Adda 247

Conceptual Quantitative Aptitude eBook

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PREFACE

Banking examinations have evolved a lot from 2016; with changes in pattern now Banking recruitment exams are dynamic in lieu of their conventional hold. ADDA 247 is proud to present you the new constructive eBook which caters to the need of ever-progressing demands and pattern for the upcoming examinations. The eBook is designed meticulously by the most prominent individuals in this sector and promises to provide you with an escapade that will broaden your horizons. We should never be confined by the limits of our brain and this eBook which is thoroughly revised and covers every crucial aspect of the examination assures you that it will help you in transcending your limits. Our ultimate aim is to help students develop de rigueur skills for success with proper approach.

Quantitative aptitude is one section which finds itself at the heart of this examination. Solving **problems** can sometimes be an uphill task; therefore **ADDA 247** presents you an eBook of **Conceptual Quantitative Aptitude eBook** for bankingexamination which will serve as an elixir for our Banking aspirants. This eBook attempts to cover every major type of **concepts** which have previously graced the Banking exams with the hope to equip candidates with basic knowledge of what to expect in the upcoming Banking and exam 2017. The aim of this book is to help students learn and understand the new pattern of banking recruitment exam which will help them to maximize their scores in the competitive examination. Desire is the key to motivation, but it's determination and commitment to an unrelenting pursuit of your goal - a commitment to excellence - that will enable you to attain the success you seek. This eBook is designed so that you can unlock your hidden potentials.

"A pessimist sees the difficulty in every opportunity; an optimist sees the opportunity in every difficulty."

- Sir Winston Leonard Spencer/Churchill

Team Adda247

CONTENT

Chapter 1

Number System, Simplification and Approximation

This chapter forms a basis of many other topics in mathematics. Let us begin by understanding various types of numbers.

(1) **Natural Numbers:** All the counting numbers are called natural number.

Example: 1, 2, 3, 4, 5, ...

(a) **Even Numbers:** The numbers which are exactly divisible by 2 are called even numbers.

Example: 2, 4, 6, 8, ...

(b) **Odd Numbers:** The numbers which leave a remainder 1 when divided by 2 are called odd numbers.

Example: 1, 3, 5, 7, ...

(c) **Prime Numbers:** If a number is not divisible by any other number except 1 and itself, it is called a prime number.

Example: 2, 3, 5, 7, 11, ...

Co-primes → Two numbers which have no common factor between them except 1 are said to be co-prime to each other. The two numbers individually may be prime or composite.

Example: 13 and 29 are co-primes.

(d) **Composite Numbers:** Numbers which are divisible by other numbers along with 1 and itself are called composite numbers.

Example: 4, 6, 8, 9, 10, ...

The number 1 is neither prime nor composite.

(2) **Whole Numbers:** Natural numbers along with '0' form the set of whole numbers.

Example: 0, 1, 2, 3, ...

(3) **Integers:** All counting numbers and their negatives along with zero are called Integers.

Example: ......-4, -3, -2, -1, 0, 1, 2, 3, 4, ...

(4) **Rational and Irrational Numbers**: Any number which can be expressed in the form of $\frac{p}{q}$, where p and q are integers and $q \neq 0$, is a rational number.

Example: $\frac{3}{5}$, 4, –6, etc.

Numbers which are represented by non-terminating and non-recurring decimals are called irrational numbers.

Example: $\sqrt{2}$ = 1.414....., $\sqrt{3}$ = 1.732.....

(5) **Real Numbers:** Rational and irrational number taken together are called real numbers.

We can summarise the above discussion as follows :

- Numbers
  - Real
    - Rational
      - Integer
        - Negative integers
        - 0
        - Positive integers
      - Fractions
    - Irrational
  - Imaginary

Some important formula :

1. $a^2 - b^2 = (a + b)(a - b)$
2. $(a + b)^2 = a^2 + b^2 + 2ab$
3. $(a - b)^2 = a^2 + b^2 - 2ab$
4. $(a + b + c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ac$
5. $(a + b)^3 = a^3 + b^3 + 3ab(a + b)$
6. $(a - b)^3 = a^3 - b^3 - 3ab(a - b)$
7. $a^3 + b^3 = (a + b)(a^2 + b^2 - ab)$
8. $a^3 - b^3 = (a - b)(a^2 + b^2 + ab)$
9. $a^3 + b^3 + c^3 - 3abc = (a + b + c)(a^2 + b^2 + c^2 - ab - bc - ac)$

Tests of divisibility

Divisibility by 2: A number is divisible by 2 if its unit digit is zero or an even number.

Example: 248, 130

Divisibility by 3: A number is divisible by 3 if the sum of its digit is divisible by 3.

Example: $279 \rightarrow 2 + 7 + 9 = 18$.

18 is divisible by 3, hence 279 is divisible by 3.

Divisibility by 4: A number is divisible by 4 if the number formed by its last two digits is divisible by 4.

Example: 236784

Here, 84 is divisible by 4, hence 236784 is divisible by 4.

Divisibility by 5: A number is divisible by 5 if the number or its unit digit is either 5 or 0.

Example: 115, 240, etc.

Divisibility by 6: A number is divisible by 6 if it is divisible by both 2 and 3.

Example: 318, 396, etc.

Divisibility by 8: A number is divisible by 8 if the number formed by its last 3 digit is divisible by 8.

Example: 23816.

Here, 816 is divisible by 8, hence 23816 is divisible by 8.

Divisibility by 9: A number is divisible by 9 if the sum of all its digits is divisible by 9.

Example: $72936 \rightarrow 7 + 2 + 9 + 3 + 6 = 27$

27 is divisible by 9, hence 72936 is divisible by 9.

Divisibility by 11: A number is divisible by 11 if the difference of the sum of the alternate digits starting from the units digit and the sum of the alternate digits starting from the tens digit is either '0' or is a multiple of 11.

Example: 1 3 3 1

$(1 + 3) - (3 + 1) = 0 \Rightarrow$ 1331 is divisible by 11.

Divisibility by 19: A number is divisible by 19 if the sum of the number formed by digits other than the unit digit and twice the unit digit is divisible by 19.

Example: $76 \Rightarrow 7 + (2 \times 6) = 19.$

Therefore 76 is divisible by 19.

Least Common Multiple (LCM)

LCM of two or more numbers is the least number which is divisible by each of these numbers.

Finding LCM

Write the numbers as product of prime factors. Then multiply the product of all the prime factors of the first number by those prime factors of the second number which are not common to the prime factors of the first number.

The product is then multiplied by those prime factors of the third number which are not common to the prime factors of the first two numbers.

The final product after considering all the numbers will be the LCM of these numbers.

Example: Find the LCM of 540 and 108?

$540 = 2 \times 27 \times 10 = 2^2 \times 3^3 \times 5$

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

$\text{LCM} = 2^2 \times 3^3 \times 5 = 4 \times 27 \times 5 = 540$

Finding LCM by division

Choose one prime factor common to at least two of the given numbers write the given numbers in a row and divide them by the above prime number. Write the quotient for each number under the number itself. If a number is not divisible by the prime factor selected, wirte the number as it is Repeat this process untill you get quotients which have no common factor.

The product of all the divisors and the numbers in the last line will be the LCM.

Example: Find the LCM of 36, 84 and 90

$$\begin{array}{c|ccc} 3 & 36, & 84, & 90 \\ \hline 3 & 12, & 28, & 30 \\ \hline 2 & 4, & 28, & 10 \\ \hline 2 & 2, & 14, & 5 \\ \hline & 1, & 7, & 5 \end{array}$$

$$\text{LCM} = 3 \times 3 \times 2 \times 2 \times 7 \times 5 = 1260$$

Highest Common Factor (HCF)

HCF is the largest factor of two or more given numbers.

HCF is also called Greatest Common Divisor (GCD).

Finding HCF by Factorisation method

Express each given number as a product of primes factors. The product of the prime factors common to all the numbers will be the HCF.

Example: Find the HCF of 144, 336 and 2016?

$$144 = 12 \times 12 = 3 \times 2^2 \times 3 \times 2^2 = 3^2 \times 2^4$$

$$336 = 2^4 \times 3 \times 7$$

$$2016 = 2^5 \times 7 \times 3^2$$

$$\text{HCF} = 3 \times 2^4 = 48$$

Finding HCF by Division method

Divide the greater number by the smaller number. Then divide the divisor by the remainder. Now, divide the second divisor by the second remainder

We repeat this process till no remainder is left. The last divisor is the HCF.

Then using the same method, find the HCF of this HCF and the third number. This will be the HCF of the three numbers.

Example: HCF of 144, 336

$$144\overline{)336}(2$$
$$\underline{288}$$
$$48\overline{)144}(3$$
$$\underline{144}$$
$$\underline{0}$$

HCF = 48

LCM and HCF of fractions:

$$\text{LCM of fractions} = \frac{\text{LCM of Numerators}}{\text{HCF of Denominators}}$$

$$\text{HCF of fractions} = \frac{\text{HCF of Numerators}}{\text{LCM of Denominators}}$$

Simplification

BODMAS Rule

This rule depicts the correct sequence in which the operations are to be executed, so as to find out the value of a given expression.

B → Bracket
O → Of
D → Division
M → Multiplication
A → Addition
S → Subtraction

Thus in simplifying an expression, first of all the brackets must be removed, strictly in the order (), { }, [].

After removing the brackets, we must use the following operations strictly in the order :

(i) of (ii) Division (iii) Multiplication (iv) Addition (v) Subtraction

Approximation

One needs to solve the questions of approximation by taking the nearest approximate values and mark the answers accordingly.

Example: If the given value is 3.009, then the approximate value is 3.
If the given value is 4.45, then the approximate value is 4.50.

Example 1: $2959.85 \div 16.001 - 34.99 = ?$

(a) 160 (b) 150 (c) 140 (d) 180 (e) 170

Sol. **(b);** $2959.85 \div 16.001 - 34.99 \cong 2960 \div 16 - 35 = 185 - 35 = 150$

Example 2: $(1702 \div 68) \times 136.05 = ?$

(a) 3500 (b) 3550 (c) 3450 (d) 3400 (e) 3525

Sol. **(d);** $(1702 \div 68) \times 136.05 \cong (1700 \div 68) \times 136 \approx 3400$

Some shortcuts and tricks for calculations

Multiplication by a number close to 10, 100, 1000, etc

Example: $999 = 1000 - 1$; $101 = 100 + 1$

To multiply with such numbers, convert the number into the form of $(10 \pm C)$ or $(100 \pm C)$ etc.

Example: $46 \times 98 = 46 \times (100 - 2) = 46 \times 100 - 46 \times 2 = 4600 - 92 = 4508$

Multiplication by 5 or powers of 5: can be converted into multiplication by 10 or powers of 10 by dividing it by 2 and its powers.

Example: $2345 \times 125 = 2345 \times 5^3 = 2345 \times \left(\frac{10}{2}\right)^3 = \frac{2345000}{8} = 293125$

Square of a number which ends with 5.

(1) Last two digits of the square are always 25.
(2) To find the number which comes before 25, perform the operation $n \times (n+1)$, where n is the digit before 5 in the original number.
(3) Put the number received in step 2 before 25 and you get the square.

Example: $(65)^2 = ?$

(1) Last two digits are 25.

(2) The digit before 5 is 6 perform n × (n + 1) operation on this
$= 6 \times (6 + 1) = 6 \times 7 = 42$

(3) Hence th square of 65 will be 4225.

Square of a number containing repeated 1's

(1) Count the number of digits. Let the count be n.

(2) Now, starting from 1, write the number till n.

(3) Then, starting from n write the number till 1.

Example: Find the square of 1111?

Sol. There are four 1's. Now we write numbers from 1 to 4. Then again form 4 to 1. So, $(1111)^2 = 1234321$

Multiplying 2-digit numbers where the unit's digits add upto 10 and ten's digits are same

Example: $42 \times 48 = ?$

(1) First multiply the unit digits of the numbers. $2 \times 8 = 16$

(2) Then multiply 4 by (4 +1) $\Rightarrow$ $4 \times 5 = 20$.

(3) The answer is 2016.

Multiplying numbers just over/below 100

Example: $108 \times 109 = 11772$.

The answer is in two parts : 117 and 72.

117 is (108 + 9) or (109 + 8), and 72 is 8 × 9.

new, check for $107 \times 106 =$ 113 42

113 ← (107+6) or (106+7)

42 → (7 × 6)

Multiplication of a 2-digit number by a 2-digit number

Example: 12 × 13?

Sol. Steps:

1. Multiply the right-hand digits of multiplicand and multiplier (unit-digit of multiplicand with unit-digit of the multiplier).

$$\begin{array}{rr} 1 & 2 \\ & \updownarrow \\ 1 & 3 \\ \hline & 6(2\times 3) \end{array}$$

2. Now, do cross-multiplication, i.e., multiply 3 by 1 and 1 by 2. Add the two products and write down to the left of 6.

$$\begin{array}{ccc} 1 & & 2 \\ & \times & \\ 1 & & 3 \\ \hline & & 56 \end{array}$$

3. In the last step we multiply the left-hand figures of both multiplicand and multiplier (ten's digit of multiplicand with ten's digit of multiplier).

$$\begin{array}{lr} 1 & 2 \\ \updownarrow & \\ 1 & 3 \\ \hline & 156(1\times 1) \end{array}$$

So, the answer is 156.

Example: 325 × 17 = ?

Sol. Steps:

1.
$$\begin{array}{rr} 3\,2 & 5 \\ & \updownarrow \\ 1 & 7 \\ \hline & 5 \end{array}$$

$(5\times 7 = 35$, put down 5 and carry over 3)

2.
$$\begin{array}{ccc} 3 & 2 & 5 \\ & 1 & 7 \\ \hline & 2 & 5 \end{array}$$

(2 × 7 + 5 × 1 + 3 = 22, put down 2 and carry over 2)

3.
$$\begin{array}{ccc} 3 & 2 & 5 \\ & 1 & 7 \\ \hline & 2 & 25 \end{array}$$

(3 × 7 + 2 × 1 + 2 = 25, put down 5 and carry over 2)

4.
$$\begin{array}{cccc} 3 & & 2 & 5 \\ & & 1 & 7 \\ \hline 5 & 5 & 2 & 5 \end{array}$$

So, answer is 5525

Multiplication of a 3-digit number by a 3-digit number

Example: 321 × 132 = ?

Sol. Steps:

1.
$$\begin{array}{ccc} 3 & 2 & 1 \\ 1 & 3 & 2 \\ \hline & & 2\,(1 \times 2 = 2) \end{array}$$

2.
$$\begin{array}{ccc} 3 & 2 & 1 \\ 1 & 3 & 2 \\ \hline & & 72 \end{array}$$
(2 × 2 + 3 × 1 = 7)

3.
$$\begin{array}{ccc} 3 & 2 & 1 \\ 1 & 3 & 2 \\ \hline \end{array}$$

(2 × 3 + 3 × 2 + 1 × 1 = 13, write down 3 and carry over 1)

4.

$$\begin{array}{ccc} 3 & 2 & 1 \\ 1 & 3 & 2 \\ \hline \multicolumn{3}{l}{2\,3\,7\,2} \end{array}$$

(3 × 3 + 1 × 2 + 1 = 12, write down 2 and carry over 1)

5.

$$\begin{array}{lccc} & 3 & 2 & 1 \\ & \updownarrow & & \\ & 1 & 3 & 2 \\ \hline 4\,2 & 3 & 7 & 2 \end{array}$$

$(1 \times 3 + 1 = 4)$ So, answer is 42372.

Some more short tricks:

(1) 2 + 22 + 222 + 2222 = 2 (1 + 11 + 111 + 1111)
2 (1234) = 2468

(2) 0.2 + 0.22 + 0.222 + 0.2222 + 022222 = 2 (0.1 + 0.11 + 0.111 + 0.1111 + 0.11111) = 2 (0.54321) = 1.08642

(3) 2 + 8 + 22 + 88 + 222 + 888 + 2222 + 8888 + 22222 + 88888 = 2 (12345) + 8 (12345) = (12345) (2 + 8) = 12345 × 10 = 123450

(4) $(2222)^2 = 2^2 \times (1111)^2 = 4 \times (1234321) = 4937284$

(5) If unit digit in each number is 5 and difference of the numbers is 10, then they are multiplied as:

Example: (1) 65 × 75 = 48 75

(6 × 8) (Constant)

(2) 125 × 135 = 168 75

(12 × 14) Constant

Percentage – fraction conversion:

The following percentage values of corresponding fractions must be on your tips :

Example: $62\frac{1}{2}\%$ of 256 can be easily calculated if we know the fractional value of $62\frac{1}{2}\%$ i.e., $\frac{5}{8}$.

$$\begin{bmatrix} 1 = 100\% \\ \frac{1}{2} = 50\% \end{bmatrix} \begin{bmatrix} \frac{1}{3} = 33\frac{1}{3}\% \\ \frac{2}{3} = 66\frac{2}{3}\% \end{bmatrix} \begin{bmatrix} \frac{1}{4} = 25\% \\ \frac{3}{4} = 75\% \end{bmatrix} \begin{bmatrix} \frac{1}{5} = 20\% \\ \frac{2}{5} = 40\% \\ \frac{3}{5} = 60\% \\ \frac{4}{5} = 80\% \end{bmatrix} \begin{bmatrix} \frac{1}{6} = 16\frac{2}{3}\% \\ \frac{5}{6} = 83\frac{1}{3}\% \end{bmatrix}$$

$$\begin{bmatrix} \frac{1}{7} = 14\frac{2}{7}\% \\ \frac{2}{7} = 28\frac{4}{7}\% \\ \frac{3}{7} = 42\frac{6}{7}\% \\ \frac{4}{7} = 57\frac{1}{7}\% \\ \frac{5}{7} = 71\frac{3}{7}\% \\ \frac{6}{7} = 85\frac{5}{7}\% \end{bmatrix} \begin{bmatrix} \frac{1}{8} = 12\frac{1}{2}\% \\ \frac{3}{8} = 37\frac{1}{2}\% \\ \frac{5}{8} = 62\frac{1}{2}\% \\ \frac{7}{8} = 87\frac{1}{2}\% \end{bmatrix} \begin{bmatrix} \frac{1}{9} = 11\frac{1}{9}\% \\ \frac{2}{9} = 22\frac{2}{9}\% \\ \frac{4}{9} = 44\frac{4}{9}\% \\ \frac{5}{9} = 55\frac{5}{9}\% \\ \frac{7}{9} = 77\frac{7}{9}\% \\ \frac{8}{9} = 88\frac{8}{9}\% \end{bmatrix} \begin{bmatrix} \frac{1}{11} = 9\frac{1}{11}\% \\ \frac{2}{11} = 18\frac{2}{11}\% \\ \frac{3}{11} = 27\frac{3}{11}\% \\ \frac{4}{11} = 36\frac{4}{11}\% \\ \frac{5}{11} = 45\frac{5}{11}\% \end{bmatrix}$$

$\frac{1}{20} = 5\%$, $\quad \frac{1}{19} = 5 + \frac{5\times 5}{100} = 5.25\%$, $\quad \frac{1}{21} = 5 - \frac{5\times 5}{100} = 4.75\%$

Similarly,

$\frac{1}{25} = 4\%$, $\frac{1}{24} = 4 + \frac{4 \times 4}{100} = 4.16\%$, $\frac{1}{26} = 4 - \frac{4 \times 4}{100} = 3.84\%$

$\frac{1}{11} = 9.09\%$, $\frac{1}{7} = 14.2857\%$, $\frac{1}{22} = 4.54\%$

$\frac{1}{14} = 7.14\%$ $\frac{1}{33} = 3.03\%$, $\frac{1}{28} = 3.57\%$

Finding the unit place digit when a number is raised to some power

(1) When the unit digit of a number is 0, 1, 5, or 6, then on raising that number to any power, the new number obtained will have its unit digit 0, 1, 5, or 6 respectively.

(2) When the unit digit of a number is 2:

Example: $(122)^{159}$

Divide 159 by 4

$$\frac{159}{4} \rightarrow \text{remainder} = 3$$

(unit digit of $122)^3 = 2^3 = 8$

So, the unit digit of $(122)^{159} = 8$

(3) When the unit digit of the number is 3 .

Example: $(53)^{145}$

Sol. $\frac{145}{4} \Rightarrow$ Remaider = 1

$3^1 = 3$

So, unit digit of $(53)^{145}$ is 3.

(4) When the unit digit is 4 :

Example: 144

if it is raised to an odd power $\rightarrow$ Example : $(144)^{145}$, then unit place is 4.

if it is raised to an even power $\rightarrow$ Example : $(144)^{144}$, then unit place is 6.

(5) When the unit digit is 7:

Example: $(327)^{329}$

Sol. $329 \div 4 \Rightarrow$ rem. = 1 $\Rightarrow 7^1 = 7$

$\Rightarrow$ So, unit digit = 7.

(6) when the unit is 8:

Example: $(88)^{178}$

Sol. $178 \div 4 \Rightarrow$ Rem. = 2 $\Rightarrow 8^2 = 6\underline{4}$

$\Rightarrow$ So, unit digit of $(88)^{178}$ is 4

(7) When the unit digit is 9 ;

Example: 119

if it is raised to an odd power

Example: $\rightarrow (119)^{119} \Rightarrow$ unit digit = 9

if it is raised to an even power

Example: $\rightarrow (119)^{118} \Rightarrow$ unit digit = 1

Finding minimum and maximum values in fractions:

Example: Find maximum value:

$$\frac{5}{7}, \frac{9}{4}, \frac{8}{13}, \frac{14}{15} \Rightarrow \text{Let us consider } \frac{5}{7} \text{ and } \frac{9}{4}$$

$$\frac{5}{7} \qquad \frac{9}{4}$$

$$5 \times 4 < 9 \times 7 \Rightarrow \frac{5}{7} < \frac{9}{4}$$

Now, let us take : $\frac{9}{4}$ and $\frac{8}{13}$

$$\frac{9}{4} \qquad \frac{8}{13}$$

$$13 \times 9 > 4 \times 8 \Rightarrow \frac{9}{4} > \frac{8}{13}$$

$\frac{9}{4}$ is greater than both $\frac{5}{7}$ and $\frac{8}{13}$.

Now, let us compare $\frac{9}{4}$ and $\frac{14}{15}$

$$\frac{9}{4} \quad \frac{14}{15}$$

$$15 \times 9 > 4 \times 14 \quad \Rightarrow \quad \frac{9}{4} > \frac{14}{15}$$

So, $\frac{9}{4}$ is the greatest value among all given values.

Chapter 2 Ratio, Proportion and Partnership

The comparision between two quantities in terms of magnitude is called **ratio**.

For example, Mohit has 5 pens and Amit has 3 pens. It means the ratio of number of pens between Mohit and Amit is 5 is to 3. It can be expressed is 5 : 3.

So the ratio of any two quantities is expressed as $\frac{a}{b}$ or a : b. The numerator 'a' is called the antecedent and denominator 'b' is called as consequent.

Rule of Ratio: The comparison of two quantities is meaningless if they are not of the same kind or in the same units (of length, volume or currency etc.) We do not compare 5 girls and 7 toys or 15 kilometers and 3 cows. Therefore, to find the ratio of two quantities (of the same kind), it is necessary to explain them in same units.

Properties of Ratio:

1. The nature of ratio does not change when the numerator and denominator both are multiplied by same quantities.

   i.e, $\frac{a}{b}=\frac{ka}{kb}=\frac{la}{lb}$ etc $\Rightarrow$ e.g. $\frac{3}{4}=\frac{6}{8}=\frac{9}{12}$ ... etc have the same ratio.

2. The value of a ratio does not change when the numerator and denominator both are divided by same quantities.

   i.e, $\frac{a}{b}=\frac{a/k}{b/k}=\frac{a/l}{b/l}$ etc, $\Rightarrow$ e.g. $\frac{3}{4}=\frac{3/2}{4/2}=\frac{3/3}{4/3}$. etc are in same ratio

3. The ratio of two fractions can be expressed in ratio of integers.

   e.g. $\frac{3/4}{5/4}=\frac{3}{4}\times\frac{4}{5}=\frac{3}{5}$ $\Rightarrow$ $\frac{a/b}{c/d}=\frac{a}{b}\times\frac{d}{c}$

4. When two or more than two ratio are multiplied with each other, then it is called compounded ratio e.g.,

$\frac{2}{3}\times\frac{4}{5}\times\frac{6}{7}=\frac{16}{35}$ is compounded ratio of $\frac{2}{3},\frac{4}{5},\frac{6}{7}$

So, $\frac{a}{b}\times\frac{c}{d}\times\frac{e}{f}....=\frac{k}{m}$(Compound ratio)

5. When the ratio is compounded with itself, it is called as duplicate, triplicate ratio etc.

$\frac{a}{b}\times\frac{a}{b}=\frac{a^2}{b^2}=\left(\frac{a}{b}\right)^2$ is called duplicate ratio of $\frac{a}{b}$ and $\frac{a}{b}\times\frac{a}{b}\times\frac{a}{b}=\left(\frac{a}{b}\right)^3$ is called triplicate ratio of $\frac{a}{b}$ similarly $\sqrt{\left(\frac{a}{b}\right)}=\left(\frac{a}{b}\right)^{\frac{1}{2}}$ is called as sub-duplicate ratio and $\sqrt[3]{\left(\frac{a}{b}\right)}=\left(\frac{a}{b}\right)^{\frac{1}{3}}$ is called as sub-triplicate ratio of $\frac{a}{b}$. If four quantities a, b, c and d form a proportion, many other proportions may be deduced by the properties of fraction. The results of these operation are very useful. These operations are

1. Inverterdo: if $\frac{a}{b}=\frac{c}{d}$ the $\frac{b}{a}=\frac{d}{c}$

2. Alternado: if $\frac{a}{b}=\frac{c}{d}$ then $\frac{a}{c}=\frac{b}{d}$

3. Componendo: if $\frac{a}{b}=\frac{c}{d}$, then $\left(\frac{a+b}{b}\right)=\left(\frac{c+d}{d}\right)$

4. Dividendo: if $\frac{a}{b}=\frac{c}{d}$, then $\left(\frac{a-b}{b}\right)=\left(\frac{c-d}{d}\right)$

5. Componendo and Dividendo: if $\frac{a}{b}=\frac{c}{d}$, then $\frac{a+b}{a-b}=\frac{c+d}{c-d}$

Concept 1: If two numbers are in the ratio of a : b and the sum of these number is x, then these numbers will be

$\frac{ax}{a+b}$ and $\frac{bx}{a+b}$ respectively.

Example : Two numbers are in the ratio of 4 : 5. If sum of these two number is 810, find the numbers?

Sol. Ratio of two number = 4 : 5

Sum = 810

$$\text{First number} = \frac{ax}{a+b}=\frac{4\times 810}{4+5}=360$$

$$\text{Second number} = \frac{bx}{a+b}=\frac{5\times 810}{4+5}=450$$

Example: a : b = 3 : 4 and b : c = 2 : 5 Find a : b : c ?

Sol.

$$\begin{array}{l}
a : b = 3 : 4 \\
b : c = 2 : 5 \\
\hline
a : b : c = 3\times2 : 4\times2 : 4\times5 \\
= 6 : 8 : 20 \\
= 3 : 4 : 10
\end{array}$$

Example: a : b = 1 : 2, b : c = 3 : 2, and c : d = 1 : 3. Find a : b : c : d?

Sol.

$$\begin{array}{cccc}
a & b & c & d \\
1 & 2 \rightarrow & 2 \rightarrow & 2 \\
3 \leftarrow & 3 & 2 \rightarrow & 2 \\
1 \leftarrow & 1 \leftarrow & 1 & 3 \\
\hline
\end{array}$$

$$a : b : c : d = 1\times3\times1 : 2\times3\times1 : 2\times2\times1 : 2\times2\times3$$
$$= 3 : 6 : 4 : 12$$

Partnership

Concept 1: If a group of n persons invested different amount for different period then their profit is the ratio is $At_1 : Bt_2 : Ct_3 : Dt_4 : \ldots : Xt_n$

Here first person invested amount A for t_1 period, second persons invested amount B for t_2 period and so on.

Example: A starts a business with Rs 2,000, B joins him after 3 months with Rs 4,000. C puts a sum of Rs 10,000 in the business for 2 months only. At the end of the year the business gave a profit of Rs 5600. How should the profit be divided among them ?

Sol: Ratio of their profits (A's : B's : C's) = 2 × 12 : 4 × 9 : 10 × 2 = 6 : 9 : 5

Now, 6 + 9 + 5 = 20

Then A's share = $\frac{5600}{20} \times 6$ = Rs 1680

B's share = $\frac{5600}{20} \times 9$ = Rs 2520

C's share = $\frac{5600}{20} \times 5$ = Rs 1400

Concept 2: If investments are in the ratio of a : b : c and the timing of their investments in the ratio of x : y : z then the ratio of their profits are in the ratio of ax : by : cz.

Example : A, B and C invested capital in the ratio 2 : 3 : 5, the timing of their investments being in the ratio 4 : 5 : 6. In what ratio would their profit be distributed?

Sol. We should know that if the duration for their investments be in the ratio x : y : z, and investment is in ratio a : b : c then the profit would be distributed in the ratio ax : by : cz.

Thus, following the same rule, the required ratio = 2 × 4 : 3 × 5 : 5 × 6 = 8 : 15 : 30

Concept 3: If investments are in the ratio a : b : c and profits in the ratio p : q : r, then the ratio of time is $\frac{p}{a}:\frac{q}{b}:\frac{r}{c}$.

Example : A, B and C invested capital in the ratio 5 : 6 : 8. At the end of the business term, they received the profits in the ratio 5 : 3 : 12. Find the ratio of time for which they contributed their capital?

Sol: Using the above formula, we have the required ratio

$$=\frac{5}{5}:\frac{3}{6}:\frac{12}{8}=1:\frac{1}{2}:\frac{3}{2}:2:1:3$$

Chapter 3 Percentage

Percent: The term 'percent' is derived from the Latin word 'Per centum'. It implies "out of every hundred".

The symbol '%' is used to denote percentage. For example, 15% means 15 out of 100. Each ratio can be expressed as a percentage.

For example, $\frac{1}{2}$ can be expressed as a percentage by multiplying by 100;

$$\frac{1}{2} \times 100 = 50\%$$

A given percentage value can be converted to corresponding fraction by dividing by 100.

Example: $75\% = 75 \text{ out of hundred} = \frac{75}{100} = \frac{3}{4}$

Percentage fraction conversion chart:

$\frac{1}{2} = 50\%$	$\frac{5}{6} = 83\frac{1}{3}\%$	$\frac{2}{9} = 22\frac{2}{9}\%$
$\frac{1}{3} = 33\frac{1}{3}\%$	$\frac{1}{7} = 14\frac{2}{7}\%$	$\frac{1}{10} = 10\%$
$\frac{2}{3} = 66\frac{2}{3}\%$	$\frac{2}{7} = 28\frac{4}{7}\%$	$\frac{1}{11} = 9\frac{1}{11}\%$
$\frac{1}{4} = 25\%$	$\frac{3}{7} = 42\frac{6}{7}\%$	$\frac{2}{11} = 18\frac{2}{11}\%$
$\frac{3}{4} = 75\%$	$\frac{1}{8} = 12\frac{1}{2}\%$	$\frac{1}{12} = 8\frac{1}{3}\%$
$\frac{1}{5} = 20\%$	$\frac{3}{8} = 37\frac{1}{2}\%$	$\frac{5}{12} = 41\frac{2}{3}\%$

$\frac{2}{5} = 40\%$ $\frac{5}{8} = 62\frac{1}{2}\%$ $\frac{1}{15} = 6\frac{2}{3}\%$

$\frac{3}{5} = 60\%$ $\frac{7}{8} = 87\frac{1}{2}\%$ $\frac{1}{20} = 5\%$

$\frac{4}{5} = 80\%$ $\frac{1}{9} = 11\frac{1}{9}\%$ $\frac{1}{25} = 4\%$

$\frac{1}{6} = 16\frac{2}{3}\%$

Formula to calculate percentage value: y% of x = $\left(\frac{y}{100}\right) \times x$

From the above formula, we have the following result: x% of y = y% of x.

whenever we have two numbers a and b, one number can be expressed as a percentage of the other as follows:

x as a percent of y = $\frac{x}{y} \times 100$, y as a percent of x = $\frac{y}{x} \times 100$.

Percentage increase or decrease:

$$\text{Percentage increase} = \frac{\text{increase in the quantity}}{\text{original quantity}} \times 100$$

$$\text{Percentage decrease} = \frac{\text{decrease in the quantity}}{\text{original quantity}} \times 100$$

For example, if the net profit of a company grew from 50 crore in 2003 to 75 crore in 2004, then the percentage increase in the net profit from 2003 to 2004 is calculated as follows:

increase in the net profit = (75 – 50) crore = 25 crore

This increase is on Rs. 50 crore.

So, Percentage increase $= \dfrac{\text{increase in profit from 2003 to 2004}}{\text{Net profit in 2003}} \times 100$

$$= \frac{25}{50} \times 100 = 50\%$$

When a quantity increases or decreases by some percent, the new value of the quantity can be directly calculated as follows:

If the original quantity is 120 and it increases by 25% , then the new quantity is: 1.25 × 120 = 150

(Here, 1.25 = 1 + 0.25, where 0.25 is equivalent to 25%)

Similarly, if there is a decrease by 25% on 120, then the new quantity is: 0.75 × 120 = 90

(Here, 0.75 = 1 – 0.25, where 0.25 is equivalent to 25%)

Some important conclusions:

(i) If x is a% more than y, then y is $\left(\dfrac{a}{100+a} \times 100\right)\%$ less than x.

(ii) If x is a% less than y, then y is $\left(\dfrac{a}{100-a} \times 100\right)\%$ more than x.

Example: If in an examination, the marks secured by Prerna are 20% less than that of Vinita, then marks secured by Vinita are how much percent more than prerna's marks?

Solution: a = 20%

According to the above formula; Required percentage

$$= \left(\frac{a}{100-a} \times 100\right)\% = \frac{20}{80} \times 100 = 25\%$$

(iii) If a number is first increased by a% and then decreased by a% then the net effect is always a decrease which is equal to 'a% of a' i.e., $\dfrac{a^2}{100}\%$

Example: The salary of a worker is first increased by 5% and then it is decreased by 5%. What is the change in his salary?

Solution: Here a = 5%

There will be a net decrease; Percent decrease

$$= \frac{a^2}{100}\% = \frac{5^2}{100}\% = 0.25\%$$

(iv) If a quantity is first changed (increased or decreased) by a% and then changed (increased or decreased) by b%, then

$$\text{Net change} = \left[\pm a \pm b + \frac{(\pm a)(\pm b)}{100}\right]\%$$

Net change is an increase or a decrease according to the positive or negative sign, respectively of the final result.

Example: The price of an article is first increased by 20% and then decreased by 25% due to reduction in sales. Find the net percent change in the final price of the article.

Solution: a = 20%, b = 25%

$$\text{Required percentage change} = \left(20 - 25 + \frac{20 \times (-25)}{100}\right)\%$$

$$= (-5 - 5)\% = -10\%$$

So, there is a net decrease of 10% in the final price of the article as the final result is negative.

(v) If the price of a commodity increases or decreases by a%, then the decrease or increase in consumption, so as not to increase or decrease the expenditure is equal to $\left(\frac{a}{100 \pm a}\right) \times 100\%$

(vi) If the population of a town is P and it increases (or decreases) at the rate of R% per annum, then

(i) Population after n years $= P\left(1 \pm \frac{R}{100}\right)^n$

(ii) Population n years ago $= \frac{P}{\left(1 \pm \frac{R}{100}\right)^n}$

('+' sign for increment; '-' sign for decrement).

Some tricks to calculate faster:

(i) Splitting the percentage into parts

Example: Find 51% of 128.

Soltion: 51% of 128 = (50 + 1)% of 128 = 50% of 128 + 1% of 128 = 64 + 1.28 = 65.28

(ii) Interchanging the percentage value and the number

Example: Find 39% of 12.5

Solution: 39% of 12.5 = 12.5% of 39 $= \frac{1}{8} \times 39$ = 4.875

Chapter 4

Profit and Loss

Theory:

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

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

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

i.e., Profit = SP – CP; SP > CP

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

i.e., Loss = CP – SP; CP > SP

Some Important Formulae:

(i) Profit = SP – CP

(ii) Loss = CP – SP

(iii) Profit percentage = $\left(\frac{\text{Profit}}{\text{CP}} \times 100\right)\%$

(iv) Loss percentage = $\left(\frac{\text{Loss}}{\text{CP}} \times 100\right)\%$

(v) S.P = $\left(\frac{(100 + \text{Profit\%}) \times \text{CP}}{100}\right) = \left(\frac{(100 - \text{Loss\%}) \times \text{CP}}{100}\right)$

(vi) C.P = $\left(\frac{100 \times \text{SP}}{100 + \text{Profit\%}}\right) = \left(\frac{100 \times \text{SP}}{100 - \text{Loss\%}}\right)$

(vii) SP = (100 + x)% of CP; when Profit = x% of CP

(viii) SP = (100 – x)% of CP; when Loss = x% of CP

Example 1: A man purchases an item for Rs. 120 and he sells it at a 20 percent profit, find his selling price

Sol.

$$SP = \left(\frac{100+\text{Profit\%}}{100}\right)\times CP$$

$$= \frac{100+20}{100}\times 120 = \frac{120}{100}\times 120 = \text{Rs. } 144$$

Note: **Profit /Loss percentage is always calcualated on C.P. unless otherwise stated.**

Example 2: Find the cost price of an article which is sold for Rs. 200 at a loss of 20%

Sol.

$$CP = \frac{100}{100-\text{Loss\%}}\times SP = \frac{100}{100-20}\times 200 = \text{Rs. } 250$$

Concept 1:

MARK UP AND DISCOUNT

Marked Price: To avoid loss due to bargaining by the customer and to get profit over the cost price, the trader increases the cost price. This increase is known as markup and the increased price (i.e., cp+markup) is called the marked price or printed price or list price of the goods.

Marked Price = CP + markup

$$\text{Marked Price} = CP + \frac{(\%\text{ marked})\times CP}{100}$$

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

Discount: Discount means reduction of marked price to sell at a lower rate or literally discount means concession.

Basically, it is calculated on the basis of marked price.

Selling price = Marked price - Discount

$$\text{Selling price} = MP - \frac{(\%\ \text{Discount}) \times MP}{100}$$

Example: If the cost price of an articale is Rs. 300 and the percent markup is 30%. What is the marked price?

Sol. MP = CP + (%markup on CP) $= 300 + \frac{30}{100} \times 300$ = Rs. 390

Concept 2:

Dishonest Dealer Case: If a trader professes to sell his goods at cost price, but uses false weights, then

$$\%\ \text{gain} = \frac{\text{Error}}{\text{True value} - \text{Error}} \times 100 \Rightarrow \%\text{gain}$$

$$= \frac{\text{True weight} - \text{False weight}}{\text{False weight}} \times 100$$

Example: A shopkeeper sold an article at cost price but use the weight of 960 gm in place of 1 kg weight. Find his profit%?

Sol. $$\text{Profit\%} = \frac{\text{True weight} - \text{False weight}}{\text{False weight}} \times 100 = \frac{1000 - 960}{960} \times 100$$

$$= \frac{40}{960} \times 100 = \frac{25}{6} = 4\frac{1}{6}\%$$

Concept 3:

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

$$\text{Loss\%} = \left(\frac{\text{Common Profit or Loss\%}}{10}\right)^2 = \left(\frac{\%\text{value}}{10}\right)^2$$

Example: Each of two car is sold for Rs. 1000. The first one is sold at 25% profit and the other one at 25% loss. What is the percentage loss or gain in the deal?

Sol. Total s.p = $1000 \times 2 = \text{Rs. } 2000$

CP of 1st car = $\frac{100 \times 1000}{125}$ $\left[\because \text{Profit} = 25\%\right] = \text{Rs. } 800$

CP of 2nd car = $\frac{100 \times 1000}{75}$ $\left[\because \text{Loss} = 25\%\right]$ = Rs. $1333\frac{1}{3}$

Total CP = Rs. $2133\frac{1}{3}$ $\Rightarrow$ Loss% = $\frac{CP - SP}{CP} \times 100$

$$= \frac{2133\frac{1}{3} - 2000}{2133\frac{1}{3}} \times 100 = 6.25\%$$

or, Using Shortcut Formula

$$\text{Loss\%} = \left(\frac{\%\text{value}}{10}\right)^2 = \left(\frac{25}{10}\right)^2 = 6.25\ \%$$

Concept 4:
When two successive discounts on an article are x% and y% resp. then net discount: $\left(x + y - \frac{xy}{100}\right)\%$

Example: A shopkeeper given two sucessive discount of 50% and 50% find the real (equivalent) discount?

Sol. Let MP = Rs. 100

Cost after 1st discount of 50% = 100 – 50% of 100 = Rs. 50

Cost after 2nd discount of 50% = 50 – 50% of 50 = Rs. 25

Price after both discount = Rs. 25

$$\% \text{ discount} = \frac{100 - 25}{100} \times 100 = 75\%$$

or, Using Shortcut Formula

$$\% \text{ discount} = x + y - \frac{xy}{100} \qquad [\text{where } x = 50\%,\ y = 50\%]$$

$$= 50 + 50 - \frac{50 \times 50}{100} = 100 - 25 = 75\%$$

Chapter 5

Simple Interest and Compound Interest

Simple Interest

If Principal = Rs. 'P', Time = 'T' years, Rate = 'R%' per annum,

$$\textbf{Simple Interest (SI)} = \frac{P \times R \times T}{100}$$

Amount = Principal + Simple Interest

$$A = P + \frac{P \times R \times T}{100} = P\left[1 + \frac{RT}{100}\right]$$

Example: Find the simple interest on Rs. 200 for 5 years at 6% per annum?

Sol. Here, P = Rs. 200, T = 5 years, R = 6%

$$\therefore \quad SI = \frac{P \times R \times T}{100} = \frac{200 \times 5 \times 6}{100} = \text{Rs. } 60$$

(i) If rate of interest is half-yearly, Rate $= \left(\frac{R}{2}\right)$% and Time = 2T

(ii) If rate of interest is quarterly, Rate $= \left(\frac{R}{4}\right)$% and Time = 4T

(iii) If rate of interest is monthly, Rate $= \left(\frac{R}{12}\right)$% and Time = 12T

Installments

When the borrower paid total money in some equal parts, then we can say that he is paying in installments.

For simple interest,

$$A = \left[x + \left(x + \frac{x \times R \times 1}{100}\right) + \left(x + \frac{x \times R \times 2}{100}\right) + \dots\dots\dots\right]$$

where A = Total amount paid

x = value of each installment

Example: A scooty is sold by an automobile agency for Rs. 19200 cash or for Rs. 4800 cash down payment together with five equal monthly instalments. If the rate of interest charged by the company is 12% per annum, then find each instalment?

Sol. Balance of the price to be paid through instalments

P = 19200 – 4800 = 14400

Now, according to the formula,

$$A = \left[x + \left(x + \frac{x \times R \times 1}{100}\right) + \left(x + \frac{x \times R \times 2}{100}\right) + \ldots + \left(x + \frac{x \times R \times 4}{100}\right)\right]$$

where, $$A = P + \frac{P \times n \times R}{100} \Rightarrow \left(14400 + \frac{14400 \times 12 \times 5}{100 \times 12}\right)$$

$$= \left[x + \left(x + \frac{12x}{12 \times 100}\right) + \left(x + \frac{12x \times 2}{12 \times 100}\right) + \ldots + \left(x + \frac{12x \times 4}{12 \times 100}\right)\right]$$

$$\Rightarrow \quad 15120 = 5x + \frac{x}{10} \Rightarrow x = \frac{151200}{51} \Rightarrow x = \text{Rs. } 2964.70$$

Compound Interest

If Principal = Rs. P, Time = n years, Rate = r% per annum and interest compounded annually

(i) When interest compounded annually

$$\Rightarrow \text{Amount} = P\left[1 + \frac{r}{100}\right]^n$$

(ii) When interest compounded half yearly

$$\Rightarrow \text{Amount} = P\left[1 + \frac{\left(r/2\right)}{100}\right]^{2n}$$

(iii) When interest compounded quarterly

$$\Rightarrow \text{Amount} = P\left[1+\frac{\left(r/4\right)}{100}\right]^{4n}$$

(iv) When interest compounded monthly

$$\Rightarrow \text{Amount} = P\left[1+\frac{\left(r/12\right)}{100}\right]^{12n}$$

(v) When time is in fraction of a year, say $3\frac{4}{5}$ years

$$\Rightarrow \text{Amount} = P\left[1+\frac{r}{100}\right]^{3}\left[1+\frac{\left(4/5\, r\right)}{100}\right]$$

(vi) When rate of interest is r_1% durring first year, r_2% durring 2nd year, r_3% durring 3rd year.

$$\text{Amount} = P\left[1+\frac{r_1}{100}\right]\left[1+\frac{r_2}{100}\right]\left[1+\frac{r_3}{100}\right]$$

Concept 2: $\mathbf{A = P\left(1+\frac{r}{100}\right)^{n}}$, $\mathbf{CI = A - P = P\left(1+\frac{r}{100}\right)^{n} - P}$,

$$\mathbf{CI = P\left[\left(1+\frac{r}{100}\right)^{n} - 1\right]}$$

Concept 3: A sum of money, placed at compound interest, becomes n times in t years and m times in x years

then, $n^{1/t} = m^{1/x}$

Example: A sum of money at compound interest amounts to thrice itself in 3 years, in how money years will it be 9 times it self?

Sol. $3^{1/3} = 9^{1/x}$, $3^{1/3} = 3^{2/x}$, $\frac{1}{3} = \frac{2}{x}$, x = 6 years

Concept 4: Relationship between CI and SI for two years

$$\frac{CI}{SI}=\frac{200+r}{200}$$

Example: The SI on a certain sum of money for 2 years at 10% per anuum is Rs. 400, find CI at the same rate and for the same time.

Sol.

$$CI=\frac{210}{200}\times 400=Rs.\ 420$$

Concept 5: When difference between the CI and SI on a certain sum of money for 2 years at r%, is given by,

$$\text{Difference} = P\left(\frac{r}{100}\right)^2$$

Example: The difference between the CI and SI on a certain sum of money at 5% per annum for 2 years is Rs. 1.50, Find the sum

Sol.

$$1.5=\frac{P(5)^2}{100^2},\quad P=Rs.\ 600$$

Concept 6: The difference between CI and SI on a certain sum for 3 years is given by,

$$\text{Difference}=\frac{Pr^2(300+r)}{100^3}$$

Example: If the difference between CI and SI on a certain sum of money for 3 years at 5% per annum is Rs. 122 find the sum.

Sol.

$$122=\frac{P(5)^2(300+5)}{100^3},\quad P = Rs.\ 16000$$

Concept 7: If a sum 'A' becomes 'B' in t_1 years at compound rate of interest, then after t_2 years the sum becomes

$$\frac{(B)^{\frac{t_2}{t_1}}}{(A)^{\frac{t_2}{t_1}-1}}$$

Example: Rs. 4800 becomes Rs. 6000 in 4 years at a certain rate of CI. What will be the sum after 12 years.

$$\text{Required Amount} = \frac{(6000)^{\frac{12}{4}}}{(4800)^{\frac{12}{4}-1}} = \frac{(6000)^3}{(4800)^2} = \text{Rs. } 9375$$

Concept 8: If a sum of money Rs. x is divided among 'n' parts in such a manner that when placed at CI, amount obtained in each case remains equal while the rate of interest on each part is $r_1, r_2, r_3 \ldots\ldots r_n$ respectively and time period for each part is $t_1, t_2, t_3 \ldots\ldots t_n$ respectively. Then the divided parts of sum will be in the ratio of:

$$\frac{1}{\left(1+\frac{r_1}{100}\right)^{t_1}} : \frac{1}{\left(1+\frac{r_2}{100}\right)^{t_2}} : \frac{1}{\left(1+\frac{r_3}{100}\right)^{t_3}} : \ldots\ldots\ldots : \frac{1}{\left(1+\frac{r_n}{100}\right)^{t_n}}$$

Example: A sum of Rs. 3903 is divided between A and B, so that A's share at the end of the 7 years be equal to B's share at the end of 9 years, CI being 4%. Find A's share.

$$\text{A's share : B's share} = \frac{1}{\left(1+\frac{4}{100}\right)^7} : \frac{1}{\left(1+\frac{4}{100}\right)^9} = 1 : \frac{1}{\left(1+\frac{4}{100}\right)^2}$$

$$= 1 : \frac{625}{676} = 676 : 625$$

$$\text{A'share} = \frac{676}{(676+625)} \times 3903 = \text{Rs. } 2028$$

Chapter 6

Average

Average: Average is defined as the sum of different data (terms) divided by total number of terms

$$\text{Average} = \frac{\text{Sum of given terms (S)}}{\text{Total number of terms (N)}}$$

Example: Find the average of given terms 2, 3, 4, 5, 6

Sol. Total number of terms = 5

$$\text{Average} = \frac{2+3+4+5+6}{5} = 4$$

Some Basic Formulae

1. Average of 'n' natural number = $\frac{(n+1)}{2}$
2. Average of 'n' even numbers = (n + 1)
3. Average of 'n' odd numbers = n
4. Average of 'n' consecutive natural numbers

$$= \frac{\text{First number} + \text{Last number}}{2}$$

5. Average of sum of squares of first 'n' natural numbers

$$= \frac{(n+1)(2n+1)}{6}$$

Some Important Points:

1. If the value of each number is increased by the same value 'a', then the average of all numbers will also increase by 'a'.
2. If the value of each number is decreased by the same value 'a', then the average of all numbers will also decrease by 'a'.
3. If the value of each number is multiplied by the same value 'a', then the average of all numbers will also get multiplied by 'a'.
4. If the value of each numbers is divided by the same value 'a', then the average of all numbers will also get divided by 'a'.

Some useful Formulae

1. If the average of 'x' numbers is a and that of 'y' numbers is b, then the average of (x + y) numbers = $\frac{xa+yb}{x+y}$

   Example: The average of 10 numbers is 15 and that of 15 numbers is 20. Find the average of all 25 numbers?

   Sol. Average = $\frac{10\times15+15\times20}{10+15} = \frac{150+300}{25} = \frac{450}{25} = 18$

2. If the average of 'n' quantities is equal to 'x' when a quantity is removed the average becomes 'y'. Then the value of the removed quantity is = [n (x – y) + y]

   Example: The average age of 24 men and 1 woman is equal to 35 years. If 1 woman left, the average becomes 34 years. Find the age of woman who left the class?

   Sol: Age of women = [25(35 – 34) + 34] = 59 years

3. If the average of marks obtained by 'n' students in an exam is 'M'. If the average marks of passed students in 'P' and that of failed students is 'F'. Then the number of students who failed in exam is $\frac{n(P-M)}{P-F}$.

   No. of failed students

   $$= \frac{\text{Total students(Passed average} - \text{Total average)}}{\text{Passed average} - \text{Failed average}}$$

   Example: The average marks obtained by 125 students in an exam is 29. If the average marks of passed students is 36 and that of failed students is 11. Find the numbers of failed students?

   Sol. No of failed students = $\frac{125(36-29)}{36-11} = \frac{125\times7}{25} = 35$

4. If a batsman in his nth innings makes a score of 's' and thereby increased his average by 't' then the average after 'n' innings is '$s - t(n - 1)$]

Example: A bastman in his 44th innings makes a score of 86 and thereby increases his average by 1. Find the average after 44 innings?

Sol. Average after 44th innings = $(86 - 1(44 - 1)) = 86 - 43 = 43$

Chapter 7 Time and Work

Concept 1:

(1) If a person can complete a work in 'D' days, then the work done by him in 1 day is $\frac{1}{D}$

Efficiency is inversely proportional to the time taken (T) when the work done is constant.

$$E \, \alpha \, \frac{1}{T}$$

(2) If P is 'n' times more efficient than Q, than P will take $\frac{1}{n}$ time of the total time taken by Q to complete the same amount of work.

Example: Ram can do a work in 40 days. Hari is 4 times more efficient than Ram. In how many days Hari can finish the work?

Sol. Ram can do a work in 40 days

Hari can complete the work in $= \frac{1}{4} \times 40$ days $= 10$ days

Concept 2:

If M_1 persons can do W_1 work in D_1 days working H_1 hours and M_2 person can do W_2 work in D_2 days working H_2 hours, then relation between them is

$$\frac{M_1 D_1 H_1}{W_1} = \frac{M_2 D_2 H_2}{W_2}$$

Example: 24 men working 8 hours a day make a road in 15 days. In how many days 48 men working 6 hours a day will make the three times long road?

Sol. $\frac{M_1 D_1 H_1}{W_1} = \frac{M_2 D_2 H_2}{W_2} \Rightarrow \frac{24 \times 15 \times 8}{1} = \frac{48 \times D_2 \times 6}{3}$

$\Rightarrow D_2 = \frac{24 \times 15 \times 8 \times 3}{48 \times 6} = 30$ days

Concept 3:

If A does a work in 'a' days and B in 'b' days then both can complete the work in $\frac{ab}{a+b}$ days.

Example: A complete the work in 10 days and B in 15 days. In how many days A + B can complete the work?

Sol. (A + B) complete the work is $\frac{10\times15}{10+15}=\frac{150}{25}=6$ days

Concept 4:

If A and B can complete a work in x days and A alone can finish that work in y days, then number of days B takes to complete the work is = $\frac{xy}{y-x}$ days

Example: A and B can complete a work in 20 days and A alone can finish that work in 30 days. In how many days B can complete the work?

Sol. B complete the work = $\frac{20\times30}{30-20}=\frac{600}{10}=60$ days

Concept 5:

A, B, C can do a work in x, y and z days respectively. They will finish the work in $\frac{xyz}{xy+yz+zx}$ days

Example: A, B and C can do a work in 10, 12 & 15 days respectively. In how many days all of them together will finish the work?

Sol. (A + B + C) complete the work in

$$\frac{10\times12\times15}{10\times12+12\times15+15\times10}=\frac{1800}{120+180+150}=4 \text{ days}$$

Concept 6:

If A and B can do a piece of work in x days, B and C can do the same work in y days and A and C can do it in z days, then, working together they can complete that work in $\frac{2xyz}{xy+yz+zx}$ days

Example: A and B can complete a work in 20 days. B and C can complete the same work in 30 days. C and A can complete the same work in 40 days. In how many days they working together to complete the work?

Sol. (A + B + C) complete the work in $\frac{2\times20\times30\times40}{20\times30+30\times40+20\times40}$

$$= \frac{48000}{600+1200+800} = \frac{48000}{2600} = \frac{240}{13} = 18\frac{6}{13} \text{ days}$$

Concept 7:

If A takes 'a' days more to complete a work than the time taken by (A+B) to do some work and B takes 'b' days more than the time taken by (A+B) to do same work. Then (A + B) do the work in $\sqrt{ab}$ days.

Example: A takes 4 days more to complete a work than the time taken by (A + B) to do the same work and B takes 9 days more than the time taken by (A + B) to do the same work. In how many days A + B complete the work?

Sol. (A + B) complete the work in $\sqrt{4\times9} = \sqrt{36} = 6$ days

Concept 8:

A can do a certain piece of work in d_1 days and B in d_2 days. Then, the ratio of wages of A and B are:

$$\text{A's share : B's share} = \frac{1}{d_1} : \frac{1}{d_2} = d_2 : d_1$$

A, B and C can do a piece of work in d_1, d_2 and d_3 days. Then the ratio of wages of A, B and C are

$$\text{A's share : B's Share : C's share} = \frac{1}{d_1} : \frac{1}{d_2} : \frac{1}{d_3}$$

Multiplying each equation by $(d_1 d_2 d_3)$

Then the ratio is A's share : B's share : C's share = $\mathbf{d_2 d_3 : d_1 d_3 : d_1 d_2}$

Concept 9:

If A, B and C can do a piece of work in x, y and z days respectively. The contract for the work is Rs. r and all of them work together.

Then,

$$\text{Share of A} = \text{Rs.}\left(\frac{ryz}{xy+yz+zx}\right),\ \text{Share of B} = \text{Rs.}\left(\frac{rzx}{xy+yz+zx}\right),\ \text{Share of C} = \text{Rs.}\left(\frac{rxy}{xy+yz+zx}\right)$$

Example: A, B and C can do a work in 20 days, 25 days and 30 days respectively. They finished together that work and gained Rs. 3700 as wage. Find the wages of A, B and C respectively.

Sol. $\text{Share of A} = \text{Rs.}\left(\frac{3700\times25\times30}{20\times25+25\times30+20\times30}\right) = \text{Rs.}\ \frac{2775000}{500+750+600} =$

$$\text{Rs.}\ \frac{2775000}{1850} = \text{Rs. } 1500$$

$$\text{Share of B} = \text{Rs.}\left(\frac{3700\times20\times30}{500+750+600}\right) = \text{Rs.}\ \frac{2220000}{1850} = \text{Rs. } 1200$$

$$\text{Share of C} = \text{Rs.}\left(\frac{3700\times20\times25}{500+750+600}\right) = \text{Rs.}\ \frac{1850000}{1850} = \text{Rs. } 1000$$

Concept 10:

A can do a piece of work in x days. With the help of B, A can do the same work in y days. If they get Rs. a for that work

Then,

$$\text{Share of } A = \text{Rs.}\left(\frac{ay}{x}\right), \qquad \text{And Share of } B = \text{Rs.}\left(\frac{a(x-y)}{x}\right)$$

Example: A can do a piece of work in 20 days. With the help of B, A can do the same work in 15 days. If A + B gets Rs. 1500 for the work, find the share of A and B respectively?

Sol. $\text{Share of } A = \text{Rs.}\left(\frac{1500 \times 15}{20}\right) = \text{Rs. } 1125$, Share of B

$$= \text{Rs.}\left(\frac{1500 \times 5}{20}\right) = \text{Rs. } 375$$

Chapter 8

Pipe and Cistern

Pipes and Cistern problems generally consist of a cistern (tank) to which one or more pipes fill the cistern or empty the cistern. These problems of pipes and cisterns can be solved by using the same method used in time and work. And we changes our formulae according to the requirement of the pipes and cisterns.

(i) A pipe connected with a tank or a cistern that fill the tank is known as inlet.

(ii) A pipe connected with a tank that empty it is known as outlet.

Important Points:

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

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

3. If a pipe can fill a tank in x hours and another pipe can empty the full tank in y hours (y > x), then the net part filled in 1 hour, when both the pipes are opened $= \left(\frac{1}{x} - \frac{1}{y}\right) = \frac{y-x}{xy}$

   Time taken to fill the tank $= \frac{xy}{y-x}$

4. If a pipe can fill a tank in x hours and another pipe can fill the same tank in y hours, the part of the tank filled in 1 hour when both pipes are opened simultaneously $= \left(\frac{1}{x} + \frac{1}{y}\right) = \frac{x+y}{xy}$

   ∴ Time taken to fill completely the tank when both pipes are open simultaneously $= \frac{xy}{x+y}$

5. If three pipes can fill a tank separately in x, y and z h respectively, then time taken to fill the tank by working together $= \frac{xyz}{xy + yz + zx}$ h.

6. If a pipe fills a tank in x hours and another fills the same tank in y hours, but a third pipe empties the full tank in z hours and all of them are opened together, the net part filled in 1 hour $= \left(\frac{1}{x} + \frac{1}{y} - \frac{1}{z}\right)$.

Time taken to fill the tank $= \frac{xyz}{yz + xz - xy}$ hours

Example: Pipe A can fill a water tank in 25 minutes, Pipe B can fill the tank in 40 minutes and Pipe C can empty the tank in 30 minutes. If all the 3 pipes are opened together, then in how many minutes will the tank be completely filled?

Sol. Time taken to fill the tank

$$= \frac{25 \times 40 \times 30}{40 \times 30 + 25 \times 30 - 25 \times 40} = \frac{600}{19} = 31\frac{11}{19} \text{ minutes}$$

7. Two pipes A and B can fill a tank in x minutes and y minutes respectively. If both the pipes are opened simultaneously, Then the time after which pipe B should be closed, so that the tank is full in 't' minutes is $\left[y\left(1 - \frac{t}{x}\right)\right]$ minutes.

Example: Two pipes A and B can fill a tank is 12 minutes and 16 minutes respectively. If both the pipes are opened simultaneously, after how much time should B be closed so that the tank is full is 9 minutes?

Sol. Pipe B should be closed after $= \left(1 - \frac{9}{12}\right) \times 16 = \frac{3}{12} \times 16 = 4$ min.

Chapter 9 Speed, Time and Distance

The concepts of time distance are most important in the terms of competitive exams. The basic concept of time and distance is used in solving the question based on motion in a straight line. The applications of time & distance are used to solve the problems related to trains and races.

The relation between time, distance and speed is

Distance = Time × Speed

i.e, $D = T \times S \Rightarrow \text{Time (T)} = \dfrac{\text{Distance (D)}}{\text{Speed (S)}} \Rightarrow \text{Speed (S)} = \dfrac{\text{Distance (D)}}{\text{Time (T)}}$

Example: A car covers 200 km in 4 hours, then find the speed of the car.

Sol. We know that, $\Rightarrow \text{Speed (S)} = \dfrac{\text{Distance (D)}}{\text{Time (T)}}$

Required speed = $\dfrac{200}{4} = 50$ km/h

Conversion of Units:

(i) When we convert km/h into m/s, we multiply the speed by $\dfrac{5}{18}$.

i.e, 1km/h = $\dfrac{5}{18}$ m/s.

(ii) When we convert m/s into km/h, we multiply the speed by $\dfrac{18}{5}$.

i.e, 1m/s = $\dfrac{18}{5}$ km/h

Example: Convert 72 km/h into m/s.

Sol. We know that, 72 km/h = $\left(72 \times \dfrac{5}{18}\right)$ m/s = 4 × 5 = 20 m/s

Concept 1:

Average speed: A certain distance is covered at 'x' km/h and the same distance is covered at 'y' km/h then the average speed during the whole journey.

$$\text{Average speed} = \frac{2xy}{x+y} \text{ km / h}$$

Example: Rohit covers a certain distance by car driving at speed of 40 km/h and he returns back to the starting point riding on a scooter with a speed of 10 km/hr. Find the average speed of the whole journey?

Sol. $$\text{Average speed} = \frac{2\times 40\times 10}{40+10} = \frac{2\times 400}{50} = 16 \text{ km / hr}$$

Concept 2: A person covers a distance in T hours and the first half at S_1 km/h and the second half at S_2 km/h, then the total distance covered by the person.

$$D = \frac{2\times T\times S_1\times S_2}{S_1+S_2}$$

Example: A car covers a distance in 10 hrs, the first half at 40 km/h and the second half at 20 km/h. Find the distance travelled by car?

Sol. $$\text{Distance} = \frac{2\times 10\times 40\times 20}{40+20} \text{ km / h} = \frac{2\times 10\times 40\times 20}{60} = 266.67 \text{ km}$$

Concept 3: If two persons P and Q start at the same time in opposite directions from two points and after passing each they complete their journeys in 'a' and 'b' hrs respectively then

$$\frac{P\text{'s speed}}{Q\text{'s speed}} = \frac{\sqrt{b}}{\sqrt{a}}$$

Example: Shivam sets out to cycle from Delhi to Ghaziabad and at the same time Hemant starts from Ghaziabad to Delhi, After passing each other they complete their journeys in 4 and 16 hours respectively. At what rate does Hemant cycle if Shivam cycle at 18 km per hour?

Sol. $\Rightarrow \dfrac{18}{\text{Hemant's speed}} = \dfrac{4}{2} \Rightarrow$ Hemant's speed

$= \dfrac{18}{2} = 9 \text{ km / h}$

Concept 4: If a man travelled a certain distance by bus at a rate of x km/h and walked back at the rate of 'y' km/h. If the whole journey took 't' hours, then the distance he travelled is $\left(\dfrac{xy}{x+y}\right)t$ km.

Example: A man travelled a certain distance by train at a rate of 15 km/h and walked back at the rate of 12 km/h. The whole journey took 9 hours. Find the distance he travelled?

Sol. Required distance = $\left(\dfrac{xy}{x+y}\right)t = \left(\dfrac{15\times12}{15+12}\right)9 = \dfrac{15\times12\times9}{27} = 60 \text{ km}$

Concept 5: If a person changes his speed to $\dfrac{a}{b}$ of its usual speed and late by T minutes, then the usual time taken by him is $\dfrac{T}{\frac{b}{a}-1}\left[\dfrac{a}{b}<1\right]$ and when $\left[\dfrac{a}{b}>1\right]$ then the usual time taken by him is $\dfrac{T}{1-\frac{b}{a}}$.

Example: Walking $\frac{4}{5}$ of his usual speed, a man is 16 minutes late. Find the usual time taken by him to cover that distance?

Sol: Usual time = $\dfrac{T}{\frac{b}{a}-1} = \dfrac{16}{\frac{5}{4}-1} = \dfrac{16\times 4}{5-4} = \dfrac{16\times 4}{1}$ = 64 minutes

Concept 6: (i) If speed is constant, then distance is directly proportional to the time; $D \propto T$

(ii) If time is constant, then distance is directly proportional to the speed; $D \propto S$

(iii) If Distance is constant, then speed is inversely proportional to the time; $S \propto \frac{1}{T}$

Example: A person covers a certain distance with a speed of 54 km/h in 15 min. If he wants to cover the same distance in 30 min, what should be his speed?

Sol. We know that, Distance = Speed × Time

$$= 54 \times \frac{15}{60} = \frac{9}{10} \times 15 = \frac{27}{2}\text{ km}$$

Speed to cover $\frac{27}{2}$ km in 30 min $= \dfrac{\frac{27}{2}}{\frac{30}{60}} = \frac{27}{2} \times 2$ = 27 km/h

Concept 7: (i) When a train passes a pole or any other object, the distance covered by train is equal to the length of the train.

(ii) If a train passes a bridge, platform etc, then distance travel by train is equal to the sum of the length of train and the stationary object through which the train is passing.

Example: A 100 m long train passes a platform of 200 m long. Find the distance covered by the train in passing the platform?

Sol. Required distance = length of train + length of platform = 100 + 200 = 300 m

Concept 8: (i) When two trains are moving is opposite directions, then their relative speed is equal to the sum of the speed of both trains.

(ii) When two trains are moving is same directions, then their relative speed is equal to the difference of the speed of both trains.

Example: Two trains are moving in the same direction with speed of 40 km/h and 50 km/h respectively. Find the relative speed?

Sol. Required relative speed = (50 – 40) km/h = 10 km/h

Concept 9: Two trains start at the same time from P and Q and proceed towards each other at the rate of x km/h and y km/h respectively. When they meet it is found that one train has travelled D km more than the other. The

Distance between P and Q is $\left(\frac{x+y}{x-y}\right)D$,

$$\text{Distance} = \frac{\text{Sum of speeds}}{\text{Difference of speed}} \times \text{Difference in distance}$$

Example: Two trains start at the same time from Kanpur and Delhi and proceed towards each other at the rate of 74 km/h and 47 km/h respectively. When they meet it is found that the train has travelled 13 km more than the other. Find the distance b/w Kanpur and Delhi?

Sol. Required Distance = $\frac{\text{Sum of speed}}{\text{Difference of speeds}} \times$ Difference in Distance

$$= \frac{(73+47)}{(73-47)} \times 13 \quad = \frac{120}{26} \times 13 = 60 \text{ km}$$

Concept 10: When the speed of two trains are in the ratio x : y. They are moving in opposite directions on parallel tracks. The first train crosses a telegraph pole in 't_1'seconds where as the second train crosses the pole in 't_2' seconds. Time taken by the trains to cross each other completely is given by $\text{Time taken} = \dfrac{t_1x + t_2y}{x + y}$ seconds.

Example: The speed of two trains are in the ratio 4 : 5. They are moving in opposite directions along the parallel tracks. If each takes 3 seconds to cross a pole. Find the time taken by the train to cross each other completely?

Sol. Time taken = $\left(\dfrac{t_1x + t_2y}{x + y}\right) = \dfrac{3 \times 4 + 3 \times 5}{4 + 5} = \dfrac{27}{9} = 3$ seconds

Chapter 10 Boat and Stream

The chapter of boat and stream is based on the application of time and distance. There are two terms which are frequently used in this chapter are downstream and upstream.

1. **Downstream** → When boat is moving along the direction of the stream.
2. **Upstream** → When boat is moving against the direction of the stream.

Basic formula: If 'x' be the speed of boat in still water and 'y' be the speed of stream.

(i) Downstream speed (v) = (x + y) km/h

(ii) Upstream speed (u) = (x – y) km/h

Where Downstream Speed is 'v' and upstream speed is 'u'.

(iii) Speed of boat in still water, (x) = $\frac{1}{2}(u+v)$

(iv) Speed of stream, (y) = $\frac{1}{2}(v-u)$

Note: If the speed of water in river is zero, then the water is considered to be still.

Example: A man row with a speed of 8 km/h in still water. Find the downstream and upstream speed of boat, if the speed of stream is 4 km/h. ?

Sol. Downstream speed = (x + y)km/h = (8 + 4) = 12 km/ h

Upstream speed = (x – y) km/h = (8 – 4) = 4 km/h

Concept 1: If the speed of boat in still water is x km/h and speed of stream is y km/h. If time taken to go and come back from a point is T, the distance between both points = $\frac{T\left(x^2-y^2\right)}{2x}$ km

Example: A man can row 14 km/h in still water. When the stream is running at 2 km/h, it takes him 7 hour to row to a place and to come back. How far is the place ?

Sol. Required distance = $\frac{7(14^2 - 2^2)}{2 \times 14}$ km = $\frac{7 \times 192}{2 \times 14}$ = 48 km

Concept 2: A person can row a certain distance downstream in t_1 h and returns upstream the same distance in t_2 h. When the stream flows at the rate of 's' km/h.

Then the speed of man = $\frac{s(t_1 + t_2)}{t_2 - t_1}$ km/h

Example: Sonu can row a certain distance is 8 h and can return the same distance is 12h. If the stream of flows at the rate of 8 km/h, then find the speed of Sonu is still water ?

Sol: Speed of man = $\frac{8(8+12)}{12-8}$ km/h = $\frac{8 \times 20}{4}$ = 40 km/h

Concept 3: If the speed of boat in still water is x km/h and river is flowing with a speed of y km/h, then average speed in going to a certain place and coming back to starting point is given by $\frac{(x+y)(x-y)}{x}$ km/h.

Example: A man can row in still water with a speed of 6 km/h to go to a certain place and to come back. Find the average speed for the whole journey, if the river is flowing with a speed of 3 km/h ?

Sol. Average speed = $\frac{(6+3)(6-3)}{6}$ km/h = $\frac{9 \times 3}{6}$ km/h = 4.5 km/h

Concept 4: If a man can row d_1 km upstream and e_1 km downstream in T_1 hours. Also, he can row d_2 km upstream and e_2 km downstream in T_2 hours. Then, the upstream speed of man

$$= \left(\frac{d_1e_2 - d_2e_1}{e_2T_1 - e_1T_2}\right) \text{km/h}$$

$$\Rightarrow \quad \text{Downstream speed of man} = \left(\frac{d_1e_2 - d_2e_1}{d_1T_2 - d_2T_1}\right) \text{km/h}$$

Example: A man can row 30 km upstream and 44 km downstream is 10 hrs. Also, he can row 40 km upstream and 55 km downstream is 13 hrs. Find the rate of current and speed of man is still water ?

Sol. Upstream speed of man $= \dfrac{30 \times 55 - 40 \times 44}{55 \times 10 - 44 \times 13} = \dfrac{-110}{-22} = 5$ km/h

Downstream speed of man $= \dfrac{30 \times 55 - 40 \times 44}{30 \times 13 - 40 \times 10} = \dfrac{-110}{-10} = 11$ km/h

Speed of man $= \dfrac{5+11}{2} = 8$ km/h

Speed of stream $= \dfrac{11-5}{2} = 3$ km/h

Chapter 11

Mixture and Alligation

Mixture: When two or more then two substances are mixed in any ratio to produce a product is known as Mixture.

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

Concept 1. Alligation Rule

Let the cost price of a unit of cheaperS article is Rs. c and that of a unit of costly article is d and the average (mean) price of mixture is m, then

$$\frac{\text{Quantity of cheaper article}}{\text{Quantity of costly article}} = \frac{\text{Cost price of a unit of costly article} - \text{Mean price}}{\text{Mean price} - \text{Cost price of a unit of a cheaper article}}$$

The above relation is represended as

$$\begin{array}{ccccc} \text{CP of cheaper} & & & & \text{CP of dearer} \\ (c) & & & & (d) \\ & \searrow & & \swarrow & \\ & & \text{Mean price} & & \\ & & (m) & & \\ & \swarrow & & \searrow & \\ (d - m) & & & & (m - c) \end{array}$$

Hence, $\frac{\text{Quantity of cheaper}}{\text{Quantity of dearer}} = (d - m) : (m - c) = \frac{d - m}{m - c}$

Alligation rule is also used to find the ratio in which two or more ingredients at their respective prices should be mixed to produce a mixture at a given price.

Example: In what proportion must tea at Rs. 14 per kg be mixed with tea at Rs. 18 per kg, so that the mixture be worth Rs. 17 a kg?

Sol. CP of 1 kg cheaper tea CP of 1 kg dearer tea

14 18

Mean price
17

1 3

$$\frac{\text{Quantity of cheaper}}{\text{Quantity of dearer}} = \frac{18-17}{17-14} = \frac{1}{3} = 1:3$$

Concept 2. A container has milk and water in the ratio a:b, a second container of some capacity as first are has milk and water in the ratio c:d. If both the mixture are emptied into a third container, then the ratio of milk to water in third container is given by

$$\left[\frac{a}{a+b}+\frac{c}{c+d}\right]:\left[\frac{b}{a+b}+\frac{d}{c+d}\right]$$

Example: There are two containers of equal capacity. The ratio of milk to water in the first container is 3 : 1, in the second container is 5 : 2. If they are mixed up, then the ratio of milk to water in the mixture will be?

Sol. Part of milk in first container $= \frac{3}{3+1} = \frac{3}{4}$

Part of water in first container $= \frac{1}{3+1} = \frac{1}{4}$

Similarly, part of milk in second container $= \frac{5}{5+2} = \frac{5}{7}$

Part of water in second container $= \frac{2}{5+2} = \frac{2}{7}$

$\therefore$ Required $= \frac{3}{4}+\frac{5}{7}:\frac{1}{4}+\frac{2}{7} = \frac{41}{28}:\frac{15}{28} = 41:15$

Concept 3: Suppose a container contains 'x' units of a liquid from which 'y' units are taken out and replaced by water. After n operation, quantity of pure liquid $= x\left(1-\frac{y}{x}\right)^n$ units

Example: A container contains 40 litres of milk. From this container 4 litres of milk was taken out and replaced by water. This process was repeated further two times. How much milk is now contained by the container?

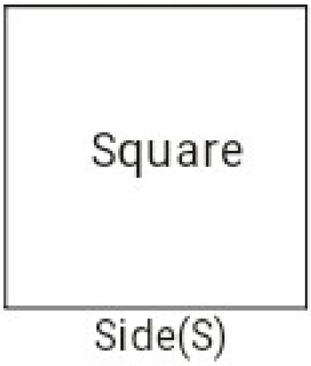
Sol. Amount of milk left after 3 operations

$$= \left[40\left(1-\frac{4}{40}\right)^3\right] \text{litres} = \left(40 \times \frac{9}{10} \times \frac{9}{10} \times \frac{9}{10}\right) = 29.16 \text{ litres.}$$

Chapter 12

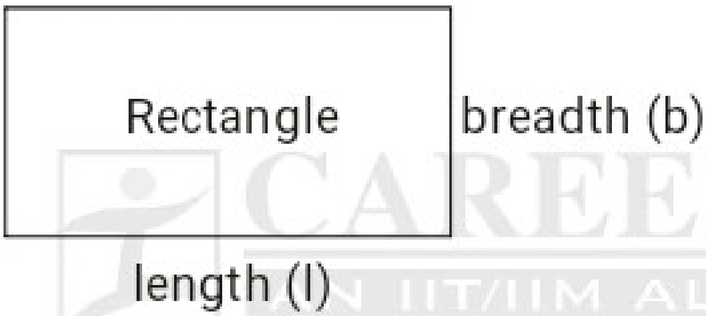
Mensuration

SQUARE

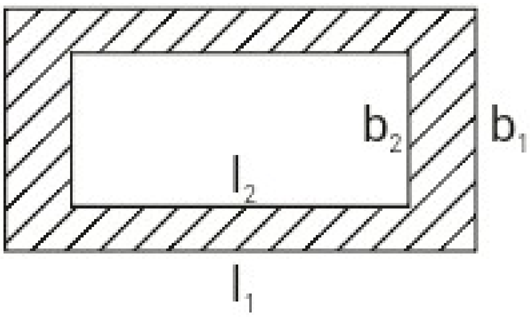


- Area = side × side = $(S)^2$
- $S = \sqrt{Area}$
- Perimeter = 4 (Side)
- Diagonal = (side) × $\sqrt{2}$

RECTANGLE

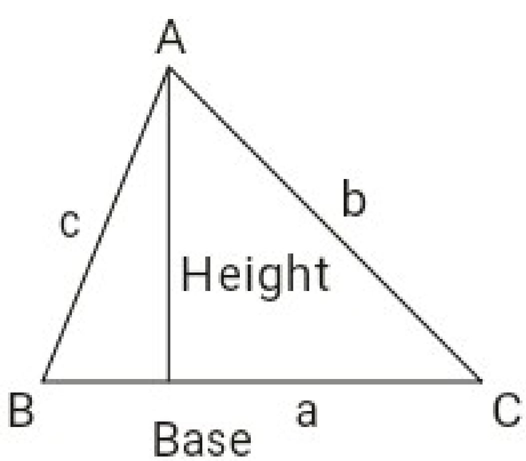


- Area = l × b
- Perimeter = 2 (l + b)
- Diagonal $= \sqrt{l^2 + b^2}$



- Area of track = $l_1b_1 - l_2b_2$

TRIANGLE

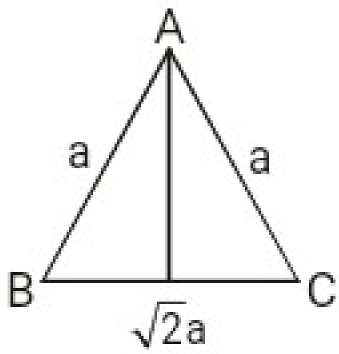


- Area $= \frac{1}{2} \times \text{base} \times \text{height}$
- Area $= \sqrt{s(s-a)(s-b)(s-c)}$

  Where, s = semi-perimeter

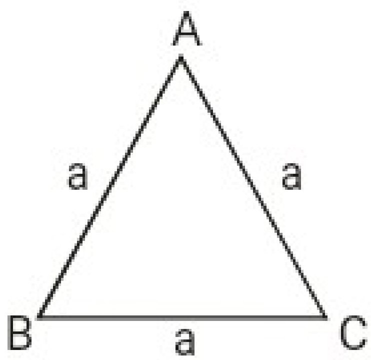
  $= \frac{a+b+c}{2}$

Area and perimeter of Right angled Isosceles Triangle



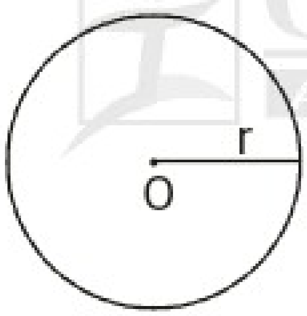
- Area $=\frac{1}{2}a^2$
- Perimeter $=(2a+\sqrt{2}a)$
- Height $=\frac{a}{\sqrt{2}}$

Area of equilateral Triangle



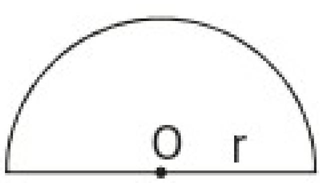
- Area $=\frac{\sqrt{3}}{4}\times(\text{side})^2=\frac{\sqrt{3}}{4}a^2$
- Altitude $=\frac{\sqrt{3}}{2}\times\text{side}=\frac{\sqrt{3}}{2}a$
- Perimeter = 3 × side = 3a

CIRCLE



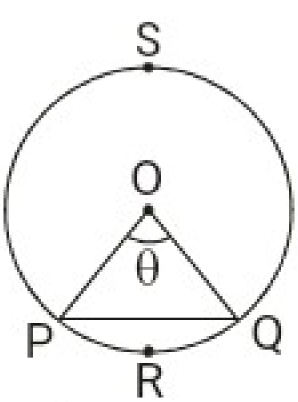
- Circumference = $2\pi r = \pi D$
- Area $=\frac{\pi}{4}D^2$

Semi circle



- Area of semi-circle $=\frac{1}{2}\pi r^2$
- Perimeter of semi-circle = $\pi r + 2r = \pi r + D$

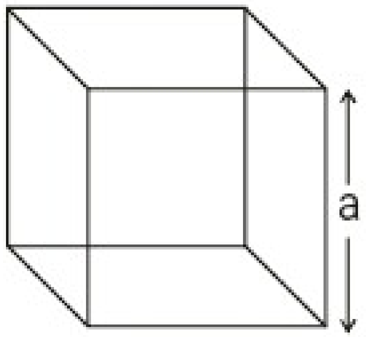
Area of Sector



- If θ be the angle at the centre of a circle of radius r
- Length of the arc PQ $=2\pi r\times\frac{\theta}{360^\circ}$
- Area of sector OPRQO $=\pi r^2\times\frac{\theta}{360^\circ}$

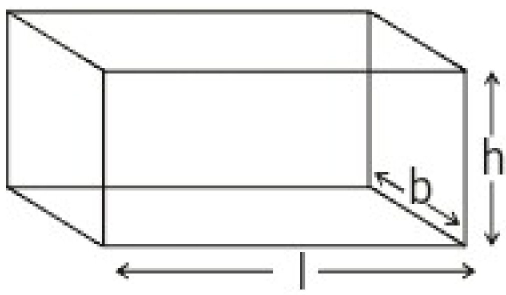
Volume

CUBE



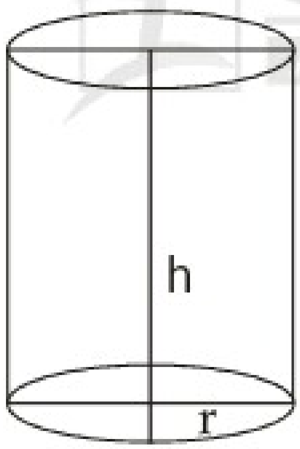
- edge of cube=length=breadth=height=a
- Volume of a cube = (edge)3 = a3
- Total surface Area = 6 × (edge)2 = 6a2
- Diagonal of a cube = $\sqrt{3}$ × edge $= \sqrt{3}a$

CUBOID



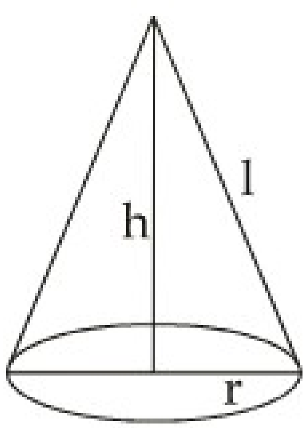
- V = l × b × h
- Surface area = 2 (lb + bh + hl)
- Diagonal $= \sqrt{l^2 + b^2 + h^2}$

Right Circular Cylinder



Volume = πr2h
Curved Surface Area = 2πrh
Total surface Area=2πrh+2πr2 = 2πr(r + h)

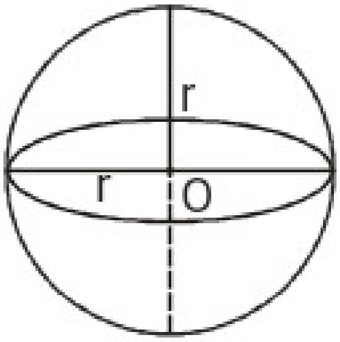
Right Circular Cone



Volume $= \frac{1}{3}\pi r^2 h$

Curved Surface Area = πrl
Total surface Area = πrl + πr^2 = πr(l + r)

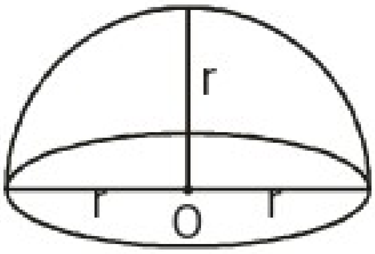
Sphere



$$\text{Volume} = \frac{4}{3}\pi r^3$$

Surface Area = $4\pi r^2$

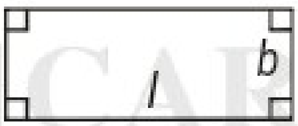
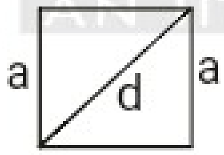
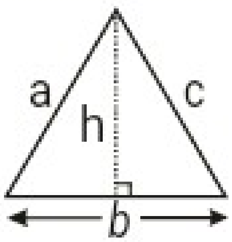
Hemi-sphere

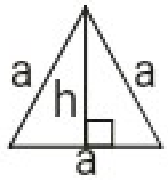
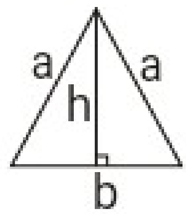
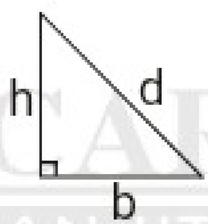
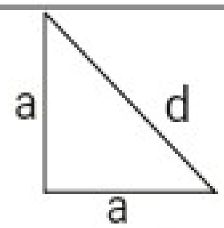
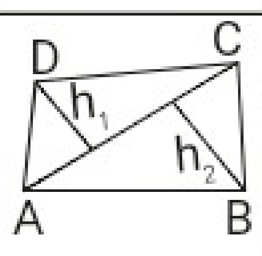
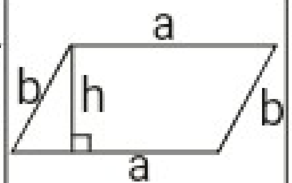


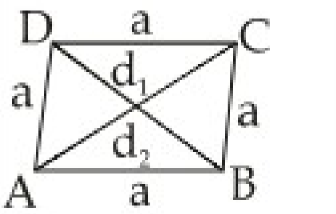
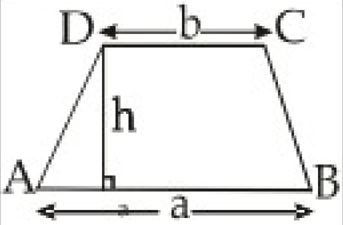
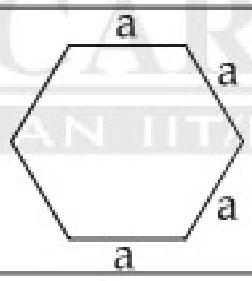
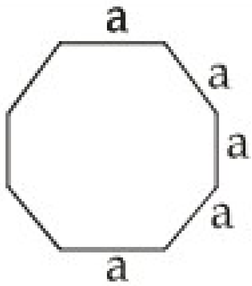
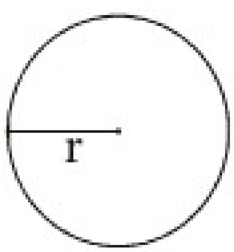
$$\text{volume} = \frac{2}{3}\pi r^3$$

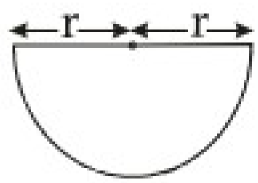
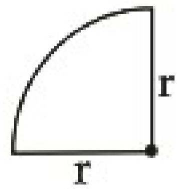
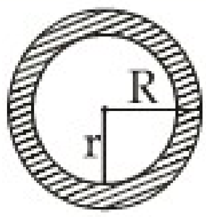
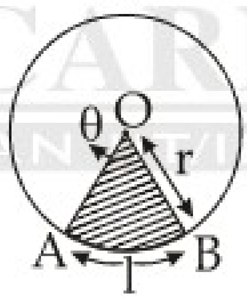
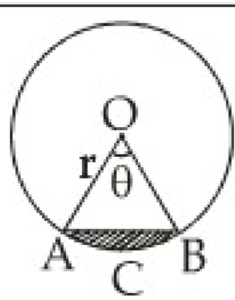
Curved Surface Area = $2\pi r^2$

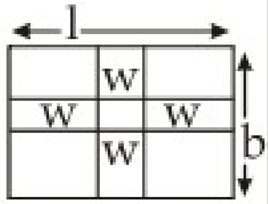
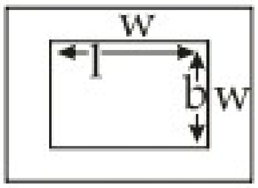
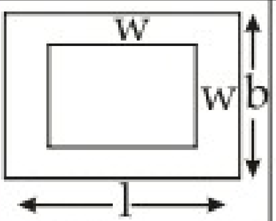
Total surface Area = $2\pi r^2 + \pi r^2 = 3\pi r^2$

S. No.	Name	Figure	Nomenclature	Area	Perimeter
1.	Rectangle		l ⟶ length b ⟶ breadth	1×b=1b	21+2b=2(1+b)
2.	Square		a ⟶ side d ⟶ diagonal $d = a\sqrt{2}$	(i) $a \times a = a^2$ (ii) $\frac{d^2}{2}$	$a+a+a+a=4a$
3.	Triangle (Scalene)		a, b and c are three side of triangle and s is the semiperimeter, where $s = \left(\frac{a+b+c}{2}\right)$ b is the base and h is the altitude of triangle	(i) $\frac{1}{2} \times b \times h$ (ii) $\sqrt{s(s-a)(s-b)(s-c)}$ (Hero's formula)	$a+b+c=2s$

S. No.	Name	Figure	Nomenclature	Area	Perimeter
4	Equilateral triangle		a → sides h → height or altitude $h = \frac{\sqrt{3}}{2}a$	(i) $\frac{1}{2} \times a \times h$ (ii) $\frac{\sqrt{3}}{4}a^2$	3a
5.	Isosceles triangle		a → equal sides b → base $h = \frac{\sqrt{4a^2 - b^2}}{2}$ h → height or altitude	(i) $\frac{1}{2} \times b \times h$ (ii) $\frac{1}{4} \times b \times \sqrt{4a^2 - b^2}$	2a + b
6.	Right angle triangle		b → base h → altitude/ height d → hypotenuse $d = \sqrt{b^2 + h^2}$	$\frac{1}{2} \times b \times h$	b + h + d
7.	Isosceles right angled triangle		a → equal sides d → hypotenuse $d = a\sqrt{2}$	$\frac{1}{2}a^2$	2a+d
8.	Quadri-lateral		AC is the diagonal and h_1, h_2 are the Altitudes on AC from the vertices D and B respectively	$\frac{1}{2} \times AC \times (h_1 + h_2)$	AB+BC+ CD+AD
9.	Parallelog-ram		a and b are sides adjacent to other. h → distance between the parallel sides	a × h	2(a + b)

S. No.	Name	Figure	Nomenclature	Area	Perimeter
10.	Rhombus		$a \rightarrow$ each equal side of Rhombus d_1 And d_2 are the diagonals $d_1 \rightarrow BD$ $d_2 \rightarrow AD$	$\frac{1}{2} \times d_1 \times d_2$	4a
11.	Trapezium		a and b are parallel sides to each other and h is the perpendicular distance between parallel sides	$\left(\frac{a+b}{2}\right) \times h$	AB+BC+ CD+AD
12.	Regular hexagon		$a \rightarrow$ each of the equal side	$\frac{3\sqrt{3}}{2} a^2$	6a
13.	Regular Octagon		$a \rightarrow$ each of equal side	$2a^2\left(1+\sqrt{2}\right)$	8a
14.	Circle		$r \rightarrow$ radius of the circle $\pi = \frac{22}{7} = 3.1416$ (approx)	πr^2	$2\pi r$ (called as circumference)

S. No.	Name	Figure	Nomenclature	Area	Perimeter
15.	Semicircle		a → radius of the circle	$\frac{1}{2}\pi r^2$	$\pi r + 2r$
16.	Quadrant		r → radius	$\frac{1}{4}\pi^2$	$\frac{1}{2}\pi r + 2r$
17.	Ring of circular path (shaded region)		R → outer radius r → inner radius	$\pi(R^2 - r^2)$	(outer) → $2\pi R$ (inner) → $2\pi r$
18.	Sector of a circle		O → centre of the circler r → radius l → length of the arc θ → angle of the sector $l = 2\pi\left(\frac{\theta}{360^\circ}\right)$	(i) $\pi r^2\left(\frac{\theta}{360^\circ}\right)$ (ii) $r \times l$	$l + 2r$
19.	Segment of a circle		θ → angle of the sector r → radius AB → chord ACB → arc of the circle	Area of segment ACB (Minorsegment) $= r^2\left(\frac{\pi\theta}{360^\circ} - \frac{\sin\theta}{2}\right)$	$\left[\frac{\theta}{360^\circ} \times 2\pi r + 2r\sin\left(\frac{\theta}{2}\right)\right]$

S. No.	Name	Figure	Nomenclature	Area	Perimeter
20.	Pathways running across the middle of a rectangle		l → length b → breadth w → width of the path (road)	(1+b−w)w	[2(l + b -4w+4w
21.	Outer pathways		l → length b → breadth w → widthness of the path	(1+b−w)w	(inner)→ 2(1+b) (inner)→ 2(1+b +4w)
22.	Inner path		l → length b → breadth w → widthness of the path	(1+b−2w) 2w	(outer)→ 2(1+b) (inner)→ 2(1+b +4w)

Chapter 13

Permutation, Combination and Probability

Permutation Combination

Rule of Sum (OR): If an experiment has n possible outcomes and another has m possible outcomes, then there are (n + m) possible outcomes when exactly one of these experiments is performed.

Rule of Product (And): If several process can be performed in the following manner; the first process in N ways, the second in M ways, the third in O ways and so on, then the total number of ways in which the whole process can be performed, in the order indicated, is given by their product i.e N.M.O. ......

Factorial: The continuous product of the first n natural numbers is called factorial n and is denoted by n! or $\underline{|n}$

n! = n (n – 1) (n – 2) (n – 3).......... 3. 2. 1 = 1. 2. 3 ....n

(i) $(m + n)! \neq m! + n!$ (ii) $(m - n)! \neq m! - n!$

(iii) $(mn)! \neq (m!)(n!)$ (iv) $\left(\frac{m}{n}\right)! \neq \frac{m!}{n!}$

Ex. 3! = 3 × 2 × 1 = 6

4! = 4 × 3 × 2 × 1 = 24

5! = 5 × 4 × 3 × 2 × 1 = 120

0! = 1

Permutations: The word permutations refers to 'arrangements'

The number of permutations of n objects, taken r at a time, is the total number of arrangements of n objects, in group of r, where the order of the arrangement is important.

$$^{n}p_{r} = \frac{n!}{(n-r)!} \text{ or } ^{n}P_{n} = \frac{n!}{(n-n)!} = n!$$

(i) **Without repetition:** Arranging n objects, taking r at a time in every arrangement, is equivalent to filling r places from n objects.

r-places	1	2	3	4	- -	r
No. of choices	n	n – 1	n – 2	n – 3	- -	n – r + 1

number of ways of arranging = No. of ways of filling

Example: In how many ways can letters of the word PENCIL be arranged so that E and N are always together.

Sol.: Keep EN together and consider as one letter. Now, we have 5 letters which can be arranged in ${}^5p_5$ = 5! = 120 ways. But E & N can be put together in 2! ways. Hence, total number of ways = 2! × 5! = 2 × 120 = 240 ways.

(ii) With Repetition: Number of arrangements of n objects, taken r at a time, When each object may occur once, twice, thrice & So on upto r times in any arrangement is equivalent to the number of ways of filling r places, each out of n objects.

r-places	1	2	3	4	- -	r
No. of choices	n	n	n	n	- -	n

Number of ways of arrangements = No. of ways to fill r places = $(n)^r$

Example: A telegraph has 5 arms and each arm is capable of 4 distinct positions, including the position of rest. Find the total number of signals that can be made.

Sol.: No. of distinct positions = 4

No. of Arms = 5

Therefore, number of signals = 4^5 = 1024

But in one case, when all the 5 arms will be in rest position, no signal will be made.

Hence required number of signals = 1024 – 1 = 1023.

Circular Permutations: Let n persons (a_1, a_2, a_3 ....a_n) are to be seated in a row. There are total n! ways. If n persons are to be seated in circle, there are total (n – 1)! ways. Since position of one will be fixed.

There may be two different circular arrangements clockwise and anti-clockwise.

(i) When distinction is made between the clockwise and the anti-clockwise arrangements of n different objects around the circle. then the number of arrangements is (n – 1)!

(ii) On the other hand, if no distinction is made between the clockwise and anticlockwise arrangement of n different objects around a circle, then the number of arrangements is $\frac{(n-1)!}{2}$

Example: Find the number of ways in which 10 different beads can be arranged to form a necklace.

Sol. Ten different beads can be arranged in circular form in (10 – 1)! = 9! ways. Since, there is no distinction between the clockwise and anticlockwise arrangements, the required number of arrangements = 9!/2

Some Important points regarding ^nc_r

(a) The number of selections from n distinct objects, taking at least one at a time is given by
$^nc_1 + {^nc_2} + {^nc_3} + \ldots\ldots\ldots\ldots {^nc_n} = 2^n - 1$

(b) The number of selections of r objects out of n identical objects is 1

(c) Total number of selections of zero or more objects from n identical objects is (n + 1)

Example: In how many ways, can 20 identical apples be divided among 5 persons?

Sol. Here, the objects are identical and any person may get any number of apple

Required number of ways = $^{n+P-1}C_{P-1}$

$$= {^{(20+5-1)}C_{5-1}} = 24C_4 = \frac{24!}{4!\,20!} = \frac{24 \times 23 \times 22 \times 21}{4 \times 3 \times 2}$$

$$= 6 \times 23 \times 11 \times 7 = 10626$$

Combinations: The meaning of combination is selection of objects & it is like permutation except that it is unordered. It is denoted by ^nC_r.

$$^nC_r = \frac{n!}{r!(n-r)!} = \frac{n(n-1)(n-2)......3.2.1}{r!(n-r)!}$$

Selection of objects without repetition

(i) $^nC_r = \frac{n!}{r!(n-r)!}$ (ii) $r = 0,\ ^nC_0 = \frac{n!}{0!\,n!} = 1$

(iii) $r = 1,\ ^nC_1 = \frac{n!}{1!(n-1)!} = n$ (iv) $r = n,\ ^nC_n = \frac{n!}{n!(n-n)!} = 1$

Selection of objects with repetition: The number of combination of n distinct objects taken r at a time when each may occur once, twice, thrice, and so on upto r times, in any combination is given by $^{(n+r-1)}C_r$.

Example: What is the number of ways of choosing 4 cards from a pack of 52 playing cards? in how many of these

(i) Four cards are of the same suit,
(ii) Four cards belong to four different suits,
(iii) are face cards,
(iv) two are red cards and two are black cards.
(v) cards are of the same colour?

Explanation:

(i) There are $^{13}C_4$ ways of choosing 4 clubs, $^{13}C_4$ ways of choosing 4 spades, $^{13}C_4$ ways of choosing 4 hearts and $^{13}C_4$ ways of choosing 4 diamonds.

Therefore, the required number of ways

$$= 4 \times\ ^{13}C_4 = \frac{4\times(13)!}{4!\,9!} = \frac{4\times10\times11\times12\times13}{2\times3\times4} = 2860$$

(ii) One card is to be selected from each suit.

This can be done in : $^{13}C_1 \times\ ^{13}C_1 \times\ ^{13}C_1 \times\ ^{13}C_1 = (13)^4$ ways.

(iii) There are 12 face cards and 4 are to be selected out of these 12 cards.

Therefore, $^{12}C_4 = \dfrac{12!}{4!\,8!} = \dfrac{9 \times 10 \times 11 \times 12}{2 \times 3 \times 4} = 495$

Cards:

(i) There are four suits Diamond, Club, Spade, heart.

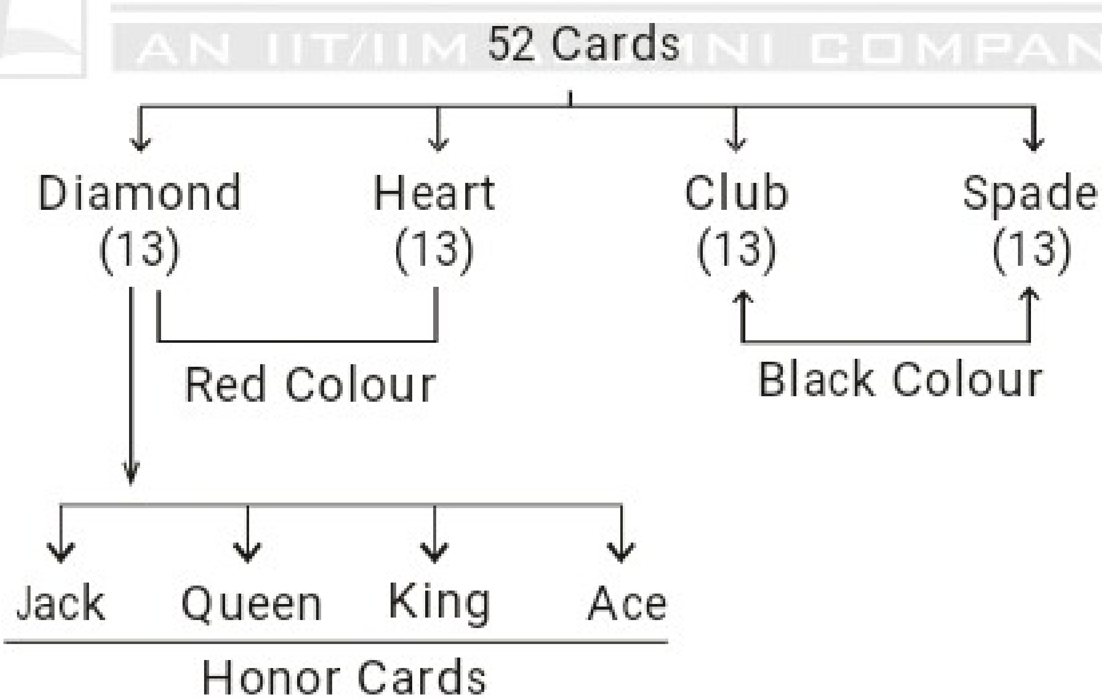
(ii) Each suit contains 13 cards, so total number of cards = 13 × 4 = 52

(iii) Each suit contains 3 face cards, (Jack, Queen, King) so total Number of face cards = 3 × 4 = 12

(iv) Each suit contains 9 number cards (2, 3, 4, 5, 6, 7, 8, 9, 10), so total numbers of cards = 9 × 4 = 36.

(v) There are 26 red cards and 26 black cards.

(vi) Each suit contains 4 honor cards (Jack, Queen, King & Ace) so total No. of honor cards = 4 × 4 = 16



(iv) The required number of ways

$$= {}^{26}C_2 \times {}^{26}C_2 = \left(\frac{26!}{2! \times 24!}\right)^2 = \left(\frac{25 \times 26}{2}\right)^2 = (325)^2 = 105625$$

(v) 4 red cards can be selected out of 26 red cards in $^{26}C_4$ ways. 4 black cards can be selected out of 26 black cards in $^{26}C_4$ ways, therefore, the required number of ways

$$= {}^{26}C_4 + {}^{26}C_4 = 2 \times \frac{26!}{22!\,4!} = 2 \times \frac{23 \times 24 \times 25 \times 26}{2 \times 3 \times 4} = 29900$$

Probability: If a random experiment has n possible outcomes, which are mutually exclusive, exhaustive & equally likely, and m of these are favourable to an event A, then the probability of the event is defined as the ratio m/n & is denoted by

$$P(A) = \frac{m}{n} = \frac{\text{Number of favourable cases to A}}{\text{Total number of possible cases}}$$

Probability of an event always lies between 0 & 1; i.e $0 \le P \le 1$

Addition Theorem of Probability: If two events A and B are mutually exclusive, then the probability of occurence of either A or B is given by the sum of their probability , i.e,

$$P(A \text{ or } B) = P(A) + P(B)$$

(1) For only two events A and B, the probability of occurence of at least one of the two given events is given by

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$

(2) For any three events A, B and C, the probability of occurence of at least one of the three events is given by

$P(A \cup B \cup C) = P(A) + P(B) + P(C) - P(A \cap B) - P(B \cap C) - P(A \cap C) + P(A \cap B \cap C)$

(3) **Conditional Probability:** The probability that the event A will occur, it being known that B has occured, is called the conditional probability of A

$$P(A/B) = \frac{P(A \cap B)}{P(B)} = \frac{n(A \cap B)}{n(B)}$$

Chapter 14 Number Series

Let us begin by observing the following series:

2, 4, 6, 8, 10, ...

clearly, it is an even number series.

Now, let us observe the following series:

62, 127, 214, 345, 510, ...

This series is obtained by alternatively substracting and adding 2 to the cubes of natural numbers beginning with 4.

i.e., 62, 127, 214, 345, 510, ...

$$\begin{array}{ccccc} 62, & 127, & 214, & 345, & 510, \\ \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\ (4^3 - 2) & (5^3 + 2) & (6^3 - 2) & (7^3 + 2) & (8^3 - 2) \end{array}$$

The pattern of the first series can be more easily understood as compared to the second one because we are more familier with the first pattern, i.e; even numbers.

So, let us familiarise ourselves with more such patterns.

Type 1: Even/odd number series

Example 1: 2, 4, 6, 8, 10, ...

The above series is an even number series. The next term in this series is 12.

Example 2: 1, 3, 5, 7, 9,............

This is an odd number series. The next term will be 11.

Type 2: Prime number series

Example 1: 2, 3, 5, 7, ...

The next term will be 11.

Example 2: 3, 7, 13, 19, ...

This series is formed by picking up alternate terms from the prime number series beginning with 3.

$\underline{3}$, 5, $\underline{7}$, 11, $\underline{13}$, 17, $\underline{19}$, 23, $\underline{29}$

So, the next term will be 29.

Example 3: 3, 7 17, ...

This series is formed by picking up terms from the prime number series beginning with 3 and leaving out one term, two terms, three terms and so on successively in between.

3, 5, 7, 11, 13, 17, 19, 23, 29, 31

So, the next term will be 31.

Type 3: **Series formed by squares of numbers**

Example 1: 4, 9, 16, 25, 36, ...

This series is formed by squares of successive numbers beginning with 2

$2^2, 3^2, 4^2, 5^2, 6^2, 7^2$

So, the next term will be 49.

Example 2: 1, 9, 25, 49, 81, ...

These are squares of odd numbes.

$1^2, 3^2, 5^2, 7^2, 9^2, 11^2$

So, the next term will be 121.

Type 4: **Series formed by Cubes of numbers**

Example 1: 64, 125, 216, 343, ...

These are cubes of successive numbers beginning with 4.

So, the next term will be 512.

Example 2: 8, 27, 125, 343, ...

These are cubes of prime numbers.

So, the next term will be $11^3 = 1331$.

Type 5 : **Series formed by addition**

Example 1: 12, 13, 15, 17, ...

This series is formed by adding 10 to each term of the prime number series beginning with 2.

(2 + 10), (3 + 10), (5 + 10), (7 + 10)

So, the next term will be (11 + 10) = 21.

Example 2: 1, 3, 4, 8, 15, 27, ...

Previous three terms are added to find the terms beginning from 8.

1 + 3 + 4 = 8, 3 + 4 + 8 = 15, 4 + 8 + 15 = 27, 8 + 15 + 27 = 50

So, the next term will be 50.

Type 6: Series formed by multiplication

Example 1: 0.5, 1.5, 4.5, 13.5, ...

Here, each term is formed by multiplying the previous term by 3. So, the next will be 40.5.

Example 2: 1, 3, 7, 15, 31, 63, ...

Each term is formed by multiplying the previous term by 2 and adding 1

So, the next term will be → 63 × 2 + 1 = 127.

Type 7: Series formed by division

Example 1: 840, 168, 42, 14, 7, ...

(840 ÷ 5) = 168, (168 ÷ 4) = 42, (42 ÷ 3) = 14, (14 ÷ 2) = 7, (7 ÷ 1) = 7.

So, the next term will be 7.

Example 2: 240, ...?..., 120, 40, 10, 2.

240 ÷ 1 = 240, 240 ÷ 2 = 120, 120 ÷ 3 = 40, 40 ÷ 4 = 10, 10 ÷ 5 = 2.

So, the missing term is 240.

Type 8: Series formed by subtracting or adding something to squares of successive terms.

Example 1: 12, 20, 30, 42, ...

This series is formed by squaring a term and adding the same term to the square.

$3^2 + 3 = 12$, $4^2 + 4 = 20$, $5^2 + 5 = 30$, $6^2 + 6 = 42$, $7^2 + 7 = 56$.

So, the next term will be 56.

Example 2: 3, 7, 13, 21, ...

$1^2 + 2$, $2^2 + 3$, $3^2 + 4$, $4^2 + 5$, $5^2 + 6$.

So, the next term will be 31.

Type 9: **Series formed by subtracting or adding something to cubes of successive terms.**

Example 1: 0, 6, 24, 60, 120, ...

$1^3 - 1 = 0$, $2^3 - 2 = 6$, $3^3 - 3 = 24$, $5^3 - 5 = 120$, $6^3 - 6 = 210$

So, the next term will be 210.

Example 2: 10, 24, 68, 120, ...

$2^3 + 2 = 10$, $3^3 - 3 = 24$, $4^3 + 4 = 68$, $5^3 - 5 = 120$, $6^3 + 6 = 222$.

So, the next term will be 222.

Type 10: **Combination of two different series.**

Example 1: $\frac{1}{2}, \frac{3}{4}, \frac{5}{8}, \frac{7}{16}$, ...

The numerators term a series of odd numbers. The series of denominators is formed by multiplying the previous number by 2.

Numerators: 1, 3, 5, 7, 9 ; Denominators : 2, 4, 8, 16, 32

So, the next term will be $\frac{9}{32}$.

Example 2: 512, 16, 343, 25, ...

It is a combination of two series.

$\underline{8}^3, 4^2, \underline{7}^3, 5^2$, ...

So, the next term will be $6^3 = 216$.

Type 11: **Series formed by adding terms at more than one level**

Example: 5, 12, 27, 58, 121, ...

Sol.

5, 12, 27, 58, 121, 248

+7 +15 +31 +63 +127

+8 +16 +32 +64

So, the next term will be 248.

Some Important Series

(i) 8, 4, 4, 6, 12, ...

$$8\times\frac{1}{2}=4,\ 4\times 1=4,\ 4\times\frac{3}{2}=6,\ 6\times 2=12,\ 12\times\frac{5}{2}=30$$

So, the next term will be 30.

(ii) 6, 9, 18, 45, ...

$$6\times\frac{3}{2}=9,\ 9\times 2=18,\ 18\times\frac{5}{2}=45,\ 45\times 3=135.$$

Some point to remember

(i) If a series increases abruptly then it may be a case of series formed by multiplication.

Example: 2, 3, 6, 18, 108, 1944.

Here, each term is formed by multiplying previous two terms.

(ii) if a series decreases abruptly, then it may be a case of series formed by division.

Example: 6120, 1020, 204, 51, 17.

6120 ÷ 6 = 1020, 1020 ÷ 5 = 204, 204 ÷ 4 = 51 and so on.

(iii) if a series decreases in the beginning and then goes on increasing, it may be a case of multiplication by fractional values.

Example: 8, 4, 4, 6, 12, ...

$$8\times\frac{1}{2}=4,\ 4\times 1=4,\ 4\times\frac{3}{2}=6,\ 6\times 2=12, \text{ and so on.}$$

(iv) The given series may be a combination of two different series in the following cases:

(a) Fractional terms are given in the question with numerators forming one series and denominators forming another series.

(b) Series increases and then decreases and again increases and then decreases and so on.

Example: 15, 14, 19, 11, 23, 8, 27, ...

1st series ÷ 15, 19, 23, 27, ... 2nd series ÷ 14, 11, 8, ...

(c) When more terms are given in the question as compared to normal cases.

for example in case (b) above we have 7 terms given in the question. in such a situation check for the case of two different series being mixed.

Chapter 15

Quadratic Equation

As we know, if we use the short method, in these types of questions it takes very little time to solve in the examination.

So let us understand the concept.

Quadratic equation: It is a second order polynomial equation with a single variable.

Example: $ax^2 + bx + c = 0$

There will be two values of x which satisfy the given equation.

Sign Method: Now from the exam's point of view, we can conclude the signs of the roots from the signs of the coefficients.

Case I: If b = +ve, c = +ve

Example: $ax^2 + bx + c = 0$, x_1 = –ve, x_2 = –ve

Case II: If b = –ve, c = –ve,

then one root will be positive(+) (bigger number) and other root will be negative(–) (smaller number)

Example: $ax^2 - bx - c = 0$, x_1 = +ve, x_2 = –ve

Case III: If b = +ve, c = –ve

then one root will be –ve (bigger number)

and other root will be +ve (smaller number)

Example: $ax^2 + bx - c = 0$, x_1 = –ve, x_2 = +ve

Case IV: If b = –ve, c = +ve

$ax^2 - bx + c = 0$

x_1 = +ve, x_2 = +ve

x's co-efficient (b)	Constant (c)	x_1	x_2
+	+	–	–
+	–	–	+
–	+	+	+
–	–	+	–

When we see the equation then we can conclude the signs of the roots, so we can find the relation between x and y.

Now we have the signs of the roots of equation and if we remember the table then we can conclude it within 5 seconds.

Now come to the second part:

Suppose we have the equation:

$$x^2 - 5x + 6 = 0$$

From the table we can conclude that both the roots of the equation will be +ve.

Now we have to break the constant (6) such that their sum will be 5.

$$6 = 3 \times 2 \quad \text{also, } (3 + 2 = 5)$$

$$\therefore\ x_1 = +3,\ \ x_2 = +2$$

Now if there is a value attached to the x's co-efficient, then we have to divide the value to get the roots.

Sol. $2x^2 - 11x + 15 = 0$

$$\begin{array}{ccc} 2 & & 3 \times 5 \\ \downarrow & & \downarrow \\ & 6 + 5 = 11 & \end{array}$$

$$\therefore\quad x_1 = +\frac{6}{2} = +3, \qquad x_2 = +\frac{5}{2} = +2.5$$

Chapter 8

Pipe and Cistern

Chapter 8

Pipe and Cistern

Pipes and Cistern problems generally consist of a cistern (tank) to which one or more pipes fill the cistern or empty the cistern. These problems of pipes and cisterns can be solved by using the same method used in time and work. And we changes our formulae according to the requirement of the pipes and cisterns.

(i) A pipe connected with a tank or a cistern that fill the tank is known as inlet.

(ii) A pipe connected with a tank that empty it is known as outlet.

Important Points:

1. If a pipe can fill a tank in x hours, then the part filled in 1 hour $= \frac{1}{x}$
2. If a pipe can empty a tank in y hours, then the part of the full tank emptied in 1 hour $= \frac{1}{y}$
3. If a pipe can fill a tank in x hours and another pipe can empty the full tank in y hours (y > x), then the net part filled in 1 hour, when both the pipes are opened $= \left(\frac{1}{x} - \frac{1}{y}\right) = \frac{y-x}{xy}$

   Time taken to fill the tank $= \frac{xy}{y-x}$
4. If a pipe can fill a tank in x hours and another pipe can fill the same tank in y hours, the part of the tank filled in 1 hour when both pipes are opened simultaneously $= \left(\frac{1}{x} + \frac{1}{y}\right) = \frac{x+y}{xy}$

   $\therefore$ Time taken to fill completely the tank when both pipes are open simultaneously $= \frac{xy}{x+y}$

5. If three pipes can fill a tank separately in x, y and z h respectively, then time taken to fill the tank by working together $= \frac{xyz}{xy+yz+zx}$ h.

6. If a pipe fills a tank in x hours and another fills the same tank in y hours, but a third pipe empties the full tank in z hours and all of them are opened together, the net part filled in 1 hour $= \left(\frac{1}{x}+\frac{1}{y}-\frac{1}{z}\right)$.

Time taken to fill the tank $= \frac{xyz}{yz+xz-xy}$ hours

Example: Pipe A can fill a water tank in 25 minutes, Pipe B can fill the tank in 40 minutes and Pipe C can empty the tank in 30 minutes. If all the 3 pipes are opened together, then in how many minutes will the tank be completely filled?

Sol. Time taken to fill the tank

$$= \frac{25\times 40\times 30}{40\times 30+25\times 30-25\times 40} = \frac{600}{19} = 31\frac{11}{19} \text{ minutes}$$

7. Two pipes A and B can fill a tank in x minutes and y minutes respectively. If both the pipes are opened simultaneously, Then the time after which pipe B should be closed, so that the tank is full in 't' minutes is $\left[y\left(1-\frac{t}{x}\right)\right]$ minutes.

Example: Two pipes A and B can fill a tank is 12 minutes and 16 minutes respectively. If both the pipes are opened simultaneously, after how much time should B be closed so that the tank is full is 9 minutes?

Sol. Pipe B should be closed after $= \left(1-\frac{9}{12}\right)\times 16 = \frac{3}{12}\times 16 = 4$ min.

Types of Questions

1. Pipe A can fill the tank in 80 minutes and pipe B in 120 minutes. Then after how much time both the pipe can together fill the tank?

Sol. Part filled by two taps in 1 minutes

$$= \frac{1}{80} + \frac{1}{120} = \frac{3+2}{240} = \frac{5}{240} = \frac{1}{48}$$

$\therefore$ Time taken to fill the tank = 48 minutes

Shortcut:

A $\longrightarrow$ 80 → LCM 240 → 3 units/min

B $\longrightarrow$ 120 → (Total Capacity) → 2 units/min

$\therefore$ Take LCM as the total capacity of the tank.

Time taken to fill the tank $= \frac{240}{3+2} = 48$ minutes

2. Two pipes A and B can empty a full tank in 20 hours and 25 hours respectively. In how many hours will tank be emptied when they are opened together?

Sol. Efficiency of both pipes $= \frac{1}{20} + \frac{1}{25} = \frac{5+4}{100} = \frac{9}{100}$

$\therefore$ Tank will be emptied in $\frac{100}{9} = 11\frac{1}{9}$ hours

Shortcut:

A $\longrightarrow$ 20 → LCM 100 → 5 units/hour

B $\longrightarrow$ 25 → 4 units/hour

A can empty 5 units/hour and B can empty 4 units/hours.

Time taken to empty the tank $= \frac{100}{9} = 11\frac{1}{9}$ hours

3. A can fill a cistern in 10 hours and B can empty it in 5 hours. If they are opened together, in how many hours will cistern be empty?

Sol. Required time $= \frac{10 \times 5}{10 - 5} = \frac{10 \times 5}{5} = 10$ hours.

Shortcut:

A $\longrightarrow$ 10 — LCM 10 — 1 units/hour

B $\longrightarrow$ 5 — LCM 10 — – 2 units/hour

Take negative sign when a pipe empty the tank therefore tank will be empty in $= \frac{10}{1 - 2} = 10$ hours

4. Two pipe P and Q can fill a cistern in 12 and 15 min, respectively. If both are opened together and at the end of 3 min the first is closed. How much extra time will Q take to fill the cistern?

Sol. Given, time taken by P to fill the tank = 12 min.

And time taken by Q to fill the tank = 15 min.

Part filled by both pipes in 1 min $= \frac{1}{12} + \frac{1}{15} = \frac{5+4}{60} = \frac{9}{60}$

Now, part filled in 3 min $= \frac{3 \times 9}{60} = \frac{27}{60} = \frac{9}{20}$

$\therefore$ Remaining part $= 1 - \frac{9}{20} = \frac{11}{20}$

Now, the remaining part is filled by pipe Q in x min.

$$x = \frac{11}{20} \times 15 = \frac{3 \times 11}{4} = \frac{33}{4} = 8\frac{1}{4} \text{ min}$$

Shortcut:

P ⟶ 12 — 5 units/min

Q ⟶ 15 — 4 units/min

LCM 60

Total capacity = 60

Part filled by (P + Q) in 3 min = 3 (5 + 4) = 27 units

Remaining part is filled by Q only $= \frac{60 - 27}{4} = \frac{33}{4} = 8\frac{1}{4}$ min

5. A tank can be filled by two pipes A and B in 20 min and 30 min, respectively. When the tank was empty the two pipes were opened. After some time, the first pipe was stopped and the tank was filled in 18 min. After how much time of the start was the first pipe stopped?

Sol. Given, tank filled by A = 20 min

And tank filled by B = 30 min

Let the first pipe be closed after x min.

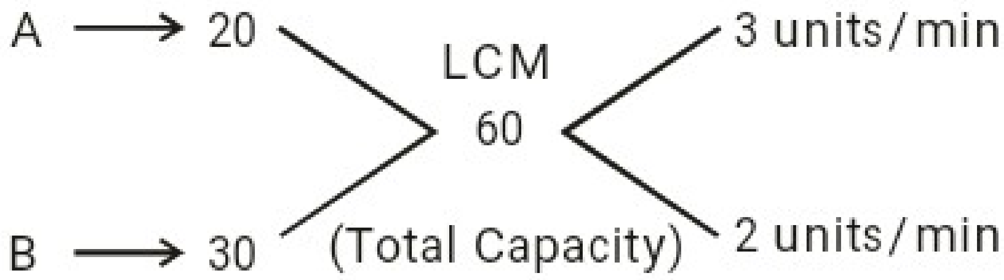
Then, work done by first pipe in x min $= \frac{x}{20}$

According to the question,

$$\frac{x}{20} + \frac{18}{30} = 1 \Rightarrow \frac{x}{20} = 1 - \frac{18}{30} \Rightarrow \frac{x}{20} = 1 - \frac{3}{5} = \frac{2}{5}$$

$$\therefore \quad x = \frac{2}{5} \times 20 = 8 \text{ min}$$

Shortcut:



B work all time, therefore part filled by B in 18 min
= 2 × 18 = 36 units

Remaining part is filled by A in $\frac{24}{3} = 8$ min

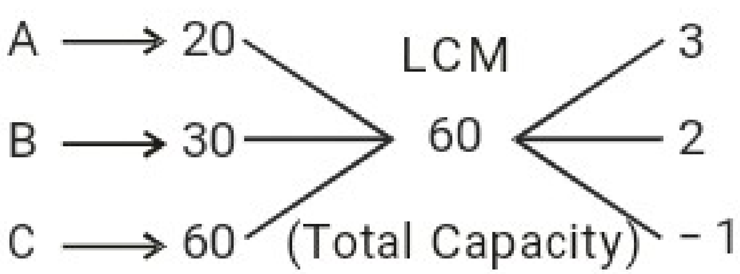
Therefore, after 8 min the first pipe is closed.

6. Pipe A can fill a cistern in 20 minutes and pipe B can fill it in 30 minutes. While pipe C can empties the full cistern in 1 hours. If all the pipes be turned on at the same time, in how much time will the cistern be full?

Sol. Filled part of cistern in 1 minute, when A, B and C be turned on at same time $= \frac{1}{20} + \frac{1}{30} - \frac{1}{60} = \frac{3+2-1}{60} = \frac{4}{60} = \frac{1}{15}$

$\therefore$ time taken to fill the cistern = 15 minutes

Shortcut:



Therefore Cistern will be filled in $\frac{60}{3+2-1} = \frac{60}{4} = 15$ minutes

7. Pipe A can fill a cistern in 5 hours and B can fill it in 20 hours. Both pipes are turned on but there is a leakage in the bottom of the cistern. So the cistern is filled in 30 minutes more. In how many time will leakage emptie the full cistern?

Sol. Efficiency of pipe A and B $= \frac{1}{5} + \frac{1}{20} = \frac{4+1}{20} = \frac{15}{20} = \frac{1}{4}$

$\therefore$ Pipe A and B working together will fill the cistern in 4 hours

But time taken with leakage = 4 hours + 30 minutes

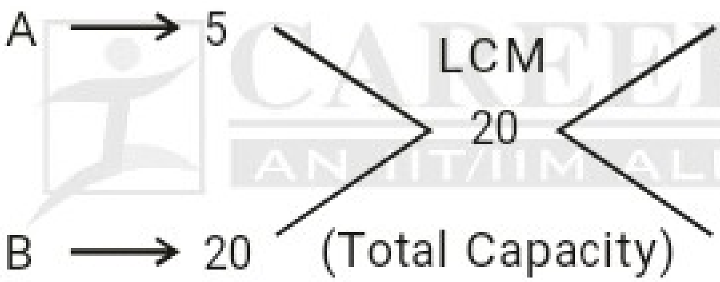
$= \left(4 + \frac{1}{2}\right)$ hours $= \frac{9}{2}$ hours

$$\frac{1}{5} + \frac{1}{20} - \frac{1}{x} = \frac{2}{9} \Rightarrow \frac{1}{5} + \frac{1}{20} - \frac{2}{9}$$

$$\frac{1}{x} = \frac{36+9-40}{180} = \frac{5}{180} = \frac{1}{36} \quad \Rightarrow \quad x = 36 \text{ hours}$$

$\therefore$ Leakage will empty the cistern in 36 hours

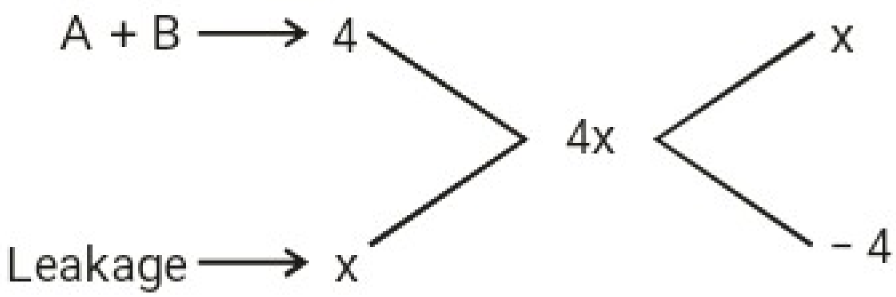
Shortcut:



A and B fill the cistern in $\frac{20}{5} = 4$ hours

But when there is a leakage in the bottom then the tank is filled in

$\left(4 + \frac{1}{2}\right) = \frac{9}{2}$ hours



$$\frac{4x}{x-4} = \frac{9}{2} \quad \Rightarrow \quad x = 36 \text{ hours}$$

8. Two pipes can fill a cistern in 20 minutes and 25 minutes respectively. These are opened alternatively for 1 minutes each, beginning with first. In how much time will the cistern b full?

Sol. Filled cistern in 1 round (or 2 minutes) $= \frac{1}{20} + \frac{1}{25} = \frac{5+4}{100} = \frac{9}{100}$

$$\left(\frac{9}{100} \Rightarrow 100 \div 9 \text{ gives 11 round complete}\right)$$

$\therefore$ Filled cistern in 11 round (or 22 minutes) $= \frac{9}{100} \times 11 = \frac{99}{100}$

$\therefore$ Empty part of cistern $= 1 - \frac{99}{100} = \frac{1}{100}$

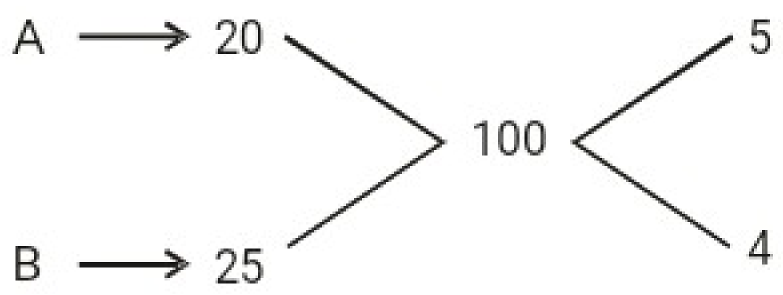
On 23rd min., it is first pipe's is opened.

$\therefore$ Time taken to fill empty part by first pipe

$$= \frac{\text{empty part}}{\text{efficiency of first pipe}} = \frac{\frac{1}{100}}{\frac{1}{20}} = \frac{1}{100} \times \frac{20}{1} = \frac{1}{5} \text{ minutes}$$

$\therefore$ Total time $= 22 + \frac{1}{5} = 22\frac{1}{5}$ minutes

Shortcut:



A and B opened alternatively.

$\therefore$ In 2 minutes filled is 9 units.

Minutes Tank Filled

$$\times 11\begin{pmatrix} 2 & & 9 \\ 22 & & 99 \end{pmatrix}\times 11$$

Remaining part = 100 – 99 = 1 unit

1 unit is filled by A in $= \frac{1}{5}$ minutes

Total time $= 22 + \frac{1}{5} = 22\frac{1}{5}$ minutes

9. A swimming pool has 3 drain pipes. The first two pipes A and B, operating simultaneously can empty the pool in half the time that C, the 3rd pipe, alone takes to empty it. Pipe A, working alone, takes half the time taken by pipe B. Together they take 6 h 40 min to empty the pool. Time taken by pipe A to empty the pool, in hours, is

Sol. Let the taken by pipe B = 2x h

Part of the pool emptied by B in 1 h $= \frac{1}{2x}$

Part of pool emptied in 1 h by $A = \frac{1}{x}$

$\therefore$ Time taken by pipe $C = \frac{2}{\frac{1}{2x}+\frac{1}{x}} = \frac{2}{\frac{1+2}{2x}} = \frac{4x}{3}$ h

Now, part of the tank filled by all together

$$= \frac{1}{x}+\frac{1}{2x}+\frac{3}{4x} = \frac{4+2+3}{4x} = \frac{1}{6+\frac{2}{3}}$$

$$= \frac{4+2+3}{4x} = \frac{3}{20} = 9\times 20 = 4x\times 3 \quad \Rightarrow \quad x = \frac{9\times 20}{4\times 3} = 15\text{ h}$$

10. A tank has a leak which would empty the completely filled tank in 10 h. If the tank is full of water and a tap is opened which admits 4 L of water per minutes in the tank, the leak takes 15 h to empty the tank. How many litres of water does the tank hold?

Sol. Let the capacity of the tank = x L

According to the question,

Quantity of water emptied by the leak in 1 h = $\frac{x}{10}$ L

Quantity of water emptied with inlet pipe in 1 h = $\frac{1}{15}$

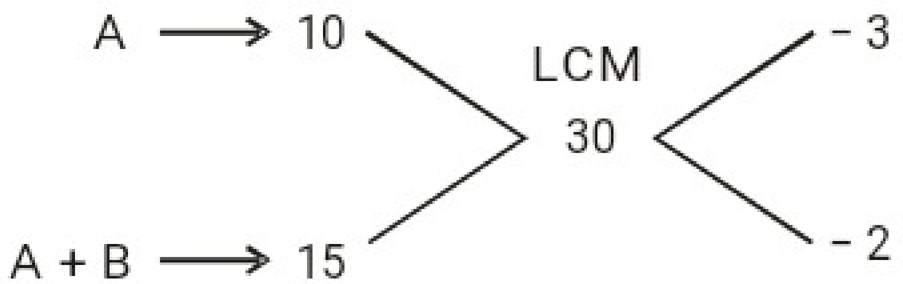
Let Inlet pipe fills tank in x h

So, $\frac{1}{x} - \frac{1}{10} = -\frac{1}{15} \Rightarrow \frac{1}{x} = \frac{1}{10} - \frac{1}{15} \Rightarrow \frac{3-2}{30} = \frac{1}{30}$

So, Intel pipe fills tank in 30 h

Capacity of tank = 30 × 60 × 4 = 7200 L.

Shortcut:



Therefore B admit 1 unit/hour and originally B admit 4 L/min. Therefore

1 = 4 × 60 $\Rightarrow$ 1 = 240

Total Capacity = 30 × 240 = 7200 L

Foundation

1. If a pipe fills a tank in 6 h, then what part of the tank will the pipe fill in 1 h?
(a) $\frac{1}{3}$ (b) $\frac{1}{6}$ (b) $\frac{1}{4}$
(d) $\frac{1}{5}$ (e) None of these

2. An inlet pipe fills $\frac{1}{8}$ part of a tank in 1 h. How much time will the pipe take to fill the empty tank?
(a) 4h (b) 2h (b) 6h
(d) 8h (e) None of these

3. An outlet pipe can empty a cistern in 3 h. In what time will the pipe empty two-third part of the cistern?
(a) 4h (b) 2h (b) 3h
(d) 5h (e) None of these

4. There are two taps A and B to fill up a water tank. The tank can be filled in 40 min, if both taps are on. The same tank can be filled in 60 min, if tap A alone is on. How much time will tap B alone take, to fill up the same tank?
(a) 64 min (b) 80 min (b) 96 min
(d) 120 min (e) None of these

5. A pipe can fill a tank in 10 h, while an another pipe can empty it in 6 h. Find the time taken to empty the tank, when both the pipes are opened simultaneously?
(a) 11h (b) 15h (b) 18h
(d) 16h (e) None of these

6. Three taps are fitted in a cistern. The empty cistern is filled by the first and the second taps in 3 and 4h, respectively. The full cistern is emptied by the third tap in 5 h. If all three taps are opened simultaneously, the empty cistern will be filled up in?

(a) $1\frac{14}{23}$ h (b) $2\frac{14}{23}$ h (b) 2 h 40 min
(d) 1 h 56 min (e) None of these

7. Pipe A can fill a tank in 30 min, while pipe B can fill the same tank in 10 min and pipe C can empty the full tank in 40 min. If all the pipes are opened together, how much time will be needed to make the tank full?

(a) $9\frac{3}{13}$ h (b) $9\frac{4}{13}$ h (b) $9\frac{7}{13}$ h
(d) $9\frac{9}{13}$ h (e) None of these

8. Three taps A, B and C together can fill an empty cistern in 10 min. The tap A alone can fill it in 30 min and the tap B alone can fill it in 40 min. How long will the tap C alone take to fill it?
(a) 16 min (b) 24 min (b) 32 min
(d) 40 min (e) None of these

9. Two pipes A and B can fill a tank in 1 h and 75 min, respectively. There is also an outlet C. If all the three pipes are opened together. The tank is full in 50 min. How much time will be taken by C to empty the full tank?
(a) 100 min (b) 150 min (b) 200 min
(d) 125 min (e) None of these

10. A, B and C are three pipes connected to a tank. A and B together fill the tank in 6 h, B and C together fill the tank in 10 h and A and C together fill the tank in 12 h. In how much time A, B and C fill up the tank together?

(a) 9 h (b) $5\frac{3}{7}$ h (b) $5\frac{2}{7}$ h
(d) $5\frac{5}{7}$ h (e) None of these

11. Inlet A is four times faster than inlet B to fill a tank. If A alone can fill it in 15 min, how long will it take if both the pipes are opened together?
(a) 10 min (b) 12 min (b) 15 min
(d) 14 min (e) None of these

12. There are two inlets A and B connected to a tank. A and B can fill the tank in 16 h and 10 h, respectively. If both the pipes are opened alternately for 1 h, starting from A, then how much time will the tank take to be filled?
(a) $13\frac{1}{4}$ h (b) $11\frac{6}{8}$ h (b) $12\frac{2}{5}$ h
(d) $12\frac{1}{4}$ h (e) None of these

13. A pipe can empty a cistern in 27 hours. Find the time in which $\frac{2}{3}$ part of the cistern will be emptied?
(a) 9 hours (b) 12 hours (b) 15 hours
(d) 18 hours (e) None of these

14. A water tank is $\frac{2}{3}$ rd full. Pipe A can fill the tank in 10 minutes and the pipe B can empty it in 6 minutes. If both the pipes are open, how long will it take to empty or fill the tank completely?
(a) 6 minutes to empty (b) 6 minutes to fill
(c) 9 minutes to empty (d) 9 minutes to fill
(e) None of these

15. A tap can fill a cistern in 8 hours and another can empty it in 16 hours. If both the taps are opened simultaneously, the time (in hours) to fill the tank is?
(a) 8 (b) 10 (c) 16
(d) 24 (e) None of these

16. A pipe can empty a tank in 15 hrs and another pipe can empty it in 10 hours. If both the pipes are opened simultaneously, find the time in which a full tank is emptied?
(a) 8 hrs (b) 6 hrs (c) 4 hrs
(d) 5 hrs (e) None of these

17. Two pipes A and B can fill a cistern in 20 minutes and 25 minutes respectively. Both are opened together, but after 5 minutes, B is turned off. How much longer will the cistern take to fill?
(a) 16 minutes (b) 18 minutes (c) 11 minutes
(d) C.N.D. (e) None of these

18. 12 pumps working 6 hours a day can empty a completely filled reservoir in 15 days. How many such pumps working 9 hours a day will empty the same reservoir in 12 days?
(a) 15 (b) 9 (c) 10
(d) 12 (e) None of these

19. A tank has a leak which would empty it in 8 hrs. A tap is turned on which admits 6 litres a minutes into the tank, and it is now emptied in 12 hrs. How many litres does the tank hold?
(a) 8260 litres (b) 8450 litres (c) 8640 litres
(d) 8660 litres (e) None of these

20. A tap can fill the cistern in 8 hours and another can empty it in 16 hours. If both the taps are opened simultaneously, the time (in hours) to fill the tank is?
(a) 16 hrs (b) 8 hrs (c) 10 hrs
(d) 12 hrs (e) None of these

21. A pipe can fill any tank with water in 5 hours and an another pipe can empty the same tank in 4 hours. If the tank is completely filled and both the taps are opened together than the tank will be empty in following time (hour)?
(a) 9 (b) 18 (c) 20
(d) $20\frac{1}{2}$ (e) None of these

22. Two pipes can fill a tank respectively in 15 and 12 hours while a third pipe can empty it in 20 hours. If the tank is empty and all three pipes are opened together then in how much time will it take to fill the tank completely?

(a) 10 hours (b) 5 hours (c) 15 hours
(d) 20 hours (e) None of these

23. 2 pipes A and B can fill a tank separately in 60 min and 70 min respectively. There is a third pipe attached to the bottom of the tank to empty it. The tank is filled in 60 min when all three pipes are opened. In how much time (min) the third pipe alone take to fill the tank?

(a) 110 min (b) 70 min (c) 120 min
(d) 90 min (e) None of these

24. Two pipes A and B can fill any tank in $37\frac{1}{2}$ min and 45 min respectively. If both the pipes are opened together, then after how much time should B be closed so that the tank is full in half hours?

(a) 15 min (b) 10 min (c) 21 min
(d) 9 min (e) None of these

25. A big tanker can be filled by two pipes A and B in 60 and 40 min respectively. Then what time it will take to fill an empty tanker if tap B is used half of time and tap A and B together are used rest half of time?

(a) 24 min (b) 30 min (c) 18 min
(d) 32 min (e) None of these

26. Two taps A and B can fill an oil tank in 15 min and 18 min respectively while a third tap is used to empty the tank. The third tap is opened after 6 min of opening of tap A and B. If the tank empties in $16\frac{1}{2}$ min after opening the third tap then in how much time the third tap can empty the full tank?

(a) 6 min (b) 12 min (c) 10 min
(d) 15 min (e) None of these

27. Three pipes A, B and C can fill a tank in 6 hours. After running them together for two hours the tap C is closed and A and B fills it completely in 7 hours. How much time would C take to fill the tank alone?

(a) 7 hours (b) 10.5 hours (c) 14 hours
(d) 21 hours (e) None of these

28. A water tank has three taps A, B, C. Tap A, when opened, can fill the water tank alone in 4 hours. Tap B, when opened, can filled the water tank alone in 6 hours and tap C, when opened, can empty the water tank alone in 3 hours. If taps A, B and C are opened simultaneously how long will it take to fill the tank completely?

(a) 10 hours (b) 8 hours (c) 18 hours
(d) 12 hours (e) None of these

29. A water tank has two taps A and B. A can fill it in 6 hours, and tap B empty it in 5 hours. If Both the taps open simultaneously the times required to fill the tank?

(a) 20 hours (b) 30 hours (c) 25 hours
(d) 35 hours (e) None of these

30. 18 pumps can fill reservoir of capacity 1440 kilo liter in 5 hours. Then how many hours required to fill a reservoir of capacity 1920 kilo liter by 8 pumps?

(a) 10 hours (b) 16 hours (c) 15 hours
(d) 20 hours (e) None of these

Moderate

1. Two pipes can fill a cistern in 14 h and 16 h, respectively. The pipes are opened simultaneously and it is found that due to leakage in the bottom, it took 92 min more to fill the cistern. When the cistern is full, in what time will the leak empty it?

(a) $43\frac{15}{23}$ h (b) $43\frac{17}{23}$ h (c) $43\frac{13}{23}$ h
(d) $43\frac{19}{23}$ h (e) None of these

2. A pipe P can fill a tank in 12 min and another pipe R can fill it in 15 min. But, the 3rd pipe M can empty it in 6 min. The 1st two pipes P and R are kept open for 5 min in the beginning and then the 3rd pipe is also opened. In what time is the tank emptied?

(a) 30 min (b) 25 min (c) 45 min
(d) 35 min (e) None of these

3. A tap having diameter 'd' can empty a tank in 40 min. How long another tap having diameter '2d' take to empty the same tank?

(a) 5 min (b) 20 min (c) 10 min
(d) 40 min (e) None of these

4. If two pipes function together, the tank will be filled in 12 h. One pipe fils the tank in 10 h faster than the other. How many hours does the faster pipe take to fill up the tank?

(a) 20 h (b) 60 h (c) 25 h
(d) 25 h (e) None of these

5. Two pipes A and B can fill a cistern in 15 and 20 min, respectively. Both the pipes are opened together, but after 2 min, pipe A is turned off. What is the total time required to fill the tank?

(a) $\frac{46}{3}$ min (b) $\frac{52}{3}$ min (a) $\frac{46}{3}$ min
(d) $\frac{41}{3}$ min. (e) None of these

6. Two pipes A and B can fill a tank in 24 and 32 min, respectively. If both the pipes are opened together, after how much time pipe B should be closed so that the tank is full in 9 min?

(a) 40 min (b) 30 min (c) 10 min
(d) 20 min (e) None of these

7. Two taps A and B can fill a tank in 20 min and 30 min, respectively. An outlet pipe C can empty the full tank in 15 min. A, B and C are opened alternatively, each for 1 min. How long will the tank take to be filled?

(a) 105 min (b) 120 min (c) 167 min
(d) 185 min (e) None of these

8. Two taps A and B can fill a tank in 25 min and 20 min, respectively. But taps are not opened properly, so the taps A and B allow $\frac{5}{6}$th and $\frac{2}{3}$rd part of water, respectively. How long will they take to fill the tank?

(a) 12 min (b) 13 min (c) 14 min
(d) 15 min (e) None of these

9. Three taps A, B and C fill a tank in 20 min, 15 min and 12 min, respectively. If all the taps are opened simultaneously, how long will they take to fill 40% of the tank?

(a) 1 min (b) 2 min (c) 3 min
(d) 4 min (e) None of these

10. A pipe can fill a cistern in 4 min and another pipe can fill it in 15 min, but a third pipe can empty it in 2 min. The first two pipes are kept open for 2 min in the beginning and then the third pipe is also opened. Time taken to empty the cistern is?

(a) 20 min (b) 22 min (c) 42 min
(d) 18 min (e) None of these

11. Taps A, B and C attached with a tank and velocity of water coming through them are 42 L/h, 56 L/h and 48 L/h, respectively. A and B are inlets and C is outlet. If all the taps are opened simultaneously, tank is filled in 16 h. What is the capacity of the tank?

(a) 2346 L (b) 1600 L (c) 800 L
(d) 960 L (e) None of these

12. A boy and girls together fill a cistern with water. The boy pours 4 litres of water every 3 minutes and the girl pours 3 litres every 4 minutes. How much time will it take to fill 100 litres of water in the cistern?

(a) 36 minutes (b) 42 minutes (c) 48 minutes
(d) 44 minutes (e) None of these

13. A tap takes 36 hours extra to fill a tank due to a leakage equivalent to half of its inflow. The inlet pipe alone can fill the tank in how many hours?
(a) 36 (b) 24 (c) 30
(d) 18 (e) None of these

14. A cylindrical tank of diameter 25 cm is full of water. If 11 litres of water is drawn off, the water level in the tank will drop by (Use $\pi = 22/7$)?
(a) $10\frac{1}{2}$ cm (b) $12\frac{6}{7}$ cm (c) 14 cm
(d) $22\frac{2}{5}$ cm (e) None of these

15. Two pipes A and B can fill a tank in 36 hours and 45 hours respectively. If both the pipes are opened simultaneously, how much time will be taken to fill the tank?
(a) 10 hrs (b) 15 hrs (c) 20 hrs
(d) 25 hrs (e) None of these

16. In what time would a cistern be filled by three pipes whose diameters are 1 cm, $1\frac{1}{3}$ cm, 2 cm, running together, when the largest alone will fill it in 61 minutes, the amount of water flowing in by each pipe being proportional to the square of its diameter?
(a) 32 minutes (b) 34 minutes (c) 36 minutes
(d) 38 minutes

17. Two pipes can separately fill a tank in 20 hrs and 30 hrs respectively. Both the pipes are opened to fill the tank but when the tank is $\frac{1}{3}$ full a leak develops in the tank through which $\frac{1}{3}$ of the water supplied by both the pipes per hour leak out. What is the total time taken to fill the tank?

(a) 12 hrs (b) 14 hrs (c) 16 hrs
(d) 18 hrs (e) None of these

18. A cistern can be filled by two pipes A and B in 4 hours and 6 hours respectively. When full, the tank can be emptied by a third pipe C in 8 hours. If all the taps be turned on at the same time, the cistern will be full in?

(a) $2\frac{2}{7}$ hrs (b) $3\frac{3}{7}$ hrs (c) $4\frac{3}{7}$ hrs
(d) $5\frac{5}{7}$ hrs (e) None of these

19. If two pipes function simultaneously, the reservoir will be filled in 6 hours. One pipe fills the reservoir 5 hours faster than the other. How many hours does the faster pipe take to fill the reservoir?
(a) 8 hrs (b) 10 hrs (c) 12 hrs
(d) C.N.D. (e) None of these

20. Three pipes A, B and C can fill cistern in 6 hrs. After working together for 2 hours, C is closed and A and B fill the cistern in 8 hrs. Then find the time in which the cistern can be filled by pipe C?
(a) 6 hrs (b) 12 hrs (c) 14 hrs
(d) 20 hrs (e) None of these

Difficult

1. Two pipes A and B can fill a tank in 24 minutes and 32 minute respectively. If both the pipes are opened simultaneously, after how much time should B be closed so that the tank is full in 18 minutes?
(a) 2 min. (b) 4 min. (c) 6 min.
(d) 8 min. (e) None of these

2. If three taps are opened together, a tank is filled in 12 hrs. One of the taps can fill it in 10 hrs and another in 15 hrs. How many hours does the third tap take alone to empty it completely?
(a) 8 hrs (b) 10 hrs (c) 12 hrs
(d) 16 hrs (e) None of these

3. A tank can be filled with water by two pipes A and B together in 36 minutes. If the pipe B was closed after 30 minutes, the tank is filled in 40 minutes. The pipe B can alone fill the tank in?
(a) 45 minutes (b) 60 minutes (c) 75 minutes
(d) 90 minutes (e) None of these

4. A tank has two pipes. The first pipe can fill it in 45 minutes and the second can empty it in 1 hour. In what time will the empty tank be filled if the pipes be opened one at a time in alternate minutes?
(a) 2 hrs 55 min (b) 3 hrs 40 min (c) 4 hrs 48 min
(d) 5 hrs 53 min (e) None of these

5. A tank can be filled by a tap in 20 min and by another tap in 60 min. Both the taps are kept open for 5 min and then the 1st tap is shut off. After this, how much time the tank will be completely filled?
(a) 20 min (b) 30 min (c) 45 min
(d) 40 min (e) None of these

6. A cistern has three pipes A, B and C. Pipes A and B can fill it in 3 h and 4 h, respectively, while pipe C can empty the completely filled cistern in 1 h. If pipes are opened in order at 3:00 pm, 4:00 pm and 5:00 pm, respectively, at what time will the cistern be empty?
(a) 6 : 15 pm (b) 7 : 12 pm (c) 8 : 12 pm
(d) 8 : 35 pm (e) None of these

7. Three pipes A, B and C can fill a tank in 30 min, 20 min and 10 min, respectively. When the tank is empty, all the three pipes are opened. If A, B and C discharge chemical solutions P, Q and R respectively, then the part of solution R in the liquid in the tank after 3 min is:
(a) $\frac{8}{11}$ (b) $\frac{5}{11}$ (c) $\frac{6}{11}$
(d) $\frac{7}{11}$ (e) None of these

8. Three pipes A, B and C can fill a cistern in 6 hrs. After working together for 2 hours, C is closed and A and B fill the cistern in 8 hrs. Then find the time in which the cistern can be filled by pipe C?
(a) 14 hrs. (b) 12 hrs. (c) 16 hrs.
(d) 18 hrs. (e) None of these

9. A, B and C are three pipes connected to tank. A and B together fill the tank in 6 hrs. B and C together fill the tank in 10 hrs. A and C together fill the tank in $7\frac{1}{2}$ hrs. In how much time will A, B and C fill the tank together?

(a) 36 hrs. (b) 32 hrs. (c) 30 hrs.
(d) 5 hrs. (e) None of these

10. Two pipes A and B can fill a tank in 15 hours and 20 hours respectively while a third pipe C can empty the full tank in 25 hours. All the three pipes are opened in the beginning. After 10 hours C is closed. Find, in how much time will the take be full?

(a) 12 hrs (b) 8 hrs (c) 10 hrs
(d) 14 hrs (e) None of these

11. Three pipes A, B and C can fill a cistern in 10 hours, 12 hours and 15 hours respectively. First A was opened. After 1 hour, B was opened and after 2 hours from the start of A, C was also opened. Find the time in which the cistern is just full?

(a) 2 hrs (b) 4 hrs (c) 2 hrs 52 min
(d) 4 hrs 52 min (e) None of these

12. A, B, C are pipes attached to a cistern. A and B can fill it in 20 and 30 minutes respectively, while C can empty it in 15 minutes. If A, B, C be kept open successively for 1 minute each, how soon will the cistern be filled?

(a) 167 min (b) 160 min (c) 166 min
(d) 164 min (e) None of these

13. A tank is filled in 5 hours by three pipes A, B and C. The pipe C is twice as fast as B and B is twice as fast as A. How much time will pipe A alone take to fill the tank?

(a) 20 hrs (b) 25 hrs (c) 35 hrs
(d) 15 hrs (e) None of these

14. Two pipes A and B can fill a tank in 15 minutes and 20 minutes respectively. Both the pipes are opened together but after 4 minutes, pipe A is turned off. What is the total time required to fill the tank?

(a) 10 min 20 sec (b) 11 min 45 sec
(c) 12 min 30 sec (d) 14 min 40 sec
(e) None of these

15. Three taps A, B and C can fill a tank in 12, 15 and 20 hours respectively. If A is open all the time and B and C are open for one hour each alternately, the tank will be full in?

(a) 6 hrs (b) $6\frac{2}{3}$ hrs (c) 5 hrs
(d) 7 hrs (e) None of these

16. A booster pump can be used for filling as well as for emptying a tank. The capacity of the tank is 2400 m^3. The emptying capacity of the tank is 10 m^3 per minute higher than its filling capacity and the pump needs 8 minutes lesser to empty the tank than it needs to fill it. What is the filling capacity of the pump?

(a) 50 m^3/min (b) 60 m^3/min (c) 72 m^3/min
(d) 32 m^3/min (e) None of these

17. 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 6 litres a minute. When the tank is full, the inlet pipe is opened and due to the leak, the tank is empty in 12 hours. How many litres does the tank hold?

(a) 7580 (b) 7960 (c) 8290
(d) 8640 (e) None of these

18. Two pipes can fill a tank in 20 and 24 minutes respectively and a waste pipe can empty 3 gallons per minute. All the three pipes working together can fill the tank in 15 minutes. The capacity of the tank is?

(a) 60 gallons (b) 100 gallons (c) 120 gallons
(d) 180 gallons (e) None of these

19. 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) 20 (e) None of these

20. Two pipes A and B can fill a tank in 24 min. and 48 min. respectively. If both the pipes are opened simultaneously, after how much time B should be closed so that the tank is full in 20 minutes?

(a) 8 (b) 12 (c) 14
(d) 16 (e) None of these

Previous Year (Memory Based)

1. Two taps can fill a tank respectively in 20 and 30 min. When the tank was empty both the taps were opened and after some time first tap was closed. It took 18 min to fill the tank. After how much time of the begining the first tap was closed?

(a) 5 min (b) 8 min (c) 10 min
(d) 12 min (e) None of these

2. Two taps P and Q can fill a water tank respectively in 12 min and 15 min. They are opened together but after 3 min P is closed. How much more time will Q take to fill the tank?

(a) 7 min (b) $7\frac{1}{2}$ min (c) 8 min
(d) $8\frac{1}{4}$ min (e) None of these

3. A pipe can fill a tank with thrice the speed of an another pipe. If both the pipes together take 36 min to fill an empty tank completely then how much time it will take for slower pipe to fill the tank alone?

(a) 1 hours 21 min (b) 1 hour 28 min (c) 2 hours
(d) 2 hours 24 min (e) None of these

4. A tap can fill an empty tank in 12 hours and another tap can empty the half filled tank in 10 hours. If both the taps are opened together then how much time it will take to fill an empty tank half filled?
   (a) 30 hours (b) 20 hours (c) 15 hours
   (d) 12 hours (e) None of these

5. An oil drum can be filled with oil in 40 min by a filling pipe. An another outlet pipe can empty the entire drum in 60 min. The outlet pipe was opened when $\frac{2}{3}$ part of the drum was filled with oil and closed after 15 min. What time will it take to fill the drum when filling pipe is opened now?
   (a) $23\frac{1}{3}$ min (b) $25\frac{2}{3}$ min (c) $27\frac{1}{3}$ min
   (d) $28\frac{2}{3}$ min (e) None of these

6. Two taps A and B can fill a water tank respectively in 20 and 24 min. and a third tap C empties the tank at a speed of 3 gallon per min. It takes 15 min to fill the tank if A, B and C are opened together. The capacity of the tank is?
   (a) 180 gallon (b) 150 gallon (c) 720 gallon
   (d) 60 gallon (e) None of these

7. Three taps P, Q and R separately can fill a tank completely in 4, 8 and 12 hours respectively. An another taps S can empty the filled tank in 10 hours. Which technique among the following will fill the empty tank in lesser time than other.
   (a) Q opened alone (b) P and S are opened
   (c) P, R and S are opened (d) P, Q and S are opened
   (e) None of these

8. A pipe can fill a tank in x h and another pipe can empty it in y(y>x) h. If both the pipes are open, in how many hours will the tank be filled?

(a) $(x - y)$ h (b) $(y - x)$ h (c) $\frac{xy}{x-y}$h

(d) $\frac{xy}{y-x}$h (e) None of these

9. A pipe can fill a tank with water in 3 h. Due to leakage in bottom, it takes $3\frac{1}{2}$ h to fill it. In what time the leak will empty the fully filled tank?

(a) 12 h (b) 21 h (c) $6\frac{1}{2}$h

(d) $10\frac{1}{2}$ h (e) None of these

10. A water tank has two pipes. The empty tank is filled in 12 min by the 1st and the, full tank is emptied by the 2nd in 20 min. The time required to fill the 1/2 full tank when both pipes are in action, is?

(a) 16 min (b) 15 min (c) 20 min
(d) 30 min (e) None of these

11. Three taps are fitted to a cistern. The empty cistern is filled by the first and second taps in 3 and 4 h, respectively. The full cistern is emptied by the third tap in 5 h. If all three taps are opened simultanceously, the empty cistern will be filled up in?

(a) $1\frac{14}{23}$ h (b) $2\frac{14}{23}$ h (c) 2 h 40 min

(d) 1 h 56 min (e) None of these

12. A tank can be filled by pipe A in 2 h and pipe B in 6 h. At 10 am pipe A was opened. At what time will the tank be filled if pipe B is opened at 11 am?

(a) 12 : 45 (b) 5 pm (c) 11 : 45
(d) 12 pm (e) None of these

13. An empty tank can be filled by pipe A in 4 h and by pipe B in 6 h. If the two pipes are opened for 1 h each alternately with first opening pipe A, then the tank will be filled in?

(a) $1\frac{3}{4}$ h (b) $2\frac{3}{5}$ h (c) $4\frac{2}{3}$ h

(d) $5\frac{1}{2}$ h (e) None of these

14. A cistern has two types . One can fill it in 8 h and other can empty it in 5 h. In how many hours will the cistern be emptied if both the pipes are opened together when $\frac{3}{4}$ of the cistern is already full of water?

(a) 12 h (b) 10 h (c) 6 h

(d) 8 h (e) None of these

15. Pipes P and Q can fill a tank in 10 and 12 h, respectively and C can empty it in 6 h. If all the three are opened at 7 am, at what time will one fourth of the tank be filled?

(a) 10 am (b) 10 pm (c) 11 pm

(d) 11 am (e) None of these

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

(a) 4 h (b) 4 h 15 min (c) 3 h 15 min

(d) 3 h 45 min (e) None of these

17. Two pipes A and B can fill a water tank in 10 and 12 min, respectively and a third pipe C can empty at the rate of 6 gallons per min. If A, B and C opened together fill the tank in 20 min, the capacity (in gallons) of the tank is:

(a) 180 (b) 150 (c) 120

(d) 60 (e) None of these

18. A tap can fill a cistern in 40 min and a second tap can empty the filled cistern in 60 min. By mistake without closing the second tap, the first tap was opened. In how many minutes will the empty cistern be filled

(a) 72 (b) 84 (c) 108
(d) 120 (e) None of these

19. Pipe A can fill a cistern in 6 h and pipe B can fill it in 8 h. Both the pipes are opened simultaneously, but after 2 h, pipe A is closed. How many hours will B take to fill the remaining part of the cistern?

(a) 2 (b) $3\frac{1}{3}$ (c) $2\frac{2}{3}$
(d) 4 (e) None of these

20. Pipes P and Q can fill a tank in 5 and 6 h, respectively and C can empty it in 3 h. If all the three are opened at 7 am, at what time will two fifth of the tank be filled?

(a) 10 am (b) 7 pm (c) 11 pm
(d) 11 am (e) None of these

Foundation

1. **(b);** Time taken to fill the tank = 6 h.

Part of tank filled in 6 h = 1

Part of tank filled in 1 h = $\frac{1}{6}$

2. **(d);** Time taken to fill $\frac{1}{8}$ part of tank = 1 h

$\therefore$ Time taken to fill the empty tank = 8 h.

3. **(b);** Time taken to empty a cistern = 3h

Time taken to empty $\frac{2}{3}$ part of the cistern = $3\times\frac{2}{3}$ = 2 h

4. (d); Given time taken by tap A to fill the tank = 60 min
Let Time taken by tap B to fill the tank = x min

There, $\frac{1}{60}+\frac{1}{x}=\frac{1}{40} \Rightarrow \frac{1}{x}=\frac{1}{40}-\frac{1}{60}=\frac{3-2}{120}$

$\frac{1}{x}=\frac{1}{120} \Rightarrow x = 120$ min

5. (b); Given pipe A can fill a tank = 10 h
Pipe B can empty it = 6 h

Time taken to empty the full tank = $\frac{1}{\frac{1}{6}-\frac{1}{10}}$

$=\frac{1}{\frac{5-3}{30}}=\frac{1}{\frac{5-3}{30}}=15$ h

6. (b); Given,
Time taken by first tap to fill the tank (A) = 3 h
Time taken by second tap to fill the tank (B) = 4 h
And time taken to empty the full tank by third tap (C) = 5hr
∴ Part of the tank will be filled by all there taps in

1 hr = $\frac{1}{3}+\frac{1}{4}-\frac{1}{5}=\frac{20+15-12}{60}=\frac{23}{60}$h

Required time = $\frac{60}{23}$h = $2\frac{14}{23}$h

7. (a); Given,
A = 30 min, B = 10 min, C = 40 min

Part of the tank filled in 1 h = $\frac{1}{30}+\frac{1}{10}-\frac{1}{40}=\frac{4+12-3}{120}=\frac{13}{120}$

Required time = $\frac{120}{13}=9\frac{3}{13}$h

8. (b); Given, $\frac{1}{a}+\frac{1}{b}+\frac{1}{c}=\frac{1}{10} \Rightarrow \frac{1}{a}=\frac{1}{30}, \frac{1}{b}=\frac{1}{40}$

$$\frac{1}{c}=\frac{1}{10}-\frac{1}{30}-\frac{1}{40} \Rightarrow \frac{12-4-3}{120}=\frac{5}{120} \Rightarrow c=24 \text{ min}$$

9. (a); Given, $a = 60, \; b = 75$

$$\frac{1}{a}+\frac{1}{b}-\frac{1}{c}=\frac{1}{50} \Rightarrow \frac{1}{c}=\frac{1}{60}+\frac{1}{75}-\frac{1}{50}$$

$$=\frac{5+4-6}{300} \Rightarrow \frac{1}{c}=\frac{3}{300} \Rightarrow c=100$$

10. (d); Let a, b, c be the time taken to fill the min tank by pipes A, B and C respectively

Given, $\frac{1}{a}+\frac{1}{b}=\frac{1}{6}, \frac{1}{b}+\frac{1}{c}=\frac{1}{10}, \frac{1}{a}+\frac{1}{c}=\frac{1}{12}$

Then, $2\left(\frac{1}{a}+\frac{1}{b}+\frac{1}{c}\right)=\frac{1}{6}+\frac{1}{10}+\frac{1}{12}=\frac{10+6+5}{60}$

$$\frac{1}{a}+\frac{1}{b}+\frac{1}{c}=\frac{21}{120}$$

Required time $=\frac{120}{21}=\frac{40}{7}=5\frac{5}{7}$ h

11. (b); Let 4x is the time taken to fill the tank by inlet B

Then x will be the time taken to fill tank by inlet A

$\Rightarrow x = 15$

Part of he tank will fill in 1 min $=\frac{4+1}{60}=\frac{1}{12}$ min

Required time = 12 min

12. (c); A = 16 h, B = 10 h

Part of the tank filled in (2h) = $\frac{1}{16}+\frac{1}{10}=\frac{5+8}{80}=\frac{13}{80}$

Part of the tank filled in (12 h) = $\frac{78}{80}$

Remaining part = $1-\frac{78}{80}=\frac{2}{80}=\frac{1}{40}$

$\frac{1}{40}$ part of the tank will be filled by inlet A

$$=\frac{\frac{1}{40}}{\frac{1}{16}}=\frac{16}{40}=\frac{8}{20}=\frac{4}{10}=\frac{2}{5}\text{ hr}$$

Required time = $12+\frac{2}{5}=12\frac{2}{5}$ hr

13. (d); 1 part of cistern will be empty by pipe A = 27 h

$\frac{2}{3}$ part of cistern will be empty by pipe A = $27\times\frac{2}{3}$ = 18 hr.

14. (e); Given, A = 10 min, B = 6 min

Part of tank will be empty in 1 min = $\frac{1}{6}-\frac{1}{10}=\frac{5-3}{30}=\frac{1}{15}$

$\therefore$ Full tank will be empty in 15 min.

$\therefore$ $\frac{2}{3}$rd part of the tank will be empty in = $15\times\frac{2}{3}$ = 10 minutes

15. (c); Part of the tank will be filled in 1 h = $\frac{1}{8}-\frac{1}{16}=\frac{1}{16}$

Required time = 16 h

16. (b); Part of the tank will empty in 1 h = $\frac{1}{15}+\frac{1}{10}=\frac{2+3}{30}=\frac{5}{30}=\frac{1}{6}$

Required time = 6 hrs

17. (c); Given, A = 20 min, B = 25 min

In 1 min, part of the tank will be filled = $\frac{1}{20}+\frac{1}{25}=\frac{5+4}{100}=\frac{9}{100}$

In 5 min part of the tank will be filled = $\frac{45}{100}$

Remaining part = $1-\frac{45}{100}=\frac{55}{100}=\frac{11}{20}$

It will take pipe A to fill the $\frac{11}{20}$ part of the tank = $\frac{\frac{11}{20}}{\frac{1}{20}}$ = 11 min

18. (c); By the formula, $\frac{M_1D_1H_1}{W_1}=\frac{M_2D_2H_2}{W_2}$

Here, $D_1 = 15$, $H_1 = 6$, $M_1 = 12$

$M_2 = ?$, $D_2 = 12$, $H_2 = 9$

$15 \times 6 \times 12 = x \times 12 \times 9$

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

Required time = 10 hrs.

19. (c); Time taken by second pipe to fill the tank

$=\frac{1}{\left(\frac{1}{8}+\frac{1}{12}\right)}=\frac{1}{\frac{3-2}{24}}=\frac{1}{\frac{1}{24}}$ = 24 hrs

Capacity of tank = 24 × 60 × 6 = 8640 litres

20. (a); Given,
First tap to fill the tank (A) = 8 hr
Second tap to empty the tank (B) = 16 hr

Part of the tank will be filled in 1 h $= \frac{1}{8} - \frac{1}{16} = \frac{2-1}{16} = \frac{1}{16}$

Required time = 16 hr

21. (c); Given,
First tap to fill the tank (A) = 5 hr
Second tap to empty the tank (B) = 4 hr

Part of the tank will be empty in 1 hr $= \frac{1}{4} - \frac{1}{5} = \frac{5-4}{20} = \frac{1}{20}$

Required time = 20 hr

22. (a); Part of the tank will be filled in 1 hr

$$= \frac{1}{15} + \frac{1}{12} - \frac{1}{20} = \frac{4+5-3}{60} = \frac{6}{60} = \frac{1}{10}$$

Required time = 10 hr

23. (b); Part of tank will be emptied in 1 hr by 3rd pipe

$$= \frac{1}{60} + \frac{1}{70} - \frac{1}{60} = \frac{1}{70}$$

Required time = 70 min

24. (d); Let after x min the pipe be closed so that the tank will be filled full in half hour

$$\therefore \quad \frac{30}{75} \times 2 + \frac{x}{45} = 1 \quad \Rightarrow \quad \frac{180+5x}{225} = 1$$

$180 + 5x = 225 \Rightarrow 5x = 45 \Rightarrow x = 9$ min

25. (b); Let the required time = x
Part of the tank will be filled by tap (A and B)

$$= \frac{1}{60} + \frac{1}{40} = \frac{5}{120} = \frac{1}{24}$$

Then according to question

$$\frac{x}{2\times 40}+\frac{x}{2\times(24)}=1 \Rightarrow \frac{x}{80}+\frac{x}{48}=1 \Rightarrow x=30$$

Required time = 30 min

26. (a); Part of tank filled in 1 min = $\frac{1}{15}+\frac{1}{18}=\frac{6+5}{90}=\frac{11}{90}$

Part of the tank that will be filled in 6 min = $\frac{66}{90}=\frac{11}{15}$

Let x be the time taken to empty the tank by third tap.

$$\frac{\frac{11}{15}}{\frac{1}{x}-\frac{11}{90}}=\frac{33}{2} \Rightarrow \frac{90-11x}{90x}=\frac{11}{15}\times\frac{2}{33}$$

$$180x = 4050 - 495x \Rightarrow x=\frac{4050}{675}=6 \text{ min}$$

27. (c); Part of the tank filled by all the three tap A, B, C in 1 hr = $\frac{1}{6}$

In 2 hr part of the tank will be fill = $\frac{1}{3}$

Remaining part = $1-\frac{1}{3}=\frac{2}{3}$

Let a and b be time to fill the tank tap A and B respectively.

$$7=\frac{\frac{2}{3}}{\frac{1}{a}+\frac{1}{b}} \Rightarrow \frac{1}{a}+\frac{1}{b}=\frac{2}{3}\times\frac{1}{7}=\frac{2}{21}$$

Part of the tank will be fill by the tap C 1 hr

$$=\frac{1}{6}-\frac{2}{21}=\frac{7-4}{42}=\frac{3}{42}=\frac{1}{14} \Rightarrow \text{Required time = 14 hr.}$$

28. (d); Part of the tank will be filled by all of the taps in 1 min

$$= \frac{3+2-4}{12} = \frac{1}{12}$$

Required time = 12 hour

29. (b); Part of the tank will be empty in 1 hr = $\frac{1}{5} - \frac{1}{6} = \frac{1}{30}$

Required time = 30 hr

30. (c); By formula; $\frac{18 \times 5}{1440} = \frac{x \times 8}{1920}$

$$x = \frac{18 \times 5 \times 1920}{1440 \times 8} \Rightarrow x = 15 \text{ hour}$$

Moderate

1. (d); Part of the cistern that can be filled in 1 hr = $\frac{1}{14} + \frac{1}{16} = \frac{8+7}{112} = \frac{15}{112}$

Time taken to fill the cistern = $\frac{112}{15}$ hr

$$= \frac{112}{15} \times 60 \text{ min} = 448 \text{ min}$$

Due to leakage, time taken to fill the cistern

= 448 + 92 = 540 min = 9 hr

Time required to empty the tank $= \frac{1}{\frac{15}{112} - \frac{1}{9}} = \frac{112 \times 9}{23} = 43\frac{19}{23}$ h

2. (c); Part of the tank that will be filled when pipe P and R are opened

for 1 min = $\frac{1}{12} + \frac{1}{15} = \frac{9}{60}$

$\therefore$ Part of the tank that will be filled after 5 min $= \frac{45}{60} = \frac{3}{4}$

6 min be the time to empty the tank by tap M.

$$\therefore \quad \text{Required time} = \frac{3}{4} \times \frac{1}{\left(\frac{1}{6} - \frac{9}{60}\right)} = \frac{3}{4} \times \frac{60}{1} = 45 \text{ min}$$

3. (c); Required time $= \frac{40}{4}$ min = 10 min

4. (a); Let first pipe fill the tank in (x) h then
Second pipe will fill it in (x + 10)h

$$\frac{1}{x} + \frac{1}{x+10} = \frac{1}{12} \Rightarrow \frac{x+10+x}{x(x+10)} = \frac{1}{12}$$

$$\frac{2x+10}{x^2+10x} = \frac{1}{12} \Rightarrow 24x + 120 = x^2 + 10x$$

$$x^2 - 14x - 120 = 0 \Rightarrow x^2 - 20x + 6x - 120 = 0$$

$$x(x - 20) + 6(x - 20) = 0 \Rightarrow x = 20$$

5. (b); Let total time = x

$$\therefore \quad \frac{2}{15} + \frac{x}{20} = 1 \Rightarrow \frac{x}{20} = 1 - \frac{2}{15} \Rightarrow \frac{x}{20} = \frac{13}{15} \Rightarrow x = \frac{52}{3}\text{min}$$

6. (d); Part of the tank that will be filled by both pipe A and B in 1 min

$$= \frac{1}{24} + \frac{1}{32} = \frac{4+3}{96} = \frac{7}{96}$$

Let after x min, pipe B should be closed

$$\therefore \quad x \times \frac{7}{96} + \frac{(9-x)}{24} = 1 \Rightarrow \frac{7x + 36 - 4x}{96} = 1$$

$$3x + 36 = 96 \Rightarrow 3x = 60 \Rightarrow x = 20 \text{ min}$$

7. **(c);** Part of the tank will be filled when all of the pipes A, B and C are opened alternatively, each of 1 min (3 min)

$$= \frac{1}{20} + \frac{1}{30} - \frac{1}{15} = \frac{3+2-4}{60} = \frac{1}{60}$$

$\therefore$ Time taken to fill $\left[1 - \left(\frac{1}{20} + \frac{1}{30}\right)\right]$ Or

$\frac{55}{60}$th part of the tank filled in = 3 × 55 = 165 min

$\therefore$ Remaining part $= 1 - \frac{55}{60} = \frac{1}{12}$

Tank A fills $\frac{1}{20}$ part in 1 min

$\therefore$ Remaining part $= \frac{1}{12} - \frac{1}{20} = \frac{1}{30}$

i.e., $\frac{1}{30}$th part is filled by B in 1 min

$\therefore$ Total time = (165 + 1 + 1) = 167 min

8. **(d);** When taps are not opened properly

Tap A will fill the tank $= 25 \times \frac{6}{5} = 30$ min

Tap B will fill the tank $= 20 \times \frac{3}{2} = 30$ min

$\therefore$ Part of the tank will be filled in 1 min $= \frac{1}{30} + \frac{1}{30} = \frac{1}{15}$

$\therefore$ Required time = 15 min

9. **(b);** Part of the tank will be filled in 1 min

$$= \frac{1}{20} + \frac{1}{15} + \frac{1}{12} = \frac{3+4+5}{60} = \frac{12}{60} = \frac{1}{5}$$

$\therefore$ Required time $= 5 \times \frac{40}{100} = 2$ min

10. **(d);** Part of the tank will be filled in 1 min by tap A and B

$$= \frac{1}{4} + \frac{1}{5} = \frac{5+4}{20} = \frac{9}{20}$$

In 2 min. part of the tank will be filled $= 2 \times \frac{9}{20} = \frac{9}{10}$

Time Required by third pipe to empty the tank

$$= \frac{9}{10} \times \frac{1}{\left(\frac{1}{2} - \frac{1}{4} - \frac{1}{5}\right)} = \frac{9}{10} \times 20 = 18 \text{ min}$$

11. **(c);** In 1 hr the amount of water that will be filled in the tank
= 42 + 56 – 48 = 50 L

$\therefore$ Capacity of the tank = 50 × 16 = 800 L

12. **(c);** In 1 min the boy will pour water in tank $= \frac{4}{3}$ L

In 1 min the girl will pour water in tank $= \frac{3}{4}$ L

$\therefore$ Both will pour water in 1 min $= \frac{1}{\frac{4}{3} + \frac{3}{4}} = \frac{12}{25}$

$\therefore$ Required time $= \frac{12}{25} \times 100 = 48$ min

13. (a); Let inlet pipe fill the tank in x hr

$\therefore$ Outlet pipe will empty the tank in 2x hr

$$\therefore \quad \frac{1}{x}-\frac{1}{2x}=\frac{1}{x+36} \Rightarrow \frac{1}{2x}=\frac{1}{x+36} \Rightarrow x = 36 \text{ hr}$$

14. (d); Volume of cylinder = $\pi r^2 h$

Given, $r=\frac{25}{2}$ cm

$$\text{Volume} = \frac{22}{7}\times\frac{25}{2}\times\frac{25}{2}\times h = 11000 \text{ cm}$$

$$h=\frac{11000\times7\times2\times2}{22\times25\times25} \Rightarrow h=\frac{112}{5}=22\frac{2}{5}\text{ cm}$$

15. (c); Part of the tank will be filled in 1 hr = $\frac{1}{36}+\frac{1}{45}=\frac{9}{180}=\frac{1}{20}$

$\therefore$ Required time = 20 hr

16. (c); In 1 minute the pipe of 2 cm fills $\frac{1}{61}\times\frac{1}{4}$ of the cistern

In 1 min the pipe of $1\frac{1}{3}$ cm diameter fill $\frac{1}{61}\times\frac{4}{9}$ of the cistern

In 1 min the pipe of 1 cm diameter fill $\frac{1}{61}$ of the cistern.

$$\therefore \quad \frac{1}{61\times4}+\frac{1}{61}\times\frac{4}{9}+\frac{1}{61}=\frac{9+16+36}{9\times4\times61}=\frac{61}{36\times61}=\frac{1}{36}$$

$\therefore$ The whole is filled with 36 minutes.

17. (c); Part of the tank will be filled, by both pipe in 1 hr

$$=\frac{1}{20}\times\frac{1}{30}=\frac{5}{60}=\frac{1}{12}$$

$\therefore$ In 1 hr the leak will empty the part of tank $= \frac{1}{12} \times \frac{1}{3} = \frac{1}{36}$

And to fill $\frac{1}{3}$ of the tank, both pipe will take $= \frac{12}{3} = 4$ hr.

to fill other $\frac{2}{3}$ part of the tank, it will take

$$= \frac{2}{3} \times \frac{1}{\frac{1}{20} + \frac{1}{30} - \frac{1}{36}} = \frac{2}{3} \times \frac{1}{\frac{9+6-5}{180}} = \frac{2}{3} \times \frac{180}{10} = 12 \text{ hr}$$

$\therefore$ Total time = (12 + 4) hr = 16 hr

18. (b); Part of tank will be full in 1 hr $= \frac{1}{4} + \frac{1}{6} - \frac{1}{8} = \frac{6+4-3}{24} = \frac{7}{24}$

$\therefore$ Required time $= \frac{24}{7} = 3\frac{3}{7}$ hrs.

19. (b); Let first pipe can fill the reservoir in x hr

$\therefore$ Second pipe will fill it in (x + 5) hr

$$\therefore \quad \frac{1}{x} + \frac{1}{x+5} = \frac{1}{6} \Rightarrow \frac{x+5+x}{x(x+5)} = \frac{1}{6}$$

$6(2x + 5) = x^2 + 5x \Rightarrow 12x + 30 = x^2 + 5x$

$x^2 - 7x - 30 = 0 \Rightarrow x^2 - 10x + 3x - 30 = 0$

$(x + 3)(x - 10) = 0 \Rightarrow x = 10$ hrs

20. (b); Let x, y and z be time to fill the cistern by pipes, A, B and C respectively. The part of the tank will be filled in 2 hr by all the pipe $= 2 \times \left(\frac{1}{6}\right) = \frac{1}{3}$

Remaining part $= 1 - \frac{1}{3} = \frac{2}{3}$

$\therefore$ Time taken by pipe A and B together to fill the tank

$= 8 \times \frac{3}{2} = 12$ hour

$\therefore$ by pipe C alone to fill the tank $= \frac{1}{6} - \frac{1}{12} = \frac{1}{12}$

$\therefore$ Required time = 12 hr

Difficult

1. **(d);** Let x be the time, after that B be closed so that the tank is full in 18 min.

$\therefore \frac{18}{24} + \frac{x}{32} = 1 \Rightarrow \frac{72 + 3x}{96} = 1$

$72 + 3x = 96 \Rightarrow 3x = 24 \Rightarrow x = 8$ min

2. **(c);** Part of the tank will be empty in 1 hr

$= \frac{1}{10} + \frac{1}{15} - \frac{1}{12} = \frac{6+4-5}{60} = \frac{5}{60} = \frac{1}{12}$

$\therefore$ Required time = 12 hr

3. **(d);** In 30 min the part of the tank will be filled by both tap $= \frac{30}{36} = \frac{5}{6}$

$\therefore$ Required part $= 1 - \frac{5}{6} = \frac{1}{6}$

$\therefore \frac{1}{6}$ part of the tank will be filled by pipe A in 10 min

$\therefore$ tap A will take 60 min. to fill the tank

$\therefore$ Pipe B will take time to fill the tank

$= \frac{1}{36} - \frac{1}{60} = \frac{5-3}{180} = \frac{2}{180} = \frac{1}{90}$

Hence B will take 90 min to fill the tank.

4. **(d);** The part of tank that will filled in

$$2\text{ min} = \frac{1}{45} - \frac{1}{60} = \frac{4-3}{2} = \frac{1}{180}$$

Part of the tank $\left(1 - \frac{1}{45} = \frac{44}{45}\right)$ will be filled in

$$= \frac{176}{180} \times 180 \times 2 = 352\text{ min}$$

And $\frac{1}{45}$ of the tank will be filled in 1 min

$\therefore$ Total time = (352 + 1) min = 353 min = 5 hr 53 min

5. **(d);** Let time = x

$$\therefore \frac{5}{20} + \frac{(x+5)}{60} = 1 \Rightarrow \frac{15+x+5}{60} = 1$$

$20 + x = 60 \Rightarrow x = 40$ min

6. **(b);** (A's 1 hour work) + (A + B)'s 1 hour work

$$\frac{1}{3} + \left(\frac{1}{3} + \frac{1}{4}\right) = \frac{11}{12}$$

At 5'o' clock $\frac{11}{12}$ part of the cistern is filled.

Total discharge if all the pipes opened

$$= 1 - \left(\frac{1}{3} + \frac{1}{4}\right) \Rightarrow \frac{12-(3+4)}{12} = \frac{5}{12}$$

Time required to empty $\frac{11}{12}$ part of the tank = $\frac{\frac{11}{12}}{\frac{5}{12}} = \frac{11}{15} = 2.2$ hr.

Hence required time = 7.12 PM

7. (c); Part of the tank will be filled in 1 min

$$= \frac{1}{30}+\frac{1}{20}+\frac{1}{10} = \frac{2+3+6}{60} = \frac{11}{60}$$

In 3 min the part of the tank will be filled = $\frac{33}{60} = \frac{11}{20}$

Part of the solution R in the liquid after 3 min = $\dfrac{\frac{3}{10}}{\frac{11}{20}} = \frac{60}{110} = \frac{6}{11}$

8. (b); Part of tank will be filled by both pipe A and B in

1 hr = $\frac{2}{3}\times\frac{1}{8} = \frac{1}{12}$

$\therefore$ Required time = $\frac{12}{2-1}$ = 12 hr

9. (d); Part of the tank that will fill the tank in 1 hr by all these pipes =

$$\frac{1}{2}\left(\frac{1}{6}+\frac{1}{10}+\frac{2}{15}\right) = \frac{1}{5}$$

So, tank will be filled in 5 hour

10. (a); Let tank is filled in x hours

$$\frac{x}{15}+\frac{x}{20}-\frac{10}{25}=1 \quad\Rightarrow\quad \frac{20x+15x-120}{300}=1$$

$35x = 300 + 120 \quad\Rightarrow\quad x = \frac{420}{35} = 12$

Therefore tank is filled in 12 hours

11. (d); (A's 1 hour work) + (A + B)'s 1 hour work = $\frac{1}{10}+\left(\frac{1}{10}+\frac{1}{12}\right) = \frac{17}{60}$

Remaining part = $1-\frac{17}{60} = \frac{43}{60}$

Now (A + B + C)'s 1 hour work = $\frac{1}{10}+\frac{1}{12}+\frac{1}{15}=\frac{1}{4}$

$\frac{1}{4}$ part is filled by then in $\left(4\times\frac{43}{60}\right)$ = 2 hr 52 min

$\therefore$ Total time = 2 + 2 hr 52 min = 4 hr 52 min

12. (a); Part of the tank that will filled when all the pipes are open in 3 min = $\frac{1}{20}+\frac{1}{30}-\frac{1}{15}=\frac{3+2-4}{60}=\frac{1}{60}$

$\left[\left(1-\frac{1}{20}-\frac{1}{30}\right)=\frac{55}{60}\right]$ part of the tank will be filled in = 55 × 3

= 165 min

Remaining part = $1-\frac{55}{60}=\frac{1}{12}$

Tap A fills $\frac{1}{20}$ part in 1 min

Remaining part = $\frac{1}{12}-\frac{1}{30}=\frac{1}{30}$

$\frac{1}{30}$ th part is filled by B in 1 min.

$\therefore$ Total time = (165 + 1 + 1) = 167 min.

13. (c); Let A can fill the tank = x

$\therefore$ B will fill the tank = $\frac{x}{2}$

$\therefore$ C will fill the tank = $\frac{x}{4}$

$\therefore \frac{4}{x}+\frac{2}{x}+\frac{1}{x}=\frac{1}{5} \Rightarrow \frac{7}{x}=\frac{1}{5} \Rightarrow x = 35$ hrs

14. (d); Let total time = x

$$\therefore \quad \frac{4}{15}+\frac{x}{20}=1 \Rightarrow \frac{16+3x}{60}=1 \Rightarrow 3x = 60 - 16$$

$$x = \frac{44}{3}\text{min} \Rightarrow \frac{44}{3}\times 60 \text{ sec} = 880 = 14 \text{ min } 40 \text{ sec}$$

15. (d); In one hour the part of the tank will be filled

$$=\frac{1}{12}+\frac{1}{15}=\frac{5+4}{60}=\frac{9}{60}$$

In second hour part of the tank will be filled

$$=\frac{1}{12}+\frac{1}{20}=\frac{5+3}{60}=\frac{8}{60}$$

$$\therefore \text{ In two hour part of the tank will be filled } = \frac{9}{60}+\frac{8}{60}=\frac{17}{60}$$

In 6 hour part of the tank will be filled = $\frac{51}{60}$

Remaining part = $1-\frac{51}{60}-\frac{9}{60} = \frac{3}{20}$

$$\therefore \text{ Remaining part will be filled in } = \frac{\frac{3}{20}}{\frac{9}{60}}$$

$$=\frac{3}{20}\times\frac{60}{9}=1 \text{ hr}; \qquad \therefore \text{ Total time } = (6+1) = 7 \text{ hr.}$$

16. (a); Let the filling capacity of the tank = x m^3/min

Emptying capacity of the tank = (x + 10) m^3/min

$$\therefore \quad \frac{2400}{x}-\frac{2400}{(x+10)}=8 \Rightarrow x^2+10x-3000=0$$

$$(x-50)(x+60)=0 \Rightarrow x = 50 \text{ m}^3/\text{min}$$

17. (d); Work done by the inlet in 1 hr $= \frac{1}{8} - \frac{1}{12} = \frac{1}{24}$

Work done by the inlet in 1 min $= \frac{1}{24} \times \frac{1}{60} = \frac{1}{1440}$

Volume of $\frac{1}{1440}$ part = 6 litres

Volume of tank = 6 × 1440 = 8640 litres

18. (c); Part of the tank will be empty by waste pipe in

1 min $= \frac{1}{20} + \frac{1}{24} - \frac{1}{15} = \frac{6+5-8}{120} = \frac{3}{120} = \frac{1}{40}$

capacity of tank = 40 × 3 = 120 gallons.

19. (c); Part of the tank will be filled in = 2 hr $= \frac{2}{6} = \frac{1}{3}$

∴ Remaining part $= 1 - \frac{1}{3} = \frac{2}{3}$

∴ together (A + B) can fill the tank $= \frac{7}{2} \times 3 = \frac{21}{2}$

∴ C's 1 hour work $= \frac{1}{6} - \frac{2}{21} = \frac{1}{14}$

Required time = 14 hrs

20. (a); Let after x minute the pipe B should be closed

$$\frac{20}{24} + \frac{x}{48} = 1 \Rightarrow \frac{40+x}{48} = 1 \Rightarrow 40 + x = 48 \Rightarrow x = 8$$

Previous Year (Memory Based)

1. (b); Let after x min. The first tap was closed.

Then, $\frac{x}{20}+\frac{18}{30}=1 \Rightarrow \frac{3x+36}{60}=1$

$3x + 36 = 60, \quad x = 8$ min

2. (d); Let x is the required time.

According to question

$$\frac{3}{12}+\frac{x+3}{15}=1 \Rightarrow \frac{15+4x+12}{60}=1$$

$$4x + 27 = 60 \Rightarrow 4x = 33$$

$$x = \frac{33}{4} \Rightarrow x = 8\frac{1}{4}$$

3. (d); Let first pipe takes x min to fill the tank then Second pipe will take 3x time to fill it

$$\therefore \frac{1}{3x}+\frac{1}{x}=\frac{1}{36} \Rightarrow \frac{1+3}{3x}=\frac{1}{36}$$

$$4 \times 12 = x \Rightarrow x = 48$$

Required time = 3 × 48 = 144 = 2 hr 24 min

4. (c); Part of the tank filled with both taps in 1 h = $\frac{1}{12}-\frac{1}{20}=\frac{5-3}{60}=\frac{1}{30}$

Required time to fill the tank completely = 30 hr.

Required time = $\frac{30}{2}$ = 15 hr

5. (a); Part of the tank will be empty in 15 min = $\frac{15}{60}=\frac{1}{4}$

Part of the tank Remained = $\frac{2}{3}-\frac{1}{4}=\frac{5}{12}$

Part of the tank that have to be filled $= 1 - \frac{5}{12} = \frac{7}{12}$

Required time $= \dfrac{\frac{7}{12}}{\frac{1}{40}} = \dfrac{40 \times 7}{12} = \dfrac{20}{6} \times 7 = \dfrac{140}{6} = 23\frac{1}{3}$

6. (c); Part of the tank will empty by tap C in 1 min

$= \frac{1}{20} + \frac{1}{24} - \frac{1}{15} = \frac{6+5-8}{120} = \frac{3}{120}$

Tap C will empty the tank in 120 min

Capacity of four 120 × 6 = 720 gallon

7. (d); Let us check option wise.

(i) Q opened alone required time = 8 hr

(ii) P and S are opened

$\frac{1}{4} - \frac{1}{10} = \frac{10-4}{40} = \frac{6}{40} = \frac{3}{20}$

Required time = 6.67 hr

(iii) P, R and S are opened $= \frac{1}{4} + \frac{1}{12} - \frac{1}{10} = \frac{15+5-6}{60} = \frac{14}{60} = \frac{7}{30}$

Required time = 4.28 hr

(iv) P, Q and S are opened $= \frac{1}{4} + \frac{1}{8} - \frac{1}{10} = \frac{10+5-4}{40} = \frac{11}{40}$

Required time $= \frac{40}{11} = 3.636$ hr

So by option conclude that (d) is correct.

8. **(d);** Part of the tank that will fill when both pipe are opened

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

$$\therefore \text{ Required time } = \frac{xy}{y-x} h$$

9. **(b);** Part of the tank that will empty in 1 h = $\frac{1}{3} - \frac{2}{7} = \frac{7-6}{21} = \frac{1}{21}$

Required time = 21 h

10. **(b);** Part of the tank is filled when both pipes are opened in 1 hour

$$= \frac{1}{15} - \frac{1}{30} = \frac{2-1}{30} = \frac{1}{30}$$

$\therefore$ Required time to fill half of the tank = $\frac{30}{2}$ = 15 min

11. **(b);** Part of the cistern will be filled up when all the taps are opened

in 1 h = $\frac{1}{3} + \frac{1}{4} - \frac{1}{5} = \frac{20+15-12}{60} = \frac{23}{60}$

$$\therefore \text{ Required time } = \frac{60}{23} = 2\frac{14}{23}$$

12. **(c);** Let in x h the tank will be filled up completely

$$\frac{x}{2} + \frac{(x-1)}{6} = 1 \Rightarrow \frac{3x+x-1}{6} = 1 \Rightarrow 4x - 1 = 6$$

$$4x = 7 \Rightarrow x = \frac{7}{4}\text{hr} \Rightarrow x = \frac{7}{4} \times 60$$

$$x = 105 \Rightarrow x = 1 \text{ hr } 45 \text{ min}$$

$\therefore$ Exact time = 11 : 45

13. (c); Part of the tank will be filled up when two pipes are opened alternatively in 2h $= \frac{1}{4} + \frac{1}{6} = \frac{6+4}{24} = \frac{10}{24} = \frac{5}{12}$

In 4 hr the part of the tank will be filled up $= \frac{10}{12}$

Remaining part $= 1 - \frac{10}{12} = \frac{2}{12} = \frac{1}{6}$

Time required to fill $\frac{1}{6}$ part of the tank by pipe A $= \frac{1}{6} \times 4 = \frac{2}{3}$

$\therefore$ Required time $= 4 + \frac{2}{3} = \frac{14}{3} = 4\frac{2}{3}$

14. (b); Part of the cistern, emptied in 1 h $= \frac{1}{5} - \frac{1}{8} = \frac{8-5}{40} = \frac{3}{40}$

Since, $\frac{3}{40}$ part is emptied in 1hr.

$\therefore$ $\frac{3}{4}$ part is empted in; $\frac{40}{3} \times \frac{3}{4} = 10h$

15. (b); Part of the tank will be filled when all the taps are opened in 1 hr $= \frac{1}{10} + \frac{1}{12} - \frac{1}{6} = \frac{6+5-10}{60} = \frac{1}{60}$

Time to fill one fourth of the tank $= \frac{60}{4} = 15$ hr

$\therefore$ Exact time = 10 PM

16. (d); Time taken to fill up half tank = 3 hr

After half an hour time required to fill the tank

$= \frac{1}{2} \times \frac{6}{4}$ hr $= \frac{3}{4}$, $\therefore$ Total time $= 3 + \frac{3}{4} = \frac{15}{4}$ hr

$= \frac{15}{4} \times 60$ min = 225 min = 3 hr 45 min

17. (c); Part of the tank emptied by tap C in 1 hr

$$= \frac{1}{10}+\frac{1}{12}-\frac{1}{20} = \frac{6+5-3}{60} = \frac{8}{60}$$

$\therefore$ Capacity of tank = $\frac{60}{8}\times 6 = 45$ gallons

18. (d); Given, part of cistern filled by A = 40 min
and emptied by B = 60 min
Part of the cistern filled in 1 min by both the taps

$$= \frac{1}{40}-\frac{1}{60} = \frac{3-2}{120} = \frac{1}{120}$$

Hence, empty cistern will be filled in 120 min

19. (b); Part of the tank will be filled-up by both pipe A and B in 2 hr

$$= 2\left(\frac{1}{6}+\frac{1}{8}\right) = 2\left(\frac{14}{48}\right) = 2\left(\frac{7}{24}\right) = \frac{14}{24}$$

Remaining part = $1-\frac{14}{24} = \frac{10}{24} = \frac{5}{12}$

Required time = $\frac{5}{12}\times\frac{8}{1} = \frac{40}{12} = \frac{10}{3} = 3\frac{1}{3}$

20. (b); Given, tank filled by P = 5 h,
tank filled by Q = 6 h
and tank emptied by C = 3 h
Part of tank filled in 1 h when all three pipes are opened

$$= \frac{1}{5}+\frac{1}{6}-\frac{1}{3} = \frac{6+5-10}{30} = \frac{1}{30}$$

Hence, the tank will be filled in 30 h.

Two fifth of the tank will be filled in = $30\times\frac{2}{5} = 12$ h

i.e., the tank will be filled at 7 pm

Adda 247

50 MUST DO QUESTIONS of

TIME & DISTANCE

PRACTICE eBOOK

PREFACE

Banking examinations have evolved a lot from 2016, with changes in pattern now Banking recruitment exams are dynamic in lieu of their conventional hold. ADDA 247 is proud to present you the new constructive eBook which caters to the need of ever-progressing demands and pattern for the upcoming examinations. The eBook is designed meticulously by the most prominent individuals in this sector and promises to provide you with an escapade that will broaden your horizons. We should never be confined by the limits of our brain and this eBook which is thoroughly revised and covers every crucial aspect of the examination assures you that it will help you in transcending your limits. Our ultimate aim is to help students develop de rigueur skills for success with proper approach.

Quantitative aptitude is one section which finds itself at the heart of this examination. Solving **Time & Distance** problems can sometimes be an uphill task; therefore **ADDA 247** presents you an eBook of **Time & Distance** for banking examination which will serve as an elixir for our Banking aspirants. This eBook attempts to cover every major type of **Time & Distance** problems which have previously graced the Banking exams with the hope to equip candidates with basic knowledge of what to expect in the upcoming Banking and exam 2017. In this edition of **eBook** there are **50 questions based on Time & Distance.**

The aim of this book is to help students learn and understand the new pattern of banking recruitment exam which will help them to maximize their scores in the competitive examination. Desire is the key to motivation, but it's determination and commitment to an unrelenting pursuit of your goal - a commitment to excellence - that will enable you to attain the success you seek. This eBook is designed so that you can unlock your hidden potentials.

"A pessimist sees the difficulty in every opportunity; an optimist sees the opportunity in every difficulty."

- **Sir Winston Leonard Spencer/Churchill**

Team Adda247

TIME & DISTANCE

1. In covering a distance of 30 km, Amit takes 2 hours more than Suresh. If Amit doubles his speed, then he would take 1 hour less than Suresh. Amit's speed is:
(a) 5 Km/h (b) 7.5 Km/h
(c) 6 Km/h (d) 6.25 Km/h
(e) None of these
2. Two cars are running along the same road. The first one, which is running at the rate of 30 km/h, starts 6 hours ahead of the second one, which is running at the rate of 50 km/h. How long will it take the second car to catch up with the first one?
(a) 6 hrs (b) 9 hrs
(c) 12 hrs (d) 15 hrs
(e) None of these
3. Two trains of equal length are running on parallel lines in the same direction at 46 Km/h and 36 Km/h. The faster train passes the slower train in 36 s. The length of each train is:
(a) 50 m (b) 80 m
(c) 72 m (d) 82 m
(e) None of these
4. It takes eight hours for a 600 Km journey, if 120 km is done by train and the rest by car. It takes 20 minutes more, if 200 km is done by train and the rest by car. The ratio of the speed of the train to the speed of the car is:
(a) 4 : 3 (b) 3 : 4
(c) 3 : 2 (d) 2 : 3
(e) None of these
5. A train can travel 20% faster than a car. Both start from the point A at the same time and reach point B 75 Km away from A

at the same time. On the way, however, the train lost about 12.5 minutes while stopping at the stations. The speed of the car is:

(a) 50 km/h (b) 55 km/h

(c) 60 km/h (d) 65 km/h

(e) None of these

6. Wheels of diameters 7 cm and 14 cm start rolling simultaneously from X and Y, which are 1980 cm apart, towards each other in opposite directions. Both of them make same number of revolutions per second. If both of them meet after 10 s, the speed of the smaller wheel is:

(a) 22 cm/s (b) 44 cm/s

(c) 66 cm/s (d) 132 cm/s

(e) None of these

7. An express train travelled at an average speed of 100 km/h, stopping for 3 minutes after every 75 km. A local train travelled at a speed of 50 km/h, stopping for 1 minute after every 25 km. If the trains began travelling at the same time, then how many kilometers did the local train travel in the time it took the express train to travel 600 km?
(a) 307.5 km (b) 900 km
(c) 1200 km (d) 1000 km
(e) None of these

8. A circular running path is 726 m in circumference. Two men start from the same point and walk in opposite directions @ 3.75 km/h and 4.5 km/h respectively. When will they meet for the first time?
(a) 5.5 minutes (b) 6.0 minutes
(c) 5.28 minutes (d) 4.9 minutes
(e) None of these

9. A train 100 m long passes a bridge at the rate of 72 km/h in 25 s. The length of the bridge is:
(a) 150 m (b) 400 m
(c) 300 m (d) 200 m
(e) None of these

10. A train 110 m in length travels at 60 km/h. How much time does the train take in passing a man walking at 6 km/h towards the train?
(a) 6 seconds (b) 12 seconds
(c) 16 seconds (d) 18 seconds
(e) None of these

11. Walking at three-fourths of his usual pace, a man reaches his office 20 minutes late. Find out his usual time.
(a) 1 hr (b) 2 hrs
(c) 3 hrs (d) 4 hrs

(e) None of these

12. Two trains travelling in the same direction at 40 km/h and 22 km/h completely pass each other in 1 min. If the length of the first train is 125 m, what is the length of the second train?
(a) 125 m (b) 150 m
(c) 175 m (d) 200 m
(e) None of these

13. A train T_1 starts from Ahmedabad to Mumbai at 7 a.m. and reaches at 12 noon. A second train T_2 starts at 7 a.m. from Mumbai reaches Ahmedabad at 1 p.m. when did the two trains cross each other?
(a) 10.13 a.m. (b) 10.00 a.m.
(c) 9.43 a.m. (d) 9.35 a.m.
(e) None of these

14. Dinesh travels 760 km to his home, partly by train and partly by car. He takes 8 hrs. if he travels 160 km by train and the rest by car. He takes 12 minutes more if he travels 240 km by train and the rest by car. The speeds of the train and the car respectively are:
(a) 80 km/h, 100 km/h (b) 100 km/h, 80 km/h
(c) 120 km/h, 100 km/h (d) 100 km/h, 120 km/h
(e) None of these

15. A bus covered a distance of 250 km, partly at an average speed of 40 km/h and partly at 60 km/h. If the total time taken is 5 hrs, then the distance covered at 40 km/h is:
(a) 130 km (b) 120 km
(c) 100 km (d) 125 Km
(e) None of these

16. Two identical trains A and B running in opposite directions at same speed take 2 minutes to cross each other completely. The

number of bogies of A are increased from 12 to 16. How much more time would they now require to cross each other?

(a) 40 s (b) 50 s
(c) 60 s (d) 20 s
(e) None of these

17. A train 270 m long is moving at a speed of 25 km/h. It will cross a man coming from opposite direction at a speed of 2 km/h in:

(a) 10 sec (b) 36 sec
(c) 20 sec (d) 18 sec
(e) None of these

18. A dog takes 4 leaps for every five leaps of a hare, but three leaps of dog are equal to four leaps of hare. Compare their speeds.

(a) 16 : 15 (b) 17 : 18
(c) 19 : 20 (d) 18:17
(e) None of these

19. A train running at the speed of 20 m/s crosses a pole in 24 second less than the time it requires to cross a platform thrice its length at the same speed. What is the length of the train?

(a) 270 m (b) 340 m
(c) 180 m (d) 160 m
(e) None of these

20. Two boys A and B start at the same time to ride from Delhi to Meerut, 60 km away. A travels 4 km an hour slower than B. B reaches Meerut and at once turns back meeting A 12 km from Meerut. The speed of A was:

(a) 4 km/h (b) 8 km/h
(c) 12 km/h (d) 16 km/h
(e) None of these

21. A hare pursued by a hound is 30 m before the hound at starting. Whilst the hare takes 4 leaps the hound takes 3 in one second. In

one leap the hare goes $1\frac{1}{2}$ m and the hound $2\frac{1}{2}$ m. How far will the hare have gone when the hound will catch the hare?

(a) 60 m (b) 120 m
(c) 90 m (d) 100 m
(e) None of these

22. The radius of the wheel of a vehicle is 70 cm. The wheel makes 10 revolutions in 5 s. The speed of the vehicle is:

(a) 29.46 km/h (b) 31.68 km/h
(c) 36.25 km/h (d) 32.72 km/h
(e) None of these

23. Two cyclists start from the same place in opposite directions. One goes towards North at 18 km/h and the other goes towards South at 20 km/h. What time will they take to be 47.5 km apart?

(a) $2\frac{1}{4}$ hrs. (b) $1\frac{1}{4}$ hrs.
(c) $2\frac{1}{3}$ hrs. (d) $3\frac{1}{4}$ hrs
(e) None of these

24. A certain distance is covered at a certain speed. If half of this distance is covered in double the time, the ratio of the two speeds is:

(a) 4 : 1 (b) 1 : 4
(c) 2 : 1 (d) 1 : 2
(e) None of these

25. A train covers a distance in 50 minutes, if it runs at a speed of 48 km/h on an average. The speed at which the train must run to reduce the time of journey to 40 minutes, will be:

(a) 50 km/h (b) 55 km/h
(c) 60 km/h (d) 70 km/h
(e) None of these

26. A man covers a certain distance on a toy train. If the train moved 4 km/h faster, it would take 30 minutes less. If it moved

2 km/h slower, it would have taken 20 minutes more. Find the distance.
(a) 60 km (b) 45 km
(c) 30 km (d) 20 km
(e) None of these
27. Two goods trains each 500 m long are running in opposite directions, on parallel tracks. Their speeds are 45 km/h and 30 km/h respectively. Find the time taken by the trains to cross each other.
(a) 60 s (b) 48 s
(c) 24 s (d) 12 s
(e) None of these
28. Two trains running in the same direction at 60 km/h and 42 km/h completely pass one another in 1 min. If the length of the first train is 100 m, the length of the second train is:
(a) 125 m (b) 150 m
(c) 175 m (d) 200 m
(e) None of these
29. A man covers a certain distance on scooter. Had he moved 3 km/h faster, he would have taken 40 minutes less. If he had moved 2 km/h slower, he would have taken 40 minutes more. The distance (in km) is:
(a) 20 (b) 36
(c) 37.5 (d) 40
(e) None of these
30. The average speed of a train is 20% less on the return journey than on the onward journey. The train halts for half an hour at the destination station before starting on the return journey. If the total time taken for the to and fro journey is 23 hrs, covering a distance of 1000 km, the speed of the train on the return journey is:

(a) 60 km/h (b) 40 km/h
(c) 50 km/h (d) 55km/h
(e) None of these

31. A train running at 7/11of its own speed reached a place in 22 hrs. How much time could be saved if the train runs at its own speed?
(a) 7 hrs (b) 8 hrs
(c) 14 hrs (d) 16 hrs
(e) None of these

32. A train travelling at 48 km/h completely crosses another train having half its length and travelling in opposite direction at 42 km/h in 12 s. It also passes a railway platform in 45 s. The length of the platform is:
(a) 400 m (b) 450 m
(c) 560 m (d) 600 m
(e) None of these

33. A train travelling at 100 km/h overtakes a motorbike travelling at 64 km/h in 40 s. What is the length of the train in metres?
(a) 400 (b) 1822
(c) 1777 (d) 1111
(e) None of these

34. A train started from station A and proceeded towards station B at a speed of 48 km/h. 45 minutes later, another train started from station B and proceeded towards station A at 50 km/h. If the distance between the two stations is 232 km, at what distance from station A will the trains meet?
(a) 108 km (b) 144 km
(c) 132 km (d) 100 Km
(e) None of these
35. Two buses, one moving towards North and the other towards South, leave the same place at the same time. The speed of one of them is greater than that of the other by 5 km/h. At the end of 2 hrs, they are at a distance of 50 km from each other. The speed of the bus going slower is
(a) 15 km/h (b) 12 km/h
(c) 10 km/h (d) 20 km/h
(e) None of these
36. Excluding stoppages, the speed of a bus is 54 km/h and including stoppages, it is 45 km/h. For how many minutes does the bus stop per hour?
(a) 12 (b) 10
(c) 9 (d) 20
(e) None of these
37. A car starts running with the initial speed of 40 km/h, with its speed increasing every hour by 5 km/h. How many hrs will it take to cover a distance of 385 km?
(a) 9 hrs (b) $9\frac{1}{2}$ hrs
(c) $8\frac{1}{2}$ hrs (d) 7 hrs
(e) None of these
38. A train starts from Delhi at 6 : 00 a.m. and reaches Ambala Cantt at 10 a.m. The other train starts from Ambala Cantt at 8 a.m. and

reaches Delhi at 11 : 30 a.m. If the distance between Delhi and Ambala Cantt is 200 km, then at what time did the two trains meet each other?

(a) 8 : 56 a.m. (b) 8 : 46 a.m.
(c) 7 : 56 a.m. (d) 8 : 30 a.m.
(e) None of these

39. A train with 90 km/h crosses a bridge in 36 s. Another train 100 m shorter crosses the same bridge at 45 km/h. What is the time taken by the second train to cross the bridge?

(a) 61 seconds (b) 63 seconds
(c) 62 seconds (d) 64 seconds
(e) None of these

40. A man has to cover a distance of 6 km in 45 min. If he covers one-half of the distance in $\frac{2}{3}^{rd}$ time, what should be his speed to cover the remaining distance in the remaining time?

(a) 12 km/h (b) 16 km/h
(c) 3 km/h (d) 8 km/h
(e) None of these

41. A runs $1\frac{2}{3}$ times as fast as B. If A gives B a start of 80 m. How far must the winning post be from the starting point of A so that A and B reach it at the same time?

(a) 300 m (b) 200 m
(c) 270 m (d) 160 m
(e) None of these

42. Two trains 100 m and 80 m long, run at the rate of 30 km/h and 50 km/h respectively on parallel rails. How long will it take a man sitting in the second train to pass first train if they run in opposite direction?

(a) 2.4 seconds (b) 4.5 seconds
(c) 8.3 seconds (d) 11.2 seconds

(e) None of these

43. A car travelled 75% of the distance from town A to B by travelling at T hours at an average speed of V km/h. The car travels at an average speed of S km/h for the remaining part of the trip. Which of the following expressions represents the average speed for the entire trip?

(a) $\frac{12VS}{V+S}$
(b) $\frac{4VS}{3S+V}$
(c) $\frac{VT}{3S}$
(d)
(e) None of these

44. A lives on 9th floor and B lives on 44th floor. A goes up at a rate of 34 floors per minute and B comes down at a rate of 36 floors per minute. At which floor they will meet?

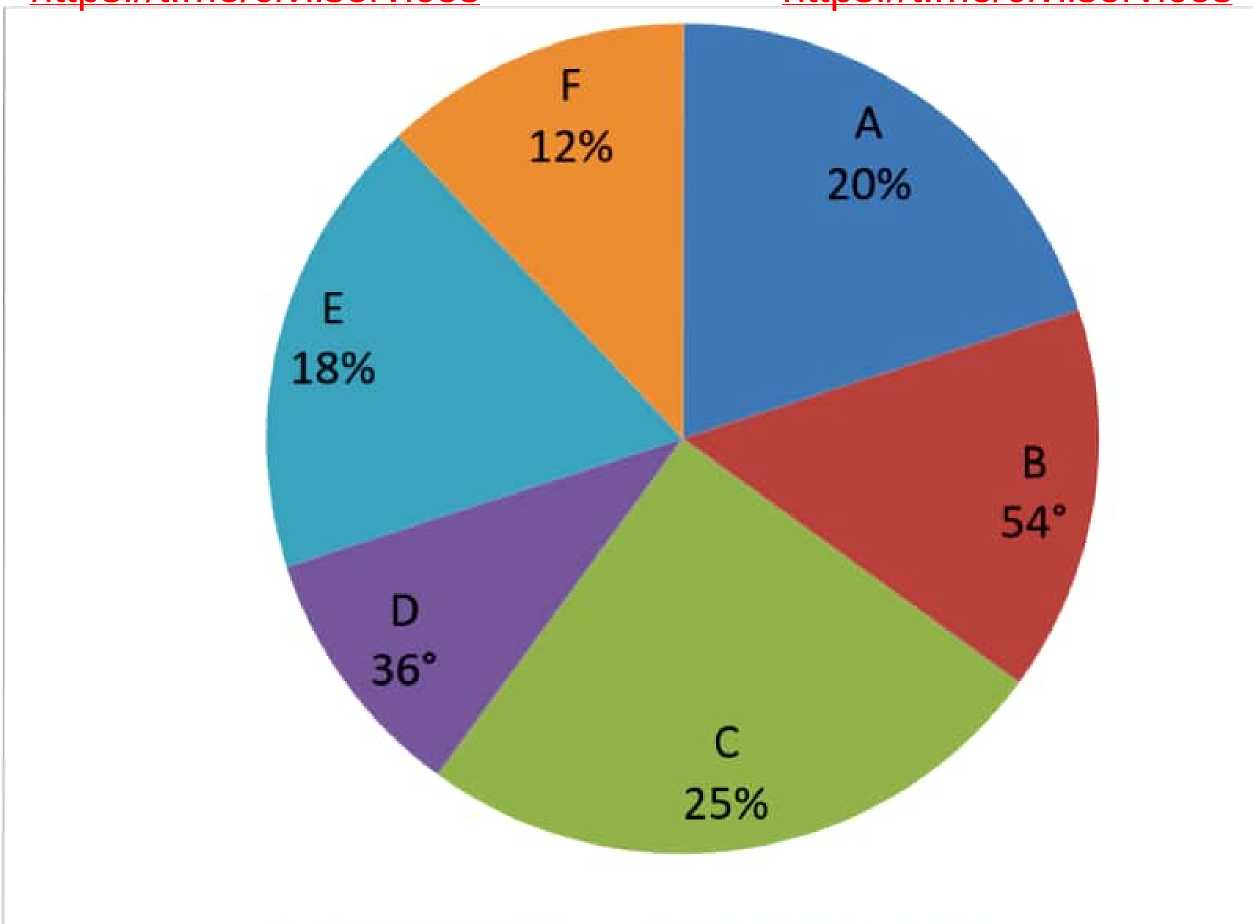
(a) 27
(b) 26
(c) 18
(d) 32
(e) None of these

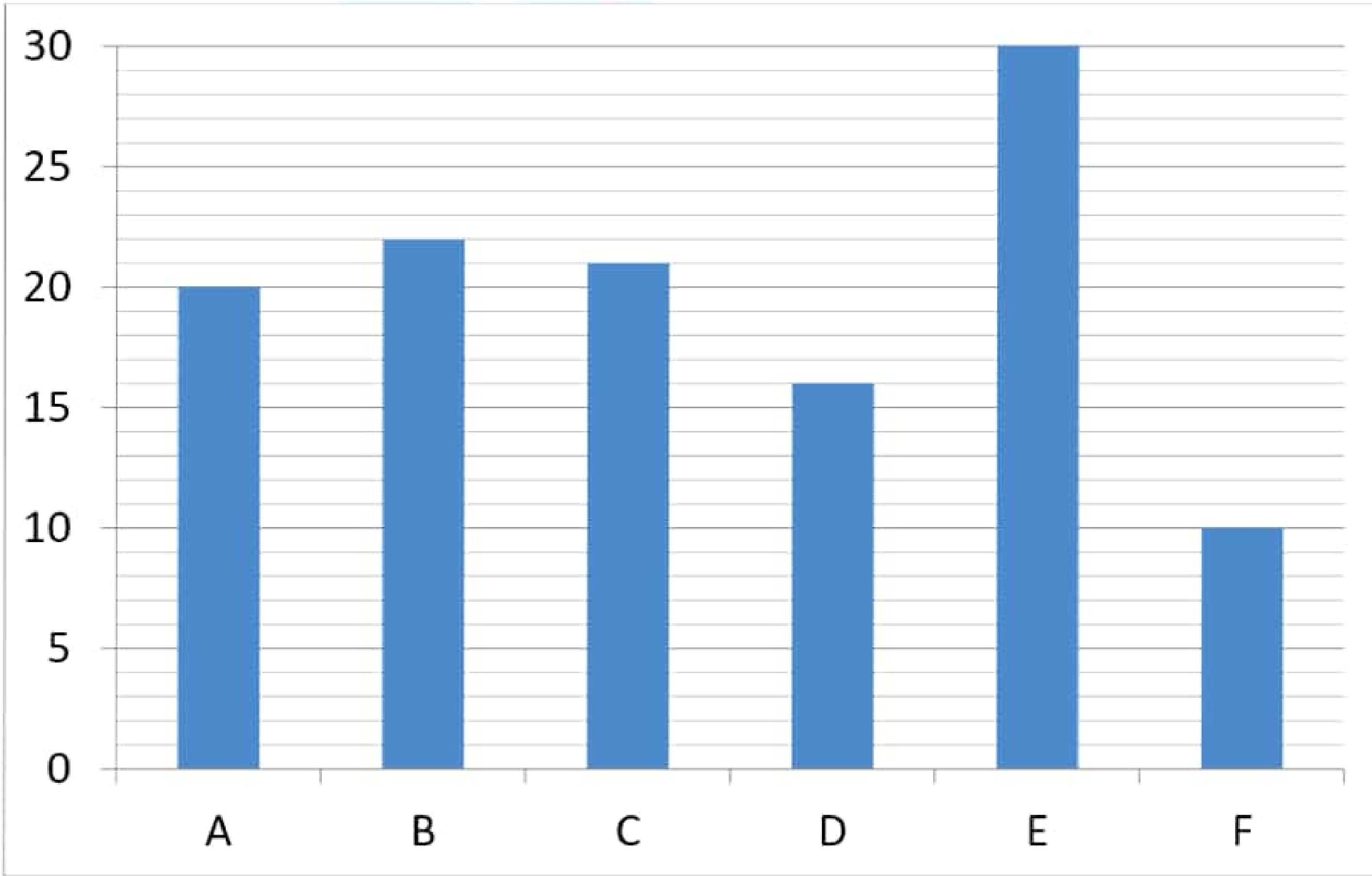
45. Train X starts at 6.00 a.m. from a certain station with P Km/h and train Y starts at 8.30 a.m. from the same station at Q km/h. If Q > P, then how many hours will train Y take to overtake train X?

(a) $\frac{5P}{2(Q-P)}$ hrs
(b) $\frac{2P}{5(Q-P)}$ hrs
(c) $\frac{2(Q-P)}{5P}$ hrs
(d) $\frac{5(Q-P)}{2P}$ hrs
(e) None of these

Direction (46-50): Study the following pie chart and bar graph and answer the following question

The following pie chart shows the percentage distance travelled by six persons A, B, C, D, E and F on Car and Motorbike together in 2010. The bar graph shows the percentage distance travelled by these persons on Car only.


F
12%
A
20%
E
18%
B
54°
D
36°
C
25%


30
25
20
15
10
5
0
A
B
C
D
E
F

46. What is the average speed of A if the total distance travelled by all of them is 600 km and the ratio of speed of A's Car to the speed of his Motorbike is 1 : 4 and the difference between these speeds is 72 km/hr?
(a) 30
(b) 45
(c) 60
(d) 80
(e) None of these
47. What is the total distance travelled by all of them on car only if distance travelled by all of them on Car and Motorbike together is 800 km (closest to).
(a) 166
(b) 165
(c) 168
(d) 170
(e) 172
48. Who travelled the maximum distance on motorbike if total distance covered by all of them together on car and motorbike together is 700.
(a) D
(b) A
(c) C
(d) F
(e) E
49. What is the difference between the distance travelled by A on Car and distance travelled by D on Motorbike if total distance is 900.
(a) 40.5
(b) 41.2
(c) 39.6
(d) 38.4
(e) None of these
50. What is the total distance travelled by A, B and C on Car and D, E and F on Motorbike if total distance covered by them on car and motorbike together is 400.
(a) 176.2
(b) 178.4
(c) 179.1
(d) 177.8
(e) None of these

SOLUTIONS

1. (a); Let Amit's speed = x km/h
& Suresh's speed = y km/h
ATQ,
$$\frac{30}{x} = \frac{30}{y} + 2 \qquad \ldots..(i)$$
If Amit doubles his speed, then
$$\frac{30}{2x} = \frac{30}{y} - 1 \qquad \ldots..(ii)$$
From eqn. (i) & (ii)
$$\frac{30}{x} - 2 = \frac{30}{2x} + 1$$
$$\Rightarrow x = 5$$
Hence, Amit's speed = 5 km/h

2. (b); Let the time taken by second car to catch up with the first one be x hr.
ATQ,
$$50x - 30(x + 6) = 0$$
$$x = 9 \text{ hr}$$

3. (a); Let the length of each train be x metre
ATQ,
$$\frac{2x}{(46-36)\times\frac{5}{18}} = 36$$
$$x = 50 \text{ m}$$

4. (b); Let speed of train be x km/h
& speed of car be y km/h
$$\frac{120}{x} + \frac{480}{y} = 8 \qquad \ldots(i)$$
$$\frac{200}{x} + \frac{400}{y} = 8\frac{1}{3} \qquad \ldots(ii)$$

Solving these equations,
$x = 60, y = 80$
Required ratio = 60 : 80 = 3 : 4

5. (c); Let speed of car be x km/h
Then, speed of train = 1.2x km/h
$\frac{75}{x} - \frac{75}{1.2x} = \frac{12.5}{60}$
$x = 60$ km/h

6. (c); Let both wheels make x revolution per second.
Circumference of first wheel $= 2 \times \frac{22}{7} \times \frac{7}{2} = 22$ cm
Circumference of second wheel $= 2 \times \frac{22}{7} \times \frac{14}{2} = 44$ cm
Distance covered by both the wheel in one second = 22x+ 44x = 66x
ATQ,
66x × 10 = 1980
⇒ x = 3
Speed of smaller wheel = 22x
$= 22 \times 3 = 66$ cm/s

7. (a); Total time express train needs to travel 75 km
$= \frac{75}{100} \times 60 + 3 = 45 + 3 = 48$ min
Time required to travel 600 km
$= 48 \times \frac{600}{75} - 3$ (Last stoppage doesn't count)
$= 384 - 3$
$= 381$ min
Time taken by local train to travel 25 km
$= \frac{25}{50} \times 60 + 1 = 30 + 1 = 31$ min
Time taken to travel 300 km
$= 31 \times \frac{300}{25} = 372$ min
In remaining 9 min, local train will cover

$= 50 \times \frac{9}{60} = 7.5$ km

Hence, total distance covered by local train

$= 300 + 7.5$

$=307.5$ km

8. (c); Men will meet for the first time after

$= \frac{726}{(3.75+4.5)\times\frac{5}{18}}$

$= 316.8\ sec = 5.28$ min

9. (b); Let the length of the bridge be x metres

ATQ,

$\frac{x+100}{72\times\frac{5}{18}} = 25$

$\Rightarrow x = 400$ metres

10. (a); Time taken by the train to pass the man

$$= \frac{110}{(60+6)\times\frac{5}{18}} = 6 \text{ sec}$$

11. (a); Let the total distance be x km

& the usual speed be y km/h

new speed $= \frac{3}{4}y$ km/h

ATQ,

$$\frac{x}{\frac{3}{4}y} - \frac{x}{y} = \frac{20}{60}$$

$$\Rightarrow \frac{x}{3y} = \frac{1}{3}$$

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

Hence, usual time is 1 hour

12. (c); Let the length of the second train be x metre

ATQ,

$$\frac{125+x}{(40-22)\times\frac{5}{18}} = 60$$

x = 175 metre

13. (c); Let the distance between Mumbai & Ahmadabad be x km

T_1's speed $= \frac{x}{5}$ km/h

T_2's speed $= \frac{x}{6}$ km/h

They will meet after,

$$= \frac{x}{\frac{x}{5}+\frac{x}{6}} = \frac{30}{11}\ hrs$$

= 2hrs. 43 min approx.

Hence, the time will be

= 7 a.m. + 2h 43 min

= 9:43 a.m.

14. (a); Let the speed of train be x and speed of car be y km/h

ATQ,

$$\frac{160}{x}+\frac{600}{y}=8 \quad \ldots(i)$$

$$\frac{240}{x}+\frac{520}{y}=8\frac{1}{5} \quad \ldots(ii)$$

⇒ x = 80 km/h, y = 100 km/h

15. (c); Let the distance travelled at 40 km/h be x km

ATQ,

$$\frac{x}{40}+\frac{250-x}{60}=5$$

$x = 100$ km

16. (d); Total bogies initially = 2 × 12 = 24

Additional bogies = 16 – 12 = 4

24 bogies take = 2 min

4 bogies take = $\frac{2}{24} \times 4$

= $\frac{1}{3}$ min

= 20 sec

17. (b); Time taken by train in crossing the men

$$\frac{270}{(25+2)\times\frac{5}{18}}=36 \text{ sec}$$

18. (a); 3 leaps of dog = 4 leaps of hare

3D = 4H

$$\frac{D}{H}=\frac{4}{3} \Rightarrow D : H = \frac{4}{3}$$

Ratio of distance covered by Dog and Hare in equal time

= 4D : 5H

= 4 × 4 : 5 × 3

= 16 : 15

Hence, ratio of speeds = 16 : 15

19. (d); Let the length of train be x metre

So, the length of platform be 3x metre

Time taken in crossing the platform

$= \frac{4x}{20}$ sec

Time taken in crossing the pole

$= \frac{x}{20}$

ATQ,

$\frac{x}{20} + 24 = \frac{4x}{20}$

$x = 160$ metre

20. (b); Let the speed of A be x km/h

Then, the speed of B be x + 4 km/h

ATQ,

$\frac{60 + 12}{x + 4} = \frac{60 - 12}{x}$

x = 8 km/h

21. (b); Let the hare taken 4 leaps / sec and hound takes 3 leaps/sec

Speed of hare = $4 \times 1\frac{1}{2} = 6$ m/sec

Speed of hound = $3 \times 2\frac{1}{2} = 7\frac{1}{2}$ m/sec

Difference in speed = $1\frac{1}{2}$ m/sec

Now,

$1\frac{1}{2} \times t = 30$

$t = 20\ sec$

Hence, Distance travelled by hare

$= 20 \times 6$

= 120 metre

22. (b); Speed = $\frac{10\times2\times\frac{22}{7}\times\frac{70}{100}}{5} \times \frac{18}{5}$

= 31.68 km/h

23. (b); Time taken = $\frac{47.5}{(18+20)}$

$= 1\frac{1}{4}$ hrs.

24. (a); Suppose x km is covered in t hours

Original speed $(S_1) = \frac{x}{t}$

In 2nd case, $\frac{x}{2}$ km is covered in 2t hours

New speed $(S_2) = \frac{\frac{x}{2}}{2t} = \frac{x}{4t}$

Ratio of speeds $= \frac{x/t}{x/4t} = 4 : 1$

25. (c); Distance covered by train in 50 minutes

$= 48 \times \frac{50}{60} = 40$ km

Now, distance to be cover in 40 min

New speed $= \frac{40}{40/60} = 60$ km/h

26. (a); Let the distance is d km and normal speed be s km/h

ATQ,

$$\frac{d}{s} - \frac{d}{s+4} = \frac{1}{2} \quad \ldots (i)$$

$$\frac{d}{s-2} - \frac{d}{s} = \frac{1}{3} \quad \ldots (ii)$$

Solving these equations

d= 60 km

27. (b); Time taken by the trains to cross each other

$$= \frac{500+500}{(45+30)\times\frac{5}{18}} = 48 \text{ sec}$$

28. (d); Let the length of the second train be x metre

ATQ,

$$\frac{100+x}{(60-42)\times\frac{5}{18}} = 60 \Rightarrow x = 200\text{m}$$

29. (d); Let the distance travelled be x km and original speed be y km/h

ATQ,

$$\frac{x}{y} - \frac{x}{y+3} = \frac{2}{3} \quad \ldots.(i)$$

$$\frac{x}{y-2} - \frac{x}{y} = \frac{2}{3} \quad \ldots.(ii)$$

Solving these equations

x = 40 km

30. (b); Let the speed of train on onward journey be x km/h

then, speed of train on return journey = 0.8x km/h

ATQ,

$$\frac{500}{x} + \frac{500}{0.8x} = 23 - \frac{1}{2}$$

x = 50 km/h

Speed of train on return journey = 0.8 × 50

= 40 km/hr

31. (b); Distance is same. Then,

$$\frac{s_2}{s_1} = \frac{t_1}{t_2}$$

$$\frac{7}{11} = \frac{t_1}{22}$$

$\Rightarrow t_1 = 14$ hour

Total time saved = 22 – 14 = 8 hours

32. (a); Let the length of the train be x m

Then length of another train = $\frac{x}{2}$ m

ATQ,

$$\frac{x+\frac{x}{2}}{(42+48)\times\frac{5}{18}} = 12$$

x= 200 m

Let the length of platform be y m

$$\frac{200+y}{48\times\frac{5}{18}} = 45$$

y = 400 m

33. (a); Length of train = $(100 - 64) \times \frac{5}{18} \times 40$

= 400 m

34. (c); Let the train will meet x hours after the train from station B started

$$48 \times \frac{45}{60} + (48 + 50) \times x = 232$$

$= 98x + 36 = 232$

x = 2 hours

Distance travelled by train starting from Station A at the meeting point

= 36 + 48 × 2 = 132 km

35. (c); Let the speed of slower bus be x km/h

Then, the speed of faster bus = x + 5 = km/h

ATQ,

$2\ (2x + 5) = 50$

x = 10 km/h

36. (b); Suppose the distance be 270 km (LCM of 54 & 45)

Without stoppage, time taken $= \frac{270}{54} = 5$ hrs

With stoppage, time taken $= \frac{270}{45} = 6$ hrs

∴ Stoppage per hour $= \frac{6-5}{6} = \frac{1}{6}\ hrs = 10$ min

37. (d); Let the total hour be x for the journey

ATQ,

$\frac{x}{2}[2 \times 40 + (x - 1) \times 5] = 385$ …… (sum of AP of x terms)

$x = 7$ hours

38. (a); Average speed of first train $= \frac{200}{4} = 50$ km/h

Average speed of second train $= \frac{200\times2}{7} = \frac{400}{7}$ km/h

ATQ,

$$2 \times 50 + \left(\frac{400}{7} + 50\right)t = 200$$

$t = \frac{14}{15}$ hour = 56 min

Hence, the trains will meet at 8 : 56 a.m.

39. (d); Let the length of first train be x m and length of bridge be y m

ATQ,

$$\frac{x+y}{90\times\frac{5}{18}} = 36$$

x + y = 900

Length of second train = x – 100 m

Time taken by second train to cross the bridge

$$= \frac{x-100+y}{45\times\frac{5}{18}} = \frac{(900-100)\times2}{25}$$

= 64 sec

40. (a); Remaining distance to be covered

$= 6 - \frac{1}{2} \times 6 = 3$ km

Remaining time $= 45 - 45 \times \frac{2}{3} = 15$ min $= \frac{1}{4}$hour

Required speed to cover the remaining distance

$= \frac{3}{1/4} = 12$ km/hr

41. (b); Let the distance of winning post from starting point of A be x m

∴ Distance travelled by A = x m

Distance travelled by B = x – 80 m

And

Speed of A $= 1\frac{2}{3}$ speed of B

$\frac{\text{Speed of A}}{\text{Speed of B}} = \frac{5}{3}$

Time is same for Both A & B

$\therefore \frac{x}{x-80} = \frac{5}{3}$

x = 200 m

42. (b); Time taken by man sitting in second train to pass the first train

$= \frac{100}{(30+50)\times\frac{5}{18}} = 4.5$ sec

43. (b); 75% of the distance = VT km

$\therefore$ Total distance $= \frac{VT}{75} \times 100 = \frac{4}{3}VT$ km

Remaining distance $= \frac{4}{3}VT - VT = \frac{1}{3}VT$ km

Remaining time $= \frac{VT}{3S}$hour

Total time $= T + \frac{VT}{3S}$

Average speed $= \frac{Total\ Distance}{Total\ Time}$

$= \frac{\frac{4}{3}VT}{T+\frac{VT}{3S}} = \frac{4VS}{3S+V}$ km/h

44. (b); Total floors between A & B = 44 – 9
= 35 floors
Relative speed = 34 + 36 = 70 floor/min
Time taken by them to meet
$= \frac{\text{Total floors}}{\text{Relative Speed}} = \frac{35}{70} = \frac{1}{2}$ min
A travels in $\frac{1}{2}$ min = $\frac{1}{2} \times 34$ = 17 floors
Floor at which A & B will meet
= 9 + 17 = 26th

45. (a); Let train y overtakes train x after t hours
ATQ,
$Qt = P\left(t + \frac{5}{2}\right)$
$\Rightarrow t = \frac{5P}{2(Q-P)}$

46. (c); ATQ
3 – 72
1 – 24
Speed of Car = 24
Speed of Motorbike = 96
Distance travelled by Car = $600 \times \frac{20}{100} \times \frac{20}{100} = 24$ km
Distance travelled by Motorbike = $600 \times \frac{20}{100} \times \frac{80}{100} = 96$
Required answer = $\frac{120}{\frac{24}{24}+\frac{96}{96}} = 60$ km/hr

47. (a); A's distance travelled by Car = $800 \times \frac{20}{100} \times \frac{20}{100} = 32$
B's distance travelled by Car = $800 \times \frac{15}{100} \times \frac{22}{100} = 26.4$
C's distance travelled by Car = $800 \times \frac{25}{100} \times \frac{21}{100} = 42$
D's distance travelled by Car = $800 \times \frac{10}{100} \times \frac{16}{100} = 12.8$

E's distance travelled by Car $= 800 \times \frac{18}{100} \times \frac{30}{100} = 43.2$

F's distance travelled by Car $= 800 \times \frac{12}{100} \times \frac{10}{100} = 9.6$

Required answer $= 32 + 26.4 + 42 + 12.8 + 43.2 + 9.6 = 166$

48. (c); A's distance travelled by Motorbike $= 700 \times \frac{20}{100} \times \frac{80}{100} = 112$

B's distance travelled by Motorbike $= 700 \times \frac{15}{100} \times \frac{78}{100} = 81.9$

C's distance travelled by Motorbike $= 700 \times \frac{25}{100} \times \frac{79}{100} = 138.25$

D's distance travelled by Motorbike $= 700 \times \frac{10}{100} \times \frac{84}{100} = 58.8$

E's distance travelled by Motorbike $= 700 \times \frac{18}{100} \times \frac{70}{100} = 88.2$

F's distance travelled by Motorbike $= 700 \times \frac{12}{100} \times \frac{90}{100} = 75.6$

Required answer = C

49. (c); A's distance travelled by Car = $900 \times \frac{20}{100} \times \frac{20}{100} = 36$

D's distance travelled by Motorbike = $900 \times \frac{10}{100} \times \frac{84}{100} = 75.6$

Required answer = 75.6 – 36 = 39.6

50. (e); A's distance travelled by Car = $400 \times \frac{20}{100} \times \frac{20}{100} = 16$

B's distance travelled by Car = $400 \times \frac{15}{100} \times \frac{22}{100} = 13.2$

C's distance travelled by Car = $400 \times \frac{25}{100} \times \frac{21}{100} = 21$

D's distance travelled by Motorbike = $400 \times \frac{10}{100} \times \frac{84}{100} = 33.6$

E's distance travelled by Motorbike = $400 \times \frac{18}{100} \times \frac{70}{100} = 50.4$

F's distance travelled by Motorbike = $400 \times \frac{12}{100} \times \frac{90}{100} = 43.2$

Required answer = 16 + 13.2 + 21 + 33.6 + 50.4 + 43.2 = 177.4

Adda 247

DATA INTERPRETATION
FOR
BANKING EXAMINATION

PRACTICE BOOK

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PREFACE

Banking examinations have evolved a lot from 2016, with changes in pattern now banking recruitment exams are dynamic in lieu of their conventional hold. ADDA 247 is proud to present you the new constructive eBook which caters to the need of ever-progressing demands and pattern for the upcoming examinations. The eBook is designed meticulously by the most prominent individuals in this sector and promises to provide you with an escapade that will broaden your horizons. We should never be confined by the limits of our brain and this eBook which is thoroughly revised and covers every crucial aspect of the examination assures you that it will help you in transcending your limits. Our ultimate aim is to help students develop de rigueur skills for success with proper approach.

Quantitative aptitude is one section which finds itself at the heart of this examination. Solving **DATA INTERPRETATION** can sometimes be an uphill task; therefore **ADDA 247** presents you an eBook on **DATA INTERPRETATION** for **upcoming banking exams in 2017** which will serve as an elixir for our banking aspirants. This eBook attempts to cover every major type of **DATA INTERPRETATION** based problems which have previously graced the banking exams with the hope to equip candidates with basic knowledge of what to expect in the upcoming banking exam 2017. In this edition of **eBook** there are **200 questions based on DATA INTERPRETATION.**

The aim of this book is to help students learn and understand the new pattern of banking recruitment exam which will help them to maximize their scores in the competitive examination. Desire is the key to motivation, but it's determination and commitment to an unrelenting pursuit of your goal - a commitment to excellence - that will enable you to attain the success you seek. This eBook is designed so that you can unlock your hidden potentials.

"A pessimist sees the difficulty in every opportunity; an optimist sees the opportunity in every difficulty."

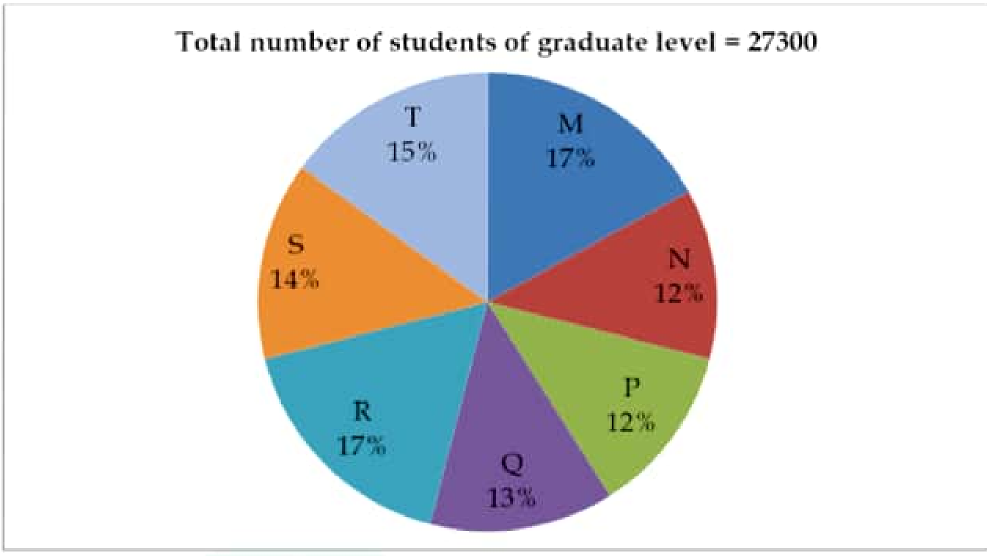
- **Sir Winston Leonard Spencer/Churchill**

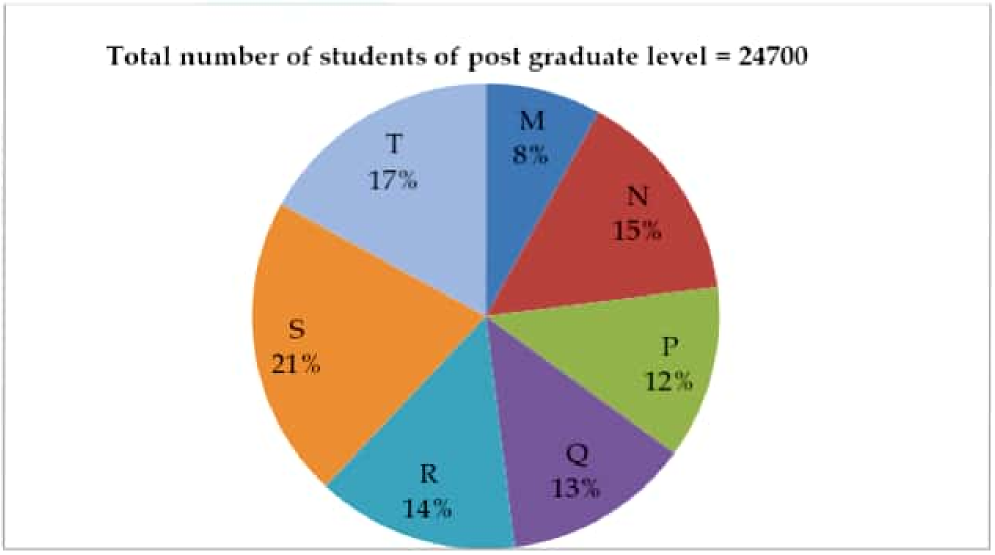
Team Adda247

DATA INTERPRETATION

Directions (1-5): The following pie charts show the distribution of students of graduate and post graduate levels in seven different institutes in a town.

Distribution of students at graduate and post graduate levels in seven institutes

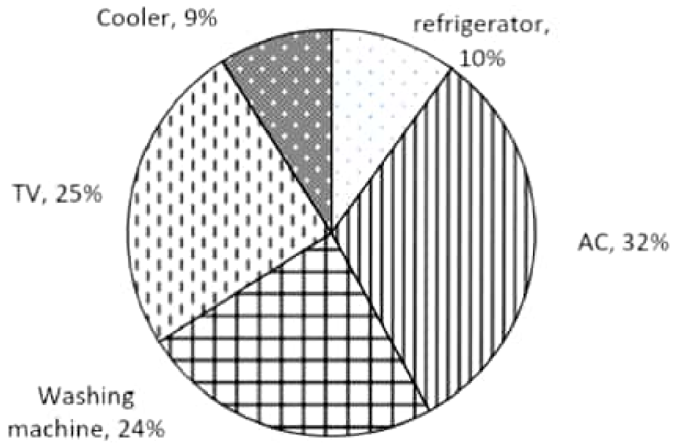




1. What is the total number of graduate and post graduate level students in institute R ?
   (a) 8320 (b) 7916 (c) 9116 (d) 8099 (e) None of these
2. What is the ratio between the number of students studying at post graduate and graduate levels, respectively from institute S ?
   (a) 14 : 19 (b) 19 : 21 (c) 17 : 21 (d) 19 : 14 (e) None of these
3. How many students of institutes M and S are studying at graduate level ?
   (a) 7516 (b) 8463 (c) 9127 (d) 9404 (e) None of these
4. What is the ratio between the number of students studying at post graduate level from institute S and the number of students studying at graduate level from institute Q ?
   (a) 13 : 19 (b) 21 : 13 (c) 13 : 8 (d) 19 : 13 (e) None of these

5. Total number of students studying at post graduate level from institutes N and P is
(a) 5601 (b) 5944 (c) 6669 (d) 8372 (e) None of these

Directions (6 -10): An electronics company sells only 5 types of products refrigerator ,TV, cooler, AC and washing machine. The total revenue generated in 1 year is 500 Cr. Given below is the percentage breakup of revenue earned by different products.



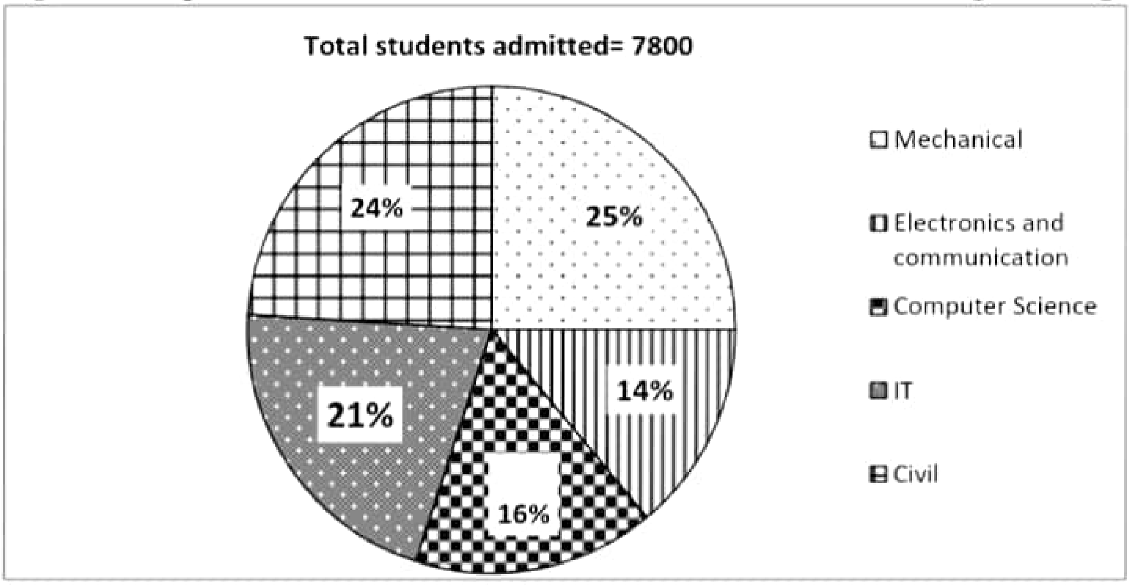
Percentage distribution of revenue of each product in different quarters of the year

Product	Qtr 1	Qtr2	Qtr3	Qtr4
Refrigerator	15	25	32	28
AC	27	16	45	12
washing machine	39	23	17	21
TV	42	27	11	20
Cooler	19	28	21	32

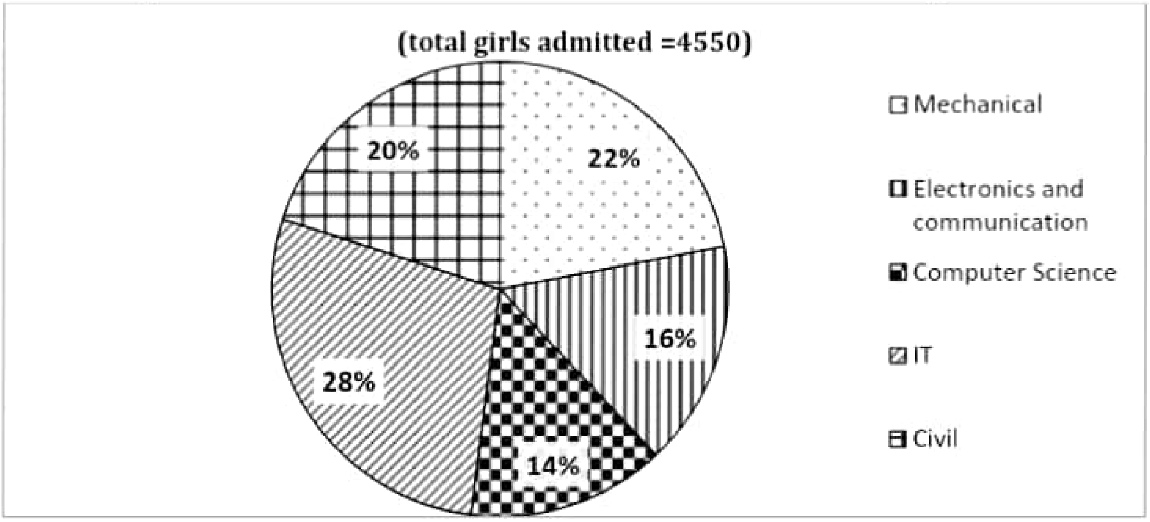
6. Revenue earned by AC in 3rd quarter is what percent more than revenue of washing machine in 2nd and 4th quarter Together? (round off to two decimal places)
(a) 36.36 (b) 34.21 (c) 38.86 (d) 32.54 (e) None of these
7. Find the respective ratio of revenue earned from refrigerators in 2nd and 3rd quarter to revenue Of washing machine from 1st and 2nd quarter?
(a) 283:744 (b) 744:283 (c) 95:248 (d) 744:285 (e) None of these
8. What is the difference between total revenue in quarter 2 and total revenue in quarter 3?
(a) 16.85 cr (b) 17.65 cr (b) 19.25 cr (d) 23.15 cr (e) None of these
9. Revenue from Sales of washing machine in 1st, 3rd and 4th quarter is approximately what times of revenue from sale of AC in 2nd and 4th quarter?
(a) 2.05 (b) 1.85 (c) 1.95 (d) 3.22 (e) 2.35
10. Revenue from sales of AC and washing machine in quarter 1 is approximately what percent of revenue from sales of all Products together in quarter 2?
(a) 80% (b) 83% (c) 63% (d) 71% (e) 86%

Directions (11-15): Study the Pie- Chart carefully and answer the following Questions.

Percentage breakup of students admitted in different Streams in an engineering college



Percentage break up of Girls admitted in these streams out of the total girls.



11. What is the percentage of boys admitted in IT branch over the total students admitted in the same stream?(Round off to 2 decimal places)
(a) 24.24% (b) 24.22% (c) 28.32% (d) 22.22% (e) 22.24%

12. How many boys are admitted in IT and mechanical together?
(a) 1311 (b) 1312 (c) 1313 (d) 1314 (e) None of these

13. Number of girls admitted in Computer science and Electronics and communication together is approximately what percent of the number of boys admitted in Civil and Computer Science together?
(a) 86 (b) 87 (c) 88 (d) 89 (e) 90

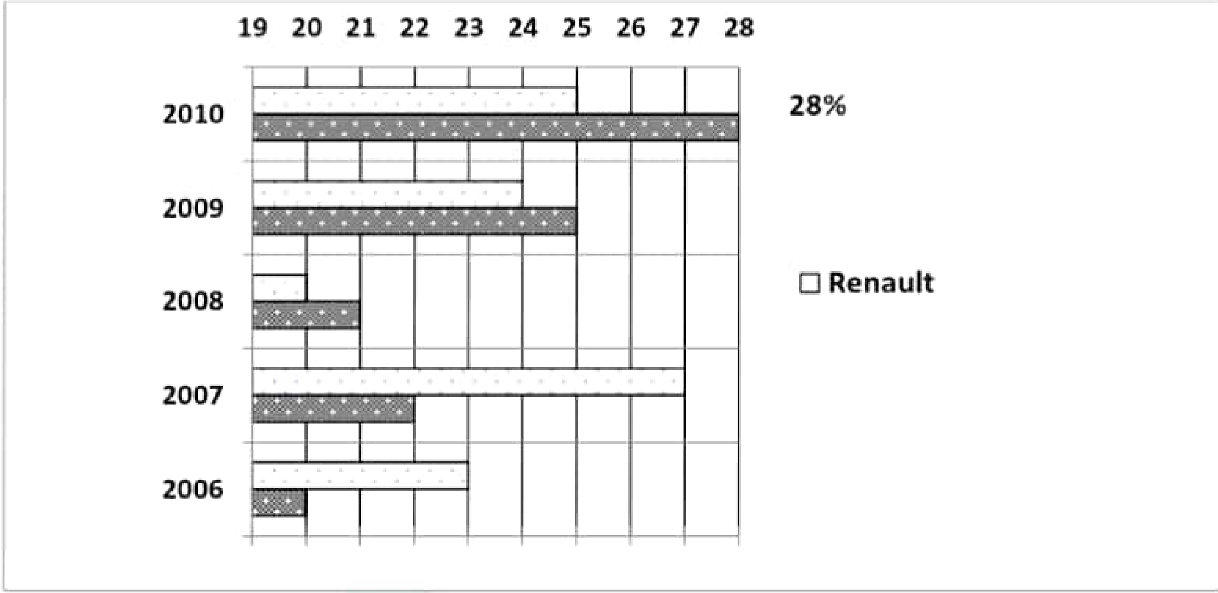
14. Number of boys Admitted in Electronics and communication is what percent of total number of students in the school (rounded off to two digits after decimal)?

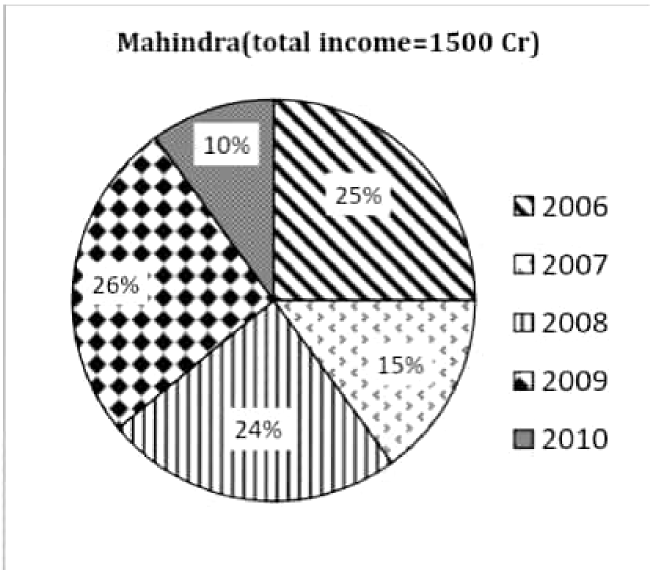
(a) 4.96 (b) 4.67 (c)5.23 (d) 4.23 (e) 5.67

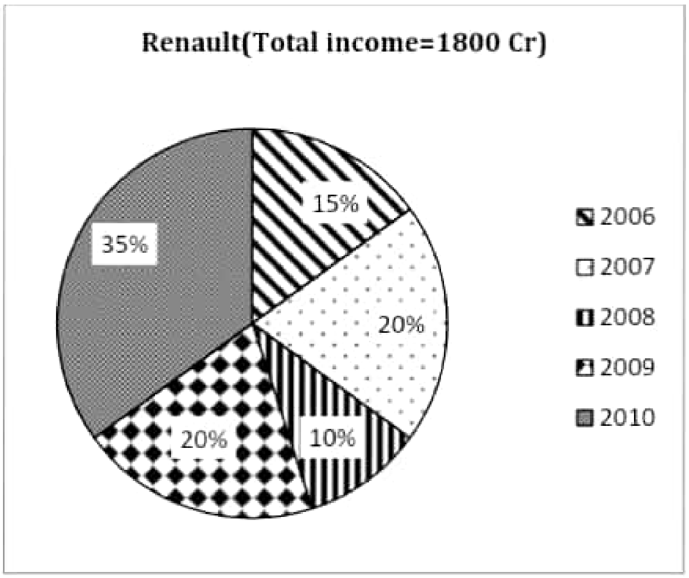
15. What is the respective ratio of no. of girls admitted in computer science to the number of boys admitted in IT?

(a) 8:5 (b) 3:2 (c) 2:3 (d) 5:4 (e) None of these

Directions (16-20): Given below is the graph showing the percentage profit of 2 automobile companies, Mahindra and Renault from year 2006 to 2010. The pie charts show the percentage distribution of total income of each company in different years. Study the data carefully and answer the following questions{Note:%profit=$\frac{\text{income}-\text{expenditure}}{\text{expenditure}} \times 100$}







16. Expenditure of Mahindra in 2007 is approximately what % of expenditure of Renault in 2006?

(a) 82% (b) 84% (c) 86% (d) 88% (e) 90%

17. The expenditure of Mahindra is maximum in:-

(a) 2006 (b) 2007 (c) 2008 (d) 2009 (e) 2010

18. What is the overall profit percentage of Mahindra, taking the total income and total expenditure of all the years together ? (approximate)

(a) 15% (b) 26% (c) 20% (d) 23% (e) 12%

19. Find the difference in expenditure of both companies in 2010. (round off to 2 decimal places)

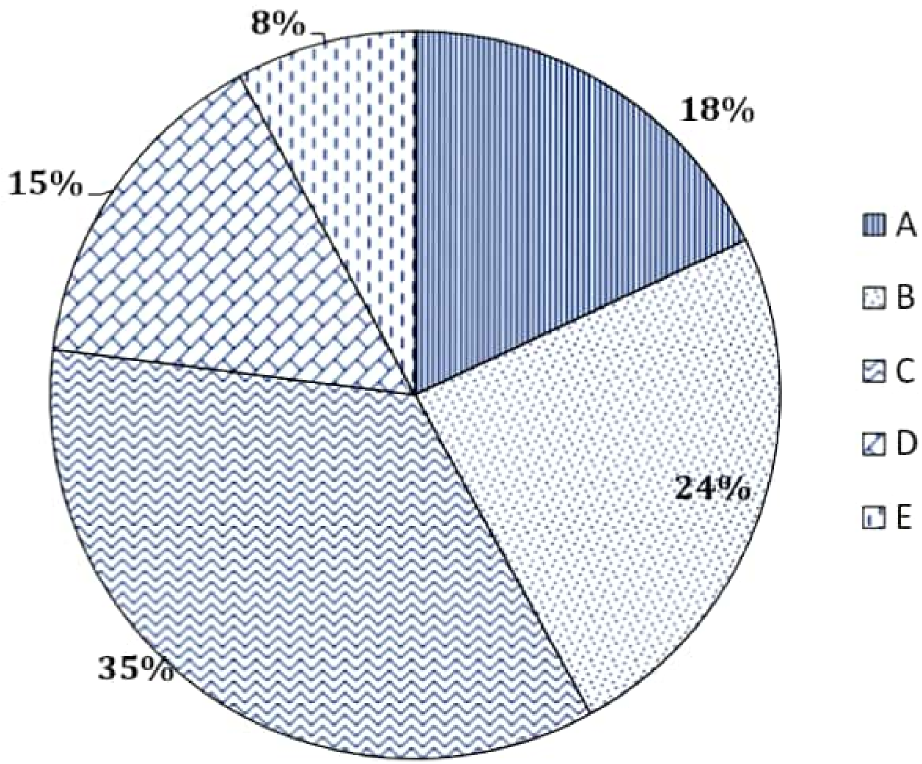
(a) 384.81 cr (b) 386.81 cr (c) 388.42 cr (d) 390.92 cr (e) 378.74 cr

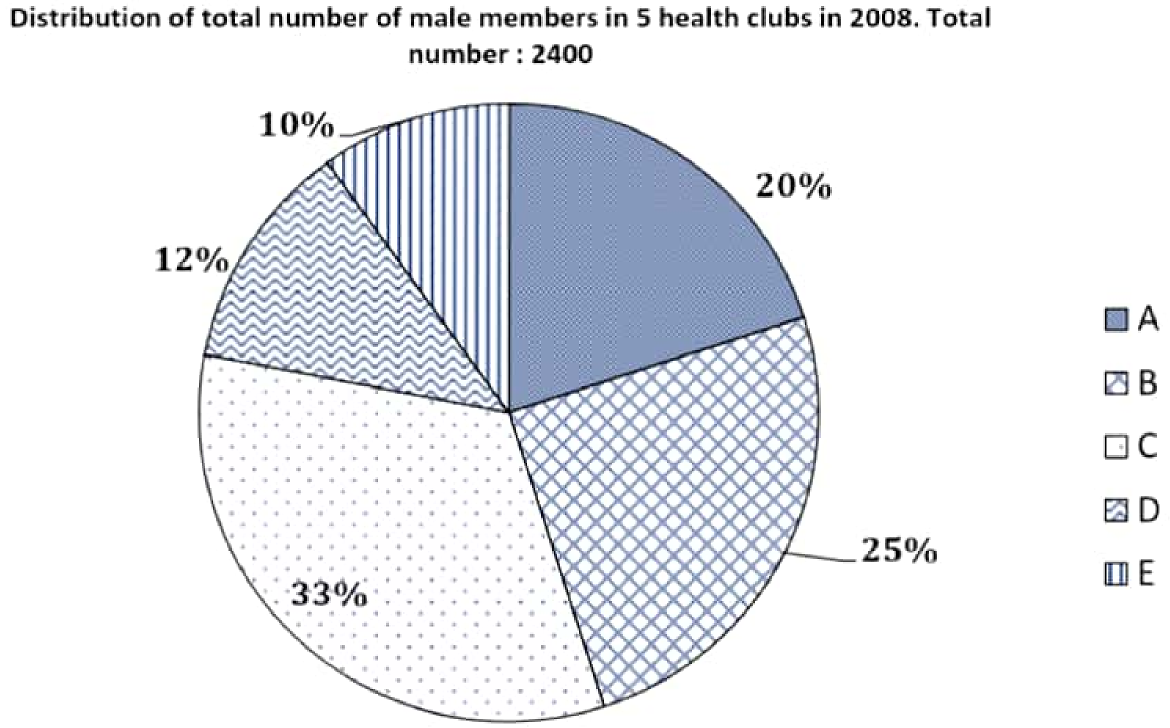
20. If there is 20% increase in profit percent of Renault in 2011 as compared to 2010, but there is 60% decrease in income of the same company in 2011 as compared to previous year. Then find the approximate expenditure of Renault in 2011.

(a) 172 cr (b) 177 cr (c) 182 cr (d) 187 cr (e) 194 cr

Directions (21 – 25) : Refer to the pie-charts and answer the given questions.

Distribution of total number of members (both males and females) in 5 health clubs in 2008. Total number : 4200





21. Number of male members in health clubs A and D increased by equal numbers from 2008 to 2009. If the ratio between number of male members in health club A and that in D in 2009 is 17 : 11, what is the number of male members in health club D in 2009?
(a) 308 (b) 352 (c) 374 (d) 396 (e) 330

22. What is the average number of female members in health clubs, C, D and E?
(a) 374 (b) 376 (c) 372 (d) 392 (e) 384

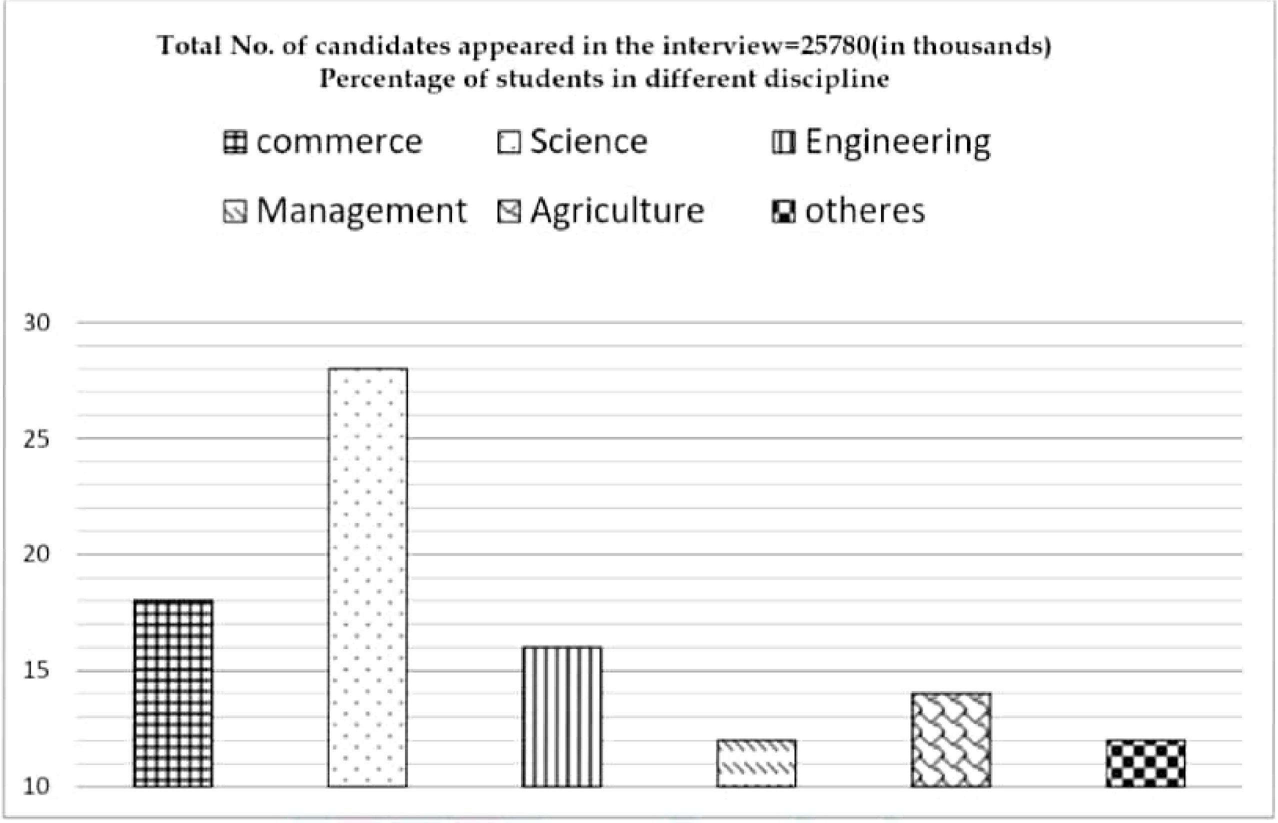
23. Only 50% of the members (both males & females) in health club E have lifetime membership. If the number of females in health club E who have lifetime membership is 44, what percent of male members in health club E have lifetime membership?
(a) $48\frac{2}{3}$ (b) $54\frac{1}{3}$ (c) $57\frac{1}{34}$ (d) $51\frac{2}{3}$ (e) $60\frac{1}{3}$

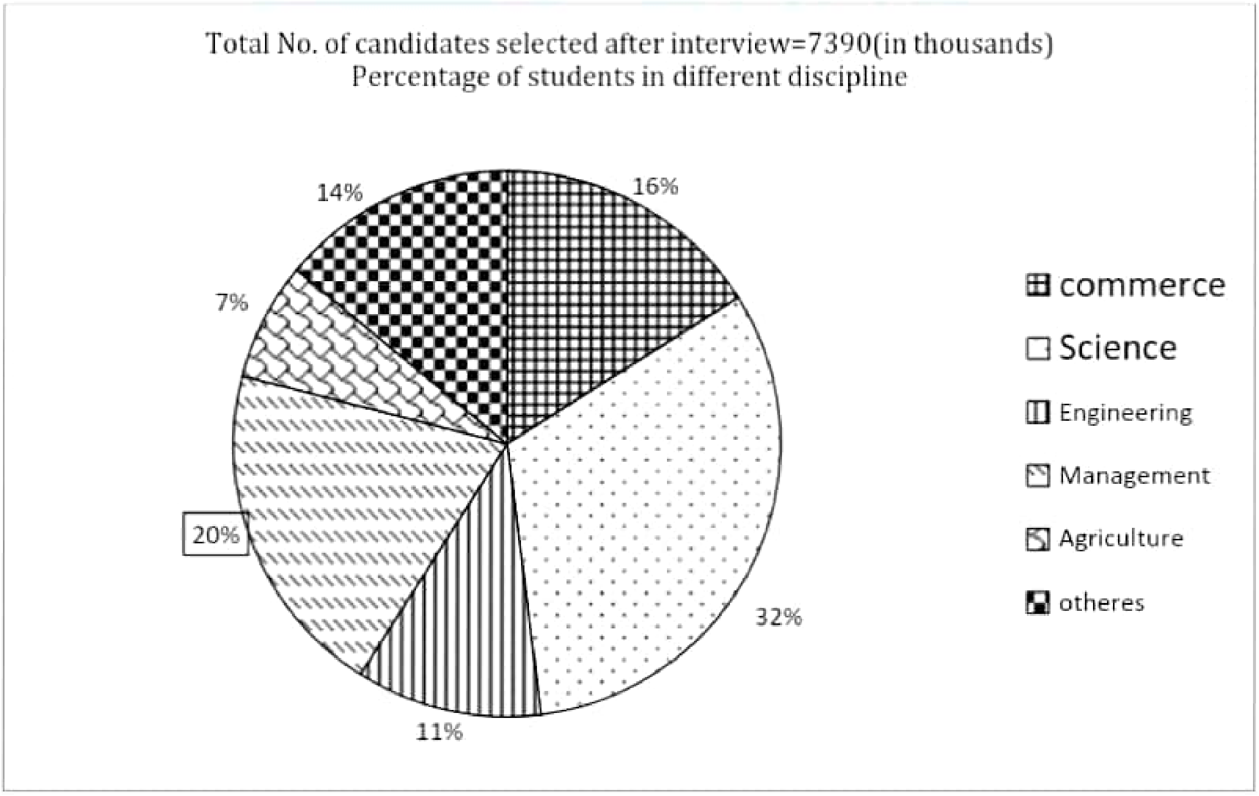
24. What is the central angle corresponding to number of members (both males & females) in health club B?
(a) 80.4° (b) 88.8° (c) 86.4° (d) 98.2° (e) 92.6°

25. Number of female members in health club A is what percent less than number of male members in health club B?
(a) 52 (b) 64 (c) 58 (d) 62 (e) 54

Directions (26-30): Study the following charts carefully and answer the questions given below:

Discipline wise breakup of number of candidates appeared in interview and Total no. of candidates selected after interview by the organization.





26. For which of the given discipline percentage of student selected over the appeared is maximum.
(a) Science (b) Commerce (c) Engineering (d) Management (e) Others

27. For which of the following disciplines difference between the number of appeared and selected student is minimum
(a) Science (b) Commerce (c) Engineering (d) Management (e) Others

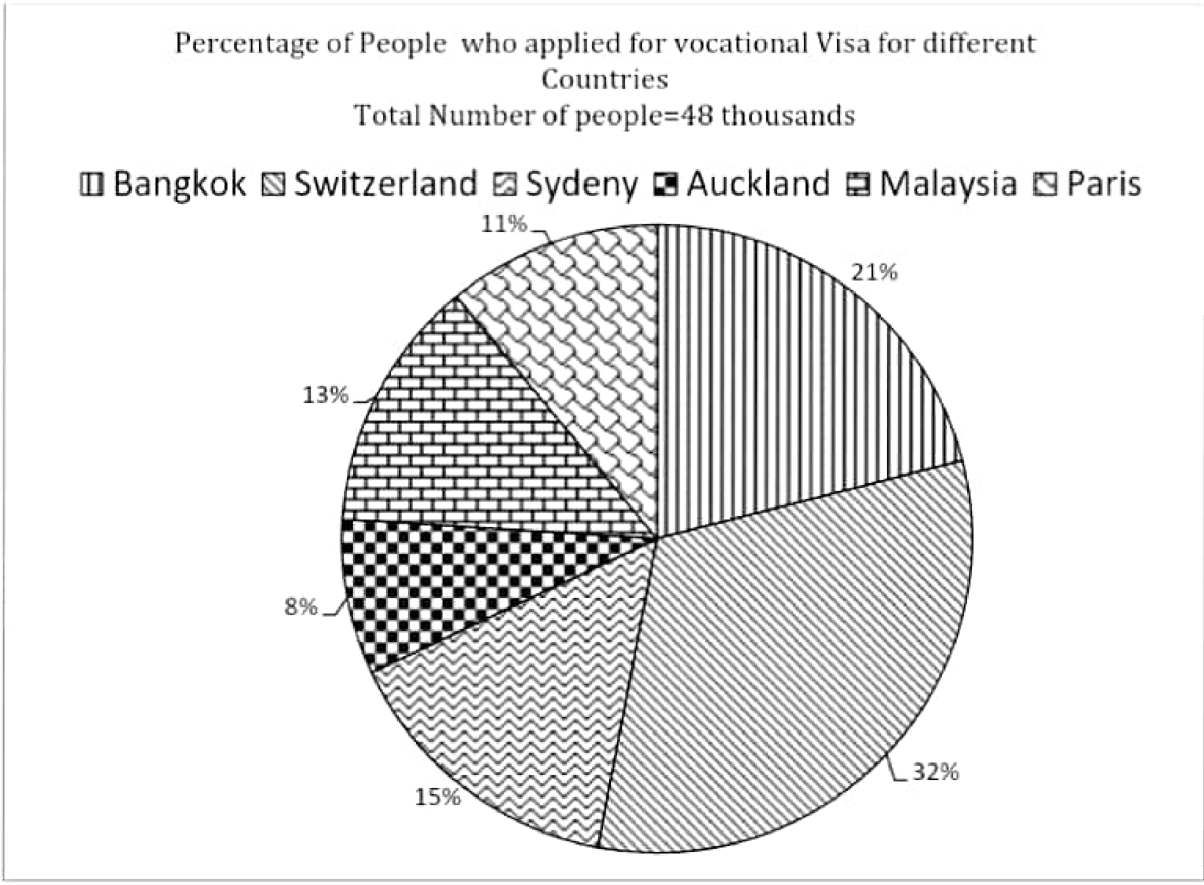
28. If the percentage of girls appeared in Engineering and others discipline are respectively 43% and 41% then find the ratio of girls selected from these disciplines.
(a) 1 : 3 (b) 2 : 3 (c) 4 : 7 (d) 5 : 7 (e) None of these

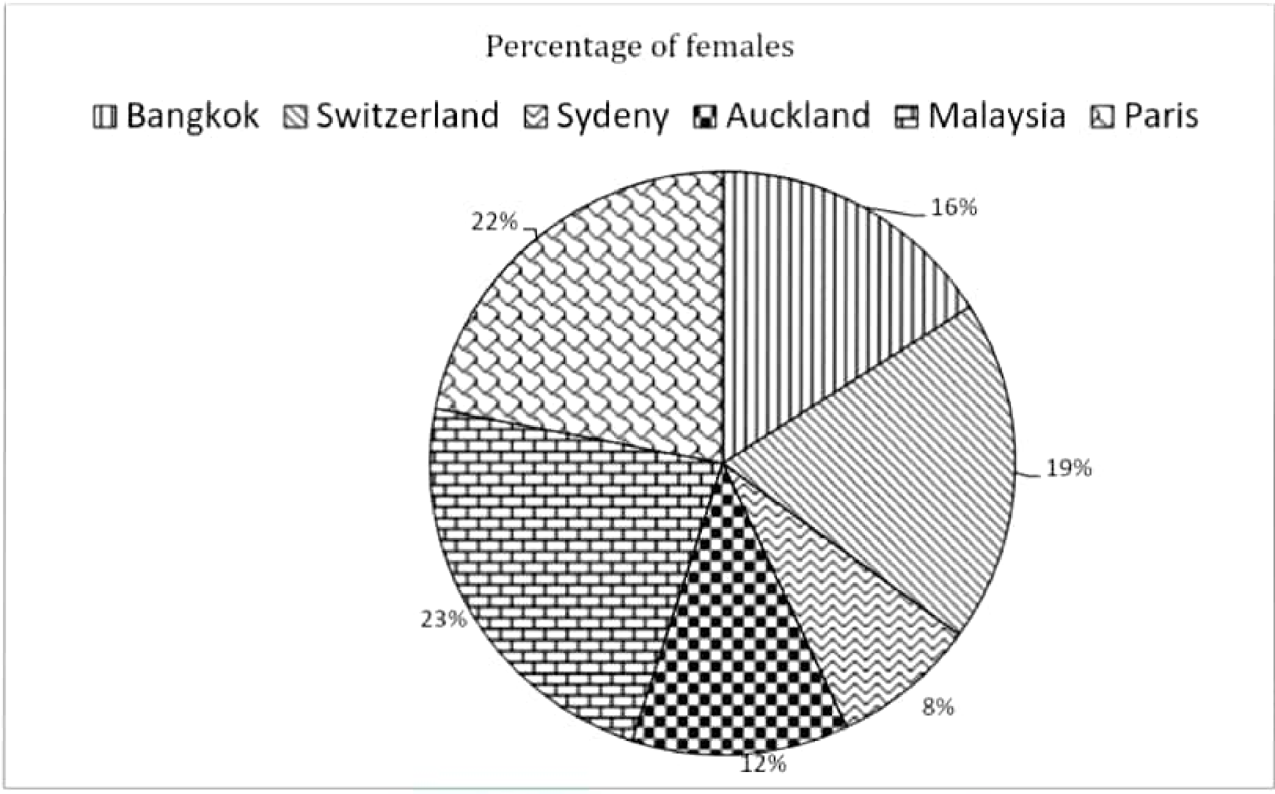
29. For which of the following discipline number of selected student is maximum?
(a) Engineering (b) Management (c) Others (d) Science (e) Commerce

30. The total number of candidates appeared from management and science discipline is approximate what percent of number of candidate appeared from Engineering?
(a) 235% (b) 240% (c) 230% (d) 245% (e) 250%

Direction (31-35):-Visa Department has received visa-applications for different countries that is shown by pie-chart-I and percentage of females interested in these countries is shown by pie chart –II

Ratio of males and females=5:3





31. What is the ratio of the number of people who applied for Visa for Malaysia and Bangkok together to that who applied for Switzerland and Paris?

(a) 23:32 (b) 34:43 (c) 101:130 (d) 11:32 (e) None of these

32. What is the difference between the number of visa application received from females for countries Auckland and Paris?

(a) 1.5 thousands (b) 2.2 thousands (c) 1.8 thousands
(d) 1.9 thousands (e) None of these

33. For which of the following countries number of male applicant is less than the number of female applicant?

(a) Malaysia, Paris (b) Paris, Auckland (c) Auckland, Malaysia, Bangkok
(d) Auckland, Malaysia, Paris (e) None of these

34. What is the ratio of the number males applied for Auckland and Sydney together to that of females applied for Bangkok and Malaysia together?

(a) 124:117 (b) 128:119 (c) 19:17 (d) 23:19 (e) None of these

35. For which of the following countries percentage of female applicant over total applicant to that country is minimum.

(a)Bangkok (b) Paris (c) Auckland (d) Sydney (e) None of these

Direction (36-40) :- Study the following table carefully and answer the questions.

States	Total Graduates passed this year	Male: Female	**Background** Rural: Urban	**Parents Education** Litetate: Illiterate	Percentage of Professional Graduates out of total graduates
Madhya Pradesh	2250000	23:22	28:17	5:3	48
Odisha	1642000	5:3	5:3	3:1	35
Gujrat	1136000	9:7	11:5	11:5	38
Uttar Pradesh	2480000	21:19	18:13	20:11	42
Bihar	2050000	13:12	16:9	3:2	56
Andamaan And Nicobaar	248000	9:7	5:3	3:1	44
Himanchal Pradesh	960000	11:9	17:7	4:1	32

36. The graduates from Madhya Pradesh and Gujrat who hailed from Urban back ground is what percent of total graduates of these two states ? (Rounded off to two digits after decimal)
(a) 32.49% (b) 35.59% (c) 38.55% (d) 32.85% (e) 29.41%

37. Approximately, by what percent is the Graduates of Madhya Pradesh hailed from Urban back ground less then the graduates who hailed from Rural Background?
(a) 33% (b) 39% (c) 49% (d) 45% (e) 50%

38. What percent of total graduates from Uttar Pradesh, Gujrat and Odisha together have illiterate parents? (Rounded off to near integer)?
(a) 28% (b) 34% (c) 29% (d) 31% (e) 33%

39. What is the difference between number of professional graduates from Odisha and the same from Andaman and Nicobar?
(a) 366340 (b) 349185 (c) 388185 (d) 382340 (e) None of these

40. What is the ratio between total female graduates of Bihar and Himachal Pradesh together and the total male graduates of these two states together, respectively
(a) 697 : 798 (b) 715 : 797 (c) 708 : 797 (d) 698 : 797 (e) None of these

Directions (41-45): Study the following table carefully and answer the following question.

The table represents the cost of production and profit percentages over the years 2001 to 2005 of FMCG companies Sahara and ITC.

Year	Sahara		ITC	
	Cost of production (Rs. in lakh)	Profit%	Cost of production (Rs. in lakh)	Profit%
2001	320	40%	–	40%
2002	–	30%	–	25%
2003	420	20%	440	35%
2004	460	45%	470	20%
2005	510	30%	580	–

Note: - A few values are missing. It is expected that the candidate should calculate the missing values, if it is required to find answer for the questions given below.

Profit = Sales – cost of production

Profit % = $\left(\frac{\text{Profit}}{\text{Cost of production}}\right) \times 100\ \%$

41. If the profit for each of the years 2001 and 2002 of company ITC is Rs. 90 lakh, what is its average cost of production over the years (in Rs. lakh):

(a) Rs. 420 (b) Rs. 430 (c) Rs. 415 (d) Rs. 475 (e) None of these

42. If the total sales of company Sahara and ITC in 2002 is Rs. 890 lakh and total cost of production of Sahara and ITC in year 2002 is 700 lakh, what is the ratio of profit of Sahara and ITC in the same year ?

(a) 9 : 10 (b) 10 : 9 (c) 11 : 10 (d) 10 : 11 (e) Can't be determined

43. For company ITC in 2003, if the entered data is about the total sales and loss percentage, then what is its actual approximate cost of production for that year?

(a) Rs. 693 lakh (b) Rs. 627 lakh (c) Rs. 677 lakh

(d) Rs. 585 lakh (e) Rs. 713 lakh

44. For company Sahara, if the ratio of profits in 2001 and 2002 is 64 : 51, then what is the cost of production in 2002 (in lakh) ?

(a) Rs. 340 (b) Rs. 240 (c) Rs. 260 (d) Rs. 220 (e) None of these

45. What is the difference between the sales of company Sahara in 2005 and that of company ITC in 2004 (in lakh)

(a) 95 (b) 98 (c) 99 (d) 100 (e) None of these

Directions (46-50): These question are based on the following table.

The following tables gives the number of units sold and the average price per unit of all the five products of a company across three years.

	2013		2014		2015	
Product	**Number of units sold**	**Average price per unit (in Rs.)**	**Number of units sold**	**Average price per unit (in Rs.)**	**Number of units sold**	**Average price per unit (in Rs.)**
Healthcare	1696	144	1924	150	1802	164
Utensils	2064	162	2014	174	2178	182
Body care	1284	106	1346	104	1286	116
Stationary	378	214	384	202	398	210
Sports item	1504	116	1814	124	1972	130

46. In 2013, the sales (by value) of Body care products, was what approximate percentage of the five products :
(a) 8% (b) 10% (c) 14% (d) 20% (e) None of these

47. The average price per unit of how many products increased by more than 15% from 2013 to 2015?
(a) 0 (b) 1 (c) 2 (d) 3 (e) None of these

48. Which product had the highest percentage increase in sales (by value) from 2013 to 2014?
(a) Health care (b) Utensils (c) Body care
(d) Stationary (e) Sports items

49. What was the approximate percentage increase in the total sales (by volume) of the company from 2013 to 2015 ?
(a) 7.9% (b) 9.2% (c) 10.25% (d) 11.6% (e) 12.42%

50. For how many products was the percentage increase in the total sales (by volume) from 2013 to 2015, more than the percentage increase of all the five products during that period?
(a) 1 (b) 2 (c) 3 (d) 4 (e) 5

Directions (51-55): Study the following table carefully and answer the questions that follow:
Number of different types of models produced in different years of a mobile company and percentage of defective models is also given-

	Model A		Model B		Model C		Model D	
	Production	% Detective	Production	% Detective	Production	% Detective	Production	% Detective
2011	18,500	6%	17,000	7.5%	23,200	8%	23,500	5%
2012	21,600	5%	21,900	6%	25,000	5.5%	24,600	4.5%
2013	19,700	9%	27,000	4%	19,200	6%	28,500	3%
2014	25,800	4.5%	26,200	5%	28,000	9.5%	21,200	7%

2015	15,800	9%	21,800	7.5%	25,200	11%	18,400	8%
2016	17,100	11%	24,200	8%	26,800	4%	16,000	6%

51. What is the difference between total defective model A mobiles manufactured in 2011 and that in 2016?
(a) 851 (b) 651 (c) 871 (d) 671 (e) None of these

52. Total number of defective mobiles manufactured in 2013 is what percent of total mobiles manufactured in the same year ? (round off to 2 decimal places)
(a) 5.15% (b) 4.15% (c) 6.15% (d) 7.15% (e) 8.15%

53. What is the average number of defective model D mobiles produced per year ?(upto nearby integer value)
(a) 1175 (b) 1185 (c) 1195 (d) 1205 (e) 1215

54. What is the average number of model B mobiles produced per year? (upto nearby integer value)
(a) 22266 (b) 23579 (c) 21015 (d) 27615 (e) 23017

55. In which year the number of detective model C mobiles is 2^{nd} maximum ?
(a) 2011 (b) 2012 (c) 2013 (d) 2014 (e) None of these

Directions (56 – 60) : The following table shows cities and post wise number of candidates appeared in competitive exam conducted by IBPS in 2014, study it carefully and answer the following questions:-

Post→ Centre↓	Officer	Clerks	Field Officer	Supervisor	Specialist Officer
Bangalore	11000	26750	1290	11150	5995
Delhi	15500	38790	1680	7550	8232
Mumbai	22580	32000	1920	8950	3120
Hyderabad	14900	52525	2125	4385	4822
Kolkata	11360	33225	2375	5795	3980
Lucknow	35500	42650	2570	9725	2282
Chennai	9550	15370	2980	4320	4554

56. The no. of candidates appeared for officers post from Delhi and Lucknow together is what percent of the candidates appeared for clerk post from banglore and Lucknow together?
(a) 71.5% (b) 73.5% (c) 75.5% (d) 77.5% (e) 79.5%

57. Find the average no. of candidates appeared for officers post for the given cities.
(a) 17200 (b) 17400 (c) 17600 (d) 17800 (e) 18200

58. 45% of the candidates applied for clerk post from Mumbai are girls and out of these girls 30% are post graduate. Total 40% of the candidates applied for clerk post from Mumbai are post graduate. Then what percent of boys applied for clerk post from Mumbai are post graduate? (round off to 2 decimal places)
(a) 42.22% (b) 44.54% (c) 52.18% (d) 48.18% (e) 55.22%

59. What is the total number of candidates applied for the supervisor post from these cities?
(a) 51925 (b) 51975 (c) 51825 (d) 51875 (e) None of these

60. What is the ratio of candidates applied for clerk post from Mumbai to the candidates applied for the same post form Hyderabad, Kolkata & Lucknow together?
(a) 80 : 323 (b) 80 : 321 (c) 80 : 327 (d) 80 : 329 (e) 80 : 331

Directions (61-65): There are five companies and we have given the no. of employees working in these companies. In the table we have also given the percentage of male and female employees of Sales and Advertising department with respect to the total no of employees.

Company	No. of Employees	Sales		Advertising	
		Male	Female	Male	Female
Infosys	450	12	14	6	6
Wipro	850	18	10	12	14
Mindtree	400	28	14	4	7
Oracle	525	20	8	8	4
TCS	375	12	20	4	8

61. The ratio of female employee in Sales dept. of company Oracle and TCS together to male employees of Advertising dept. in company Infosys and Wipro together?
(a) 41:55 (b) 43:39 (c) 55:41 (d) 39:43 (e) None of these

62. Difference between male employees of Advertising dept. in all companies together (excluding company TCS) and the female employees of Sales dept. in all companies together (excluding company Wipro and TCS)?
(a) 21 (b) 26 (c) 31 (d) 36 (e) None of these

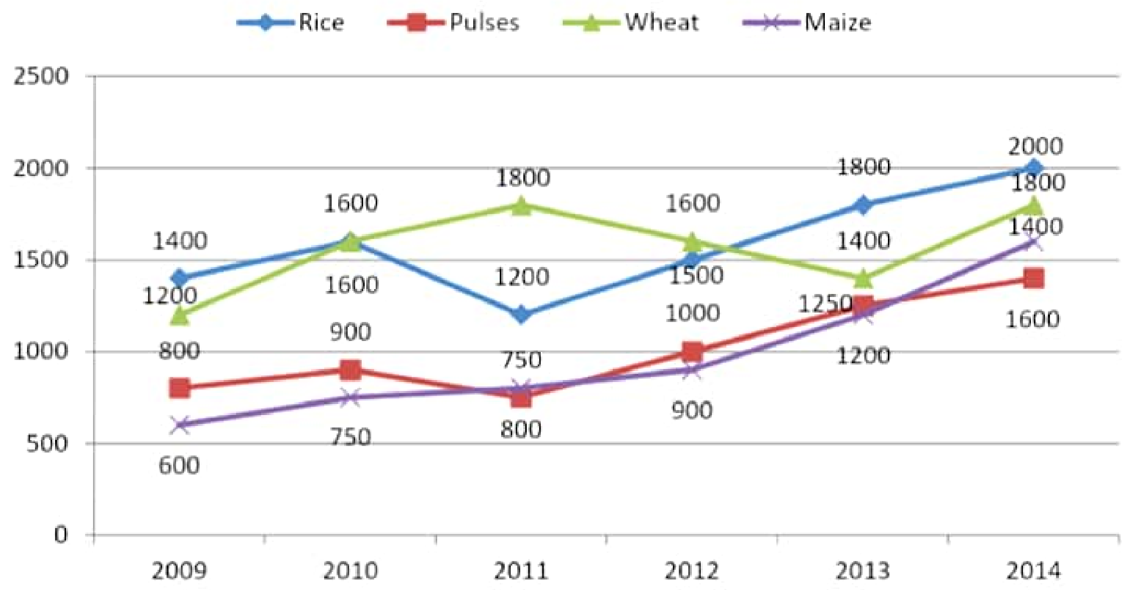
63. Total number of Advertising employees of company Wipro and Oracle is what % more than the total no. of Advertising employee in company Mindtree?
(a) 536.76% (b) 526.67% (c) 576.76% (d) 546.67% (e) 545.45%

64. If 40% of the employees of company TCS in Sales department have graduation degree and 60% of the employees of the same company in the Advertising dept. have graduation degree, then how many employees have graduation degree in company TCS in both dept. together?
(a) 75 (b) 108 (c) 106 (d) 92 (e) 66

65. The ratio of female employee of company Infosys and Wipro in Sales dept. to male employee of company Oracle and Mindtree in Advertising dept.?
(a) 41:13 (b) 74:29 (c) 22:59 (d) 29:74 (e) None of these

Directions (66-70): Study the following line graph and table carefully to answer the given questions.

Total production under various heads



Percentage of total production used under various heads

Year	Export	PDS Supply	Supply in open market
2009	42%	38%	-
2010	55%	-	25%
2011	48%	22%	-
2012	-	20%	18%
2013	-	33%	32%
2014	40%	-	35%

66. What is the approximate average of exports for the given six years? (In thousand tonnes)
(a) 2300 (b) 2388 (c) 2450 (d) 2488 (e) None of these

67. What is the ratio of the total production of all food grains in the year 2012 to the total quantity of export in the year 2009, 2011 and 2014 together?
(a) 1250 : 1671 (b) 1671 : 1250 (c) 1250 : 1661
(d) 1250 : 1675 (e) None of these

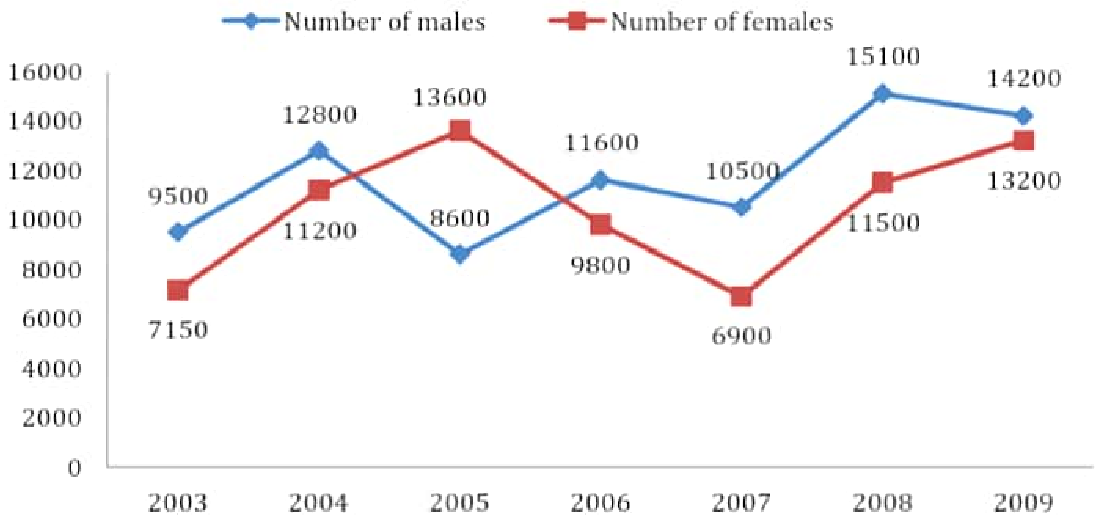
68. What is difference between the amount of the total supply in open market in the year 2009 and the total export in the year 2012? (In thousand tonnes)
(a) 2500 (b) 2400 (c) 2300 (d) 2200 (e) None of these

69. The total production of Maize in the year 2009, 2011, 2012 and 2013 together is what per cent of the total production of Pulses in the year 2011, 2012 and 2013 together?
(a) 112% (b) 114% (c) 115.76% (d) 113.11% (e) None of these

70. In which of the following years is the quantity of PDS supply the minimum?
(a) 2009 (b) 2010 (c) 2014 (d) 2013 (e) 2011

Directions (71 – 75): Read the following graph and table carefully and answer the questions given below.

Number of males and females in a village in different years



Year	% of males of the age group more than 50 years	% of females of the age group more than 50 years
2003	27%	31%
2004	19%	26%
2005	32%	28%
2006	37%	42%
2007	21%	36%
2008	27%	35%
2009	23%	24%

71. What is the respective ratio of the number of males of the age group more than 50 years in 2004 and the numbers of females of the age group more than 50 years in 2009?
(a) 76 : 33 (b) 99 : 23 (c) 20 : 23 (d) 6 : 7 (e) None of these

72. The number of females of the age group more than 50 years in 2006 is **approximately** what percent of the numbers of males of the age group less than 50 years in the same year?
(a) 52 (b) 59 (c) 64 (d) 48 (e) 56

73. What is the average number of males of the age group less than 50 years in all the years?
(a) 8673 (b) 8556 (c) 8430 (d) 8328 (e) None of these

74. The total number of females of the age group more than 50 years in 2005 is **approximately** what percent more than number of females of the same age group in 2004?
(a) 27 (b) 22 (c) 39 (d) 30 (e) 34

75. The number of males of the age group more than 50 years in 2005 is **approximately** what percent more than number of males of the same age group in 2004?
(a) 26 (b) 13 (c) 52 (d) 12 (e) 36

Directions (76-80): Study the following table carefully to answer these questions.

Number of workers employed in six units of a factory during the years.						
Unit / Year	A	B	C	D	E	F
1998	145	88	115	120	140	136
1999	128	76	122	112	152	132
2000	136	96	132	124	158	140
2001	183	92	125	135	166	126
2002	160	107	140	118	170	146
2003	152	110	148	128	175	150

76. In the year 2000 the number of employed workers by unit 'C' is what per cent of the total number of employed workers by (A, B and C) units in the same year (rounded off to two places of decimal)?
(a) 36.26 (b) 37.52 (c) 36.66 (d) 36.48 (e) None of these

77. For all the given years, what is the average of the average number of workers in units D and E?
(a) 140.6 (b) 141.5 (c) 140.8 (d) 141.4 (e) None of these

78. In which year is the no. of workers in unit A equal to the no. of workers in unit E in any of the given years?
(a) 1998 (b) 2001 (c) 1999 (d) 2003 (e) None

79. For all the given years, in which unit the average number of employed workers were minimum?
(a) D (b) A (c) B (d) E (e) None of these

80. In the year 1998 what is the approximate ratio of the number of employed workers in units A & B together to that of C, D, E & F together?
(a) 13 : 14 (b) 372 : 361 (c) 10 : 9 (d) 233 : 511 (e) 4 : 3

Directions (81-85): Study the table carefully to answer the questions that follow it.

Number of students appeared (App) and qualified (Qua), for an examination in six states over the years

Years	States											
	A		B		C		D		E		F	
	App	Qua	App	Qua	App	Qua	App	Qua	App	Qua	App	Qua
2001	1567	124	1745	156	1684	150	1440	165	1564	162	1886	142
2002	1678	110	1897	178	1550	178	1390	172	1575	188	1764	186
2003	1785	156	1674	162	1754	210	1364	114	1510	214	1738	194
2004	1630	234	1986	154	1806	186	1478	138	1654	196	1644	182
2005	1805	256	2107	193	1666	198	1560	189	1690	180	1680	162

2006	1922	234	2080	245	1884	254	1672	193	1432	206	1572	222
2007	1790	198	2095	220	1728	202	1778	195	1864	216	1444	218

81. The number of candidates qualified from state C in 2002 and 2005 together is what per cent of the number of candidates appeared from state F in 2003 and 2004 together? (rounded off to two digits after decimal)
(a) 10.65% (b) 12.44% (c) 14.86% (d) 11.11% (e) None of these

82. The percentage of candidates qualified over appeared in 2004 is the highest for which of the following states?
(a) B (b) D (c) A (d) E (e) None of these

83. The percentage of candidates qualified over appeared from state B is the lowest during which of the following years?
(a) 2007 (b) 2004 (c) 2001 (d) 2005 (e) None of these

84. Approximately what is the percentage of candidates qualified over appeared from state D over the given years?
(a) 11% (b) 21% (c) 27% (d) 15% (e) None of these

85. Approximately what is the average number of candidates qualified from state D over the given years?
(a) 132 (b) 116 (c) 167 (d) 192 (e) None of these

Directions (86-90): Study the table carefully and answer the given questions.

Publishing House	Number of books published	Ratio of Academic to Non-academic books	Percentage of books distributed	Number of distributors in publishing house
M	28200	7 : 3	81	17
N	32200	5 : 9	74	23
O	29700	6 : 5	92	18
P	31200	8 : 5	86	24
Q	33800	7 : 6	79	25
R	35700	11 : 6	82	21
S	37800	5 : 13	89	24

86. What is the difference between the number of Academic books published by publishing house M and P?
(a) 450 (b) 640 (c) 540 (d) 504 (e) None of these

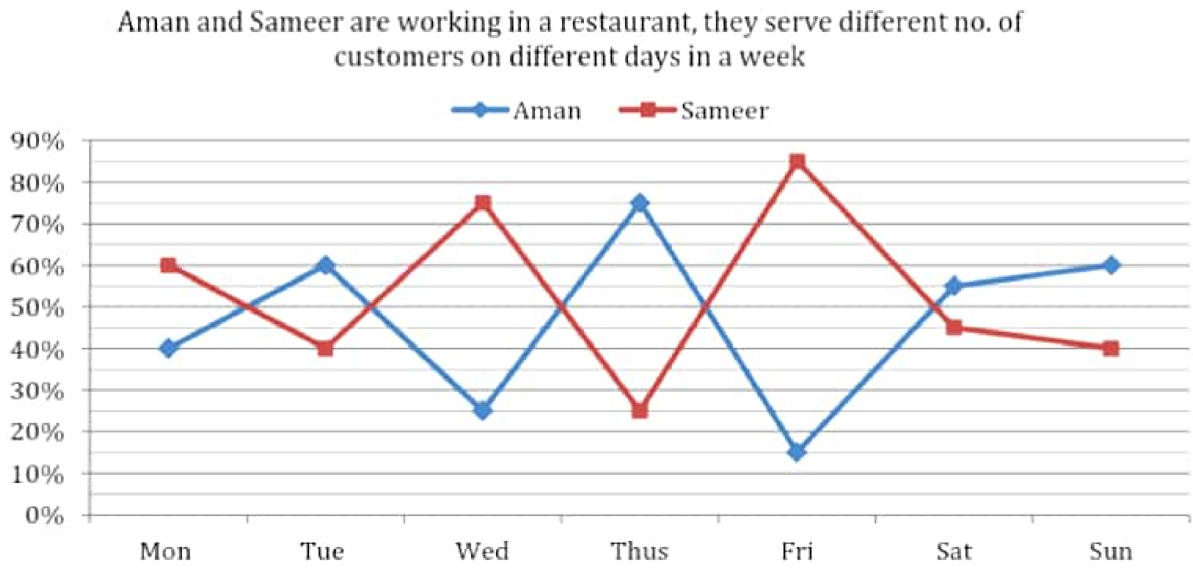
87. How many books were given to each distributor by Publisher Q if each publisher gets equal number of books?
(a) 1806 (b) 1068 (c) 1608 (d) 1308 (e) 1568

88. What is the average number of Non-academic books published by publisher R and S?
(a) 18750 (b) 18850 (c) 19950 (d) 18950 (e) 19990

89. If the total number of books of publishers P, Q and R is increased by 30% and the total number of books published by the remaining publishers is decreased by 20% then what will be the new average of books published by all the publishers together?
(a) 33418 (b) 33318 (c) 32518 (d) 33618 (e) 33328

90. What is the total number of books distributed by publishers O and Q?
(a) 26702 (b) 27324 (c) 55026 (d) 54026 (e) None of these

Directions (91-95): Study the following line graph and answer the following questions carefully :-



Total no. of customers visiting the restaurant on different days in a week

Day	No. of visitors
Mon	8000
Tue	7000
Wed	9000
Thus	12000
Fri	15000
Sat	22000
Sun	25000

91. Customers served by Aman on Monday and Saturday together is what percent of customers served by Sameer on Saturday ?
(a) 150% (b) 155% (c) 154.5% (d) 155.5% (e) None of these

92. Average number of customers served by Aman during the whole week is approximately what % more or less than average number of customers served by Sameer?
(a) 5% (b) 3% (c) 4% (d) 6% (e) None of these

93. On which day did Aman serve the minimum customers?
(a) Tuesday and Friday both (b) Wednesday (c) Monday
(d) Tuesday and Sunday both (e) None of these

94. What is the ratio of customers served by Aman on Monday and Thursday together to the customers served by Sameer on Wednesday and Monday together?
(a) 110 : 1101 (b) 244:231 (c) 112 : 1150
(d) 120 : 3751 (e) None of these

95. The customers served on Sunday are approximately what % of the customers served by Sameer on Tuesday and Thursday together?
(a) 431% (b) 440% (c) 435% (d) 420% (e) None of these

Directions (96-100): Study the following table carefully and answer the questions given below.

Number of Students Passed and Failed in Five Classes of a School over the Years

	Classes									
	VI		VII		VIII		IX		X	
Years	Pass	Fail	Pass	Fail	Pass	Fail	Pass	Fail	Pass	Fail
2001	50	42	76	14	58	18	65	17	48	23
2002	60	19	95	22	71	30	75	12	76	28
2003	45	13	61	19	49	15	48	08	74	20
2004	58	21	75	25	80	28	60	11	84	14
2005	55	18	66	29	59	26	70	13	65	17
2006	68	31	54	38	77	34	82	21	55	14

96. What is the average number of failed students from class X for the given years?
(a) 27.5 (b) 19.33 (c) 26.5 (d) 26 (e) 24.5

97. What is the ratio between total number of passed students and total number of failed students for the year 2004?
(a) 3 : 1 (b) 56 : 23 (c) 67 : 13 (d) 68 : 35 (e) 119 : 33

98. Total passed students from class VI is what percent of total failed students of that class taking all years together?
(a) 123.33% (b) 333.33% (c) 233.33% (d) 124.33% (e) none of these

99. What is the number of passed students, for all the classes together, in the year 2002?
(a) 377 (b) 298 (c) 316 (d) 354 (e) 373

100. What is the total percentage of passed students of class X from all the years together?
(a) 52.6% (b) 87 .6% (c) 77.6% (d) 78.6% (e) 95.6%

Directions (101-105): These questions are based on the following table. Study it carefully and answer the questions:

Number of Cars (in thousands) manufactured (M), rejected (R) and sold (S) by five different companies over the years

Company	Porsche			Audi			BMW			Volkswagen			Mercedes		
Year	M	R	S	M	R	S	M	R	S	M	R	S	M	R	S
2001	136	1.2	125	98	0.5	90	165	3.5	158	158	1.5	149	85	0.6	80
2002	164	1.7	138	115	1.1	102	172	2.9	166	169	1.9	162	96	0.8	90
2003	148	1.5	136	152	2.6	132	169	2.3	160	173	2.3	168	88	0.5	83
2004	156	2.2	145	147	1.8	140	178	3.2	172	166	2.1	159	102	0.9	98
2005	168	2.5	160	138	1.3	129	158	1.8	152	159	2.0	150	86	0.7	81
2006	175	2.8	168	168	2.2	148	180	2.4	171	171	2.4	165	105	0.8	101

Note : Number of Cars accepted = Number of items manufactured - Number of items rejected

101. What is the percentage (rounded off to two digits after decimal) of Cars rejected out of the total Cars manufactured by Audi in the year 2003?
(a) 1. 97 (b) 1.71 (c) 1.82 (d) 1. 96 (e) None of these

102. How many Cars remained unsold out of the accepted Cars by Porsche in 2004?
(a) 800 (b) 880 (c) 8000 (d) 8800 (e) None of these

103. What is the total number of Cars accepted by all the five companies together in 2002?
(a) 707600 (b) 77600 (c) 70760 (d) 776000 (e) None of these

104. Approximately, what was the average number of Cars rejected by Volkswagen for all the given years?
(a) 2100 (b) 2060 (c) 2090 (d) 1990 (e) 2030

105. What was the total number of Cars manufactured by all the companies together in 2006?
(a) 582000 (b) 827000 (c) 799000 (d) 595000 (e) None of these

Directions (106 – 110): Study the table carefully to answer the following questions.

Number of Units (in millions) Manufactured by Six Companies and Percentage of Units Sold over the Years

Company	Years											
	1999		2000		2001		2002		2003		2004	
	M	%	M	%	M	%	M	%	M	%	M	%

A	18	92	20	85	22	79	30	78	28	79	23	94
B	28	86	12	86	16	68	24	80	25	90	28	68
C	16	75	16	93	24	84	26	82	26	80	30	82
D	12	78	14	90	24	82	20	84	27	75	32	77
E	14	90	18	81	16	91	22	96	18	75	30	76
F	13	88	17	91	20	86	26	92	19	84	25	85

M – Number of units manufactured in millions

% – Percentage of units sold

106. What is the increase/decrease percent in the no. of units sold by C during years 1999 to 2002 ?

(a) 77.67% (b) 87.67% (c) 85% (d) 77% (e) 74.6%

107. Which company sold the maximum no. of units in 2004?

(a) Company A (b) Company D (c) Company F
(d) Company C (e) None of these

108. Which company sold the minimum units in the year 2000?

(a) Company C (b) Company A (c) Company F
(d) Company B (e) None of these

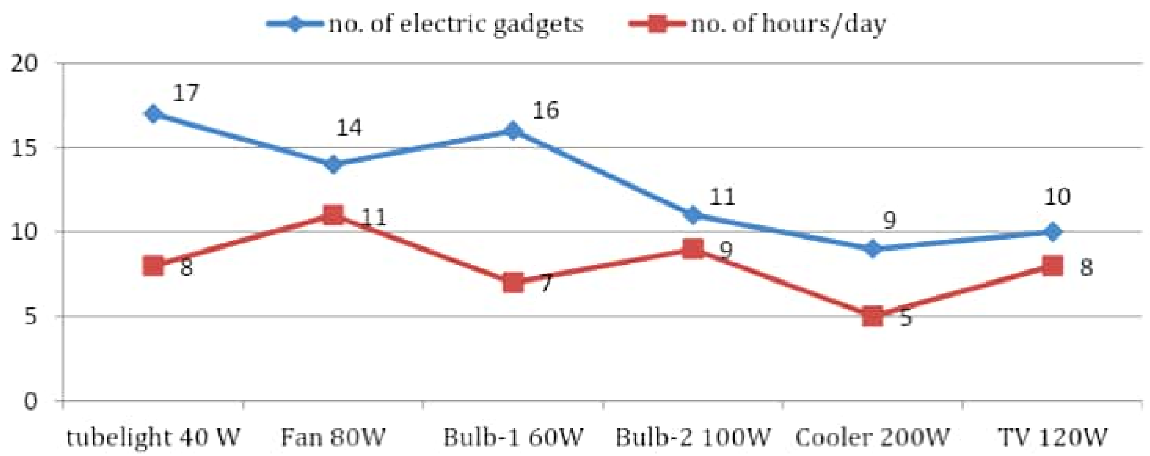
109. What is the ratio of units sold by company B in 2000 to the no. of units sold by company D in 2004?

(a) 129 : 300 (b) 129 : 352 (c) 129 : 308 (d) 129 : 317 (e) None of these

110. Which company manufactured the minimum no. of units over all the years together?

(a) Company E (b) Company C (c) Company A
(d) Company D (e) None of these

Directions (111-115): The following graph shows the number of different electric gadgets and their hours of use per day in a jeweler's shop. Study the graph carefully and answer the following questions:-



NOTE: If a 80W fan used for 2 hours then it consumes 160watt hours energy and 1000W hour=1Unit.

111. Which of the following consumes 2nd highest amount of electricity in the shop?

(a) Tube light (b) Cooler (c) bulb-2 (d) TV (e) Fan

112. If 1 electric unit costs Rs. 2.7 then what money is paid to electricity department for using fans and tube lights for the month of August?
(a) Rs. 1438.56 (b) Rs. 1486.512 (c) Rs. 1495.64
(d) Rs. 1498.37 (e) None of these

113. Electricity consumption by all the fans is what percent of the consumption by Bulb I and Bulb II together?
(round off to 2 decimal places)
(a) 73.14% (b) 75.19% (c) 71.11% (d) 74.13% (e) None of these

114. Find the total consumption of energy in the shop in kwh (kilowatt hours) in 1 week.
(a) 367.63 (b) 354.52 (c) 384.85 (d) 370.86 (e) None of these

115. If the coolers are of power 175W instead of 200W then how much less units it would consume in the whole month (30 days)?
(a) 33.75 units (b) 43.25 units (c) 41.85 units
(d) 34.95 units (e) None of these

Directions (116-120): The ratio of male to female employees in an organization is 5 : 7. All employees of the organization work at different levels. (Level - I, II, III, IV, V). $16\frac{2}{3}\%$ of the male employees work at level I. The difference between male employees working at level II and male employees working at level IV is 114, while the sum of the same is 250. (male employees at level II < male employees at level IV). 9 male employees work at level V, which is 2% of the total number of male employees. Remaining male employees work at level III. $22\frac{2}{9}\%$ of the female employees work at level I. The no. Female employees working at level II is 6 more than the no. of female employees working at level III. The number of female employees working at level IV is 2 more than the number of male employees at the same level. The number of female employees working at level V is $57\frac{1}{7}\%$ of the female employees working at level I.

116. Find the total number of employees working on level II.
(a) 176 (b) 184 (c) 188 (d) 192 (e) None of these

117. Female employees working on level V constitutes what percent of total number of employees in the organization?
(a) $5\frac{1}{9}\%$ (b) $5\frac{1}{3}\%$ (c) $5\frac{5}{9}\%$ (d) $7\frac{11}{27}\%$ (e) None of these

118. What is the respective ratio of male employees working at level I to the female employees working at level V?
(a) 15 : 16 (b) 14 : 15 (c) 15 : 17 (d) 17 : 19 (e) None of these

119. What is the total number of employees working at level I, level II and level III?
(a) 325 (b) 425 (c) 475 (d) 525 (e) None of these

120. The number of female employees of which level is equal to the number of male employees of level III?
(a) level I (b) level II (c) level III (d) level IV (e) level V

Directions (121-125): The following table shows the sales figures of the four brands of laptops - HP, Compaq, IBM and Sony in the various regions of the world. The figures are given either in absolute numbers or as percentage of the total sales in the region. Assume that no other brand of laptops is present in the given regions. Based on the given table, answer the questions that follow.

	HP	Compaq	IBM	Sony
North Asia	4960	18%	14%	480
East Europe	19%	630	22%	17%
West Europe	32%	13%	19%	2160
North America	4260	9%	12%	8%
South America	5%	1260	990	20%
East Africa	225	484	517	128
West Africa	180	26%	900	2250
South Asia	450	4050	1350	35%
Australia	25%	32%	14%	754

121. What is the total number of laptops sold by IBM across all the regions combined?
(a) 7431 (b) 12680 (c) 8451 (d) 7831 (e) None of these

122. The ratio of laptops sold in South Asia, West Africa and East Europe is
(a) 6 : 3 : 2 (b) 3 : 6 : 2 (c) 6 : 3 : 1 (d) 3 : 2 : 1 (e) None of these

123. Which of the following options is/are true?
I. Total sales of Laptops in South America is 3000 units.
II. Sales of IBM in East Africa is 25% more than sales of HP in West Africa.
III. The ratio of sales of Compaq in North America to the sales of the same in South America is 3 : 7.
(a) Only I (b) I and II (c) I and III (d) II and III (e) None of these

124. Sales of HP and Compaq in north America is what times of the Sales of HP in south America and Australia ?
(a) 6 (b) 8 (c) 5 (d) 4.5 (e) none of these

125. Find the difference between total sale of IBM laptops and total sale of sony laptops in all regions together.
(a) 2836 (b) 2736 (c) 2826 (d) 2876 (e) None of these

Directions (126-130): The following information is about the production of bikes by 3 different companies from Monday to Friday in a specific week. Read the information carefully and answer the following question:-

The total production by 3 companies on Monday was 540 out of which $33\frac{1}{3}\%$ bikes were produced by Hero. The number of bikes produced by Bajaj on Monday are less than the bikes produced by

Hero on Monday by the same extent as the number of bikes produced by Honda on Monday is more than the bikes produced by Hero on Monday. The difference between bikes produced by Bajaj and Honda on Monday is 40. 150 bikes are produced by Hero on Tuesday, which is 100 less than the bikes produced by the same company on Wednesday. A total of 910 bikes were produced by Hero from Monday to Friday. The ratio between bikes produced by Hero on Thursday to bikes produced by the same company on Friday is 5 : 6. 220 bikes were produced by Bajaj on Tuesday, which is 80 less than the bikes produced by Honda on Wednesday. A total of 570 bikes were produced on Tuesday, which is 76% of the total bikes produced on Wednesday. The number of bikes produced by Honda on Thursday is $66\frac{2}{3}$% more than bikes produced by Hero on the same day. Total 580 bikes were produced on Thursday. The number of bikes produced by Honda on Friday is same as that on Monday. 140 bikes were produced by Bajaj on Friday.

126. Find the ratio between total bikes produced on Monday to that on Wednesday.
(a) 18 : 29 (b) 18 : 25 (c) 18 : 31 (d) 3 : 5 (e) None of these

127. Find the total number of bikes produced by Bajaj from Monday to Friday.
(a) 900 (b) 980 (c) 950 (d) 960 (e) None of these

128. Find the average number of bikes produced per day by Honda from Monday to Friday. (approximate)
(a) 250 (b) 220 (c) 270 (d) 240 (e) 230

129. On which pair of days, the number of bikes produced by Hero is the same ?
(a) Tuesday and Wednesday (b) Wednesday and Thursday (c) Tuesday and Thursday
(d) Monday and Wednesday (e) Monday and Tuesday

130. On which day the total number of bikes produced was the maximum ?
(a) Monday (b) Tuesday (c) Wednesday
(d) Thursday (e) Friday

Directions (131-135): Given below is the information regarding to the result of 3 students Arun, Sanjeev, Kamal in sessional exams of class 12th. Read it carefully and answer the following questions :
There are total 5 subjects i.e. Physics, Chemistry, Maths, English, and computers each carrying different maximum marks. Physics and Chemistry both carries equal maximum marks i.e. 35. Math carries maximum marks 5 more than Physics and 10 more than English. Total of maximum marks of the 5 subjects is 160. Kamal scored 60% in Physics, while Sanjeev scored $48\frac{4}{7}$% in the same subject. Arun scored only 13.5 marks in Physics. Arun scored 24 marks in Chemistry which is 60% more than the marks scored by Sanjeev in the same subject. The total of the marks of 3 students in chemistry is 58, Kamal scored 15.5 marks in Maths, while Sanjeev scored 35% in the same subject and Arun scored highest in maths with 29 marks. Arun scored 40% in English which is $33\frac{1}{3}$% less than the marks of Sanjeev in the same subject. Score of Kamal in English is 14 marks. The sum of marks of Arun and Sanjeev in computers is 32 while the ratio of the same is 9 : 7. Kamal scored 77.5% marks in computers.

131. What is the average marks scored by the 3 students in English? (round off to nearest integer)

(a) 11 (b) 14 (c) 18 (d) 15 (e) None of these

132. Find the difference between total marks scored by Arun in all subjects and the total marks scored by Sanjeev in all subjects together.
(a) 12 (b) 18.5 (c) 17 (d) 21 (e) None of these

133. Calculate the percentage of marks obtained by Kamal in the sessional exams.
(a) 50.5% (b) 52.25% (c) 53.125% (d) 53.75% (e) None of these

134. Marks of Sanjeev in English and Maths in what percent more or less than the marks of all the 3 students in computers ?(round off to 2 decimal places).
(a) 32.63% (b) 33.33% (c) 35.63% (d) 36.63% (e) 38.63%

135. If the passing marks in each sessional are 40%, then total number of compartment of all students together?
(a) 1 (b) 2 (c) 3 (d) 4 (e) 5

Directions (136-140): Given below is the information regarding the number of children in 5 different societies. Study the information carefully and answer the following questions:

The ratio of male children to female children in society A is 2 : 3, while the difference between them is 45. The total number of children in society A is 30% of the total population of this society. In society B there are 65 female children which is 26% of the total children of society B and $8\frac{1}{8}\%$ of the total population of this society. The total number of children in society C is 325 out of which $\frac{8}{13}$ are male. The female children in society C is $12\frac{1}{2}\%$ of the total population of this society.

In society D, total number of children is 40% of the total population. Male children in this society are $66\frac{2}{3}\%$ of the female children in this society. Total children in society D are 370.

Total population of society A, B, C, D and E together is 4000. Total children in society E is 56% of the population of this society while the difference between number of male children and female children in this society is 66. (male children are more than female children in society E)

136. What is the total population of society E ?
(a) 500 (b) 550 (c) 525 (d) 575 (e) None of these

137. What is the ratio between number of female children in society A to the male children in society E ?
(a) 1 : 2 (b) 2 : 3 (c) 3 : 4 (d) 4 : 5 (e) None of these

138. Female children in society E is what percent of the total population of this society ?
(a) $21\frac{3}{7}\%$ (b) $21\frac{5}{7}\%$ (c) $21\frac{6}{7}\%$ (d) $22\frac{1}{2}\%$ (e) None of these

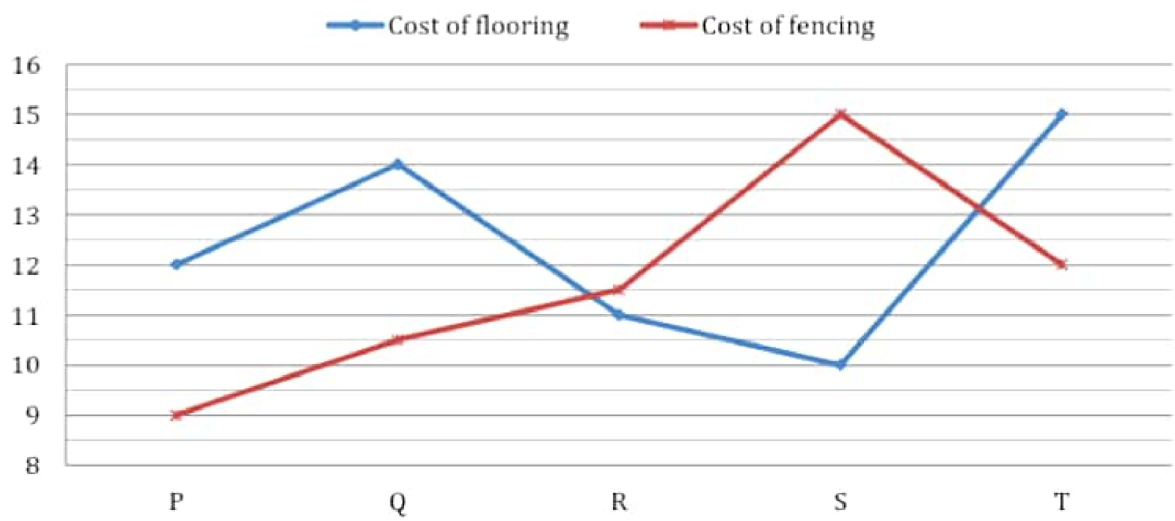
139. Find the total number of female children in all societies together.
(a) 650 (b) 655 (c) 658 (d) 661 (e) None of these

140. Total number of children in society A, B and C together forms what percent of the population of these 3 societies?
(a) $31\frac{19}{51}\%$ (b) $32\frac{22}{51}\%$ (c) $33\frac{1}{3}\%$ (d) 35% (e) None of these

Directions (141-145): Given below is the table showing the data related to 5 different fields of different shapes and their corresponding dimensions, area and circumference. Some of the values are missing. You are expected to calculate the missing values, if necessary and answer the questions given below.

Field Name	field shape	Side (in m)	Base (in m)	Height (in m)	Radius (in m)	Area (in sq. m)	Perimeter/circumference (in m)
P	Triangular	–	78	24	–	–	–
Q	Rectangular	94 × –	–	–	–	7050	–
R	Square	89	–	–	–	–	–
S	Parallelogram	75 × 96	–	–	–	4500	–
T	Circular	–	–	–	–	–	110

Cost of flooring (in Rs/m²) and cost of fencing (in Rs/m)



141. Cost of fencing of the plot which is rectangular in shape is approximately what percent of the cost of flooring of plot T? (round off to 2 decimal places)
(a) 20.42% (b) 21.84% (c) 24.58% (d) 22.94% (e) 23.74%

142. If the triangular field is in the shape of right angled triangle with the same base and height as given in table then find the difference between cost of fencing and cost of flooring of this field.
(a) 9510 Rs. (b) 9475 Rs. (c) 9550.4 Rs. (d) 9579.6 Rs. (e) 9670 Rs.

143. If the field R is in the shape of circle instead of being square with the radius equal to side of square then find the percentage increase in cost of flooring of field R as compared to the initial cost of flooring . (approximate)
(a) 114% (b) 120% (c) 150% (d) 110% (e) 100%

144. What is the difference between the cost of fencing and flooring of triangular field together and the same for the rectangular field ? (assume the triangular field is the shape of right angled triangle)

(a) 101149 (b) 101199 (c) 104151 (d) 104199 (e) None of these

145. What is the sum of cost of flooring all the fields ? (in Rs.)
(a) 256500.5 (b) 255500.5 (c) 258500.5 (d) 261500.5 (e) None of these

Directions (146-150): Study the following information carefully and answer the given questions.

Data regarding number of graduates studying various courses in university A and that in university B in the year 2001.

(Note : Universities A and B offer courses in six courses only, namely- Commerce, Science, Engineering, Arts, Management and Law).

In university A, graduates in Commerce, Science and Engineering together constituted 60% of the total number of graudates (in all the given six courses together). Graudates in Arts, Management and Law were 1300, 1440 and 860 respectively, Commerce graduates were 25% more than that of engineering graduates. Management graduates were 20% less than that of science graduates.

In university B, Commerce graduates were 10% less than the Commerce graduates in university A.

In university B, Management graduates were 900 and they constituted 12% of the total number of graduates (in all the given six courses together). Also management graduates were 40% less than that of Science graduates. Total number of graduates in engineering and Arts together were double the total number of graduates in management and law together. The ratio of engineering and arts graduates is 3 : 5 respectively.

146. What is the difference between the total number of graduates in management and law together in university A and that in the same courses together in university B ?
(a) 1200 (b) 900 (c) 800 (d) 110 (e) 700

147. $\frac{3}{4}$th of the number of arts graduates in university A were females. If the number of female arts graduates in university A is less than that in university B by 175, what is the number of male arts graduates in university B?
(a) 800 (b) 720 (c) 600 (d) 680 (e) 700

148. What is the respective ratio between the total number of graduates in Engineering and Commerce together in university A and that in the same courses together in university B ?
(a) 9 : 8 (b) 5 :4 (c) 6 : 5 (d) 13 : 12 (e) 24 : 19

149. Number of Science graduates in university B is what percent less than that in university A ?
(a) $16\frac{2}{3}$ (b) 25 (c) 20 (d) $25\frac{1}{3}$ (e) $14\frac{1}{7}$

150. Total number of graduates (in all the given six courses together) in university A, was what percent more than that in university B ?
(a) 10 (b) 20 (c) 25 (d) 30 (e) 15

Directions (151-155): Study the information carefully and answer the following questions.

A total of 1650 employees are working in a company in different departments. The ratio of male employees to female employees in the organisation is 86 : 79. There are total 5 departments in the company i.e. Production, Quality, Maintenance, 'Finance' and HR. Total 198 males work in

"Production department". 18% employees works in Quality department, in which male to female ratio is 5 : 4. In Finance department, 77 males are working and the number of females in this department is $\frac{5}{7}$ of the number of males. The number of males in Quality department is equal to number of females in Production department. The number of males of Finance department is half of the number of males in HR department. Male to female ratio in Maintenance department is 14 : 19.

151. No. of males in Maintenance department is how much more than females in Production department?
(a) 99 (b) 91 (c) 109 (d) 105 (e) None of these

152. Females in Maintenance department is what percent of total number of females in the company (approximate)?
(a) 44.7% (b) 45.7% (c) 48.9% (d) 49.2% (e) 38.9%

153. No. of Females in Finance department is what percent less than the no. of females in Production department?
(a) $33\frac{1}{3}$ (b) $66\frac{2}{3}$ (c) 61 (d) 70 (e) None of these

154. What is the difference between no. of male employees of Production, Quality and HR department together and no. of females of Production, Finance and Maintenance department together?
(a) 54 (b) 64 (c) 35 (d) 96 (e) None of these

155. If $\frac{5}{12}$ of the females of the Quality department are shifted in HR department. Then males in HR department is what times of no. of females in the same department. (round off to 2 decimal places).
(a) 1.07 (b) 1.17 (c) 1.27 (d) 1.37 (e) 1.32

Directions (156-160): Study the following information carefully and answer the questions that follow:
(**Note:** total earning = salary + incentives)

Gaurav and Vivek are currently working in an M.N.C. as software developers. Both of them have different monthly salary. Salary of Gaurav is 62500 Rs. per month, which is $16\frac{2}{3}$% less than monthly salary of Vivek. Both of them also earns a certain amount of incentive. Amount of incentives of Gaurav is 15% of the monthly salary of Vivek and is 12.5% more than the monthly incentive of Vivek. Monthly expenditure of Gaurav for food is Rs.7550, while the same of Vivek is 8850. Both of them are sharing the same flat which cost them a rent of Rs. 16000 (each of them is paying 50% of rent). Gaurav spends 30%of his total earning (salary +incentive) on shopping, while Vivek is also spending the same amount on shopping. Gaurav makes a saving of Rs. 26500 and the remaining is spent as 'other expenditures' The "other expenditures" of vivek are $\frac{7}{5}$ of the "other expenditures" of Gaurav. The remaining money is saved by Vivek.

156. Find the difference in savings of Vivek and savings of Gaurav.
(a) 6250 Rs. (b) 6120 Rs. (c) 6520 Rs. (d) 7200 Rs. (e) None of these

157. If Vivek would have earned only half of the incentive, then his expenditure on 'rent' would be what percent of his total earnings ?
(a) 10% (b) 20% (c) 15% (d) 12.5% (e) None of these

158. Neeraj, who is the team leader of Vivek and Gaurav have a total earning equal to 80% of the sum of total earning of Vivek and Gaurav and saving is 870 Rs. less than the savings of Vivek. What percent of income Neeraj is saving ?
(a) 20% (b) 22.5% (c) 25% (d) 30% (e) None of these

159. What is the ratio of money spent by Gaurav on rent to the incentive of Vivek ?
(a) 4 : 3 (b) 5 : 7 (c) 7 : 5 (d) 5 : 6 (e) None of these

160. Find the sum of the money spent by Vivek and Gaurav on 'other expenditures'.
(a) Rs. 21780 (b) Rs. 21750 (c) Rs. 22980 (d) Rs. 23950 (e) None of these

Directions (161-165): Study the table carefully and answer the following question carefully –
Distribution of LED's in different states and among different category of people of India under Unnatjyoti Affordable LED's for All (UJALA) scheme

Total LED's distributed = 35 lakh

States	LEDs distributed (in lakhs)	High income people	Middle income people	Low income people
Arunachal Pradesh	2.4	15%	–	50%
Gujarat	3.6	12%	32%	–
U.P.	1.8	8%	13%	–
Odisha	5.4	–	25%	–
West Bengal	–	21%	22%	–
TamilNadu	6.8	–	9%	78%
Rajasthan	7.9	15%	–	60%

Note- some values are missing, you have to find these values as per given data only.

161. Total distribution of LED's in West Bengal is what % more/less than that of total distribution of LED's in Odisha and U.P. together?

(a) $1\frac{5}{18}\%$ (b) $1\frac{7}{18}\%$ (c) $2\frac{7}{18}\%$ (d) $2\frac{5}{18}\%$ (e) None of these

162. What is the ratio of distribution of LED's in low income people of U.P. to the middle income people of Rajasthan ?

(a) 25:18 (b)17:29 (c) 29:17 (d) 18 : 25 (e) None of these

163. Total distribution of LED's in low income people of all the state together excluding odisha is approximately what % of the total distribution of LED's in all states together?

(a) 63% (b) 48% (c) 54% (d) 51% (e) 58%

164. What is the difference between the LED's distribution in High income people of UP, West Bengal and Tamil Nadu together to the LED's distribution in Middle income people of Arunachal Pradesh, Gujarat and Rajasthan together?

(a) 144800 (b) 140700 (c) 140900 (d) 14420 (e) None of these

165. In Odisha state the ratio of % distribution of LED's in High income people to the Low income people is 8 : 7, then the distribution of LED's in high income people in the same state is how much more than that of in Low income people?

(a) 29000 (b) 14000 (c) 21000 (d) 24000 (e) None of these

Directions (166-170): In Kurukshetra institute of technology and Management (KITM) , there are only 2 master degree course i.e. MBA and M.Tech. Total 1500 students study in MBA and M. tech, out of which 45% study in MBA, while the remaining are in M. tech. Each student knows 1 or more than 1 language out of Hindi, English and Punjabi.

In MBA, the ratio of boys to girls is 4 : 5. Out of the total boys of MBA, 12% knows only English, 18% knows only Hindi. $\frac{1}{3}$rd of the sum of students who know Hindi only and English only, know only Punjabi. 14% knows English and Hindi. $\frac{1}{4}$ of the total boys of MBA knows Hindi and Punjabi. 8% knows English and Punjabi. Remaining boys of MBA know all the 3 languages.

Out of total girls of MBA, 12% knows Hindi only, 20% knows English only. The number of girls of MBA who knows Punjabi only is double of the number of boys of MBA who knows Punjabi only, while the number of girls of MBA who knows Hindi and Punjabi are double of the number of boys of MBA who know Hindi and Punjabi. Only 25 girls of MBA know English and Hindi. Only 5 girls of MBA knows all 3 languages. Remaining girls of MBA know English and Punjabi.

The total number of girls in M. tech are equal to total number of boys in MBA, 15% of girls of M. tech know only English, which is half of the number of boys of M. tech who know only English. Total 100 students of M. tech know Hindi only, in which number of boys is 3 times of number of girls. 15 boys of M. tech know only Punjabi, while 35 girls of M. tech know only Punjabi, The number of boys M. tech who know English and Hindi are 105, which is 30 more than the number of girls of M. tech. who know English and Hindi. 20% of the boys of M. tech knows Hindi and Punjabi, while 15% of the girls of M. tech knows Hindi and Punjabi. 4% of the boys of M. tech know all 3 languages. The remaining boys of M. tech know English and Punjabi. None of the girls of M. tech know all 3 languages.

166. The total number of students in KITM who know only Hindi are :
(a) 201 (b) 199 (c) 200 (d) 175 (e) None of these

167. The number of boys of MBA who knows Punjabi only are what percent of the number of girls of MBA who know Punjabi only?
(a) 50% (b) 75% (c) 100% (d) 125% (e) None of these

168. What percent of the total girls of M. tech know English and Punjabi only ?
(a) 20% (b) 40% (c) 25% (d) 50% (e) None of these

169. Total number of students in KITM who know all 3 languages are what percent of the total no. of students in the college ?
(a) $4\frac{1}{3}\%$ (b) $4\frac{2}{3}\%$ (c) $5\frac{1}{3}\%$ (d) $5\frac{2}{3}\%$ (e) None of these

170. The ratio of number of students of MBA who know Hindi and Punjabi only to the number of students of M. tech who know Hindi and Punjabi only is:
(a) 3 : 4 (b) 4 : 3 (c) 2 : 3 (d) 3 : 2 (e) None of these

Directions (171-175): Study the following table carefully and answer the questions that follow :

Month	Total no. of mobiles produced	% of mobiles passing the quality test	Total no. of mobiles passing the quality test	Average selling price per mobile for company	Total revenue (in lakhs)
January	28500	78%	–	7000	–
February	–	85%	–	7200	1413.72
March	25000	–	20250	7500	–
April	–	84%	19488	–	1559.04
May	31850	–	–	7500	1958.775
June	35500	–	26625	–	1890.375

[**Note:** 1. Only the mobiles which passed the quality test, are sold by the company and total revenue = Average selling price per mobile × total mobiles sold.
2. Some of the values are missing, you are expected to calculate the missing values and answer the questions]

171. If the average cost price per mobile for the company in the month of April is Rs. 6200, then what is the percentage profit or loss of the company in that month? (approximate)
(a) 4.4% profit (b) 4.4% loss (c) 8.4% profit
(d) 8.4% loss (e) 10.4% profit

172. What percent of mobiles produced in May, passed the quality test?
(a) 81% (b) 75% (c) 82% (d) Can't be determined (e) None of these

173. Find the difference between total number of mobiles passing the quality test in January to that in February.
(a) 2795 (b) 2895 (c) 2595 (d) Can't be determined (e) None of these

174. Find the total number of mobiles passing the quality test in the given months.

(a) 123345 (b) 145345 (c) 143345 (d) 134345 (e) None of these

175. Total revenue generated in Ist quarter of the year is how much more or less than the revenue generated in IInd quarter of the year? (approximate)
(a) 760 lakhs (b) 860 lakhs (c) 920 lakhs (d) 1060 lakhs (e) 1120 lakhs

Directions (176-180): In a school 35% of the total students participated in the annual function of the school. Out of the total students participated the ratio of boys to girls was 3 : 5. While the percentage of total girls out of total students in the school is 75%. out of total girls, $29\frac{1}{6}$% participated in the function i.e. 350. 10% of the boys participants participated in solo dancing. $15\frac{5}{21}$%of the boy participants participated in group dancing. The ratio of girls participated in solo dancing and group dancing is 10 : 13, while the sum of the same is 115. Total 140 students participated in drama , out of which 55% are girls. 40% of the boys participants participated in games. The no of girl participants in games is 25% more than the boys who participated in games. The remaining boy participants participated in singing and the remaining girl participants participated in singing.
[**Note: -** Each participant participated in 1 event only]

176. Participant boys are what percent of the total number of the boys in the school?
(a) 50% (b) 52.5% (c) 55% (d) 60% (e) None of these

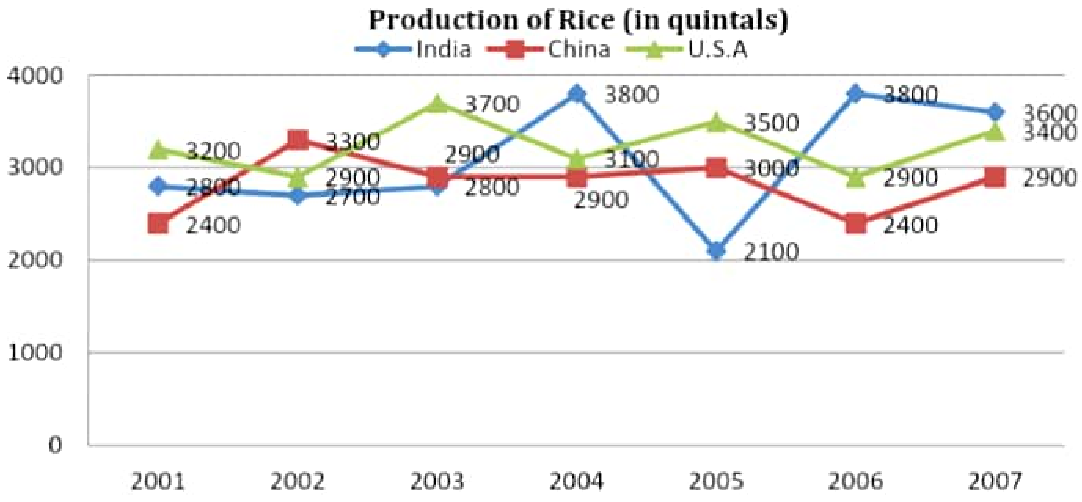
177. Out of the total girls participated in games 20% participated in basketball, 75% of the remaining participated in cricket. Out of the remaining girls the ratio of girls participated in football and that in table tennis is 2 : 1. What percent of total girls participants participated in table tennis?
(a) 4% (b) 10% (c) 2% (d) 15% (e) None of these

178. No. of Boys participated in solo dancing is what percent more than the no. of boys participated in singing?
(a) 90% (b) 100% (c) 110% (d) 120% (e) None of these

179. Total no. of students who participated in games is what percent of total no. of students in school?
(a) 11.25% (b) 11.2625% (c) 11.8125% (d) 12.625% (e) None of these

180. The ratio of the no. of girl participants in group dancing and games together to the total no. of boy participants except singing is:
(a) 3 : 4 (b) 4 : 5 (c) 13 : 20 (d) 21 : 20 (e) None of these

Directions (181-185): In the following multiple graphs production of rice (in quintals) by three countries – India, China and U.S.A has been given. Study the following graphs carefully to answer the questions.



181. If the production of rice by India in the years 2003, 2004, 2005 and 2007 increase by 30%, 40%, 45% and 40% respectively, what will be the overall approximate percentage increase in the production of rice in the country in the given years?
(a) 40% (b) 50% (c) 60% (d) 45% (e) 55%

182. What was the average production of rice by all three states in the year 2007? (in quintals)
(a) 3400 (b) 3300 (c) 3200 (d) 3100 (e) None of these

183. In the given years, what is the average production of rice in U.S.A? (in quintals)
(a) $3242\frac{5}{7}$ (b) $3242\frac{4}{7}$ (c) $3242\frac{3}{7}$ (d) $3242\frac{6}{7}$ (e) None of these

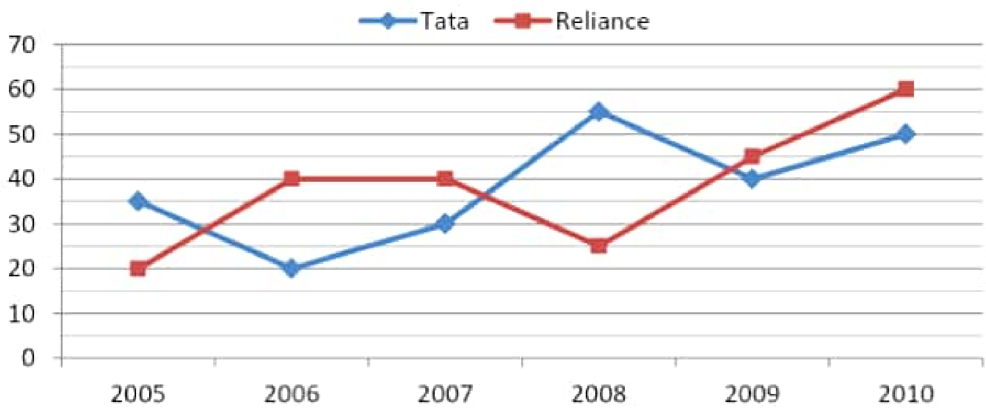
184. If the productions of rice in U.S.A in the years 2001, 2002, 2003 and 2004 increase by 20%, 25%, 28% and 35% respectively; what will be the approximate percentage increase in the average production of the countries for the given years?
(a) 22% (b) 25% (c) 27% (d) 28% (e) 30%

185. By what per cent is the total production of rice by three countries in the years 2002, 2003, and 2004 more or less than that in the years 2005, 2006 and 2007?
(a) 2.5% (b) 2.6% (c) 2.9% (d) 1.8% (e) None of these

Directions (186 – 190): Study the following graph carefully and answer the questions given below:

Percentage profit earned by the two companies Tata and Reliance over the given years

$$\text{Percentage Profit} = \frac{\text{Income} - \text{Expenditure}}{\text{Expenditure}} \times 100$$



186. If the incomes of company Tata in 2006 and 2007 were in the ratio 7:8, what was the ratio of expenditure of the company in these two years?
(a) 7 : 8 (b) 6 : 7 (c) 8 : 7
(d) Can't be determined (e) None of these

187. The income of company Reliance in 2005 was Rs. 48 crore. If the expenditure of company Reliance in 2006 was twice the expenditure of company Reliance in 2005, what was the income of company Reliance in 2006 ?
(a) Rs. 42.66 crore (b) Rs. 54 crore (c) Rs. 85.32 crore
(d) Rs. 112 crore (e) Rs. 124.88 crore

188. If the ratio of the income of companies Tata and Reliance in 2008 was 3:7, what was the ratio of the expenditure of Reliance and Tata in 2008?
(a) 75:215 (b) 217 : 75 (c) 93:175 (d) 175 : 93 (e) None of these

189. Total income of company Reliance in all the given year together was Rs. 1125 core. What was the total expenditure company Reliance in all the given years together?
(a) Rs. 486 crore (b) Rs. 631.56 crore (c) Rs. 587.19 crore
(d) Can't be determined (e) None of these

190. If the profit of company Tata in 2008 is 310 crore. What is the profit (in crore) of the same company in 2010, whose expenditure is half the expenditure of company Tata in 2008?
(a) $130\frac{10}{11}$ (b) $140\frac{9}{11}$ (c) 400 (d) $140\frac{10}{11}$ (e) None of these

Directions (191-195): Given below is the table showing the data related to sales of cold drinks (in litres) of different brands by a shopkeeper in 6 months. Some of the values are missing. You are expected to calculate the missing value, if necessary and answer the following questions.

	January	February	March	April	May	June	Total
Mirinda	8750	4520	4245	–	4325	9425	36215
Pepsi	4480	–	3670	8740	–	13450	42640
Dew	4540	–	8220	10250	15525	11260	53245
Limca	–	–	–	–	10550	–	–
Total	22500	14900	20865	33400	39500	44500	

191. The quantity of Limca cold drinks sold in January is what percent of the quantity of Limca cold drinks sold in March ?
(a) 90% (b) 110% (c) 75% (d) 100% (e) None of these

192. Find the ratio of the quantity of Mirinda cold drinks sold in April to the Pepsi cold drinks sold in May.
(a) 99 : 181 (b) 99 : 182 (c) 181 : 99
(d) Can't be determined (e) None of these

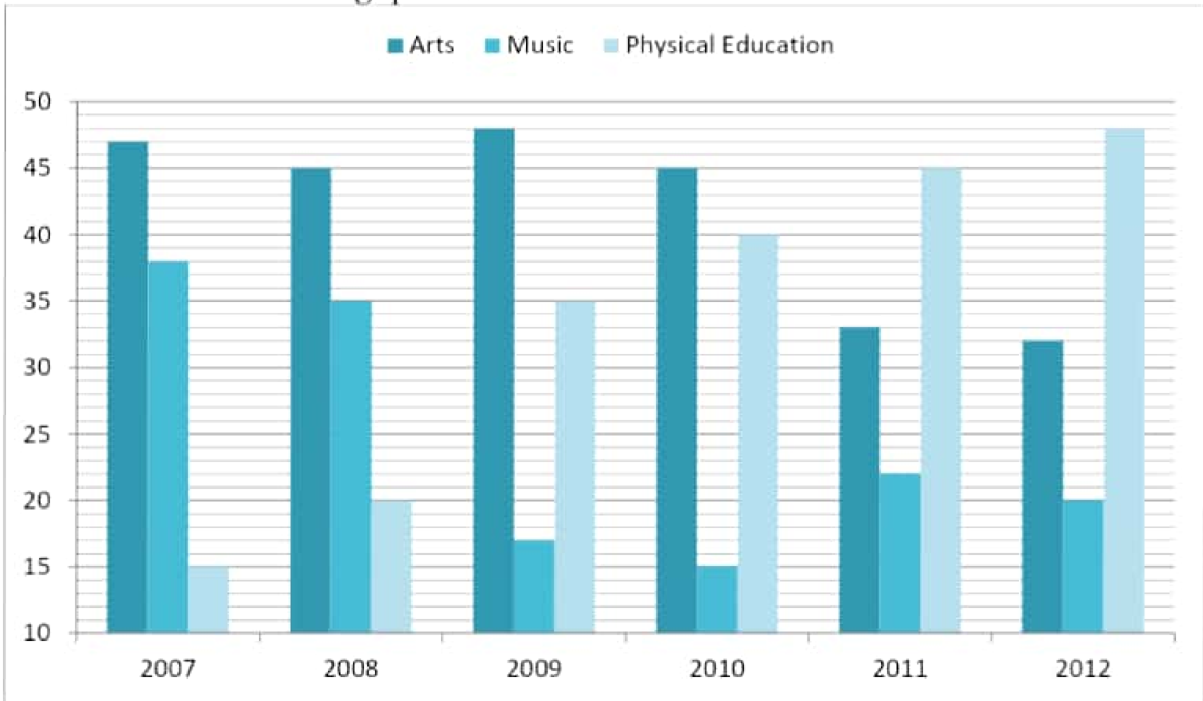
193. Quantity of Limca sold in February is what percent less than the quantity of Pepsi and Dew together sold in the same month ? (approximate)
(a) 44% (b) 56% (c) 52% (d) 60% (e) 40%

194. Find the total quantity (in litres) Limca sold in all months together.

(a) 43365 ℓ (b) 43565 ℓ (c) 41565 ℓ (d) 41365 ℓ (e) None of these

195. Find the total quantity of cold drinks sold of all brands together in all months.
(a) 171665 ℓ (b) 172665 ℓ (c) 182665 ℓ (d) 18665 ℓ (e) None of these

Directions (196-200): Given below is the line graph showing percentage of students taking Arts, Music or Physical education as their optional subject in class 8th in different years. Study the graph carefully and answer the following questions:



196. The total number of Arts students in 2012 is 176 and total number of Arts students in 2010 is 486. Then find the difference between total students in 2012 to that in 2010.
(a) 510 (b) 500 (c) 530 (d) 550 (e) None of these

197. The sum of number of Arts students in 2008 and the music students in 2012 is 337, while the total number of students in 2012 is 190 more the total number of students in 2008. Then find the total number of students in these 2 years.
(a) 1100 (b) 1110 (c) 1150 (d) 1160 (e) None of these

198. Find the average percentage of music students over the years.
(a) 22.5% (b) 30% (c) 24.5% (d) 25% (e) None of these

199. If the total students in 2007 is 1300, then find the ratio of difference between the number of Arts students and Physical education students in 2007 to the sum of the same in 2007.
(a) 16 : 29 (b) 21 : 31 (c) 17 : 25 (d) 19 : 31 (e) None of these

200. If the total number of students in 2012 is 45% more than the total number of students in 2011. Then the number of Arts students in 2011 is what percentage of the number of physical education students in 2012. (approximate)
(a) 47% (b) 49% (c) 51% (d) 53% (e) 55%

SOLUTIONS

1. (d); Required number = 17% of 27300 + 14% of 24700
= 4641 + 3458
= 8099
2. (d); Required Ratio = $\frac{21\%\ of\ 24700}{14\%\ of\ 27300}$
$= \frac{21\times247}{14\times273}$
$= \frac{19}{14}$
= 19 : 14
3. (b); Total number of students at graduate level in Institute M and S = (17 + 14)% of 27300
$= \frac{31}{100} \times 27300$
= 8463
4. (d); Required Ratio = $\frac{21\times247}{13\times273} = 19 : 13$
5. (c); Required number of students = $\frac{15}{100} \times 24700 + \frac{12}{100} \times 24700$
$= \frac{27}{100} \times 24700$
= 6669
6. **(a);** Revenue earned by AC in 3rd quarter = $\frac{45}{100} \times \frac{32}{100} \times 500 = 72$ cr
Revenue of Washing machine in 2nd and 4th quarter = $\frac{(21+23)}{100} \times \frac{24}{100} \times 500 = 52.8$ cr
Required percentage = $\frac{72-52.8}{52.8} \times 100 \approx 36.36\%$
7. **(c);** Revenue from refrigerator in 2nd and 3rd quarter = 28.5 cr
Revenue of Washing machine from 1st and 2nd quarter = 74.4 cr
Ratio = 285 : 744
8. **(e);** Total revenue in quarter 2
$= \left(\frac{10}{100} \times 500 \times \frac{25}{100}\right) + \left(\frac{32}{100} \times 500 \times \frac{16}{100}\right) + \left(\frac{24}{100} \times 500 \times \frac{23}{100}\right) + \left(\frac{25}{100} \times 500 \times \frac{27}{100}\right) + \left(\frac{9}{100} \times 500 \times \frac{28}{100}\right)$
= 112.05 cr
total revenue in quarter 3
$\left(\frac{10}{100} \times 500 \times \frac{32}{100}\right) + \left(\frac{32}{100} \times 500 \times \frac{45}{100}\right) + \left(\frac{24}{100} \times 500 \times \frac{17}{100}\right) + \left(\frac{25}{100} \times 500 \times \frac{11}{100}\right) + \left(\frac{9}{100} \times 500 \times \frac{21}{100}\right) =$
131.6 cr
Difference=19.55 cr
9. **(a);** revenue from sales of Washing machine in 1st, 3rd and 4th quarter = $\frac{24}{100} \times 500 \times \frac{77}{10} = 92.4$ cr
Revenue from sales of AC from 2nd and 4th quarter = $\frac{32}{100} \times 500 \times \frac{28}{100} = 44.8$ cr
$\frac{92.4}{44.8} = 2.0625 \approx 2.05$
10. **(a);** Revenue from sales of AC and Washing machine in Quarter 1 = $\frac{32}{100} \times 500 \times \frac{27}{100} + \frac{24}{100} \times 500 \times \frac{39}{100} = 90$ cr
Total revenue in quarter 2 = 112.05 cr
% age = $\frac{90}{112.05} = 80.32 \approx 80\%$

11. (d); Total No. of students in IT $= \frac{21}{100} \times 7800 = 1638$

No. of boys in IT $= 1638 - (\frac{28}{100} \times 4550) = 364$

Required percentage $= \frac{364}{1638} \times 100 = 22.22\%$

12. (c); Boys in IT=364

Boys in mechanical=949, total boys in IT and Mechanical together=1313

13. (b); No. of girls in computer science and Electronics and communication together = 1365

No. of boys in Civil and computer science together=1573

Required percentage $= \frac{1365}{1573} \times 100 \approx 87\%$

14. (b);

Required % age $= \frac{364}{7800} \times 100 = 4.66 \approx 4.67\%$

15. (e); No. of girls in computer science $= \frac{14}{100} \times 4550 = 637$

No. of boys in IT $= \left(\frac{21}{100} \times 7800\right) - \left(\frac{28}{100} \times 4550\right) = 364$

Ratio $= \frac{637}{364} = 7 : 4$

16. (b); Income of Mahindra in 2007 $= \frac{15}{100} \times 1500 = 225$ cr

Expenditure of Mahindra in 2007 $= 225 \times \frac{100}{(100+22)} = 184.43$ cr

Income of Renault in 2006 $= \frac{15}{100} \times 1800 = 270$ cr

Expenditure of Renault in 2006 $= 270 \times \frac{100}{(100+23)} = 219.51$ cr

Required percentage $= \frac{184.43}{219.51} \times 100 \approx 84\%$

17. (a); Expenditure of Mahindra in 2006 $= 375 \times \frac{100}{120} = 312.5$ cr

In 2007 = 184.43 cr

In 2008 $= 360 \times \frac{100}{121} = 297.52$ cr

In 2009 $= 390 \times \frac{100}{125} = 312$ cr

In 2010 $= 150 \times \frac{100}{128} = 117.19$ cr

So expenditure of Mahindra in maximum in 2006.

18. (d); Total expenditure $= 312.5 + 184.43 + 297.52 + 312 + 117.19 = 1223.64$ cr

% profit $= \frac{1500-1223}{1223} \times 100 \approx 23\%$

19. (b); Expenditure of Mahindra in 2010 = 117.19 cr

Expenditure of Renault in 2010 $= 630 \times \frac{100}{125} = 504$ cr

Required difference $= 504 - 117.19 = 386.81$ cr

20. (e); Profit % in 2011 $= \frac{120}{100} \times 25 = 30\%$

Income in 2011 $= \frac{(100-60)}{100} \times 630 = 252$ cr

Expenditure in 2011 $= 252 \times \frac{100}{130} = 193.84 \text{ cr} \approx 194Cr$

21. (b); No. of male members in 2008

health club A $= \frac{2400\times20}{100} = 480$

health club D $= \frac{2400\times12}{100} = 288$

$\therefore \frac{480+x}{288+x} = \frac{17}{11}$

$x = 64$

Required No. of male members = 288 + 64 = 352

22. (c); Total no. of members in health clubs C, D and E

$= 4200 \times \left(\frac{35+15+8}{100}\right)$

$= 2436$

$Total\ No. male\ members\ in\ C, D\ and\ E = 2400\ \left(\frac{33+12+10}{100}\right)$

= 1320

No. of female members = 2436 – 1320

= 1116

$Required\ average = \frac{1116}{3} = 372$

23. (d); Total members health club E = $\frac{4200\times8}{100}$ = 336,members with lifetime membership=168

Total male members = $\frac{10}{100} \times 2400 = 240$

Lifetime male members = 168 – 44 = 124

Required % = $\frac{124}{240} \times 100 = 51\frac{2}{3}\%$

24. (c); $100 \to 360^0$

$24\% \to \frac{360}{100} \times 24$

$= 86.4^0$

25. (e); Total members in health club A = $\frac{18}{100} \times 4200 = 756$

Male members = $\frac{20}{100} \times 2400 = 480$

Female members = 756 – 480 = 276

In health club B

Male members = $\frac{25}{100} \times 2400 = 600$

Required % = $\frac{600-276}{600} \times 100 = \frac{324}{6} = 54\%$

26. (d); Commerce = $\frac{1182}{4640} \times 100 = 25.47\%$

Science = $\frac{2365}{7218} \times 100 = 32.76\%$

Engineering = $\frac{813}{4125} \times 100 = 19.7\%$

Management = $\frac{1478}{3094} \times 100 = 47.76\%$ (Maximum)

Agriculture = $\frac{517}{3609} \times 100 = 14.33\%$

Others = $\frac{1035}{3094} \times 100 = 33.45\%$

27. (d); Difference between the appeared and selected students in

Commerce = 4640 – 1182 = 3458

Science = 7218 – 2365 = 4853

Engineering = 4125 – 813 = 3312

Management = 3094 – 1478 = 1616 (minimum)

Agriculture = 3609 – 517 = 3092

Others = 3094 – 1035 = 2059

28. (e); We can't determine the ratio from the given data

29. (d); Science = 2365

30. (e); Number of candidates appeared from management and Science = 3094 + 7218 = 10312

Number of candidates appeared from Engineering = 4125

Required percentage = $\frac{10312}{4125} \times 100 = 250\%$

31. (b); Required ratio = $\frac{13+21}{32+11} = \frac{34}{43}$

32. (c); Number of visa applications received from

Females for Aukland = $\frac{3}{8} \times 48 \times \frac{12}{100}$ = 2.16 Thousands

Number of Visa applicants received from females for Paris =

$\frac{3}{8} \times 48 \times \frac{22}{100} = 3.96$ *thousands*

Required Difference = 3.96 – 2.16 = 1.8 thousands

33. (d);

Country	Male applicant	Female applicant
Bangkok	$48 \times \frac{21}{100} - 2.88 = 7.2$	$\frac{3}{8} \times 48 \times \frac{16}{100} = 2.88$
Switzerland	$48 \times \frac{32}{100} - 3.42 = 11.94$	$\frac{3}{8} \times 48 \times \frac{19}{100} = 3.42$
Sydney	$48 \times \frac{15}{100} - 1.44 = 5.76$	$\frac{3}{8} \times 48 \times \frac{8}{100} = 1.44$
Auckland	$48 \times \frac{8}{100} - 2.16 = 1.68$	$\frac{3}{8} \times 48 \times \frac{12}{100} = 2.16$
Malesiya	$48 \times \frac{13}{100} - 4.14 = 2.1$	$\frac{3}{8} \times 48 \frac{23}{100} = 4.14$
Paris	$48 \times \frac{11}{100} - 3.96 = 1.32$	$\frac{3}{8} \times 48 \times \frac{22}{100} = 3.96$

34. (a) required ratio = $\frac{5.76+1.68}{2.88+4.14} = \frac{7.44}{7.02} = \frac{124}{117}$

35. (d); Bangkok = $\frac{2.88}{10.08} \times 100 = 28.57\%$

Switzerland = $\frac{3.42}{15.36} \times 100 = 22.26\%$

Sydney = $\frac{1.44}{7.2} \times 100 = 20\%$

Auckland = $\frac{2.16}{3.84} \times 100 = 56.25\%$

Malesiya = $\frac{4.14}{6.24} \times 100 = 66.34\%$

Paris = $\frac{3.96}{5.28} \times 100 = 75\%$

36. (b); Required percentage = $\frac{2250000 \times \frac{17}{45} + 1136000 \times \frac{5}{16}}{2250000+1136000} \times 100$

$= \frac{5000 \times 17 + 71000 \times 5}{3386000} \times 100$

$= \frac{850000+355000}{33860}$

= 35.59%

37. (b); Required percentage = $\frac{28-17}{28} \times 100$

$= \frac{1100}{28} \approx 39\%$

38. (d); Number of graduates from Uttar Pradesh who have illiterate parents = $\frac{11}{31} \times 2480000 = 880000$

Number of graduates from Gujrat who have illiterate parents = $\frac{5}{16} \times 1136000$

$= 355000$

Number of graduates from Odisha who have illiterate parents = $\frac{1}{4} \times 1642000$

$= 410500$

$Required\ percentage = \frac{880000+355000+410500}{2480000+1136000+1642000} \times 100$

$\frac{1645500}{5258000} \times 100$

$= 31\%$

39. (e); Number of professional graduates from Odisha = $\frac{35}{100} \times 1642000$

$= 574700$

Number of professional graduates from Andaman and Nicobar = $\frac{44}{100} \times 248000$

$= 109120$

$Difference = 465580$

40. (c); Female graduates from Bihar = $\frac{12}{25} \times 2050000$

$= 984000$

Female graduates from Himachal Pradesh = $\frac{9}{20} \times 960000$

$= 432000$

Male graduates from Bihar = $\frac{13}{25} \times 2050000$

$= 1066000$

Male graduates from Himachal Pradesh = $\frac{11}{20} \times 960000$

$= 528000$

Required Ratio = $\frac{1416000}{1594000} = \frac{708}{797}$

41. (c); For company ITC

The cost of production in 2001 = $\frac{90}{40} \times 100$

$= 225$ lakh

The cost of production in 2002 = $\frac{90}{25} \times 100$

$= 360$ lakh

Average cost of production over the year = $\frac{1}{5}(225 + 360 + 440 + 470 + 580)$

$= \frac{1}{5}(2075) = 415$ lakh

42. (a); Let the cost of production for companies Sahara and ITC is a and b

$1.3a + 1.25b = 890$ .... (i)

$a + b = 700$ .... (ii)

a = 300 lakh

b = 400 lakh

Profit ratio = $\frac{30\% \text{ of } 300}{25\% \text{ of } 400} = \frac{6}{5} \times \frac{3}{4}$

$= \frac{9}{10}$

43. (c); Cost of production $= \frac{440}{65} \times 100$

≈ 677 lakh

44. (a); Let cost of production in 2002 is x

$\frac{40\% \text{ of } 320}{30\% \text{ of } x} = \frac{64}{51}$

$= 40 \times 5 \times 51 = 30 \times x$

$x = 340$ lakh

45. (c); Sales of Sahara in 2005 $= \frac{130}{100} \times 510$

$= 663$ lakh

Sals of ITC in 2004 $= \frac{120}{100} \times 470 = 564$ lakh

Difference = 99 lakh

46. (c); Required percentage $= \frac{1284 \times 106}{1696 \times 144 + 2064 \times 162 + 1284 \times 106 + 378 \times 214 + 1504 \times 116}$

$= \frac{136104}{244224 + 334368 + 136104 + 80892 + 174464}$

$= \frac{136104}{970052} \times 100$

$= 14.03\%$

47. (a); For health care, the increase is $\frac{20}{144} \times 100 = 13.8\%$

For Utensils, the increase in $\frac{20}{162} \times 100 = 12.34\%$

For Body care, the increase is $\frac{10}{106} \times 100 = 9.43\%$

For Stationary, there is decrease and

For sports item, the increase is $= \frac{14}{116} \times 100 = 12.6$

48. (e); Health care

$\left.\begin{array}{l}\text{Total sale in 2013} = 1696 \times 144 = 244224 \\ \text{in 2014} = 1924 \times 150 = 288600\end{array}\right] \uparrow 15\%$

Utensils

$\left.\begin{array}{l}\text{Total sale in 2013} = 2064 \times 162 = 334368 \\ \text{in 2014} = 2014 \times 174 = 350346\end{array}\right] \uparrow 5\%$

Body care

$\left.\begin{array}{l}\text{Total sale in 2013} = 1284 \times 106 = 136104 \\ \text{in 2014} = 1346 \times 104 = 139984\end{array}\right] \uparrow 3\%$

Stationary

Total sale in 2013 $= 378 \times 214 = 80892$

in 2014 $= 384 \times 202 = 73568$ decrease

Sports items

$\left.\begin{array}{l}\text{Total sale in 2013} = 1504 \times 116 = 174464 \\ \text{in 2014} = 1814 \times 124 = 224936\end{array}\right] \uparrow 30\%$

49. (c); Total sales in 2013 $= 1696 + 2064 + 1284 + 378 + 1504$

$= 6926$

Total sales in 2015 $= 1802 + 2178 + 1286 + 398 + 1972$

$= 7636$

% increase = $\frac{7636-6926}{6926} \times 100$
= 10.25%

50. (a); Percentage increase of all the five products (by volume) during 2013 to 2015 = 10.25%
% increase of Healthcare = $\frac{106}{1696} \times 100$
% increase of Utensils = $\frac{114}{2064} \times 100$
% increase of Body care = $\frac{2}{1284} \times 100$
% increase of Stationary = $\frac{20}{378} \times 100$
% increase of Sports item = $\frac{468}{1504} \times 100$
As the total increase was slightly more than 10% we need to check the product with more than 10% increase. Only sports item increased by more than 10%.

51. (e); Required difference = 1881 – 1110 = 771

52. (a); Total number of defective mobiles produced in 2013 = 1773 + 1080 + 1152 + 855 = 4860
Total number of mobiles manufactured in 2013 = 94,400
Required percentage = $\frac{4860}{94400} \times 100 = 5.15\%$

53. (a); Required average = $\frac{1175+1107+855+1484+1472+960}{6}$
≈ 1175

54. (e); Required average = $\frac{138100}{6} \approx 23017$

55. (d); Number of defective model C mobiles is 2nd maximum in 2014 i.e. 2660

56. (b); Required % = $\frac{51000}{69400} \times 100 \approx 73.5\%$

57. (a); Required average $\frac{120390}{7} \approx 17200$

58. (d); Girls from Mumbai = $\frac{45}{100} \times 32000 = 14400$
P.G. Girls = 4320
Total P.G. candidates = $\frac{40}{100} \times 32000 = 12800$
Total boys from Mumbai = $32000 - 14400$
$= 17600$
Required percentage = $\frac{8480}{17600} \times 100 = 48.18\%$

59. (d); Total candidate for supervisor post = 51875

60. (b); Required ratio = $\frac{32000}{128400} = 80 : 321$

61. (d); Required Ratio = $\frac{42+75}{27+102}$
$= 117 : 129$
$= 39 : 43$

62. (b); Required difference = $(27 + 102 + 16 + 42) - (63 + 56 + 42)$
$= 187 - 161$
$= 26$

63. (e); Required % = $\frac{(221+63)-44}{44} \times 100 = 545.45\%$

64. (a); Required employees = $\left(\frac{40}{100} \times 120\right) + \left(\frac{60}{100} \times 45\right)$
$= 48 + 27$

= 75

65. (b); Required Ratio = (63 + 85): (16 + 42)
= 148 : 58
= 74 : 29

66. (b); Quantity of export in 2009 = $4000 \times \frac{42}{100} = 1680$
Quantity of export in 2010 = $4850 \times \frac{55}{100} = 2667.5$
Quantity of export in 2011 = $\frac{48}{100} \times 4550 = 2184$
Quantity of export in 2012 = $\frac{62}{100} \times 5000 = 3100$
Quantity of export in 2013 = $\frac{35}{100} \times 5650 = 1977.5$
Quantity of export in 2014 = $\frac{40}{100} \times 6800 = 2720$
Required average = $\frac{14,329}{6}$ = 2388 thousand tonnes

67. (e); Total production in year 2012 = 5000
Quantity of export in 2009 = 1680
Quantity of export in 2011 = 2184
Quantity of export in 2014 = 2720
Required Ratio = $\frac{5000}{1680+2184+2720}$
= 625 : 823

68. (c); Required difference = $\frac{62}{100} \times 5000 - \frac{20}{100} \times 4000$
= 2300

69. (d); Required % = $\frac{600+750+900+1200}{800+1000+1250} \times 100$
= $\frac{3450}{3050} \times 100$
= 113.11%

70. (b); Quantity of PDS supply in the year 2009 = 1520
Quantity of PDS supply in the year 2010 = 970
Quantity of PDS supply in the year 2011 = 1001
Quantity of PDS supply in the year 2013 = 1864.5
Quantity of PDS supply in the year 2014 = 1700
Required year = 2010

71. (e); Required ratio = 2432 : 3168 = 76 : 99

72. (e); Required percentage = $\frac{4116}{7308} \times 100$ = 56% (approx)

73. (a); Required average = $\frac{60711}{7} = 8673$

74. (d); Required percentage = $\frac{3808-2912}{2912} \times 100 \cong 30\%$

75. (b); Required percentage = $\frac{2752-2432}{2432} \times 100 \cong 13\%$

76. (a); $\frac{132}{136+96+132} \times 100 = 36.26\%$

77. (b); $\frac{\frac{737}{6}+\frac{961}{6}}{2} = 141.5$

78. (d); clearly, the year is 2003.

79. (c); Average no. of employed workers for unit B

$= \frac{88+76+96+92+107+110}{6} = 94.8$

This is minimum of all

80. (d); $\frac{145+88}{115+120+140+136} = \frac{233}{511}$

81. (d); Required % $= \frac{178+198}{1738+1644} \times 100$

$= \frac{376}{3382} \times 100$

$= 11.11\%$

82. (c); A $- \frac{234}{1630} \times 100 = 14.35\%$

B $- \frac{154}{1986} \times 100 = 7.75\%$

C $- \frac{186}{1806} \times 100 = 10.3\%$

D $- \frac{138}{1478} \times 100 = 9.33\%$

E $- \frac{196}{1654} \times 100 = 11.85\%$

F $- \frac{182}{1644} \times 100 = 11.07\%$

Required state = A

83. (b); For state B

2001 – 8.93%

2002 – 9.38%

2003 – 9.67%
2004 – 7.75%
2005 – 9.15%
2006 – 11.77%
2007 – 10.50%
Required year = 2004

84. (a); Required% $= \frac{1166}{10682} \times 100 \approx 11\%$

85. (c); Required average $= \frac{165+172+114+138+189+193+195}{7}$
$= \frac{1166}{7} \approx 167$

86. (c); Req. difference
$= 28200 \times \frac{7}{10} - 31200 \times \frac{8}{13}$
$= 19740 - 19200 = 540$

87. (b); Req. number of books
$= \frac{33800 \times \frac{79}{100}}{25} = \frac{338 \times 79}{25} = 1068.08$
≈ 1068

88. (c); Req. average
$= \frac{35700 \times \frac{6}{17} + 37800 \times \frac{13}{18}}{2}$
$= \frac{12600+27300}{2} = 19950$

89. (b); Req. new average
$= \left((31200 + 33800 + 35700) \times \frac{130}{100} + (28200 + 32200 + 29700 + 37800) \times \frac{80}{100}\right) \div 7$
$= \frac{100700 \times 1.30 + 127900 \times 0.8}{7}$
$= \frac{130910+102320}{7} = \frac{233230}{7} = 33318.57$
≈ 33318

90. (d); Req. total number of books
$= 29700 \times \frac{92}{100} + 33800 \times \frac{79}{100}$
$= 27324 + 26702 = 54026$

91. (c); $\frac{\frac{40}{100} \times 8000 + \frac{55}{100} \times 22000}{\frac{45}{100} \times 22000} \times 100 = 154.5\%$

92. (c); Average number of served by Aman
$= \frac{0.4 \times 8000 + 0.6 \times 7000 + 0.25 \times 9000 + 0.75 \times 12000 + 0.15 \times 15000 + 0.55 \times 22000 + 0.6 \times 25000}{7}$
$= \frac{48000}{7}$
≈ 6857
Average number of customers served by Sameer $= \left(\frac{98000-48000}{7}\right) \approx 7142$
Required % $= \frac{(7142-6857)}{7142} \times 100 \approx 4\%$

93. (a); On Tuesday and Friday both, Aman served 2250 customers.

94. (b); $\frac{0.4 \times 8000 + 0.75 \times 12000}{0.6 \times 8000 + 0.75 \times 9000} = \frac{12200}{11550} = \frac{244}{231}$

95. (a); $\frac{25000}{(0.4\times7000+0.25\times12000)}\times100\approx431\%$

96. (b); Average number of failed students from Class x
$=\frac{23+28+20+14+17+14}{6}=\frac{116}{6}=19.33$

97. (e); Required ratio $=\frac{58+75+80+60+84}{24+25+28+11+14}$
$\frac{357}{99}=\frac{119}{33}$

98. (c); Total passed students from Class VI = 336
Total failed students from class VI = 144
Required percent $=\frac{336}{144}\times100=233.33\%$

99. (a); Number of passed students in 2002
$=60+95+71+75+76$
$=377$

100. (c); Total number of passed students in class x
$=48+76+74+84+65+55=402$
Total number of failed students in class x =
$=23+28+20+14+17+14=116$
Required percent $=\frac{402}{402+116}\times116$
$=\frac{402}{518}\times100=77.6\%$

101. (b); Reqd. % $=\frac{2.6}{152}\times100=1.71\%$

102. (d); Number of Cars that remain unsold out of the accepted Cars for Porsche In the year 2004 = 156 – 2.2 – 145 = 8.8
Since the figures is in thousands, the accepted Cars that remains unsold = 8.8 x 1000 = 8800

103. (a); Total number of Cars accepted In 2002 = (164 – 1.7) + (115 – 1.1) + (172 – 2.9) + (169 – 1.9) + (96 – 0.8)
= 707.6
Since the figure is in thousands is in thousands, number of Cars accepted in 2002 = 707.6 x 1000 = 707600

104. (e); Required average $=\frac{12.2\times1000}{6}\approx2030$

105. (c); Required manufactured Cars by all the companies in 2006 = 799 × 1000 = 799000

106. (a); Units sold in 1999 $=\frac{75}{100}\times16$ million = 12 million
Units sold in 2002 $=\frac{82}{100}\times26$ million = 21.32 million
% increase $=\frac{(21.32-12)}{12}\times100=77.67\%$

107. (b);

Company	Units sold in 2004
A	21620000
B	19040000
C	24600000
D	24640000
E	22800000
F	21250000

Company D

108. (d);

Company	Units sold in 2000
A	17000000
B	10320000
C	14880000
D	12600000
E	14580000
F	15470000

Company B

109. (c); Required Ratio = $\frac{\frac{86}{100}\times 12 \text{ million}}{\frac{77}{100}\times 32 \text{ million}} = \frac{1032}{2464} = \frac{129}{308}$

110. (a);

Company	Units manufactured
A	141
B	133
C	138
D	129
E	118
F	120

111. (c); Electricity consumption per day of tube lights = 17 × 8 × 40

= 5440 w hours

Of fans = 14 × 11 × 80 = 12320w hours

Of bulb I = 6720w hours

Of bulb II = 9900w hours

Of coolers = 9000w hours

Of TVs = 9600w hours

2nd highest consumption is by bulb – II

112. (b); Required amount to be paid

$= \frac{(5440+12320)31\times 2.7}{1000} =$ Rs. 1486.512

113. (d); Required percentage $= \frac{12320}{16620} \times 100 = 74.13\%$

114. (d); Total consumption in 1 week $= \frac{52980\times 7}{1000} = 370.86$ kwh

115. (a); units consumed by cooler (200w)

$= \frac{9000\times 30}{1000} = 270$ units

Units consumed by cooler (175 w)

$= \frac{7875\times30}{1000} = 236.25$ units

Required difference = 270 – 236.25 = 33.75 units

Directions (116-120):

Level	male employees (450)	Female employees (630)
I	75	140
II	68	116
III	116	110
IV	182	184
V	9	80

116. (b); Required number = 68 + 116 = 184

117. (d); Required percentage = $\frac{80}{1080} \times 100 = 7\frac{11}{27}\%$

118. (a); Required ratio = $\frac{75}{80}$ = 15 : 16

119. (e); Total no. of employees at level I, level II and level III

= 75 + 68+ 116 + 140 + 116 + 110

= 625

120. (b);

121. (a); Laptops sold by IBM in North Asia = $\frac{14}{68} \times 5440 = 1120$

In East Europe = $\frac{22}{42} \times 630 = 330$

In West Europe = $\frac{19}{36} \times 2160 = 1140$

In North America = $\frac{12}{71} \times 4260 = 720$

In South America = 990

In East Africa = 517

In West Africa = 900

In South Asia = 1350

In Australia = = $\frac{14}{29} \times 754 = 364$

Total Laptop sold by IBM = 7431

122. (c);

South asia	:	West africa	:	East europe
$\frac{100}{65}\times5850$	:	$\frac{100}{74}\times3330$	:	$\frac{100}{42}\times630$
9000	:	4500	:	1500
6	:	3	:	1

123. (c); **Statement I** — Total sales in South America = $\frac{100}{75} \times 2250 = 3000$

So it is true

Statement II — Sales of HP in West Africa = 180

Sales of IBM is East Africa = 517

$\frac{517-180}{180} \times 100 = 187.22\%$

So it is false

Statement III – Sales of Compaq in North America = $\frac{9}{71} \times 1260 = 540$

Sales of Compaq in South America =1260

Ratio = $\frac{540}{1260} = 3 : 7$

So it is true.

So I and III are true

124. (a); Sales of HP and Compaq in North America = 4260 + 540 = 4800

Sales of HP in South America and Australia = 150 + 650 = 800

$\frac{4800}{800} = 6$

125. (c); Total sale of IBM laptops = 7431

Total sale of Sony laptops = 480 + 255 + 2160 + 480 + 600 + 128 + 2250 + 3150 + 754 = 10257

Required difference = 2826

Directions (126-130)

	Monday	Tuesday	Wednesday	Thursday	Friday
Hero	180	150	250	150	180
Bajaj	160	220	200	180	140
Honda	200	200	300	250	200
	540	570	750	580	520

126. (b); $\frac{540}{750} = 18 : 25$

127. (a); Total number of bikes produced by Bajaj from Monday to Friday = 900

128. (e); Required average = $\frac{1150}{5} = 230$

129. (c); No. of bikes produced on Tuesday and Thursday is same i.e. 150

130. (c); Maximum number of bikes produced = 750, on Wednesday.

131. (d); Required average = $\frac{12+18+14}{3} \approx 15$

132. (b); Required difference = 96.5 – 78 = 18.5

133. (c); required percentage = $\frac{85}{160} \times 100 = 53.125\%$

134. (a); required percentage = $\frac{47.5-32}{47.5} \times 100 = 32.63\%$

135. (c); total compartment = 3

Arun in physics, Sanjeev & Kamal in Maths

Directions (136-140)

Society	Population	Total Number of Children	Male children	Female Children
A	750	225	90	135
B	800	250	185	65

C	1000	325	200	125
D	925	370	148	222
E	525	294	180	114

136. (c); Total population of society E = 525
137. (c); Required ratio = $\frac{135}{180} = 3 : 4$
138. (b); Required percentage = $\frac{114}{525} \times 100 = 21\frac{5}{7}\%$
139. (d); Total number of female children = 135 + 65 + 125 + 222 + 114
= 661
140. (a); Required percentage = $\frac{800}{2550} \times 100 = 31\frac{19}{51}\%$
141. (c); Breadth of rectangular plot = $\frac{7050}{94} = 75$ m
Perimeter = 2(94 + 75) = 338 m
Cost of fencing = 338 × 10.5 = Rs3549
Radius of plot T = $\frac{110}{44} \times 7 = 17.5$ m
Cost of flooring = $15 \times \frac{22}{7} \times 17.5 \times 17.5$ = Rs. 14437.5
Required percentage = $\frac{3549}{14437.5} \times 100 = 24.58\%$
142. (d); cost of flooring = $\frac{1}{2} \times 78 \times 24 \times 12$ = Rs. 11232
Hypotenuse of this right angled triangular field = $\sqrt{78^2 + 24^2} \approx 81.6$
Cost of fencing = 9 × (78 + 24 + 81.6) = Rs. 1652.4
Required difference = 9579.6 Rs.
143. (a); Increase in cost of flooring = $11(\pi - 1)89^2$=186709.28 Rs
Initially cost of flooring = 11 × 89 × 89 = 87131Rs
Percentage increase = 114.28%
144. (e); Total cost of fencing and flooring of triangular field = $\left(\frac{1}{2} \times 78 \times 24 \times 12\right) + (78 + 24 + 81.6) \times 9$
= Rs. 12884.4
Total cost of fencing and flooring of rectangular field = 7050 × 14 + 2 × (94 + 75) × 10.5 = 102249 Rs.
Required difference = 89364.6 Rs.
145. (a); Sum of cost of flooring of all the fields = 11232 + 98700 + 87131 + 45000 + 14437.5
= Rs. 256500.5
146. (b); Required different = 1440 + 860 − 900 − 500 = 900
147. (c); Female Arts graduates in university
A = $\frac{3}{4} \times 1300 = 975$
Female Arts graduates in university B.
= 975 + 175 = 1150
∴ Male Arts graduates = 1750 − 1150 = 600
148. (e); Required Ratio = (1600 + 2000): (1050 + 1800)

$= 3600 : 2850 = 24 : 19$

149. (a); Required percent $= \frac{1800-1500}{1800} \times 100$

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

150. (b); Required percentage $= \frac{9000-7500}{7500} \times 100 = 20\%$

Directions (151 – 155):

Males in company $= \frac{86}{79+86} \times 1650 = 860$

Females in company $= 1650 - 860 = 790$

Males in Product development department = 198

Employees in Quality department $= \frac{18}{100} \times 1650 = 297$

Males in Quality department $= \frac{5}{9} \times 297 = 165$

Females in Quality department = 132

Males in finance department = 77

Females in Finance department $= \frac{5}{7} \times 77 = 55$

Females in Product development department = 165

Males in HR department = 77 × 2 = 154

Males in maintenance department = 860 – (198+165+77+154) = 266

Females in Maintenance department $\frac{19}{14} \times 266 = 361$

Females in HR department = 790 – (132 + 55 + 165 + 361) =77

151. (e); Required difference = 266 – 165 = 101

152. (b); Required percentage $= \frac{361}{790} \times 100 \approx 45.7\%$

153. (b); Required percentage$= \frac{165-55}{165} \times 100 = 66\frac{2}{3}\%$

154. (b); No. of males in Product development , Quality and HR departments = 198+ 165 + 154 = 517

No. of females in Product development, finance and Maintenance department = 361 + 55 + 165 = 581

Difference = 64

155. (b); Females shifted from Quality

Department $\frac{5}{12} \times 132 = 55$

Females in HR department = 77 + 55 = 132

Males in HR department = 154

Required ratio$= \frac{154}{132} = 1.17$

Directions (156-160)

Earnings		
	Gaurav	**Vivek**
Salary	62500	75000
Incentive	11250	10000
Expenditure		
	Gaurav	**Vivek**

Food	7550	8850
Rent	8000	8000
Shopping	22125	22125
Other expenditure	9575	13405
Savings	26500	32620

156. (b); Required difference = 32620 – 26500 = Rs. 6120

157. (a); Total earning = $75000 + \frac{1}{2}(10000) = 80000$

Required percentage = $\frac{8000}{80000} \times 100 = 10\%$

158. (c); Total earning of Neeraj= $\frac{80}{100} \times (73750 + 85000)$

= 127000 Rs.

Saving of Neeraj= 32620 – 870

= 31750

Required percentage = $\frac{31750}{127000} \times 100 = 25\%$

159. (e); Required ratio = $\frac{8000}{10000} = 4 : 5$

160. (c); 9575 + 13405 = Rs. 22980

161. (b); Required % = $\frac{7.2-7.1}{7.2} \times 100$

$= \frac{0.1}{7.2} \times 100 = 1\frac{7}{18}\%$

162. (d); Required Ratio = $\left(\frac{100-21}{100} \times 1.8\right) : \left(\frac{100-75}{100} \times 7.9\right)$

$= \left(\frac{79}{100} \times 1.8\right) : \left(\frac{25}{100} \times 7.9\right)$

= 1.422 : 1.975

= 18 : 25

163. (c); Required % = $\frac{\left(\frac{50}{100}\times2.4\right)+\left(\frac{56}{100}\times3.6\right)+\left(\frac{79}{100}\times1.8\right)+\left(\frac{57}{100}\times7.1\right)+\left(\frac{78}{100}\times6.8\right)+\left(\frac{60}{100}\times7.9\right)}{35} \times 100$

$= \frac{1.2+2.016+1.422+4.047+5.304+4.74}{35} \times 100$

$= \frac{18.729}{35} \times 100 \approx 54\%$

164. (a); Required difference = |(0.144 + 1.491 + 0.884) – (0.84 + 1.152 + 1.975)|

= |2.519 – 3.967|

= 1.448 lakh

= 144800 units

165. (e); Required units = $\frac{5}{100} \times 5.4$

= 0.27 lakh

= 27000 units

Directions (166-170)

	MBA (675)			M. tech (825)		
	Boys (300)	:	Girls (375)	Boys (525)	:	Girls (300)
English only→	36		75	90		45
Hindi only→	54		45	75		25
Punjabi only→	30		60	15		35
English and hindi →	42		25	105		75
Hindi and Punjabi→	75		150	105		45
English & Punjabi→	24		15	114		75
All 3 languages→	39		5	21		0

166. (b); $54 + 45 + 75 + 25 = 199$

167. (a); Required percentage $= \frac{30}{60} \times 100 = 50\%$

168. (c); Required percentage $= \frac{75}{300} \times 100 = 25\%$

169. (a); Required percentage $= \frac{65}{1500} \times 100 = 4\frac{1}{3}\%$

170. (d); $\frac{225}{150} = 3 : 2$

171. (c); Total no. of mobiles produced in April $= \frac{100}{84} \times 19488 = 23200$

Total cost to the company = 23200 × 6200

= 1438.4 lakh

Required percentage $= \frac{(1559.04-1438.4)}{1438.4} \times 100 \approx 8.4\%$

172. (c); Total number of mobiles, passed the quality test in May $= \frac{195877500}{7500}$

= 26117

Required percentage $= \frac{26117}{31850} \times 100 = 82\%$

173. (c); Total no. of mobiles passing the quality test in January $= 28500 \times \frac{78}{100} = 22230$

Total no. of mobiles passing the quality test in February $= \frac{141372000}{7200} = 19635$

Required difference $= 22230 - 19635 = 2595$

174. (d); $22230 + 19635 + 20250 + 19488 + 26117 + 26625 = 134345$

175. (c); Required difference $= |(1556.1 + 1413.72 + 1518.75) - (1559.04 + 1958.775 + 1890.375)|$

$= 919.62$ lakh ≈ 920 lakhs

Directions (176-180)

Activity	Girls(1200)	Boys(400)
	[350]	[210]
Solo dancing	50	21

Group dancing	65	32
Drama	77	63
Games	105	84
Singing	53	10

176. (b); Required percentage = $\frac{210}{400} \times 100 = 52.5\%$

177. (c); Total girls in games = 105

basketball games = 21

cricket = 63

football = 14

T.T = 7

Required percentage = $\frac{7}{350} \times 100 = 2\%$

178. (c); Required percentage = $\frac{21-10}{10} \times 100 = 110\%$

179. (c); Required percentage = $\frac{105+84}{1600} \times 100 = 11.8125\%$

180. (e); Required ratio = $\frac{65+105}{210-10} = 17 : 20$

181. (a); Increase in Rice Production

Year 2003 = 130% of 2800 = 3640

Year 2004 = 140% of 3800 = 5320

Year 2005 = 145% of 2100 = 3045

Year 2007 = 140% of 3600 = 5040

Total earlier production = 2800 + 3800 + 2100 + 3600 = 12300

New rice production = 3640 + 5320 + 3045 + 5040 = 17045

Percentage increase = $\frac{17045-12300}{12300} \times 100 \approx 40\%$

182. (b); Average production of Rice in 2007 = $\frac{1}{3} \times [3600 + 3400 + 2900]$

$= \frac{1}{3} \times 9900 = 3300$

183. (d); Average production of Rice by U.S.A. = $\frac{1}{7} \times [3200 + 2900 + 3700 + 3100 + 3500 + 2900 + 3400]$

$= \frac{1}{7} \times 22700 = 3242\frac{6}{7}$

184. (c); Increase in production

Year 2001 = 120% of 3200 = 3840

Year 2002 = 125% of 2900 = 3625

Year 2003 = 128% of 3700 = 4736

Year 2004 = 135% of 3100 = 4185

Total new production = 16386

Total earlier production = 12900

% increase $= \frac{16386-12900}{12900} \times 100 = 27\%$ (approx)

185. (d); Total production of Rice by three countries in the year 2002, 2003 and 2004 = 3300 + 2900 + 2700 + 2900 + 3700 + 2800 + 2900 + 3100 + 3800 = 28100

Total production of Rice by three countries in the year 2005, 2006 and 2007 = 3000 + 3500 + 2100 + 2400 + 2900 + 3800 + 2900 + 3400 + 3600 = 27600

Req. % $= \frac{28100-27600}{27600} \times 100 = 1.8\%$

186. (e); $20 = \frac{7x-Exp_{T6}}{Exp_{T6}} \times 100$

$120\ Exp_{T6} = 700x$............(i)

And, $30 = \frac{8x-Exp_{T7}}{Exp_{T7}} \times 100$

$130\ Exp_{T7} = 800x$ ....(ii)

Required Ratio $= \frac{Exp_{T6}}{Exp_{T7}} = \frac{7x}{8x} \times \frac{13}{12} = \frac{91}{96}$

187. (d); Expenditure of Company Reliance in 2005 $= \frac{4800}{120} = 40$ crore

∴ expenditure of company Reliance in 2006 = 2 × 40 = 80 crore

$\therefore 40 = \frac{x-(80)}{80} \times 100$

$x = 112$crore

188. (b); $55 = \frac{3x-Exp_T}{Exp_T} \times 100$

$155\ Exp_T = 300x$ ....(i)

And, $25 = \frac{7x-Exp_R}{Exp_R} \times 100$

$125\ Exp_R = 700x$ ....(ii)

By dividing eqn. (i) ÷ eqn. (ii)

$\frac{Exp_T}{Exp_R} = \frac{3}{7} \times \frac{125}{155} = \frac{3\times25}{7\times31} = \frac{75}{217}$

$\therefore Exp_R : Exp_T = 217 : 75$

189. (d); Since individual profit is not known, so we can't determine the required value.

190. (d); 55% of expenditure of Tata in 2008=310

100% expenditure = $310 \times \frac{100}{55}$

profit of Tata in 2010 $= \frac{1}{2} \times \frac{1}{2} \times 310 \times \frac{100}{55} = 140\frac{10}{11}$ crores

191. (d); Required percentage $= \frac{[22500-(8750+4480+4540)]}{[20865-(4245+3670+8220)]} \times 100$

= 100%

192. (b); Required ratio $= \frac{4950}{9100} = 99 : 182$

193. (a); Required percentage $= \frac{6650-3730}{6650} \times 100 \approx 44\%$

194. (b); Total quantity of Limca sold = 4730 + 3730 + 4730 + 9460 + 10550 + 10365

= 43565 (

195. (e); Total cold drink sold = 36215 + 42640 + 53245 + 43565
= 175665 ℓ

196. (c); Required difference $= \left(\frac{100}{45} \times 486\right) - \left(\frac{100}{32} \times 176\right)$
=530

197. (b); $0.45x + 0.2y = 337$
$y - x = 190$
$x = 460, y = 650$
$x + y = 1110$

198. (c); Required average $= \frac{147}{6} = 24.5\%$

199. (e); Required ratio $= \frac{32}{62}$ or 16 : 31

200. (a); Let the total number of students in 2011= x
Let the total number of students in 2012 = $1.45x$
$\frac{0.33 \times x}{0.48 \times 1.45x} \times 100 \approx 47\%$