 as cut-off in aggregate?

    a. 3 b. 4 c. 5

    d. 6 e. 7

20. The percentage of the number of students getting at least 60% marks in Chemistry over those getting at least 40% marks in aggregate, is approximately:

    a. 21% b. 27% c. 29%

    d. 31% e. 34%

21. If it is known that at least 23 students were eligible for a Symposium on Chemistry, the minimum qualifying marks in Chemistry for eligibility to Symposium would lie in the range:

    a. 40-50 b. 30-40 c. 20-30

    d. Below 20 e. Cannot be determined

Ques. (22-25): The following table gives the percentage distribution of population of five states, P, Q, R, S and T on the basis of poverty line and also on the basis of sex. Study the table and answer the questions based on it.

State	Percentage of Population below Poverty line	Proportion on Males and Females	
		Below Poverty Line	Above Poverty Line
		M : F	M : F
P	35	5 : 6	6 : 7
Q	25	3 : 5	4 : 5
R	24	1 : 2	2 : 3
S	19	3 : 2	4 : 3
T	15	5 : 3	3 : 2

22. What will be the number of females above poverty line in the state S if it is known that the population of State S is 7 million?

a. 3 million b. 2.43 million c. 1.33 million

d. 5.7 million e. 1.61 million

23. If the male population above poverty line for State R is 1.9 million, then the total population of State R is:

a. 4.5 million b. 4.85 million c. 5.35 million

d. 6.25 million e. 7.6 million

24. What will be the male population above poverty line for State P if the female population below poverty line for state P is 2.1 million?

a. 2.1 million b. 2.3 million c. 2.7 million

d. 3.3 million e. 3.4 million

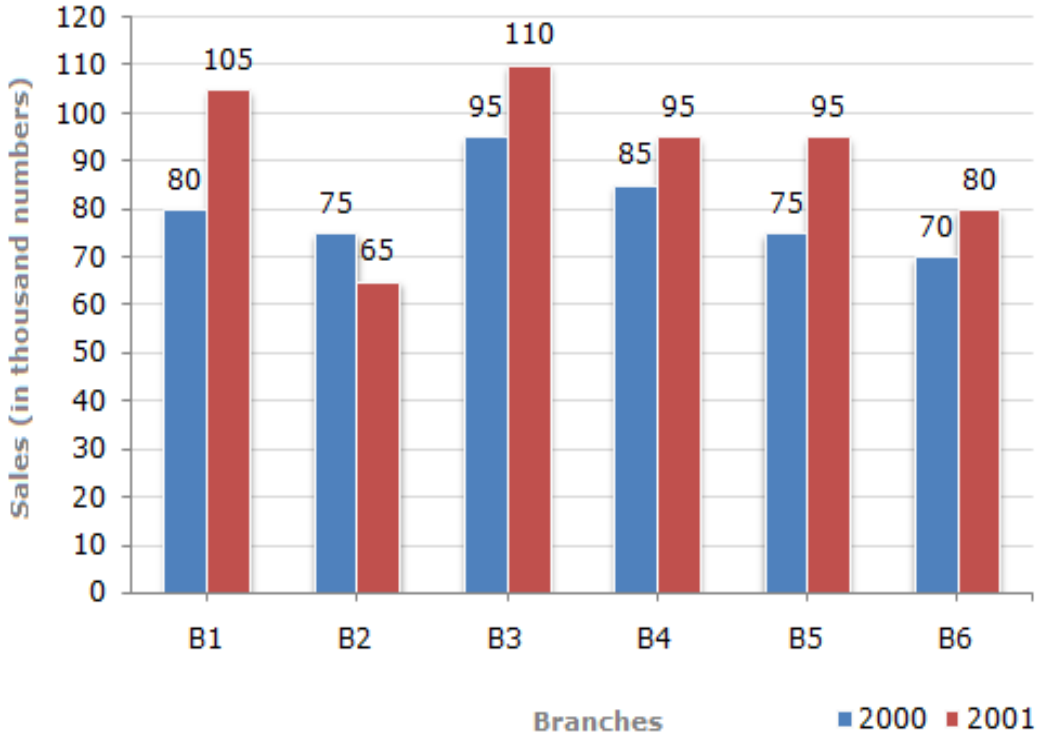
25. If the population of males below poverty line for State Q is 2.4 million and that for State T is 6 million, then the total populations of states Q and T are in the ratio:

a. 1:3 b. 2:5 c. 3:7

d. 4:9 e. 5:12

Ques. (26-30): The bar graph given below shows the sales of books (in thousand number) from six branches of a publishing company during two consecutive years 2000 and 2001.

Sales of Books (in thousand numbers) from Six Branches - B1, B2, B3, B4, B5 and B6 of a publishing Company in 2000 and 2001.



26. What is the ratio of the total sales of branch B2 for both years to the total sales of branch B4 for both years?

a. 2:3 b. 3:5 c. 4:5 d. 7:9

27. Total sales of branch B6 for both the years are what percent of the total sales of branches B3 for both the years?

a. 68.54% b. 71.11% c. 73.17% d. 75.55%

28. What percent of the average sales of branches B1, B2 and B3 in 2001 is the average sales of branches B1, B3 and B6 in 2000?

a. 75% b. 77.5% c. 82.5% d. 87.5%

29. What is the average sale of all the branches (in thousand numbers) for the year 2000?

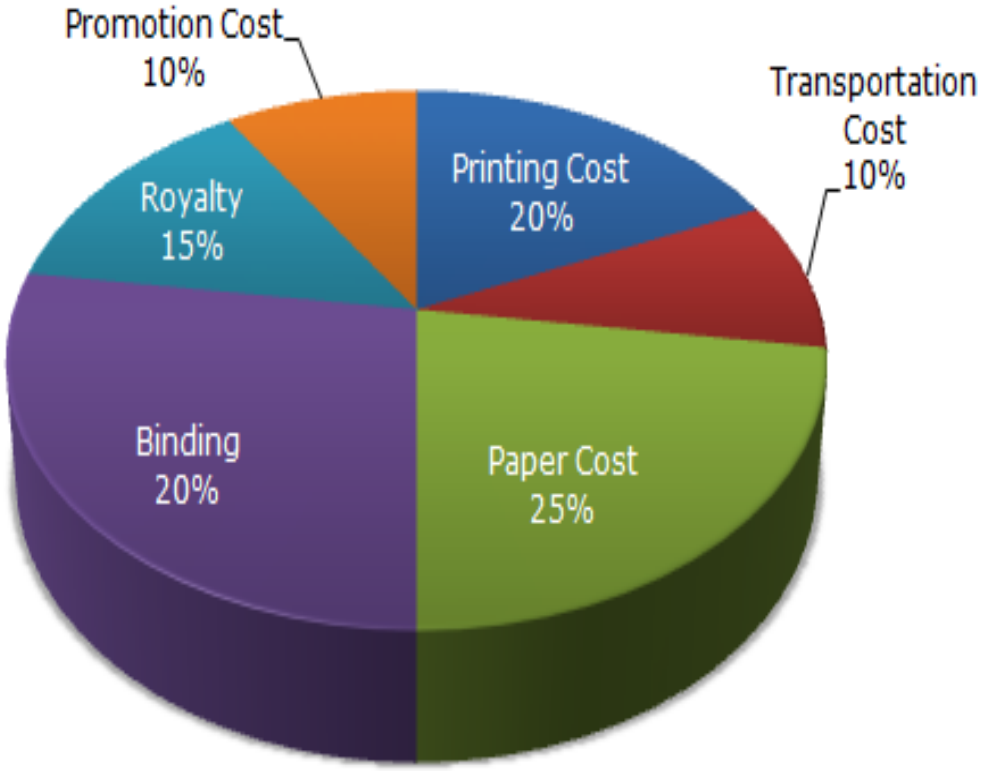
a. 73 b. 80 c. 83 d. 88

30. Total sales of branches B1, B3 and B5 together for both the years (in thousand numbers) are?

a. 250 b. 310 c. 435 d. 560

Ques. (31-33): The following pie-chart shows the percentage distribution of the expenditure incurred in publishing a book. Study the pie-chart and the answer the questions based on it.

Various Expenditures (in percentage) Incurred in Publishing a Book



31. If for a certain quantity of books, the publisher has to pay R30,600 as printing cost, and then what will be amount of royalty to be paid for these books?

a. R19,450 b. R21,200 c. R22,950 d. R26,150

32. What is the central angle of the sector corresponding to the expenditure incurred on Royalty?

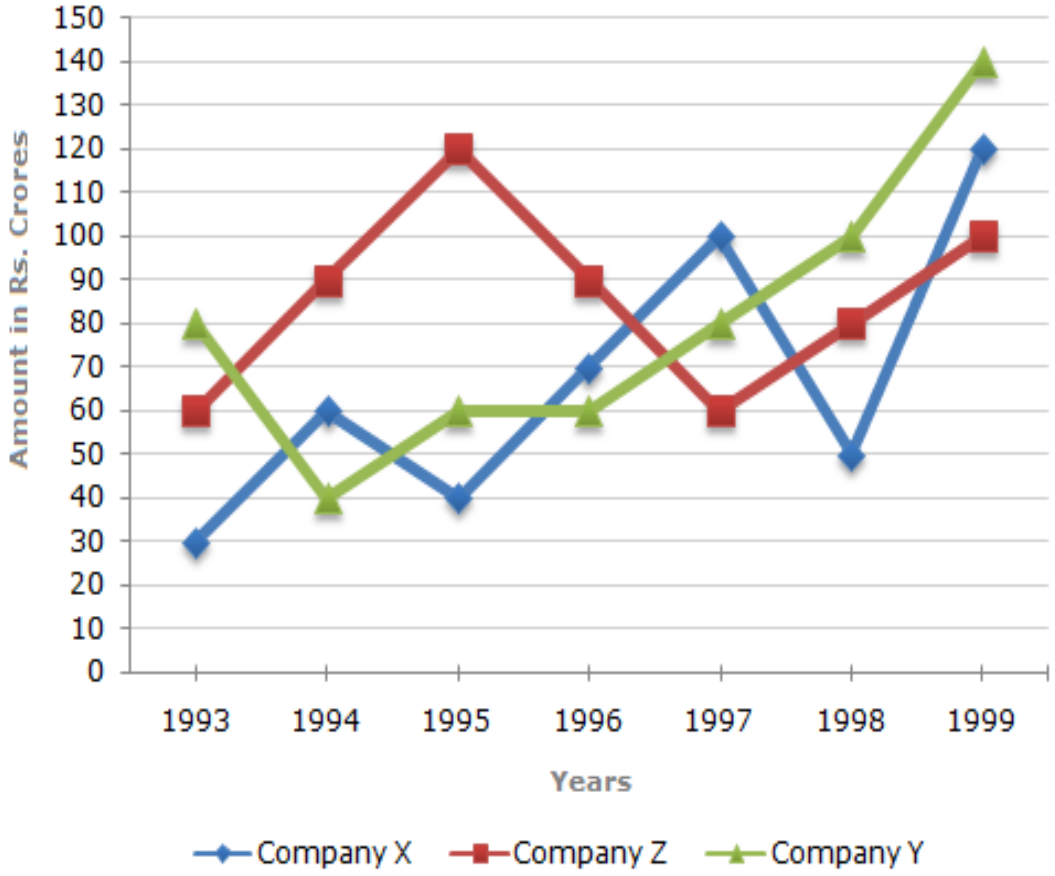
a. 15° b. 24° c. 54° d. 48°

33. If 5500 copies are published and the transportation cost on them amounts to R82500 if cost price of one copy is R135, then what should be the selling price of the book so that the publisher can earn a profit of 25%?

a. R187.50 b. R191.50 c. R175 d. R180

Ques. (34-36):Study the following line graph and answer the questions.

Exports from Three Companies over the Years (in Rs. cr)



34. For which of the following pairs of years the total exports from the three Companies together are equal?

a. 1995 & 1998 b. 1996 & 1998 c. 1997 & 1998 d. 1995 & 1996

35. In which year was the difference between the exports from Companies X and Y the minimum?

a. 1994 b. 1995 c. 1996 d. 1997

36. What was the difference between the average exports of the three Companies in 1993 and the average exports in 1998?

a. R 15.33 cr b. R 19.67 cr c. R 20 cr d. R 16.17 cr

ANSWER KEY-QUANTITATIVE

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

PROBLEMS ON NUMBERS							
1)3	2)3	3)3	4)4	5)1	6)4	7)2	8)1
9)1	10)3	11)3	12)2	13)1	14)2	15)3	16)3
17)1	18)1	19)2	20)3	21)2	22)1	23)3	24)1
25)4	26)2	27)1	28)3	29)2	30)3	31)1	32)4
33)3	34)2						

HCF & LCM							
1)1	2)2	3)1	4)3	5)2	6)3	7)2	8)3
9)4	10)1	11)3	12)2	13)3	14)3	15)3	16)2
17)3	18)2	19)2	20)1	21)2	22)2	23)2	24)4
25)3	26)3	27)2	28)3	29)3	30)2	31)3	32)2

AVERAGE							
1)C	2)B	3)B	4)A	5)D	6)C	7)B	8)A
9)C	10)D	11)C	12)C	13)B	14)A	15)A	16)D
17)C	18)A	19)D	20)B	21)D	22)B	23)D	24)C
25)B	26)C	27)A	28)B	29)C	30)C	31)A	

AGES							
1)A	2)C	3)B	4)C	5)B	6)B	7)A	8)B
9)B	10)C	11)B	12)B	13)C	14)B	15)B	16)C

PERCENTAGE							
1)D	2)C	3)B	4)B	5)B	6)C	7)C	8)B
9)B	10)A	11)D	12)A	13)C	14)C	15)D	16)B
17)C	18)D	19)B	20)C	21)D	22)B	23)D	24)C
25)D	26)C	27)C	28)D	29)C	30)A		

PROFIT & LOSS							
1)A	2)C	3)C	4)C	5)C	6)C	7)B	8)B
9)A	10)C	11)A	12)C	13)C	14)D	15)D	16)B
17)B	18)D	19)B	20)D	21)B	22)B	23)B	24)D
25)C	26)C	27)B	28)B				

RATIO & PROPORTIONS							
1)C	2)D	3)D	4)C	5)A	6)C	7)B	8)D

9)A	10)D	11)A	12)B	13)B	14)C	15)B	16)C
17)C	18)B	19)B	20)D				

PARTNERSHIP							
1)B	2)C	3)C	4)D	5)D	6)A	7)D	8)C
9)B	10)A	11)C					

TIME & WORK / CHAIN RULE							
1)D	2)D	3)A	4)B	5)C	6)D	7)A	8)D
9)C	10)B	11)B	12)C	13)B	14)D	15)C	16)B
17)B	18)B	19)C	20)B	21)B			

PIPES & CISTERNS							
1)C	2)C	3)A	4)A	5)B	6)C	7)A	8)D
9)C	10)C						

SPEED, TIME & DISTANCE							
1)B	2)D	3)D	4)B	5)B	6)C	7)B	8)B
9)A	10)C	11)B	12)B	13)C	14)B	15)C	

PROBLEMS ON TRAINS							
1)C	2)C	3)	4)C	5)C	6)B	7)B	8)D
9)A	10)D	11)B	12)A				

BOATS & STREAMS							
1)C	2)A	3)C	4)B	5)C	6)B	7)C	8)C
9)A	10)B						

ALLEGATION & MIXTURE							
1)A	2)B	3)D	4)A	5)C	6)B	7)A	8)A
9)D	10)D	11)C					

SIMPLE & COMPOUND INTEREST							
1)B	2)A	3)B	4)A	5)B	6)D	7)	8)C
9)B	10)C	11)A	12)D	13)C	14)C	15)C	
16)B	17)B	18)C	19)B	20)C			

MENSURATION							
1)C	2)B	3)B	4)C	5)C	6)D	7)B	8)D
9)C	10)A	11)C	12)B	13)B	14)A	15)D	16)C
17)A	18)D	19)B	20)C	21)C	22)C	23)D	24)C
25)B	26)C	27)B	28)D	29)D	30)C	31)D	32)D
33)D	34)C	35)C					

LOGARITHMS							
1)D	2)A	3)D	4)C	5)B	6)C	7)B	8)C
9)C	10)B	11)A	12)C	13)C	14)C	15)B	16)A
17)D	18)	19)C	20)D				

CLOCKS							
1)D	2)C	3)D	4)B	5)D	6)D	7)B	8)B

PERMUTATION & COMBINATION							
1)D	2)C	3)C	4)C	5)B	6)C	7)C	8)A
9)C	10)D	11)D	12)C	13)D	14)B	15)C	16)A
17)B	18)B	19)A	20)A	21)A	22)B		

PROBABILITY							
1)D	2)B	3)A	4)A	5)B	6)D	7)D	8)A
9)C	10)C	11)A	12)D	13)B	14)D	15)A	16)A
17)A	18)B	19)A	20)D	21)B	22)A	23)B	24)C
25)B							

DATA INTERPRETATION							
1)C	2)D	3)D	4)B	5)D	6)C	7)B	8)D
9)E	10)E	11)C	12)E	13)C	14)B	15)B	16)B
17)D	18)B	19)D	20)C	21)C	22)B	23)D	24)D
25)B	26)D	27)C	28)D	29)B	30)D	31)C	32)C
33)A	34)D	35)C	36)C				