Guidance Programme for SSC Combined Graduate Level Exam 2012
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Study Kit Details

Dear Candidates,
The Complete Study Kit in Hard copy of for Tier -2 examination is now available.

Our Objectives:

- Firstly to cover 100% SSC Combined Graduate Level (CGL) examination syllabus.
- Secondly to compile all the required study materials in a single place, So to save the precious time of the aspirants. Further, in this study kit we have incorporated all the available study material in the market, we have also include the material of standard Books meant for SSC CGL preparation; like QUANTITIVE APTITUTE BY RS AGRRAWAL, VIJAY MISHRA, SINHA & SINHA etc. for ENGLISH LANGUAGE & COMPREHENSION BY WREN & MARTIN, KP THAKUR, INTERNET & VARIOUS BOOKS. It is in the interest of candidate so that they need not to study separate books for both section.

Our Strategy:

- Content of every section of the syllabus is developed after a thorough research of last year Question Papers.
- Every section is covered with practice set.

Implementation Aspects:

- You will Get 3 booklets of (i) Numerical Aptitude, (ii) Data Interpretation and (iv) English Comprehension.
- Study Kit will be delivered to your postal Address after payment confirmation.
- After dispatching your kit we will provide you a courier tracking details.
- For any help we will provide Telephonic & Email Support to the candidates.

Contents of the Kit:

Booklet No	Subjects	Pages	MCQs
1 2	Numerical Aptitude Numerical Aptitude (Data Interpretation)	400+ 150+	3000+
3	English Comprehension	300+	1000+
Total Booklets - 3		Total Pages: 820+	Total MCQs: 4000+

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Price of the Kit:

- The price of our Study Kit is **Rs. 2300**, including courier charges.

Payment Options:

First option: Cash Deposit
You can deposit the amount at any ICICI Branch in these following Account Numbers.

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Sample Chapters of Our Study Kit

Sample Study Material of Numerical Aptitude & Data Interpretation

CHAPTER 1

Number System

A Civil Servant should be well-versed in basics of Number System. In the Civil Services Aptitude Test Paper 2, in Basic Numeracy, certainly there will be asked some questions based on types of, and operations on numbers.

In Indian system, numbers are expressed by means of symbols 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, called digits. Here, 0 is called insignificant digit whereas 1, 2, 3, 4, 5, 6, 7, 8, 9 are called significant digits. We can express a number in two ways.

Notation: Representing a number in figures is known as notation as 350.

Numeration: Representing a number in words is known as numeration as 'Five hundred and forty five'.

Place Value (Indian)

Crore		Lakh		Thousand			Unit	
Ten Crore	Crore	Ten Lakhs	Lakh	Ten Thousands	Thousand	Hundred	Tens	One
100000000	10000000	1000000	100000	10000	1000	100	10	1
10^8	10^7	10^6	10^5	10^4	10^3	10^2	10^1	10^0

Place Value (International)

Million			Thousand				Unit	
Hundred Millions	Ten Millions	One Million	Hundred Thousands	Ten Thousands	Thousand	Hundred	Tens	One
100000000	10000000	1000000	100000	10000	1000	100	10	1
10^8	10^2	10^6	10^5	10^4	10^3	10^2	10^1	10^0

Face Value and Place Value of a Digit

Face Value: It is the value of the digit itself eg, in 3452, face value of 4 is 'four', face value of 2 is 'two'.

Place Value: It is the face value of the digit multiplied by the place value at which it is situated eg, in 2586, place value of 5 is $5 \times 10^2 = 500$.

Number Categories

Natural Numbers (N): If N is the set of natural numbers, then we write $N = \{1, 2, 3, 4, 5, 6,\ldots\}$

The smallest natural number is 1.

Whole Numbers (W): If W is the set of whole numbers, then we write $W = \{0, 1, 2, 3, 4, 5,\ldots\}$

The smallest whole number is 0.

EXERCISE

1. Five- eighth of three-tenth of four-ninth of a number is 45. What is the number?
   (a) 470 (b) 550 (c) 560 (d) 540
2. Which of the following numbers should be added to 11158 to make it exactly divisible by 77?
   (a) 9 (b) 8 (c) 6 (d) 7
3. If n is odd, $(11)^n + 1$ is divisible by:
   (a) 11 + 1 (b) 11 – 1
   (c) 11 (d) 10 + 1
4. Three numbers are in the ratio 3 : 5 : 6. Sum of the greatest and the smallest is equal to the sum of the middle and 16. Find the smallest number.
   (a) 12 (b) 20 (c) 24 (d) 16
5. Sum of squares of two numbers is 60 and difference of the squares is 12. Find the sum of two numbers.
   (a) 4 (b) 10
   (c) 6 (d) 8

ANSWER

1. (d) **2.** (d) **3.** (a) 4. (a) 5. (B)

EXPLANATIONS

1. $\frac{5}{8}\times\frac{3}{10}\times\frac{4}{9}\times x = 45$

   $\Rightarrow 45\times\frac{9}{4}\times\frac{10}{3}\times\frac{8}{5} = 540$

2. Dividing 11158 by 70 we get 70 as remainder. Thus 7 is to be added to make it divisible by 77.
3. We know that $(a^n + 1)$ is always divisible by $(a + 1)$ when n is odd.
4. Let the numbers be $3x$, $5x$ and $6x$.
   Now, $3x + 6x = 5x + 16$
   $x = 4$
   $\therefore$ The smallest number is $3x = 12$.
5. Let the number be x and y.
   $x^2 + y^2 = 60$, $x^2 - y^2 = 12$
   Adding, $2x^2 = 72$
   $x = 6$ and $y = 4$
   $\therefore$ Required sum is 10.

CHAPTER 2

Fractions

A fraction is a part of the whole (object, thing, region). It forms the part of basic aptitude of a person to have and idea of the parts of a population, group or territory. Civil servants must have a feel of 'fractional' thinking. eg, $\frac{5}{12}$, here '12' is the number of equal part into which the whole has been divided, is called denominator and '5' is the number of equal parts which have been taken out, is called numerator.

Example1: Name the numerator of $\frac{3}{7}$ and denominator of $\frac{5}{13}$.

Solution: Numerator of $\frac{3}{7}$ is 3.

Denominator of $\frac{5}{13}$ is 13.

Lowest Term of a Fraction

Dividing the numerator and denominator by the highest common element (or number) in them, we get the fraction in its lowest form.

eg, To find the fraction $\frac{6}{14}$ in lowest form Since '2' is highest common element in numerator 6 and denominator 14 so dividing them by 2, we get $\frac{3}{7}$. Which is the lowest form of $\frac{6}{14}$.

Equivalent Fractions

If numerator and denominator of any fraction are multiplied by the same number then all resulting fractions are called equivalent fractions.

eg, $\frac{1}{2},\frac{2}{4},\frac{3}{6},\frac{4}{8}$ all are equivalent fractions but $\frac{1}{2}$ is the lowest form.

EXERCISE

1. LCM of 0.25, 0.5, 0.3 is
(a) 0.1 (b) 0.15
(c) 1.5 (d) 10

2. Ascending order of $\frac{10}{13}, \frac{12}{17}, \frac{5}{6}$ and $\frac{11}{21}$, is

(a) $\frac{10}{13}, \frac{12}{17}, \frac{5}{6}, \frac{11}{21}$ (b) $\frac{11}{21}, \frac{12}{17}, \frac{10}{13}, \frac{5}{6}$

(c) $\frac{5}{6}, \frac{10}{13}, \frac{11}{21}, \frac{12}{17}$ (d) $\frac{5}{6}, \frac{10}{13}, \frac{12}{17}, \frac{11}{21}$

3. Descending order of $\frac{15}{16}, \frac{11}{20}, \frac{13}{25}, \frac{1}{3}$, is

(a) $\frac{15}{16}, \frac{11}{20}, \frac{13}{25}, \frac{1}{3}$ (b) $\frac{1}{3}, \frac{13}{25}, \frac{11}{20}, \frac{15}{16}$

(c) $\frac{1}{3}, \frac{11}{20}, \frac{13}{25}, \frac{15}{16}$ (d) $\frac{15}{16}, \frac{13}{25}, \frac{11}{20}, \frac{1}{3}$

4. 25.625 × 100 is equal to
(a) 256.25 (b) 2562.5
(c) 25625 (d) 256250

5. 75.83 ÷ 1000 is equal to
(a) 7.583 (b) 0.7583
(c) 0.07583 (d) 0.007583

ANSWERS

1. (c) **2.** (b) **3.** (a) 4. (b) 5. (c)

EXPLANATIONS

1. Given numbers are 0.25, 0.5 are and 0.3 or 0.25, 0.50 and 0.30
Now, LCM of 25, 50 and 30 = 150
∴ LCM of 0.25, 50 and 30 = 1.50 = 1.5

2. $\frac{10}{13} = 0.76$, $\frac{12}{17} = 0.70$, $\frac{5}{6} = 0.82$, $\frac{11}{21} = 0.52$

∴ ascending order is $\frac{11}{21}, \frac{12}{17}, \frac{10}{13}, \frac{5}{6}$

3. $\frac{15}{16} = 0.93$, $\frac{11}{20} = 0.55$, $\frac{13}{25} = 0.52$, $\frac{1}{3} = 0.34$

∴ descending order is $\frac{15}{16}, \frac{11}{20}, \frac{13}{25}, \frac{1}{3}$

4. 25.625 × 100 = 2562.5

5. 75.83 ÷ 1000 = 0.07583

CHAPTER 3

Indices and Surds

In our day-to-day life, we get plenty of data in form of powers of numbers. To have a feeling of what they measure we need to have an exact idea of indices and surds. There may be some kit items in CSAT, specifically designed to test proficiency of candidates in indices and surds.

Indices

In the expression x^n, n is called the exponent or index and x is called the base and x^n is read as 'x to the power of n' or 'x raised to the power n'.

eg,

1. $3^6 = 3 \times 3 \times 3 \times 3 \times 3 \times 3 = 729$

$4^3 = 4 \times 4 \times 4 = 64$

The expression $(x^m)^n$ is read as 'x raised to the power m whole raised to the power n'.

2. $(2^4)^3 = (16)^3 = 2^{12}$

The expression x^{m^n} is read as 'x raised to the power m power n'.

3. $2^{4^3} = 2^{64}$

Hence, $(x^m)^n \neq x^{m^n}$

Laws of Indices

1. $a^m \times a^n = a^{m+n}$
2. $\frac{a^m}{a^n} = a^{m-n}$ $(a \neq 0)$
3. $(a^m)^n = a^{mn}$
4. $(ab)^m = a^m b^m$
5. $\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$ (b ¹ 0)
6. $a^0 = 1$ if $(a \neq 0)$
7. $a^{-n} = \frac{1}{a^n}$ if $(a \neq 0)$
8. $a^{\frac{1}{n}} = \sqrt[n]{a}$ is called the n^{th} root of a.

9. $a^{\frac{m}{n}} = \sqrt[n]{a^m}$ is called the n^{th} root of a^m.
10. When the bases of two numbers are equal, then their powers are also equal.
    eg, If $3^n = 3^2$, then, $n = 2$.
11. When the powers of two numbers are equal, then their bases are equal.
    eg, If $a^3 = 43$, then $a = 4$.
    Where a is a positive real number and n is a rational number.

EXERCISE

1. The least value of $3^x + 3^{-x}$ is
(a) 2 (b) 1
(c) 0 (d) 2/3

2. Given $t = 2 + \sqrt[3]{4} + \sqrt[3]{2}$, determine the value of $t^3 - 6t^2 + 6t - 2$.
(a) 0 (b) 1
(c) $\sqrt{2}$ (d) 2

3. If $a = -5$ and $b = -6$, find the value of $(a - b)^{b-a} + (b - a)^{a-b}$.
(a) 1 (b) −1
(c) 0 (d) −2

4. In Republic Day Parade, 6440 NCC cadets were asked to stand in rows to form a perfect square. It was fond that 40 NCC cadets were left out. What was the number of NCC cadets in each row?
(a) 40 (b) 80
(c) 64 (d) 60

5. Two numbers are in the ratio of 9 : 7. If the difference of their squares is 288, then the smaller of the number is:
(a) 21 (b) 23
(c) 27 (d) 28

ANSWERS

1. (a) **2.** (a) **3.** (c) **4.** (b) 5. (a)

EXPLANATIONS

1. Let $3^x + 3^{-x} = a$

Let $3x = K$

Then, $a = K + 1/K = (K^2 + 1)/K$

ie, $K^2 - Ka + 1 = 0$

For this to have real roots, the discriminant should be greater than or equal to 0.

ie, $a^2 - 4 \geq 0$

or $a \geq /2/2a \geq 2$

or $a < -2$ (not possible)

Least value = 2.

2. $t = 2 + \sqrt[3]{4} + \sqrt[3]{2}$

$t - 2 = \sqrt[3]{4} + \sqrt[3]{2}$

$= 2^{2/3} + 2^{1/3} = 2^{1/3}(1 + 2^{1/3})$

$(t - 2)^3 = [2^{1/3}(1 + 2^{1/3})]^3 = 2(1 + 2^{1/3})^3$

$= 2[1 + 2 + 3 \times 2^{1/3}(1 + 2^{1/3})]$

3. $a = -5$ and $b = -6$

$(a - b)^{b-a} + (b - a)^{a-b}$

$= (-5 + 6)^{-6+5} + (-6 + 5)^{-5+6}$

$= (1)^{-1} + (-1)^1 = 1 - 1 = 0$

4. Remaining NCC cadets = 6440 − 40 = 6400

So, NCC cadets in each row = $\sqrt{6400} = 80$

5. Let the numbers be $9x$ and $7x$.

$\therefore \quad 81x^2 - 49x^2 = 288$

or, $32x^2 = 288$

or, $x^2 = 9$

or, $x = 3$

The smaller number is 21.

CHAPTER 4

Square Root & Cube Root

A Civil Servant should be well-versed in concepts of Square Root & Cube Root. In the Civil Services Aptitude Test Paper 2, in Basic Numeracy, certainly there will be asked some questions from square roots and cube roots of number to test fast calculation skills of a candidate.

Square Root

The square root of a number is that number the product of which itself gives the given number, ie, the square root of 400 is 20, the square root of 625 is 25.

The process of finding the square root is called evaluation. The square root of a number is denoted by the symbol $\sqrt{\ }$ called the radical sign. The expression "$\sqrt{9}$" is read as "root time", "radical nine" or "the square root of nine".

How to Find the Square Root of an Integer?

(i) By the method of Prime Factors: When a given number is a perfect square, we resolve it into prime factors and take the product of prime factors, choosing one out of every two.

Example 1: Find the square root of 4356.

Solution.

2	4356
2	2178
3	1089
3	363
11	121
	11

$4356 = 2 \times 2 \times 3 \times 3 \times 11 \times 11 = 2^2 \times 3^2 \times 11^2$

$\sqrt{4356} = 2 \times 3 \times 11 = 66$

Thus from the above example it is clear that in order to find the complete square root of a given number every prime factor of that number should be repeated twice. Thus, we can make a number which is not a perfect square, a perfect square by multiplying or dividing the number by those factors of it which are not contained in pairs.

Example 2: Find the least number by which 1800 be multiplied or divided to make it a perfect square.

Solution. 1800 = 2 × 2 × 2 × 3 × 3 × 5 × 5

The least number by which the given number be multiplied or divided is 2.

(ii) By the method of Long Division: This method can be used when the number is large and the factors cannot be determined easily. This method can also be used when we want to add a least number or to subtract a least number from a given number so that the resulting number may give a perfect square of some number.

Example 3: Find the square root of 156816.

Solution.

3	156816	396
	9	
69	668	
	621	
786	4716	
	4716	
	×	

Explanations: Firstly, mark off the digits in pairs starting from the unit's digit. Each pair is called a period.

Now, $3^2 = 9$ and $4^2 = 16$. So we take $3^2 = 9$ and on subtracting 9 from 15 we get 6 as remainder.

Now, bring down the next period ie,

Now, double the root figure already found which is 3 and write it to the left.

Now, from trial and error we find 69 × 9 = 621 which is closet and least to 668. So, place 9 to right of 6 changing it to 69. We also put another 9 to the right of the quotient 3 making it 39. Now, we subtract 621 from 668. We get a remainder of 47.

Now, repeat the whole process till there is no period left over to be brought down.

So, $\sqrt{156816} = 396$

To Find the Square Root of a Decimal

Example 4: Find the square root of 1.8225

Method 1:

1	1.8225	1.35
	1	
23	82	
	69	
265	1325	
	1325	
	×	

$\therefore \quad \sqrt{1.8225} = 1.35$

Method 2: $\sqrt{1.8225} = \sqrt{\frac{18225}{10000}} = \frac{\sqrt{18225}}{\sqrt{10000}} = \frac{135}{100} = 1.35$

EXERCISE

1. $\sqrt{144}$ is equal to
(a) 12 (b) 14
(c) 16 (d) 18

2. Square root of 2025 is
(a) 35 (b) 45
(c) 55 (d) 65

3. Find the square root of 906.01.
(a) 322
(b) 324
(c) 326 (d) 328

4. Find the square root of 906.01.
(a) 30.1 (b) 31.1
(c) 30.11 (d) 31.11

5. Find the value of $\sqrt{17+\sqrt{51+\sqrt{152+\sqrt{289}}}}$.
(a) 11 (b) 5
(c) 7 (d) 9

ANSWERS

1. (a) **2**. (b) **3**. (b) **4**. (a) **5**. (b)

EXPLANATIONS

1. $144 = 2 \times 2 \times 2 \times 2 \times 3 \times 3$

$\therefore \quad \sqrt{144} = 2 \times 2 \times 3 = 12$

2. $2025 = 5 \times 5 \times 9 \times 9$

$\therefore \quad \sqrt{2025} = 45$

3.

3	104976 324
	9
62	149
	124
644	2576
	2576
	×

$\therefore \quad \sqrt{104976} = 324$

4.

3	906.01 30.1
	9
601	601
	601
	×

$\therefore \quad \sqrt{906.01} = 30.1$

5. Given $\sqrt{17+\sqrt{51+\sqrt{152+\sqrt{289}}}}$

$= \sqrt{17+\sqrt{51+\sqrt{152+17}}}$

$= \sqrt{17+\sqrt{51+\sqrt{169}}}$

$= \sqrt{17+\sqrt{51+13}}$

$= \sqrt{17+\sqrt{64}}$

$= \sqrt{17+8} = \sqrt{25} = 5$

CHAPTER 5

Simplification

In simplification of an expression there are certain laws which should be strictly adhered to. These laws are as follows:

'VBODMAS' Rule

This rule gives the correct sequence in which the mathematical operation are to be executed so as to find out the value of a given expression.

Here, 'V' stands for Vicnaculum (or Bar), 'B' stands for 'Brcket', 'O' stands for 'Of', 'D' stands for 'Division', 'M' stands for 'Multiplication', 'A' stands for 'Addition' and 'S' stand for 'Subtraction'.

(a) Here, 'VBODMAS' gives the order of simplification. Thus, the order of performing the mathematical operations in a given expression are

First : Virnaculum or line bracket or bar

Second: Bracket

Third: Of

Fourth: Division

Fifth: Multiplication

Sixth: Addition &

Seventh: Subtraction

The above order should strictly be followed.

(b) There are four types of brackets.

(i) Square brackets [ ]

(ii) Curly brackets { }

(iii) Circular brackets ( )

(iv) Bar or Virnaculum –

Thus, in simplifying an expression all the brackets must be removed in the order '–', '( )', '{ }' and '[ ]'.

Modulus of a Real Number

The modulus of a real number x is defined as

$$|x| = x, \text{ if } a > 0$$

$$|x| = x, \text{ if } a < 0$$

EXERCISE

1. Find the value of $\frac{(3+3+3+3)\div 3}{5+5+5+5+\div 5}$.

(a) $\frac{1}{4}$ (b) $\frac{3}{4}$ (c) $\frac{5}{4}$ (d) $\frac{9}{4}$

2. Find the value of $\frac{5+5\times 19-15-7}{13\times 13-156}$.

(a) 4 (b) 8 (c) 6 (d) 9

3. Simplify $1 \div [1 + 1 \div \{1 \div 1)\}]$.

(a) $\frac{3}{2}$ (b) $\frac{2}{5}$ (c) $\frac{2}{3}$ (d) $\frac{2}{3}$

4. Simplify $\frac{1}{4\frac{2}{5}}+\frac{1}{2\frac{4}{9}}$.

(a) $\frac{14}{22}$ (b) $\frac{17}{22}$ (c) $\frac{13}{22}$ (d) $\frac{19}{22}$

5. If 217 × 15 = 3255, then 2.17 × 0.15 is

(a) 32.55 (b) 0.3255
(c) 3.255 (d) 325.5

ANSWERS

1. (a) **2**. (c) **3**. (c) **4**. (a) **5**. (b)

EXPLANATIONS

1. Given expression = $\frac{12\div 3}{5+5+5+1}=\frac{4}{16}=\frac{1}{4}$

2. Given expression = $\frac{5+95-15-7}{169-156}=\frac{78}{13}=6$

3. Given expression = $1 \div [1 + 1 \div \{1 + 1 \div (1 \div 1)\}]$
$= 1 \div [1 + 1 \div \{1 + 1 \div 1\}]$
$= 1 \div [1 + 1 \div \{1 + 1\}]$

$= 1 \div [1 + 1 \div 2] = 1\div\left[1+\frac{1}{2}\right]$

$= 1\div\frac{3}{2}=\frac{2}{3}$

4. Given expression = $\frac{1}{4\frac{2}{3}}+\frac{1}{2\frac{4}{9}}$

$=\frac{1}{\frac{22}{5}}+\frac{1}{\frac{22}{9}}=\frac{5}{22}+\frac{9}{22}=\frac{14}{22}$

5. Given expression = 2.17 × 0.15

$=\frac{217}{100}\times\frac{15}{100}=\frac{3255}{100\times 100}=0.3255$

CHAPTER 6

HCF & LCM

Highest Common Factor

The highest common factor of two or more given numbers is the largest of their common factors. It is known as GCD also.

eg, Factors of 20 are 1, 2, 4, 5, 10, 20

Factors of 36 are 1, 2, 3, 4, 6, 9, 12, 18, 36

Here greatest and common factor of 20 and 36 is 4.

∴ HCF of 20 and 36 is 4.

Least Common Multiple

The least common multiple of two or more given numbers is the least of their common multiples.

eg, Multiple of 25 are 25, 50, 75, 100, 125, 150, 175, ...

Multiple of 30 are 30, 60, 90, 120, 150, 180, 210, ...

Here 150 is least common multiple of 25 and 30

∴ LCM of 25 and 30 is 150.

Using Division Method

Example 1: Determine the HCF and LCM of 36, 48, 64 and 72.

Solution. To find HCF

```
36 ) 48 ( 1
     36
     12 ) 36 ( 3
          36
          ×
12 ) 64 ( 5
     60
      4 ) 12 ( 3
          12
          ×
      4 ) 72 (18
          4
          32
          32
           ×
```

∴ HCF of 36, 48, 64 and 72 is 4.

EXERCISE

46. Find the least number which when divided by 12, 15 and 20 leaves remainders 4, 7 and 12 respectively.
(a) 48 (b) 60
(c) 52 (d) 64

47. Find the least number which when divided by 5, 6, 7 and 8 leaves a remainder 3 but when divided by 9 leaves no remainder.
(a) 1683 (b) 1725
(c) 1685 (d) 1723

48. Five bells begin to toll together and toll at intervals of 24, 40, 64, 72 and 120 s. After what interval to time will they toll again together ?
(a) 42 min (b) 36 min
(c) 48 min (d) 54 min

49. Four wheels moving 12, 24, 20 and 30 revolutions in a minute starting at a certain point on the circumference downwards. After what interval of time will they come together again in the same position ?
(a) 30 s (b) 20 s
(c) 15 s (d) 45 s

50. The traffic lights at three different road crossings change after every 48,72 and 108 s respectively. If they change simultaneously at 9 am,at what time will they change again simultaneously.
(a) 10 min 10 s (b) 7 min 12 s
(c) 7 min 10 s (d) 12 min 10 s

ANSWERS

1. (c)	**2**. (a)	**3**. (c)	**4**. (a)	**5**. (b)

EXPLANATIONS

1. LCM of 12, 15 and 20 = 60
Now, 12 – 4 = 8, 15 – 7 = 8
and 20 – 12 = 8
So, required number = 60 – 8 = 52

2. LCM of 5, 6, 7 and 8 = 840
Multiples of 840 = 840, 1680, ...
∴ Required number = 1680 + 3 = 1683
Which is exactly divisible by 9.

3. LCM of 24, 40, 64, 72 and 120 = 2880

$$\therefore \quad \text{Required time} = \frac{2880}{60} = 48 \text{ min}$$

4. Time taken for 1 revolution

$$= \frac{1}{12}, \frac{1}{24}, \frac{1}{20}, \frac{1}{30} \text{ min}$$

$$\therefore \quad \text{Required time} = \frac{\text{LCM of Numerators}}{\text{HCF of Denominators}}$$

$$= \frac{1}{2} \text{min}$$

$$= \frac{1}{2} \times 60 = 30\text{s}$$

5. LCM of 48, 72 and 108 = 432 s
Traffic lights will change simultaneously after
432 s = 7 min 12 s

CHAPTER 7

Orders of Magnitude

According to the syllabus of Civil Services Preliminary Exam CSAT Paper II, some questions may be asked from 'orders of magnitude'. So, the deep study of this chapter is necessary. In this chapter, we study the increasing or decreasing order related to distance, time, area etc.

Example 1: Ajay, Akshay and Saroj cover a distance of $33\frac{1}{2}$ km, 33500 m and 290 hactometre respectively in an hour. Who has the maximum speed?

Solution. Distance covered by Ajay = $33\frac{1}{2}$ km = 67 × 1000 m = 33500 m

Distance covered by Akshay = 33500 m

Distance covered by Saroj = 290 hactometre

= 290 × 100 m = 29000 m

Since, distance covered by Ajay and Akshay are maximum and equal. Hence, Ajay and Akshay have maximum speed.

EXERCISE

1. Ramesh gave milk to have to his three sons Harish, Shayam and Ajay in three pots of the shape hemisphere, cube and cuboid. If radius of hemisphere pot is 5 cm, side of cubic pot is 5 cm and sides of cuboid pot are 5 cm × 5 cm × 6 cm, then who will get more milk?
(a) Harish (b) Shayam
(c) Ajay (d) Equal to all

2. The velocity of sound in first medium is 320 m/s and in second medium is 1152 km/h. In which medium velocity of sound is maximum?
(a) First (b) Second
(c) Equal in both (d) Can't be determined

3. A minister of a village gave land to his four sons A, B, C and D. He gave them 5 hectare, 12 acre, 1600 sq m and 20 sq hectometre land respectively. Who got the maximum land?
(a) A (b) B
(c) C (d) D

4. Aakash, Amar and Sawan has the lengths 20 decimetre, 1.7 m and 180 cm respectively. Who is shortest?
(a) Aakash (b) Amar
(c) Sawan (d) All are of equal length

5. Rotation period of four planets Mercury, Venus, Saturn and Earth are respectively 3784320

thousand s, 4572720 thousand min, 166 yr and 365 days, 5 h, 56 min, 4 s. Which planet has the least rotation period?

(a) Mercury (b) Venus
(c) Saturn (d) Earth

ANSWERS

1. (a)	**2**. (c)	**3**. (d)	**4**. (b)	**5**. (d)

EXPLANATIONS

1. Volume of hemispherical pot = $\frac{2}{3}\times\pi r^3$

$= \frac{2}{3}\times\frac{22}{7}\times(5)^3 = 261.90\ cm^3$

Volume of cubic pot = $(5)^3 = 125\ cm^3$

Volume of cuboid pot = $5 \times 5 \times 6 = 150\ cm^3$

Since, volume of hemispherical pot is maximum.

Hence, Harish will get the maximum milk.

2. Velocity of sound

In first medium = 320 m/s

In second medium = 1152 km/h

$= 1152\times\frac{5}{18}\text{m/s} = 320\ \text{m/s}$

Hence, velocity of sound is same in both mediums.

3. A got the land = 5 hectare = $5 \times 10000\ m^2$
$= 50000\ m^2$

B got the land = 12 acre
$= 12 \times 4046.86\ m^2$
$= 48562.32\ m^2$

C got the land = $1600\ m^2$

D got the lan = 20 sq hactometre
$= 200000\ m^2$

Hence, D got the maximum land.

4. Length of Aakash = 20 decimetre
= 200 cm

Length of Amar = 1.7 m = 170 cm

Length of Sawan = 180 cm

∴ Hence, Amar is shortest.

5. Rotation period of Mercury = 3784320 thousands
= 3784320000 s

Rotation period of Venus = 4572720000 min
= 4572720000 × 60 s
= 274363200000 s

Rotation period of Saturn = 166 yr
= 166 × 365 × 24 × 60 × 60 s
= 5234976000 s

Rotation period of Earth = 365 days 5 h 56 min 4 s
= (365 × 24 × 60 × 60 + 5 × 60 × 60 + 56 × 60 + 4) s
= (3153600 + 18000 + 3360 + 4) s
= 31557364 s

Hence, according to question rotation period of Earth is least.

CHAPTER 8

Unitary Method

Unitary method is the basic area of arithmetic. In the CSAT paper this portion of Basic numeracy will help you to solve myriad problems.

Direct Proportion

Two quantities are said to be directly proportional, if on the increase in one the other increases proportionally or on the decrease in one the other decreases proportionally.

eg, More the numbers of articles, More is the cost.
More the number of workers, More is the work done.
Less the number of articles, Less is the cost.
Less the number of workers, Less is the work done.

Indirect Proportion

Two quantities are said to be indirectly proportional, if on the increase in one the other decreases proportionally or on the decrease in one the other increases proportionally. eg, More the number of workers, less is the number of days required to finish a work. More the speed, less is the time taken to cover a certain distance. Less the number of workers, more is the number of days required to finish a work. Less the speed, more is the time taken to cover a certain distance.

Chain Rule

When a series of variables are connected with one another, that we know how much of the first kind is equivalent to a given quantity of second, how much of the second is equivalent to a given quantity of the third and so on. The rule by which we can find how much of the last kind is equivalent to a given quantity of the first kind is called the Chain Rule.

Example 1: If 12 apples cost ` 216, what is the cost of 3 dozen apples ?

Solution. Let the required cost be ` x. Also, 3 dozen apples = 35 apples more apples, more cost (Direct Proportion);

Apples	Cost in `
12	216
36	x

$$12 \times x = 36 \times 216 \Rightarrow x = \frac{36 \times 216}{12} = ` 648$$

EXERCISE

11. 10 workers can make 15 boxes in 6 days, how many boxes will 12 workers make in 3 days.
(a) 10 (b) 9
(c) 6 (d) 8

12. If 25 binders bind 25 books in 25 days. How many binders can bind 10 books in 10 days.
(a) 25 (b) 10
(c) 15 (d) 20

13. If 8 monkeys eat 8 bananas in 8 min. How many monkeys will eat 12 bananas in 12 min?
(a) 6 (b) 8
(c) 12 (d) 10

14. If 15 men build a wall 35 m high 14 days, in how many days will 30 men build a similar wall 20 m high?
(a) 5 days (b) 4 days
(c) 7 days (d) 6 days

15. If 36 persons consume 180 kg of rice in 12 days, in how many days will 42 persons consume 105 kg of rice?
(a) 6 days (b) 8 days
(c) 4 days (d) 9 days

ANSWERS

1. (b)	**2**. (a)	**3**. (b)	**4**. (b)	**5**. (a)

EXPLANAIONS

1. Let the number of boxes made be x.
More workers, More boxes (Direct Proportion)
Less days, Less boxes (Direct Proportion)

Workers	Days	Boxes
10	6	15
12	5	x

$$\Rightarrow \quad x = \frac{12}{10}\times\frac{3}{6}\times 15 = 9 \text{ boxes}$$

2. Let the number of binders required be x.
Less books, Less binders (Direct Variation)
Less days, More binders (Indirect Variation)

Books	Days	Binders
25	25	25
10	10	x

$$\Rightarrow \quad x = \frac{10}{25}\times\frac{25}{10}\times 25 = 25 \text{ binders}$$

3. Let the required number of monkeys be x.
More bananas, More monkeys (Direct Proportion)
More time, Less monkeys (Indirect Proportion)

Bananas	Time in min	Monkeys
8	8	8
12	12	x

$$\Rightarrow \quad x = \frac{12}{8}\times\frac{8}{12}\times 8 = 8 \text{ monkeys}$$

4. Let the required number of days be x.
More men, Less days (Indirect Proportion)
Less height, Less days (Direct Proportion)

Men	Height in metres	Days
15	35	14
30	20	x

$$\Rightarrow \quad x = \frac{15}{30}\times\frac{20}{35}\times 14 = 4 \text{ days}$$

5. Let the required number of days be x.
More persons, Less days (Indirect Proportion)
Less rice, Less days (Direct Proportion)

Persons	Rice (in kg)	days
36	180	12
42	105	x

$$\Rightarrow \quad x = \frac{36}{42}\times\frac{105}{180}\times 12 = 6 \text{ days}$$

CHAPTER 9

Average

Average

The average of a given number of quantities of the same kind is expressed as

$$\text{Average} = \frac{\text{Sum of the quantities}}{\text{Number of the quantities}}$$

Average is also called the Arithmetic Mean.

Also, $\text{Sum of the quantities} = \text{Average} \times \text{Number of the quantities}$

$$\text{Number of quantities} = \frac{\text{Sum of the quantities}}{\text{Average}}$$

- If all the given quantities have the same value, then the number itself is the average.
- If all the given quantities are not all the same, then the average of the given quantities is always greater, then the smallest number and always less than the largest number. Equivalently, atleast one of the numbers is less than the average and atleast one is greater then the average.
- If each of the given quantities is increased by a constant p, then their average is also increased by p.
- If each of the given quantities is decreased by a constant p, then their average is also decreased by p.
- If each of the given quantities is multiplied by a constant p, then their average is also multiplied by p.
- Whenever the given quantities form an arithmetic sequence and if the given quantities has odd terms, then the average is the middle term in the sequence and if the given quantities has even terms, then the average of the sequence is the average of the middle two terms.
- In order to calculate the weighted average of a set of numbers, multiply each number in the set by the number of times it appears, add all the products and divide by the total number of numbers in the set.
- If the speed of an object from A to B is x km/h and from B to A is y km/h,then the average speed during the whole journey is $\frac{2xy}{x+y}$ km/h .
- If the average of N_1 quantities is x and N_2 quantities is y then the average of total $(N_1 + N_2)$ quantities is given by $\frac{(N_1x + N_2y)}{N_1 + N_2}$

Example 1: What is the average of first five even numbers.

Solution. The first prime even numbers are 2, 4, 6, 8, 10

$$\text{Average} = \frac{2+4+6+8+10}{5} = \frac{30}{5} = 6$$

Example 2: The average of five consecutive even numbers is 50. What is the largest of these numbers?

Solution. Let the numbers be $x - 4$, $x - 2$, x, $x + 2$, $x + 4$.

$$\text{Average} = \frac{\text{Sum of the quantities}}{\text{Number of the quantities}}$$

$$= \frac{x-4+x-2+x+x+2+x+4}{5} = 50$$

$$\Rightarrow \quad \frac{5x}{5} = 50$$

$$\Rightarrow \quad x = 50$$

So, the numbers are 46, 48, 50, 52, 54.

The largest of these numbers is 54.

Example 3: Average weight of 32 students of a class is 30.5 kg. If weight of a teacher is also included then average weight is increased by 500 g. What is the weight of the teacher?

Solution. Total weight of 32 students = 30.5 × 32 = 976 kg

Average weigth of (32 students + 1 teacher) = (30.5 + 0.5) = 31 kg

∴ Total weight of (32 students + 1 teacher) = 31 × 33 = 1023 kg

∴ Weight of teacher = (1023 – 976) kg = 47 kg

Example 4: The average salary per head of all the employees of an institution is Rs 60. The average salary per head of 12 officers is ` 400 and average salary per head of the rest is ` 56. Find the total number of employees in the institution.

Solution. Let the total number of employees be x.

Then,
$$60 = \frac{\text{Total salary of all employees}}{x}$$

$$60 = \frac{12\times 400 + (x-12)\times 56}{x}$$

$$\Rightarrow \quad 60x = 12 \times 400 + (x - 12) \times 56 = 4800 + 56x - 672$$

$$\Rightarrow \quad 60x - 56x = 4800 - 672$$

$$\Rightarrow \quad 4x = 4128 \Rightarrow x = 1032$$

Hence, the total number of employees is 1032.

Example 5: If the average of p and q is 58 and the average of q and 5 is 64, what is the value of $s - p$?

Solution. Given, $\frac{p+q}{2} = 58 \Rightarrow \quad p + q = 116 \qquad ...(i)$

Also, $\frac{q+s}{2} = 64 \Rightarrow \quad q + s = 128 \qquad ...(ii)$

Subtracting Eq. (i) from (ii), we get

$$(q + s) - (p + q) = 128 - 116 \Rightarrow s - p = 12$$

EXERCISE

1. The average age of a husband, his wife and daughter 2 yr ago was 24 yr and that of his wife and daughter 4 yr ago was 18 yr. What is the husband's present age ?
(a) 32 yr (b) 30 yr
(c) 34 yr (d) 36 yr

2. Five years ago the average age of four men is 48 yr. Now, a new man joins and the average age increases by 2 yr. What is the age of the new man?
(a) 36 yr (b) 42 yr
(c) 41 yr (d) 38 yr

3. The mean yearly salary of an employee of a company was ` 20000. The mean yearly salaries of male and female employees were ` 20800 and ` 16800 respectively. Find the ratio of males to females employed by the company
(a) 3 : 2 (b) 4 : 1
(c) 2 : 1 (d) 5 : 3

4. Average of two numbers is 14.5 and square root of their product is 10. What are the numbers ?
(a) 16 and 9 (b) 25 and 4
(c) 4 and 16 (d) 25 and 9

5. The average age of a group of four men whose ages are in the ratio 2 : 3 : 4 : 5 is 42 yr, what is the age of the eldest person in this group ?
(a) 60 yr (b) 48 yr
(c) 36 yr (d) 24 yr

ANSWERS

1. (c)	**2**. (d)	**3**. (b)	**4**. (b)	**5**. (a)

EXPLANATIONS

1. Let the age of husband, wife and daughter 2 year ago be x, y and z year respectively.

$$\text{Then, } \frac{x+y+z}{3} = 24$$

$$\Rightarrow x + y + z = 72 \quad \ldots(i)$$

$$\text{Also } \frac{(y-z)(z-2)}{2} = 18$$

$$\Rightarrow y + z = 40 \quad \ldots(ii)$$

$$\Rightarrow x = 32 \text{ year}$$

So, present age of husband = $(x + 2)$ year
= (32 + 2) year = 34 year

2. Sum of the ages of the four men five year ago
= (48 × 4) year = 192 year
Present sum of the ages of the four men
= (192 + 5 × 4) year = 212 year

$$\text{Now, } 50 = \frac{212 + \text{Age of the new man}}{5}$$

∴ Age of the new man = (50 × 5 – 212) year
= 38 year

3. Let the number of males be x and the number of females be y.
Sum of the salaries of the men = $20800x$
Sum of the salaries of the females = $16800y$

$$\text{Now, } 20000 = \frac{20800x + 16800}{x+y}$$

$$\Rightarrow 20000(x + y) = 20800x + 16800y$$

$$\Rightarrow 800x = 3200y$$

$$\Rightarrow \frac{x}{y} = \frac{4}{1} \Rightarrow x : y = 4 : 1$$

4. Let the number be a and b. Then,

$$\frac{a+b}{2} = 14.5$$

$$\Rightarrow a + b = 29$$

$$\Rightarrow \sqrt{ab} = 10$$

$$\Rightarrow ab = 100$$

$$(a - b)^2 = (a + b)^2 - 4ab$$

$$= (29)^2 - (4 \times 100) = 441$$

$$\Rightarrow (a - b) = 21$$

On solving $a + b = 29$ and $a - b = 21$, we get $a = 25$ and $b = 4$.

5. Let the ages of the four men be $2x$, $3x$, $4x$ and $5x$ year respectively.

$$\text{Then, } 42 = \frac{2x + 3x + 4x + 5x}{4}$$

$$\Rightarrow 14x = 42 \times 4$$

$$\Rightarrow x = \frac{42 \times 4}{14} = 12$$

Hence, the age of the eldest person = $5x$ = (5 × 12) year = 60 year

CHAPTER 10

Percentage

Percentage

'Per cent' means 'per hundred'. It is given by % symbol. Here x% means x per hundred or $\frac{x}{100}$. Thus, any percentage can be converted into an equivalent fraction by dividing it by 100.

eg $20\% = \frac{20}{100} = \frac{1}{5}$; $150\% = \frac{150}{100} = \frac{3}{2}$

Also, any fraction or decimal can be converted into its equivalent percentage by multiplying with 100.

eg $\frac{1}{5} = \frac{1}{5} \times 100 = 20\%$; $\frac{3}{2} = \frac{3}{2} \times 100 = 150\%$.

Important Formulae

1. Percentage increase = $\frac{\text{Increase}}{\text{Original value}} \times 100$
2. Percentage decrease = $\frac{\text{Decrease}}{\text{Original value}} \times 100$
3. If the price of the commodity increases by r% then the reduction in consumption so as not to increase the expenditure is $\left[\frac{r}{100+r} \times 100\right]\%$
4. If the price of the commodity decreases by r% then the reduction in consumption so as not to increase the expenditure is $\left[\frac{r}{100-r} \times 100\right]\%$
5. If A's income is r% more than B's income then B's income is less than A's income by $\left[\frac{r}{100+r} \times 100\right]\%$.
6. If A's income is r% less than B's income then B's income is more than A's income by $\left[\frac{r}{100-r} \times 100\right]\%$.

7. Let the population of a town be P and it increases at the rate of r% per annum, then

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

(b) Population n years ago = $\frac{P}{\left(1+\frac{r}{100}\right)^n}$

8. Let the present value of the machine be P and if it depreciates at the rate of r% per annum.

(a) Value of machine after n years = $P\left(1-\frac{r}{100}\right)^n$

(b) Value of machine n years ago = $\frac{n}{P\left(1-\frac{r}{100}\right)^n}$

Example 1: Express 3/2 as rate per cent.

Solution. $\frac{3}{2} = \left(\frac{3}{2}\times 100\right)\% = 150\%$

Example 2: Find 25% of 1000.

Solution. 25% of 1000 = $\frac{25}{100}\times 1000 = 250$

Example 3. What per cent of 6 is 144?

Solution. Required percentage = $\left(\frac{144}{6}\times 100\right)\% = 2400\%$

Example 4: What per cent of 2.5 kg is 15 g?

Solution. Required percentage = $\left(\frac{15}{2.5\times 1000}\times 100\right)\% = 0.6\%$

Example 5. If the price of tea falls by 12%, by how much pr cent must a house holder increase its consumption, so as not to decrease its expenditure on tea?

Solution. (Short cut method)

$$\text{Increase \% in consumption} = \left\{\frac{r}{100-r}\times 100\right\}\% = \left\{\frac{12}{100-12}\times 100\right\}\%$$

$$= \left(\frac{12}{88}\times 100\right)\% = \frac{150}{11}\% = 13\frac{7}{11}\%$$

Example 6: The value of a machine depreciates at the rate of 10% per annum. If its present value is ` 162000, what was the value of the machine 2 year ago?

Solution. Value of machine 2 year ago = $` \left[\frac{162000}{\left(1-\frac{10}{100}\right)^2}\right] = ` \left(162000\times\frac{10}{9}\times\frac{10}{9}\right)$

= ` 200000

Example 7: Due to a reduction of 5% in prices of sugar, a man is able to buy 1 kg more for ` 95. Find the original and reduced rate of sugar.

Solution. Let the original rate be ` x per kg.

Reduced rate = ` $(100-5)\times\frac{1}{100}x$ = ` $\frac{95x}{100}$ $\therefore$ $\frac{95}{\frac{95x}{100}}-\frac{95}{x}=1$

$\Rightarrow$ $\frac{5}{x}=1 \Rightarrow x=5$

$\therefore$ Original rate = ` 5 per kg

Reduced rate = ` $\left(\frac{19}{20}\times\frac{5}{1}\right)$per kg = ` $\frac{19}{4}$ = 4.75 er kg

Example 8: If the price of 1 kg cornflakes is increased by 25%, the increase is ` 10. Find the new price of cornflakes per kg.

Solution. Original price = $\frac{\text{Difference in price}}{\text{Difference in per cent}}\times 100=\frac{10}{25}\times 100=400$

$\therefore$ New price = $40\times\frac{125}{100}$ = ` 50

EXERCISE

1. A man spends 30% of his income on food, 12% on house rent, 28% on miscellaneous. If the savings at the end of a month is ` 810, then the man's total income is
(a) ` 2100 (b) ` 2400
(c) ` 2600 (d) ` 2700

2. In an examination, 950 boys and 250 girls appeared. 90% of the boys and 60% of the girls passed the examination. The percentage of candidates failed is
(a) 16.25% (b) 16.75%
(c) 16.50% (d) None

3. A student multiplied a number by 2/5 instead of 2/5. What is the percentage error in the calculation?
(a) 82% (b) 86%
(c) 84% (d) 89%

4. A batsman scored 120 runs which included 6 boundaries and 7 sixes. What per cent of his total score did he make by running between the wickets?
(a) 64% (b) 46%
(c) 54% (d) 45%

5. A fruit seller had some apples. He sells 35% apples and still has 390 apples. Originally he had
(a) 600 (b) 540
(c) 660 (d) 580

ANSWERS

1. (d) **2.** (a) **3.** (c) **4.** (d) **5.** (a)

EXPLANATIONS

1. Saving = [100 – (30 + 12 + 28)]% = 30%

$\therefore$ 30% of x = 810

$\Rightarrow$ $\frac{30x}{100}$ = 810

$\Rightarrow$ $x=\frac{810\times 100}{30}$ = ` 2700

2. Number of failures = (10% of 950 + 40% of 250)

$=\left(\frac{10}{100}\times 950+\frac{40}{100}\times 250\right)$

$= (95 + 100) = 195$

$$\text{Fail\%} = \frac{195}{950+250}\times 100 = \frac{195}{200}\times 100 = 16.25\%$$

3. Let the number x. Then, error $= \frac{5x}{2} - \frac{2x}{5} = \frac{21x}{10}$

$$\text{Error \%} = \left(\frac{21x}{10}\times\frac{2}{5x}\times 100\right)\% = 84\%$$

4. Number of runs made by running

$= 120 - (6 \times 4 + 7 \times 6)$

$= 120 - 66 = 54$

$$\therefore \text{Required percentage} = \left(\frac{54}{120}\times 100\right)\% = 45\%$$

5. Let originally he had x apples.

Then, $(100 - 35)\%$ of $x = 390$

$$\Rightarrow \frac{65}{100}\times x = 390$$

$$\Rightarrow x = \left(\frac{390\times 100}{65}\right)$$

$$x = 600$$

CHAPTER 11

Profit and Loss

Cost Price

The price at which an article is purchased is called the cost price or CP.

Selling Price

The price at which an article is sold is called the selling price or SP.

Formulae

$$\text{Gain or Profit} = \text{SP} - \text{CP}$$

$$\text{Gain per cent or Profit per cent} = \left(\frac{\text{Gain}}{\text{CP}} \times 100\right) \text{or} \left(\frac{\text{Profit}}{\text{CP}} \times 100\right)$$

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

Similarly,

$$\text{Loss} = \text{CP} - \text{SP}$$

$$\text{Loss per cent} = \left(\frac{\text{Loss}}{\text{CP}} \times 100\right); \text{SP} = \frac{(100 - \text{Loss}\%)}{100} \times \text{CP}$$

- The Profit and Loss per cent is always calculated on the cost price.
- If a trader professes to sell his goods at CP but uses false weight, then Gain per cent or Profit per cent

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

Marked Price or List Price

Price that is indicated or marked on the article is called marked price or MP.

Discount

It is reduction given on the Marked Price or List Price of an article.

$$d \text{ per cent} = \frac{100 \times \text{discount}}{\text{MP}}; \text{ Selling Price} = \frac{(100 - d\%)}{100} \times MP$$

If a trade gets x% profit and x% loss in selling two different articles, then in over all transaction, there is always a loss which is given by

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

Example 1: A chair is bought for ` 1950 and sold at ` 2340. Find the gain per cent.

Solution. CP = ` 1950 and SP = ` 2340

$$\text{Gain} = \text{` } (2340 - 1950) = \text{` } 390$$

$$\text{Gain \%} = \left(\frac{390}{1950} \times 100\right)\% = 20\%$$

Example 2: A radio is bought for ` 780 and sold at ` 650. Find the loss per cent.

Solution. CP = ` 780 and Sp = ` 650

$$\text{Loss} = \text{CP} - \text{SP} = \text{` } (780 - 650) = \text{` } 130$$

$$\text{Loss \%} = \left(\frac{13}{780} \times 100\right) = 16\frac{2}{3}\%$$

Example 3: A book is bought for ` 80 and sold at the gain of 5%. Find the selling price.

Solution. CP = ` 80, Gain = 5%

$$\text{SP} = 105\% \text{ of ` } 80 = \text{` } \left(\frac{105}{100} \times 80\right) = \text{` } 84$$

Example 4: If cost price of 15 articles is equal to the selling price of 12 articles, then find the gain per cent.

Solution. Let cost price of each article = ` 1

Then, Cost price of 15 articles = ` 15

$\therefore$ Selling price of 12 articles = ` 15

But Cost price of 12 articles = ` 12

$\therefore$ Profit = ` (15 – 12) = ` 3

$\therefore$ $$\text{Profit \%} = \frac{3}{12} \times 100 = 25\%$$

Example 5: What is the equivalent discount of three consecutive discount 30%, 20% and 5%.

Solution. Let MP = ` 100

$\therefore$ $$\text{SP} = 95\% \text{ of } 80\% \text{ of } 70\% \text{ of } 100 = \frac{95}{100} \times \frac{80}{100} \times \frac{70}{100} \times 100 = \text{` } 53.20$$

$\therefore$ Required equivalent discount = ` (100 – 53.20) = ` 46.80

Example 6: By selling 66 m of cloth a person gains the cost price of 22 m. Find the gain per cent.

Solution. Let CP of 1 m cloth = ` 1

Then, $$\text{Gain \%} = \frac{\text{gain}}{\text{CP}} \times 100 = \frac{\text{CP of 22 m cloth}}{\text{CP of 66 m cloth}} \times 100 = \frac{22}{66} \times 100 = 33\frac{1}{3}\%$$

Example 7: A radio is listed at ` 500 with a discount of 10%. What additional discount must be offered to the customer to bring the net price to ` 423?

Solution. List price = ` 500, Discount = 10%

$$\text{SP} = 90\% \text{ of } ` 500 = ` \left(\frac{90}{100}\times 500\right) = ` 450$$

$$\text{Sale price} = ` 423$$

$$\text{Additional discount} = \left(\frac{27}{450}\times 100\right) = 6\%$$

EXERCISE

1. A man buys an article with 20% discount on its marked price. He makes a profit of 10% by selling it at ` 825. Find its marked price.
(a) ` 985.25 (b) ` 937.50
(c) ` 925.50 (d) ` 945.25

2. If a commission of 25% is offered on the list price, a person gains 20%. If the commission is increased to 30%, what will be the gain per cent?
(a) 8% (b) 10%
(c) 12% (d) 6%

3. A person sells two articles at the same price. On one, he gets a profit of 25% and on the other, he losses 20%. Find his profit or loss per cent in the whole transaction.
(a) $12\frac{1}{3}\%$ loss (b) $12\frac{1}{3}\%$ profit
(c) $2\frac{18}{41}\%$ profit (d) $2\frac{18}{41}\%$ loss

4. An article is listed at ` 1000 and two successive discounts, one of them being 20% is offered on it. Find the other discount, if its selling price is ` 720.
(a) 10% (b) 8%
(c) 12% (d) 11%

5. A person buys a TV set which is listed at ` 15000 and gets two successive discounts of 20% and 10%. He spends 5% of this CP on transport. At what price should he sell to get a profit of 15%?
(a) ` 13252 (b) ` 13041
(c) ` 13125 (d) ` 13345

ANSWERS

1 (b) **2.** (c) **3.** (d) **4.** (a) **5.** (b)

EXPLANATIONS

1. Let the marked price be ` x.

$$\text{CP} = 80\% \text{ of } ` x = ` \left(\frac{80}{100}\times x\right) = ` \frac{4x}{5}$$

$$\text{SP} = 110\% \text{ of } \frac{4x}{5} ` = ` \left(\frac{110}{100}\times\frac{4x}{5}\right) = ` \frac{22x}{25}$$

$$\therefore \frac{22x}{25} = 825 \Rightarrow x = \left(\frac{825\times 25}{22}\right) = 937.50$$

$\therefore$ MP = ` 937.50

2. Let the MP = ` 100, Commission = 25%
$\therefore$ SP = ` 75, Gain = 20%

$$\text{CP} = ` \left(\frac{75\times 100}{120}\right) = ` 62.5$$

New SP = ` 70 and New gain = ` (70 – 62.5) = ` 7.5

$$\text{New gain\%} = \left(\frac{7.5}{62.5}\times 100\right)\% = 12\%$$

3. Let SP of each article = ` 100
On first 25% profit on second 20% loss

$$\text{CP of first} = ` \left(\frac{100\times 100}{125}\right) = ` 80$$

$$\text{CP of second} = ` \left(\frac{100\times 100}{80}\right) = ` 125$$

Total CP = ` (80 + 125) = ` 205
Total SP = ` 200
Loss on the whole = ` (205 – 200) = ` 5

$$\text{Loss\%} = \left(\frac{5}{205}\times 100\right)\% = 2\frac{18}{41}\%$$

4. Let the other discount = x%

MP = ` 1000 and SP = ` 720

Now, $\left[\frac{(100-20)}{100}\times\frac{(100-x)}{100}\times 100\right] = 720$

$\Rightarrow \frac{80}{100}\times\frac{100-x}{100}\times 1000 = 720$

$\Rightarrow 8\,(100-x) = 120$

$\Rightarrow 800 - 8x = 720$

$\Rightarrow x = 10\%$

5. MP of the TV set = ` 15000

SP of the TV set (v) CP of the person

$= ` \left(\frac{80}{100}\times\frac{90}{100}\times 15000\right)$

= ` 10800

Cost of transport = $` \left(\frac{5}{100}\times 10800\right) = ` 540$

Total CP = ` (10800 + 540) = ` 11340

Gain % = 15%

$\therefore$ Required SP = $` \left(\frac{11340\times 115}{100}\right) = ` 13041$

CHAPTER 12

Ratio & Proportion

Ratio

The ratio of two quantities a and b is the fraction $\frac{a}{b}$ and is expressed as $a : b$. Here a is the first term or antecedent and b is the second term or consequent. Since the ratio expresses the number of times one quantity contains the other, it is an abstract (without units) quantity.

A ratio remains unaltered if its numerator and denominator are multiplied or divided by the same number. eg, 4 : 3 is the same as (4 × 10) : (3 × 10) ie, 40 : 30.

20 : 15 is the same as $\left(\frac{20}{5}\right):\left(\frac{15}{5}\right)$ *ie*, 4 : 3.

"A ratio is said to be a ratio of greater or less inequality or of equality according as antecedent is greater than, less than or equal to consequent".

- If $a > b$, then $a : b$ is called a ratio of greater inequality (*eg*, 4 : 3, 5 : 2, 11 : 3, ...)
- If $a < b$, then $a : b$ is called a ratio of less inequality (*eg*, 3 : 4, 2 : 5, 3 : 11, ...)
- If $a = b$, then $a : b$ is called a ratio of equality (*eg*, 1 : 1, 3 : 3, 5 : 5, ...)

From this we find that

(i) If $a > b$ and some positive number is added to each term of $a : b$, then the ratio is diminished.
If $a > b$, then $(a + x) : (b + x) < a : b$.

(ii) If $a < b$ and some positive number is added to each term of $a : b$, then the ratio is increased.
If $a < b$, then $(a + x) : (b + x) < a : b$.

(iii) If $a = b$ and some positive number is added to each term of $a : b$, then the ratio is unaltered. If $a = b$, then $(a + x) : (b + x) = a : b$

Kinds of Ratios

Duplicate Ratio: $a^2 : b^2$ is called duplicate ratio of $a : b$.

Triplicate Ratio: $a^3 : b^3$ is called triplicate ratio of a : b.

Sub-Duplicate Ratio: $\sqrt{a} : \sqrt{b}$ is called sub-duplicate ratio of $a : b$.

Sub-triplicate Ratio : $\sqrt[3]{a} : \sqrt[3]{b}$ is called sub-triplicate ratio of $a : b$.

Compound Ratio : $ab : cd$ is the compound ratio of $a : c$ and $b : d$. It is the ratio of the product of the antecedents to that of the consequents of two or more given ratios.

Inverse Ratio : $\frac{1}{a} : \frac{1}{b}$ is the inverse ratio of $a : b$.

Componendo and Divedendo: If $\frac{a}{b} = \frac{c}{d}$, then $\frac{a+b}{a-b} = \frac{c+d}{c-d}$

Proportion

When two ratios are equal, they make a proportion. *ie*, if $\frac{a}{b} = \frac{c}{d}$, then a, b, c and d are in proportion.

This is represented as $a : b :: c : d$ and is read as "a is to b as c is to d".

When a, b, c and d are in proportion, then a and d are called the Extremes and b and c are called the Means. also, Product of the Means = Product of the Extremes *ie*, $be = ad$.

Continued Proportion

If three quantities a, b and c are such that $a : b :: b : c$, then $b^2 = ac$ and a, b and c are in continued proportions. Also, the quantity c is called the **third proportion** of a and b.

Fourth Proportion

If four quantities a, b, c and x are such that $a : b :: b : c$, then $ax = be$ and x is called the **fourth proportion** of a, b, and c.

Mean or Second Proportion

If three quantities a, b and x are such that $a : x :: x : b$, then $x^2 = ab$ and x is called the mean of a and b. Also, If $a : b = c : d$, then the following properties hold good.

(i) $b : a = d : c$ (Invertendo)

(ii) $a : c = b : d$ (Alter nendo)

(iii) $(a + b) : b = (c + d) : d$ (Componendo)

(iv) $(a - b) : b = (c - d) : d$ (Dividendo)

(v) $\frac{a+b}{a-b} = \frac{c+d}{c-d}$ (Componendo - Dividendo)

Variation

If two quantities x and y are related in such a way that as the quantity x changes it also brings a change in the second quantity y, then the two quantities are in variation.

Direct Variation

The quantity x is in direct variation to y if an increase in x makes y to increase proportionally. Also a decrease in x makes y to decrease proportionally it can be expressed as $x = ky$. Where, k is called the constant of proportionality. eg, Cost is directly proportional to the number of articles bought.

Inverse Variation

The quantity x is in inverse variation to y if an increase in x makes y to decrease proportionally. Also, a decrease in x makes y to increase proportionally. It can be expressed as $x = \frac{k}{y}$. Where, k is called the constant of proportionality. *eg*, The time taken by a vehicle in covering a certain distance is inversely proportional to the speed of the vehicle.

Example 5: The ratio between two numbers is 3 : 7. If their LCM is 210, find the numbers.

EXERCISE

1. Ratio between sum and difference of two numbers is 3 : 1. Find the ratio between the numbers.
(a) 2: 1 (b) 1: 4
(c) 4: 2 (d) 3: 2

2. Two numbers are in the ratio 3 : 5. If we subtract 5 from each number, then the new ratio becomes 2 : 5. The numbers are
(a) 9, 15 (b) 12, 20
(c) 18, 30 (d) 21, 35

3. If 5 times a number is equal to 7 times another number, find the ratio between the two numbers
(a) 5 : 7 (b) 7 : 5
(c) 4 : 5 (d) 3 : 7

4. The ratio of expenditure and savings of a person is 26: 3. If his monthly income is ` 7250, then what is his monthly savings.
(a) ` 290 (b) ` 350
(c) ` 750 (d) ` 780

5. ` 750 is distributed in A, B and C such that $A : B = 5 : 2$, $B : C = 7 : 13$ then what is A's part ?
(a) ` 140 (b) ` 250
(c) ` 260 (d) ` 350

ANSWERS WITH SOLUTIONS

1. (a) **2.** (a) **3.** (b) **4.** (c) **5.** (d)

EXPLANATIONS

1. Ratio between the number is $(3 + 1) : (3 - 1)$
$= 4 : 2 = 2 : 1$

2. Let the two number be $3x$ and $5x$.

$$\text{Now,} \quad \frac{3x-5}{5x-5} = \frac{2}{5}$$
$$\Rightarrow \quad 5(3x - 5) = 2(5x - 5)$$
$$\Rightarrow \quad 15x - 25 = 10x - 10$$
$$\Rightarrow \quad x = 3$$

So, the two numbers are 3(3) and 5(3) ie, 9 and 15.

3. Let the two number be x and y.

$$5x = 7y \Rightarrow \frac{x}{y} = \frac{7}{5}$$
$$\Rightarrow \quad x : y = 7 : 5$$

4. Let monthly expenditure = $26x$ and monthly savings = $3x$
Then, monthly income = $26x + 3x = 29x$
$\therefore \quad 29x = 7250$
$\Rightarrow \quad x = 250$
$\therefore$ Monthly savings = ` $3 \times 250$ = ` 750

5. $A : B = 5 : 2 = \frac{5}{2} : 1$

$B : C = 7 : 13 = 1 : \frac{13}{7}$

$A : B : C = \frac{5}{2} : 1 : \frac{13}{7} = 35 : 14 : 26$

$\therefore \quad A\text{'s part} = 750 \times \frac{35}{75}$ = ` 350

CHAPTER 13

Partnership

Partnership

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

Partnership is of two types

1. Simple Partnership
2. Compound Partnership

1. Simple Partnership: When investments of all the partners are for the same period of time, the profit or loss is distributed among the partners in the ratio of their original investments.

Suppose *A* and *B* invest ` *p* and ` *q* respectively for a year in a business, then at the end of the year. Share of *A*'s profit (loss) : Share of *B*'s profit (loss) = *p* : *q*.

2. Compound Partnership: When investments of all the partners are for different period of time, then equivalent capitals are calculated for a unit of time and the profit or loss is divided in the ratio of the product of time and investment.

Suppose *A* and *B* invest ` *p* and ` *q* for *x* months and *y* months respectively, then Share of *A*'s profit (loss): Share of *B*'s profit (loss) = *px* : *qy*.

Partners are of two types

(i) Working Partner, and

(ii) Sleeping Partner

(i) Working Partner: A partner who manages the business is called a working partner.

(ii) Sleeping Partner: A partner who only invests the money is called a sleeping partner.

Example 1: *A* and *B* started a business with capitals of ` 25000 and ` 40000 respectively. Find the share of *A* and *B* out of an annual profit of ` 6500.

Solution. Ratio of shares of *A* and *B* = Ratio of their investments = 25000 : 40000 = 5 : 8

$$A\text{'s share} = ` \left(\frac{5}{13}\times 6500\right) = ` 2500$$

and

$$B\text{'s share} = ` \frac{8}{13}\times 6500 = ` 4000$$

Example 2: *A, B* and *C* start a business each investing ` 16000. After 3 months *A* withdrew ` 2000, *B* withdrew ` 4000 and *C* invests ` 8000 more. At the end of year a total profit of ` 41580 made. Find the share of *A, B* and *C*

Solution. Ratio of capitals of *A, B* and *C*

$= (16000 \times 3 + 14000 \times 9) : (16000 \times 3 + 12000 \times 9) : (16000 \times 3 + 24000 \times 9)$

$= 174000 : 156000 : 264000 = 29 : 26 : 44$

A's share = ` $\left(\frac{29}{99} \times 41580\right)$ = ` 12180

B's share = ` $\frac{26}{99} \times 41580$ = ` 10920

C's share = ` $\frac{44}{99} \times 41580$ = ` 18480

Example 3: *A, B* and *C* enter into a partnership with a total of ` 8200. *A*'s capital is ` 1000 more than *B*'s and ` 2000 less than *C*s. What is *B*'s share of the year's profit of ` 2,460.

Solution. Given, $A = B + 1000 = C - 2000$

$C = B + 3000$

$A + B + C = (B + 1000) + (B) + (B + 3000)$

$8200 = 3B + 4000 \Rightarrow 3B = 8200 - 4000$ ∴ B = ` 1400

Share of profit of B = ` $\frac{1400}{8200} \times 2460$ = ` 420

EXERCISE

1. *A, B* and *C* started a business. *A* invests 1/2 capital for 1/4 time, *B* invests 1/8 of capital for 1/2 time and *C* invests the remaining capital for whole time. Find the share of *B* in the total profit of ` 9900.
(a) ` 2200 (b) ` 1100
(c) ` 6600 (d) ` 4400

2. *A, B* and *C* enter into a partnership with investment in the ratio 4 : 3 : 2. After 4 months *A* and *B* withdraw half of their capital and after 7 months *C* added 2/5 of his capital. Find the share of *B* in the total profit of ` 12600 at the end of the year.
(a) ` 3600 (b) ` 4800
(c) ` 4200 (d) ` 3900

3. *A* and *B* invest in a business in a ratio 2 : 3. If 10% of the total profit goes for donations and if, *A*'s share is ` 1080, then find the total profit.
(a) ` 3000 (b) ` 2400
(c) ` 2800 (d) ` 3200

4. Four transport companies *A, B, C* and *D* rented a parking place *A* kept 12 cars for 5 months, *B* kept 20 cars for 6 months, *C* kept 15 cars for 5 months and *D* kept 30 cars for 6 months in the parking place. If As share of rent is ` 2400 the total rent of the parking place is
(a) ` 17400 (b) ` 18600
(c) ` 16500 (d) ` 19200

5. *A, B* and *C* start a business with investments of ` 90000, ` 60000 and ` 45000 respectively. *A* and *B* leave the business after a few months at the same time. At the end of the year, they share the profits in the ratio of 6 : 4 : 9. After how many months did *A* and *B* leave the business ?
(a) 6 months (b) 2 months
(c) 3 months (d) 4 months

ANSWER

1. (b) **2.** (a) **3.** (a) **4.** (a) **5.** (d)

EXPLANATIONS

1. C's capital's $= 1-\left(\frac{1}{2}+\frac{1}{8}\right)= 1-\left(\frac{5}{8}\right)=\frac{3}{8}$

Ratio of capital's of A, B and C

$$= \left(\frac{1}{2}\times\frac{1}{4}\right):\left(\frac{1}{8}\times\frac{1}{2}\right):\left(\frac{3}{8}\times 1\right)$$

$$= \frac{1}{8}:\frac{1}{16}:\frac{3}{8}= 2:1:6$$

$$B\text{'s share} = ` \left(\frac{1}{9}\times 9900\right)= ` 1100$$

2. Let their initial investments be $4x$, $3x$ and $2x$

Ratio of the capitals of A, B and C is

$$\left[(4x\times 4)+\left(4x-\frac{4x}{2}\right)\times 8\right]:\left[(3x\times 4)+\left(3x-\frac{3x}{2}\right)\times 8\right]$$

$$:\left[(2x\times 7)+\left\{\left(2x+\frac{2x\times 2}{5}\right)\times 5\right\}\right]$$

$= (16x + 16x) : (12x + 12x) : (14x + 14x)$
$= 32x : 24x : 28x$
$= 8 : 6 : 7$

$\therefore$ B's share $= ` \left(\frac{6}{21}\times 12600\right)= ` 3600$

3. Let the total profit be ` 100.

After paying for donations, A's share

$$= ` \left(90\times\frac{2}{5}\right)= ` 36$$

If A's share is ` 36, total profit = ` 100.

If A's share is ` total profit $= ` \left(\frac{100}{36}\times 1080\right)$

$= ` 3000$

4. Ratio of shares of A, B, C and D
$= (12 \times 5) : (20 \times 6) : (15 \times 5) : (30 \times 6)$
$= 60 : 120 : 75 : 180$
$= 4 : 8 : 5 : 12$

Let the total rent for the parking place be ` x

Then, A's share $= ` \frac{4x}{29}$

$\therefore$ $\frac{4x}{29} = 2400$

$\Rightarrow$ $x = \frac{2400\times 29}{4} = 17400$

Hence, the total rent for the parking place
$= ` 17400$

5. Let A and B leave the business after x months

Ratio of capitals of A, B and C is
$= 90000 \times x : 60000 \times x : 450000 \times 12$
$= 3x : 2x : 18$

But, $3x : 2x : 18 = 6 : 4 : 9$

$\Rightarrow$ $\frac{2x}{18} = \frac{4}{9}$

$\Rightarrow$ $x = \frac{18\times 4}{2\times 9} = 4$

Hence, A and B left the business after 4 months.

CHAPTER 14

Alligation or Mixure

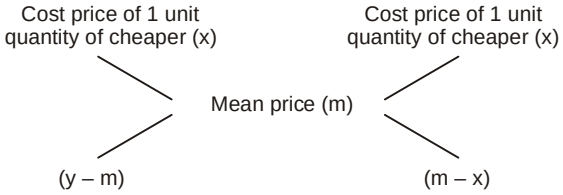
Introduction

It is the rule that is used to determine the mean value of the mixture when the prices of the individual items being mixed together and the proportion in which they are being mixed are given. Here, the value of the mixture is always higher than the lowest value and lower than the higher value of the items being mixed.

According to the Rule of Alligation

$$\frac{\text{Quantity of cheaper}}{\text{Quantity of dearer}} = \frac{\text{Price of dearer} - \text{Mean price}}{\text{Mean price} - \text{Price of cheaper}}$$

It can be also expressed as,



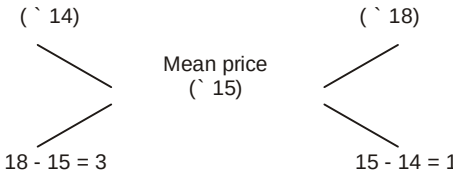
$\therefore$ (Cheaper quantity : Dearer quantity) = $(y - m) : (m - x)$

Where, mean price (m) is the cost price of a unit quantity of the mixture.

Also, if a container contains x units of liquid from which y units are taken out and replaced by water. After n operations, the quantity of pure liquid is $\left[x\left(1-\frac{y}{x}\right)^n\right]$ unit.

Example 1: How many kilograms of rice costing ` 18 per kg must be mixed with 30 kg of rice costing ` 14 per kg, so that the resultant mixture cost ` 15 per kg.

Solution. Applying the rule of alligation, we have



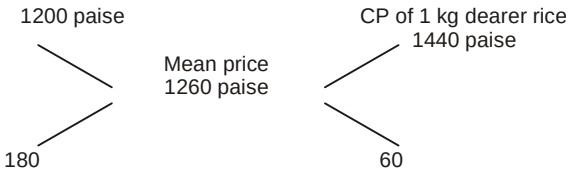
$$\therefore \quad \frac{\text{Quantity of cheaper rice}}{\text{Quantity of dearer rice}} = \frac{3}{1}$$

If cheaper rice is 3 kg, dearer rice is 1 kg.

If cheaper rice is 30 kg, dearer rice = $\left(\frac{30\times1}{3}\right)$kg = 10 kg

Example 2: In what proportion must a person mix rice ` 12.00 per kg and ` 14.40 per kg so as to make a mixture worth ` 12.60 per kg?

Solution.



By the alligation rule,

$$\frac{\text{Quantity of cheaper rice}}{\text{Quantity of dearer rice}} = \frac{180}{60} = \frac{3}{1}$$

∴ He must mix rice in the ratio 3 : 1.

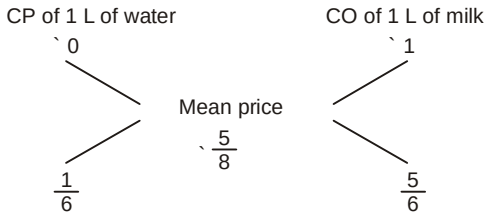
Example 3: In what proportion must water be mixed with milk to gain 20% by selling it at cost price?

Solution. Let CP of milk = Rs. 1 per litre

∴ SP of 1 L of mixture = Rs. 1,

Profit = 20%

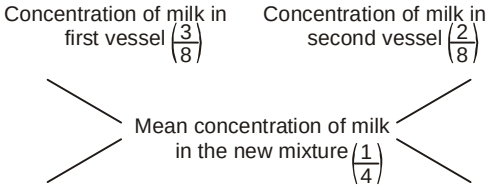
∴ CP of 1 L mixture = $\frac{1}{120}\times100$ = Rs. $\frac{5}{6}$



∴ Required ratio = $\frac{1}{6}:\frac{5}{6}$ = 1 : 5

Example 4: Two vessels contain mixture of milk and water in the ratio of 3 : 5 in the first vessel and in the ratio of 2 : 7 in the second. In what ratio should the contents of these two vessels be mixed such that the resultant mixture has milk and water inthe ratio 1 : 3?

Solution. Here, we can apply the alligation rule taking the concentration of the mixtures. The concentration of milk in the first vessel is 3/8 and that i the second $\frac{2}{9}$.



$\frac{1}{4}-\frac{2}{9}=\frac{1}{36}$ $\qquad$ $\frac{3}{8}-\frac{1}{4}=\frac{1}{8}$

The ratio in which the two mixture should be mixed is $\frac{1}{36}:\frac{1}{8}$ = 8 : 36 = 2 : 9

EXERCISE

1. A trader has 280 L of oil, a part of which he sells at a profit of 18% and the rest at 10% loss. He gains 14% on the whole. What is the quantity sold at 10% loss?
(a) 40 L (b) 110 L
(c) 240 L (d) 160 L

2. A trader has 200 kg of rice, a part of which he sells at 18% profit and the rest at 12% loss. On the whole he loses 6%. What is the quantity sold at 12% loss?
(a) 120 kg (b) 160 kg
(c) 40 kg (d) 60 kg

3. A person travels 340 km in 8 h. The first part of the journey, he travels by car at the speed of 50 km/h and in the second part of the journey he travels by train at the speed of 38 km/h. How many km did he travel by train?
(a) 120 km (b) 190 km
(c) 150 km (d) 210 km

4. A dealer mixes tea costing ` 50 per kg with a high quality tea and sells the mixture at ` 54 per kg. If the ratio in which the two quality tea were mixed is 2 : 1, what is the cost of higher quality tea?
(a) ` 62 per kg (b) ` 58 per kg
(c) ` 66 per kg (d) ` 72 per kg

5. In what ratio should water and 66% wine solution be mixed to obtain 55% wine solution ?
(a) 2 : 5 (b) 1 : 5
(c) 2 : 3 (d) 1 : 4

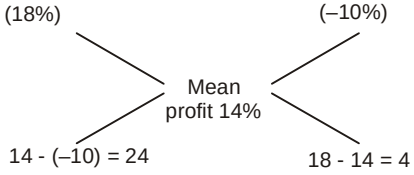
ANSWERS

1. (a) **2.** (b) **3.** (b) **4.** (a) **5.** (b)

EXPLANATIONS

1. By the rule of alligation

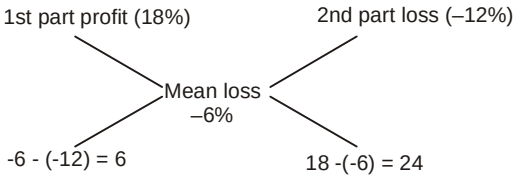
1st part of profit 2nd part loss



Ratio of 1st and 2nd part = 24 : 4 = 6 : 1

Quantity sold at 10% loss = $\frac{1}{7} \times 280 = 40$ L

2. By the rule of alligation,

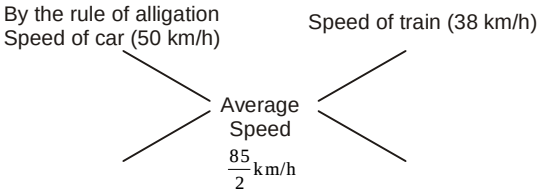


Ratio of 1st and 2nd part = 6 : 24 - 1 : 4

Quantity sold at 12% loss = $\frac{4}{5} \times 200 = 160$ kg

3. Average speed of the journey = $\frac{340}{8} = \frac{85}{2}$ km/h

By the rule of alligation,



$\frac{85}{2} - 38 = \frac{9}{2}$ $50 - \frac{85}{2} = \frac{15}{2}$

Time spent in car : Time spent in train = $\frac{9}{2} : \frac{15}{2}$

= 3 : 5

Time spent in train = $\frac{5}{8} \times 8 = 5$ h

Distance traveleld by train = 38 × 5 = 190 km

4. Let the rate of second quality be ` *x* per kg. By the rule of alligation

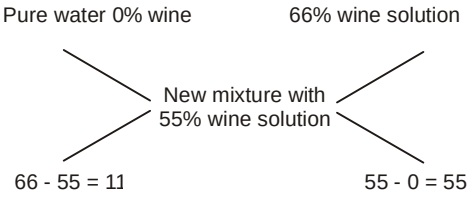
CP of 1 kg tea of 1st kind CP of 1 kg tea of 2 nd kind

Now $\frac{x - 54}{4} = \frac{2}{1}$

$\Rightarrow x - 54 = 4 \times 2 = 8 \Rightarrow x = 54 + 8 = 62$

$\therefore$ CP of second quality tea is ` 62 per kg

5. By the rule of alligation



Ratio of water and wine = 11 : 55 = 1 : 5

CHAPTER 15

Time and Work

Work

Work to be done is generally considered as one unit. It may be digging a trench constructing or painting a wall, filling up or emptying a tank, reservoir or a cistern.

General rules to be followed in the problems on Time and Work

1. If Acan do a piece of work in *n* days, then work done by Ain 1 day is 1/n. ie,if a person can do some work in 12 days, he does 1/ 12th of the work in one day.
2. If A s 1 day's work = 1/n, then A can finish the whole work in n days. ie, if a person's one day work is 1/10, then he can finish the whole work in 10 days.
3. If A is thrice as good a workman as B, then ratio of work done by A and B = 3 : 1. ie, if a man works three times as fast as a woman does, then when the work is complete, 3 parts of the work has been done by the man and 1 part by the woman.
4. If A is thrice as good a workman as B, then ratio of time taken by A and B = 1 : 3. ie, if the woman takes 15 days to complete the work, then the man takes 5 days to complete the same work.
5. If two persons A and B can individually do some work in a and b days respectively, then A and B together can complete the same work in $ab\ (a + b)$ days.
6. The fundamental rules on variation also apply in Time and Work.
   (i) Work and men are directly proportional to each other ie, if the work increases, the no. of men required to do it, also increases, if the work is to be completed in the same number of days.
   (ii) Men and days are inversely proportional, ie, if the number of men increases, the number of days required to complete the same work decreases and vice versa.
   (iii) Work and days are directly proportional, ie, if the work increases, the number of days required also increases, if the work is to be completed with the same number of men and vice versa.

Example 1: Ravi can do a job 10 days. Determine his one day job.

Solution. Ravi's 10 days work = 1

$$\text{Ravi's 1 day work} = \frac{1}{10}$$

Example 2: Tuktuki and Rasmani can do a job alone in 20 days and 30 days respectively. In how many days the job will be finished, if they work together.

Solution. Tuktuki's 1 day work = $\frac{1}{20}$

Rasmani's 1 day work = $\frac{1}{30}$

(Tuktuki + Rasmani) 1 day work = $\frac{1}{20}+\frac{1}{30}=\frac{5}{60}+\frac{1}{12}$

$\Rightarrow$ (Tuktuki + Rasmani) will complete the job in 12 days.

Alternate: Required no. of days = $\frac{20\times30}{20+30}$ =12

EXERCISE

1. *A* and *B* together can do a piece of work in 12 days, which *B* and *C* together can do in 16 days. After *A* has been working at it for 5 days and *B* for 7 days, *C* finishes it in 13 days. In how many days C alone will do the work?
(a) 16 (b) 24
(c) 37 (d) 48

2. *A* and *B* can do a piece of work in 45 days and 40 days respectively. They began to do the work together but *A* leaves after some days and then *B* completed the remaining work in 23 days. The number of days after which *A* left the work was:
(a) 11 (b) 7
(c) 9 (d) 12

3. *A* can do a piece of work in 14 days which *B* can do in 21 days. They begin together but 3 days before the completion of the work, *A* leaves off. The total number of days to complete the work is:
(a) $6\frac{3}{5}$ (b) $8\frac{1}{2}$ (c) $10\frac{1}{5}$ (d) $13\frac{1}{2}$

4. *A*, *B* and *C* can complete a work separately in 24, 36 and 48 days respectively. They started together but *C* left after 4 days of start and *A* left 3 days before the completion of the work. In how many days will the work be completed?
(a) 15 days (b) 24 days
(c) 25 days (d) 38 days

5. *A*, *B* and *C* together earn `300 per day, while *A* and *C* together earn `188 and *B* and *C* together earn `152. The daily earning of *C* is:
(a) `40 (b) `70
(c) `112 (d) `160

ANSWERS

1. (b) **2.** (c) **3.** (c) **4.** (a) **5.** (a)

EXPLANATIONS

1. *A*'s 5 days' work + *B*'s 7 days' work + *C*'s 13 days work = 1

$\Rightarrow$ (*A* + *B*)'s 5 days' work + (*B* + *C*)'s 2 days' work + C's 11 days' work = 1

+ *C*'s 11 days' work = 1

$\Rightarrow \frac{5}{12}+\frac{2}{16}$ + *C*'s 11 days' work = 1.

$\Rightarrow$ *C*'s 11 day's work = $1-\left(\frac{5}{12}+\frac{2}{16}\right)=\frac{11}{24}$.

$\Rightarrow$ *C*'s 1 day's work = $\left(\frac{11}{24}\times\frac{1}{11}\right)=\frac{1}{24}$. $\therefore$

C alone can finish the work in 24 days.

2. (*A* + *B*)'s 1 day's work = $\left(\frac{1}{45}+\frac{1}{40}\right)=\frac{17}{360}$.

Work done by *B* in 23 days = $\left(\frac{1}{40}\times23\right)=\frac{23}{40}$.

Remaining work = $\left(1-\frac{23}{40}\right)=\frac{17}{40}$.

Now, $\frac{17}{360}$ work was done by (*A* + *B*) in 1 day.

$\frac{17}{40}$ work was done by (*A* + *B*) in $\left(1\times\frac{360}{17}\times\frac{17}{40}\right)=9$ days.

$\therefore$ A left after 9 day's.

3. *B*'s 3 day's work = $\left(\frac{1}{21}\times 3\right)=\frac{1}{7}$. Remaining work

$=\left(1-\frac{1}{7}\right)=\frac{6}{7}$

(*A* + *B*)'s 1 day's work = $\left(\frac{1}{14}+\frac{1}{21}\right)=\frac{5}{42}$.

Now, $\frac{5}{42}$ work is done by A and B in 1 day.

$\therefore$ $\frac{6}{7}$ work is done by *A* and *B* in = $\left(\frac{42}{5}\times\frac{7}{7}\right)=\frac{36}{5}$

= days.

Hence, total time taken = $\left(3+\frac{36}{5}\right)$ days = $10\frac{1}{5}$ days.

4. (*A* + *B* + *C*)'s 1 day's work

$=\left(\frac{1}{24}+\frac{1}{36}+\frac{1}{48}\right)=\frac{13}{144}$

Work done by (*A* + *B* + *C*) in 4 days

$=\left(\frac{13}{144}\times 4\right)=\frac{13}{36}$.

Work done by *B* in 3 days = $\left(\frac{1}{36}\times 3\right)=\frac{1}{12}$.

Remaining work = $\left[1-\left(\frac{13}{36}+\frac{1}{12}\right)\right]=\frac{5}{9}$.

(*A* + *B*)'s 1 day's work = $\left(\frac{1}{24}+\frac{1}{36}\right)=\frac{5}{72}$.

Now, $\frac{5}{72}$ work is done by *A* and *B* in $\left(\frac{72}{5}\times\frac{5}{9}\right)$

= 8 days.

Hence, total time taken = (4 + 3 + 8) days = 15 days.

5. *B*'s daily earning = `(300 – 188)
= `112.
A's daily earning = `(300 – 152)
= `148.
C's daily earning = `[300 – (112 + 148)]
= `40.

CHAPTER 16

Time and Distance

Relation between Time, Speed and Distance

Distance covered, time and speed are related by

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}} \quad \text{...(i)}$$

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}} \quad \text{...(ii)}$$

$$\text{Distance} = \text{Speed} \times \text{Time} \quad \text{...(iii)}$$

- Distance is measured in metres, kilometres and miles.
- Time in hours, minutes and seconds.
- Speed in km/h, miles/h and m/s.

1. To convert speed of an object from km/h to m/s multiply the speed by $\frac{5}{18}$.
2. To convert speed of an object from m/s to km/h, multiply the speed by $\frac{18}{5}$.

Average Speed

It is the ratio of total distance covered to total time of journey.

$$\therefore \text{Average speed} = \frac{\text{Total distance covered}}{\text{Total time of journey}}$$

General Rules for Solving Time & Distance Problems

Rule 1

If a certain distance is covered with a speed of 'x' km/h and another equal distance with a speed of 'y' km/h, then the average speed for the whole journey is the harmonic mean of the two speeds.

$$\text{Average speed} = \left(\frac{2}{\frac{1}{x}+\frac{1}{y}}\right)\text{km/h} = \left(\frac{2xy}{x+y}\right)\text{km/h}$$

EXERCISE

1. A man can row at a speed of 4.5 km/h in still water to a certain upstream point and back to the starting point in a river which flows at 1.5 km/h. Find his average speed for total journey.
(a) 4 km/h (b) 4.5 km/h
(c) 5 km/h (d) 5.5 km/h

2. Two cars *A* and *B* are placed at 100 km from each other. If they start running simultaneously towards each other, they meet after 1 h. If they start running simultaneously in the same direction with car '*A*' running towards car '*B*, the distance between them after 1 h becomes 80 km. What is the speed of car '*A*' in km/h?
(a) 40 (b) 80
(c) 60 (d) Data inadequate

3. A passenger train running at the speed of 80 km/h leaves the railway station 6 h after a goods train leaves and overtakes it in 4 h. The speed of the goods train is
(a) 32 km/h (b) 40 km/h
(c) 50 km/h (d) 60 km/h

4. Two persons *A* and *B* are at two places *P* and *Q* respectively. *A* walks at *v* km/h and *B* is 2 km/h faster than *A*, starting simultaneously from where they stand. If they walk towards each other, they meet in 72 min. If they walk in the same direction, the faster overtakes the slower in 6 h. Find their respective speeds (in km/h).
(a) 3 and 5
(b) 4 and 6
(c) 2½ and 4½ (d) 3½ and 5½

ANSWERS

1. (a) **2.** (c) **3.** (a) **4.** (b)

EXPLANATIONS

1. $x = 4.5$ km/h (given) and $y = 1.5$ km/h
Using the formula (6),
Average speed for total journey

$$= \frac{\text{Upstream rate} \times \text{Downstream rate}}{\text{Speed in still water}}$$

$$= \frac{(x+y)\times(x-y)}{x} = \frac{6\times 3}{4.5}$$

$= 4$ km/h

2. Let the speed of car *A* be *x* km/h and that of car *B* be *y* km/h.

$$x + y = 100 \quad \text{...(i)}$$
$$(100 + y) - x = 80$$
$$x - y = 20 \quad \text{...(ii)}$$

Solving Eqs. (i) and (ii), we get $x = 60$

2. Let the speed of the goods trains = *x* km/h
Distance travelled by the goods train in 6 h = 6*x*

Now, $\text{Time} = \dfrac{\text{Distance}}{\text{Relative Speed}}$

$$\therefore \quad 4 = \frac{6x}{80-x}$$
$$\Rightarrow \quad 320 - 4x = 6x$$
$$\Rightarrow \quad 10x = 320$$
$$\Rightarrow \quad x = 32 \text{ km/h}$$

3. Let *d* kilometre be the distance between *A* and *B*. When *A* and *B* walk toward each other, then

$$\frac{d}{v+(v+2)} = \frac{72}{60}$$

and if they walk in the same direction

$$\frac{d}{(v+2)-v} = 6$$
$$\Rightarrow \quad \frac{d}{2} = 6 \qquad \Rightarrow d = 12 \text{ km}$$
$$\therefore \quad \frac{d}{2v+2} = \frac{72}{60} \qquad \therefore v = 4 \text{ km/h}$$

Hence, the speed are 4 km/h and (4 + 2) = 6 km/h

CHAPTER 17

Simple Interest

Interest

It is the sum which is paid by the borrower to the lender for using the money for a specific time period. The money borrowed is called the **Principal.** The rate at which the interest is calculated on the principal is called **Rate of Interest.** The time for which the money is borrowed is **Time** and the total sum of principal and interest is called the **Amount.**

Simple Interest

If P = Principal, R = Rate per cent per annum T = Number of years, SI = Simple Interest and A = Amount. Then,

(i) $SI = \dfrac{P \times T \times R}{100}$ (ii) $P = \dfrac{100 \times SI}{R \times T}$ (iii) $R = \dfrac{100 \times SI}{P \times T}$

(iv) $T = \dfrac{100 \times SI}{P \times R}$ (v) $A = P + SI = P + \dfrac{P \times T \times R}{100} = P\left(1 + \dfrac{RT}{100}\right)$

Here, the interest is calculated on the original principal ie, the principal to calculate the interest remains constant throughout the time period. The interest earned on the principal is not taken into account for the purpose of calculating interest for later years.

Example 1: Find the SI on ` 7200 at 8% per annum for 10 months.

Solution. Here, P = ` 7200, R = 8% per annum and $T = \dfrac{10}{12}\text{yr} = \dfrac{5}{6}\text{yr}$.

$SI = \left(\dfrac{P \times T \times R}{100}\right) = \text{`} \left(7200 \times \dfrac{5}{6} \times 8 \times \dfrac{1}{100}\right) = \text{`}\ 480$

Example 2: A sum is lent at 10% per annum. Simple interest will get doubled in how many years?

Solution. Sum will be doubled when $SI = P$

Therefore, $SI = P = \dfrac{PRT}{100}$

$\Rightarrow$ $RT = 100 \Rightarrow T = \dfrac{100}{R} = \dfrac{100}{10} = 10$ year

Example 3: Three persons separately borrow ` 51000 in all from a banker at 10% and returned with interest after 2, 5 and 6 year respectively. It the returned amounts are equal, what are the sums borrowed by each of them?

Solution. It P_1, P_2, P_3 be the sums borrowed and A_1, A_2, A_3 be the amounts. Then,

$$A_1 = A_2 = A_3$$

$$P_1 + \frac{P_1 \times 10 \times 2}{100} = P_2 + \frac{P_2 \times 10 \times 5}{100} = P_3 + \frac{P_3 \times 10 \times 6}{100}$$

$$\Rightarrow \quad \frac{6P_1}{5} = \frac{3P_2}{2} = \frac{8P_3}{5} = K$$

$$\Rightarrow \quad P_1 = \frac{5K}{6}, P_2 = \frac{2K}{3}, P_3 = \frac{5K}{8}$$

But $$P_1 + P_2 + P_3 = 51000 \Rightarrow \frac{5K}{6}, + \frac{2K}{3}, + \frac{5K}{8} = 51000$$

$$\Rightarrow \quad \frac{20K + 16K + 15K}{24} = 51000 \Rightarrow K = \frac{51000 \times 24}{51}$$

$$\Rightarrow \quad K = 24000$$

Hence, $$P_1 = \frac{5K}{6} = \frac{5}{6} \times 24000 = ` 20000$$

$$P_2 = \frac{2K}{3} = \frac{2}{3} \times 24000 = ` 16000$$

$$P_3 = \frac{5K}{8} = \frac{5}{8} \times 24000 = ` 15000$$

Example 4: What annual instalment will discharge a debt of ` 600 due in 3 year at 10% per annum simple interest?

Solution. Let each instalment be ` x.

Clearly, first instalment will be paid after 1 year. This money will be with the lender for 2 year. Similarly, he will have ` $x$ for 1 year and ` x at the end.

(amount of ` $x$ for 2 year) + (amount of ` x for 1 year ` x) = 6600

$$= \left(x + x \times \frac{10}{100} \times 2\right) + \left(x + x \times \frac{10}{100} \times 1\right) + x = 6600$$

$$\Rightarrow \quad \left(x + \frac{x}{5}\right) + \left(x + \frac{x}{10}\right) + x = 6600$$

$$\Rightarrow \quad \left(\frac{6x}{5} + \frac{11x}{10} + x\right) = 6600$$

$$\Rightarrow \quad \left(\frac{12x + 11x + 10x}{10}\right) = 6600$$

$$\Rightarrow \quad 33x = 66000$$

$\Rightarrow \quad x = \frac{66000}{33} = 2000$

Hence, each installment = ` 2000

EXERCISE

1. If ` 64 accounts to ` 83.20 in 2 years, what will ` 86 amount to in 4 years at the same rate per cent pr annum?
(a) ` 115.80 (b) ` 127.70
(c) ` 127.40 (d) ` 51.60

2. The simple interest on a certain sum of money at the rate of 5% p.a. for 8 years is ` 840. At what rate of interest the same amount of interest can be received on the same sum after 5 years?
(a) 10% (b) 8%
(c) 9% (d) 12%

3. The interest on a certain deposit at 4.5% p.a. is ` 202.50 in one year. How much will the additional interest in one year be on the same deposit at 5% p.a.?
(a) ` 30.25 (b) ` 22.50
(c) ` 25 (d) ` 52.75

4. A sum invested at 5% simple interest per annum grows to ` 504 in 4 years. The same amount at 10% simple interest per annum in 2½ years will grow to:
(a) ` 530 (b) ` 555
(c) ` 525 (d) ` 650

5. What will be the ratio of simple interest earned by certain amount at the same rate of interest for 6 years and that for 9 years?
(a) 5 : 3 (b) 4 : 7
(c) 2 : 3 (d) data inadequate

ANSWERS

1. (d) **2.** (b) **3.** (b) **4.** (c) **5.** (c)

EXPLANATIONS

1. P = ` 64, S.I. = ` (83.20 – 64) = ` 19.20, T = 2 years.

So, rate = $\left(\frac{100\times19.20}{64\times2}\right)\% = 15\%$

Now, P = ` 86, R = 15%, T = 4 years.

$\therefore$ S.I. $= \left(\frac{86\times15\times4}{100}\right)$ = ` 51.60.

2. S.I. = ` 840, R = 5%, T = 8 years.

Principal = ` $\left(\frac{100\times840}{5\times8}\right)$.

= ` 2100.

Now, P = ` 2100, S.I. = ` 840, T = 5 years.

$\therefore$ Rate = $\left(\frac{100\times840}{2100\times5}\right)\% = 8\%$

3. S.I. = ` 202.50, R = 4.5%, T = 1 year.

Principal = ` $\left(\frac{100\times202.50}{4.5\times1}\right)$ = ` 4500.

Now, P = ` 4500, R = 5%, T = 1 year.

S.I. = ` $\left(\frac{4500\times5\times1}{100}\right)$ = ` 225.

$\therefore$ Difference in interest
= ` (225 – 202.50) = ` 22.50.

4. Let the sum be ` $x$. Then, S.I. = ` (504 – x).

$\therefore \quad \left(\frac{x\times5\times4}{100}\right) = 504 - x$

$\Leftrightarrow \quad 20x = 50400 - 100x$

$\Leftrightarrow \quad 120x = 50400$

$\Leftrightarrow \quad x = 420.$

Now, P = ` 420, R = 10%, T = $\frac{5}{2}$ years.

S.I. = ` $\left(\frac{420\times10}{100}\times\frac{5}{2}\right)$ = ` 105.

$\therefore$ Amount = ` (420 + 105)
= ` 525.

5. Let the principal be P and rate of interest be R%.

$\therefore$ Required ratio = $\left[\frac{\left(\frac{P\times R\times6}{100}\right)}{\left(\frac{P\times R\times9}{100}\right)}\right] = \frac{6PR}{9PR}$ =

2 : 3.

CHAPTER 18

Compound Interest

In compound interest, the interest is added to the principal at the end of each period and the amount thus obtained becomes the principal for the next period. The process is repeated till the end of the specified time.

If P = Principal

R = Rate per cent per unit time

Time = n years

A = Amount; CI = Compound Interest

When the interest is compounded annually

$$\text{Amount after } n \text{ years} = A = P\left(1+\frac{R}{100}\right)^n$$

$$\text{Compound Interest} = P\left(1+\frac{R}{100}\right)^n - P = P\left[\left(1+\frac{R}{100}\right)^n - 1\right]$$

Important Formulae

1. If the rate of interest differs from year to year ie, R_1 in the first year, R_2 in the second year, R_3 in the third year. Then, $A = P\left(1+\frac{R_1}{100}\right)\left(1+\frac{R_2}{100}\right)\left(1+\frac{R_3}{100}\right)$
2. When the principa changes every year, we say that the interest is compounded annually. Then,

$$A = P\left(1+\frac{R}{100}\right)^n$$

3. When the principal changes as per every six months, we say that the interest is compounded half yearly or semi-annually. Then,

$$A = P\left(1+\frac{\frac{R}{2}}{100}\right)^{2n}$$

4. When the principal changes every three months, we say that the interest is compounded quarterly. Then,

$$A = P\left(1+\frac{\frac{R}{4}}{100}\right)^{4n}$$

5. When the principal changes after every month, we say that the interest is compounded monthly. Then,

$$A = P\left(1+\frac{\frac{R}{12}}{100}\right)^{12n}$$

6. When the interest is compounded annually but time is in fraction say $2\frac{3}{4}$ year.

Then, $$A = P\left(1+\frac{R}{100}\right)^{2}\left(1+\frac{\frac{3R}{4}}{100}\right)$$

7. The difference between the simple interest and compound interest for 2 year (or terms) is given by the formula

$$D = P\left(\frac{R}{100}\right)^{2}$$

Where D is the difference, P is the principal and R is the rate of interest.

8. Present worth of x ` due n years, hence is given by

$$\text{Present worth} = \frac{x}{\left(1+\frac{R}{100}\right)^{n}}$$

Example 1: Find the compound interest on ` 5500 at 9% per annum for 2 year, if the interest is compounded annually?

Solution. P = ` 5500, R = 10% per annum and n = 2 year

$$\text{Amount} = P\left(1+\frac{R}{100}\right)^{2}\left(1+\frac{\frac{R}{2}}{100}\right) = ` \left[15000\left(1+\frac{10}{100}\right)^{2}\left(1+\frac{5}{100}\right)\right]$$

(The rate for the third year is halfed)

$$= ` \left[15000\left(\frac{11}{10}\right)^{2}\left(\frac{21}{20}\right)\right] = ` 19057.50$$

$$\text{Compound interest} = ` (19057.50 - 15000) = ` 4057.50$$

EXERCISE

1. A sum of money amounts to ` 9680 in 2 yr and ` 10648 in 3 yr at compound interest. The sum is
(a) ` 8000 (b) ` 8400
(c) ` 9000 (d) ` 9600

2. A sum of money placed at compound interest doubles itself in 6 yr. In how many year it would amount to 4 times of itself at the same rate of interest?
(a) 12 yr (b) 24 yr
(c) 18 yr (d) 15 yr

3. If the rate of interest be 5% per annum for first year, 8% per annum for second year and 12% per annum for third year, then the compound interest of ` 8000 for 3 yr will be
(a) `10550.16 (b) ` 10480.24
(c) ` 10160.64 (d) ` 10350.36

4. A money-lender borrows money at 5% per annum and pays interest at the end of the year. He lends it at 8% per annum compound interest compounded half-yearly and receives the interest at the end of the year. Thus, he gains ` 118.50 in a year. The amount of money he borrows is
(a) ` 3450 (b) ` 3600
(c) ` 3750 (d) ` 3900

5. Effective annual rate of interest, corresponding to a nominal rate of 4% per annum payable half-yearly is
(a) 4.04% per annum (b) 4.15% per annum
(c) 4.18% per annum (d) 4.10% per annum

ANSWERS

1. (a)	**2.** (a)	**3.** (c)	**4.** (c)	**5.** (a)

EXPLANATIONS

1. Let the sum be ` x and the rate of interest be R% per annum, Then,

$$x\times\left(1+\frac{R}{100}\right)^2 = 9680 \quad ...(i)$$

and $$x\times\left(1+\frac{R}{100}\right)^3 = 10648 \quad ...(ii)$$

Dividing Eq. (ii) by Eq. (i), we get,

$$1+\frac{R}{100} = \frac{10648}{9680}$$

$$\Rightarrow \quad \frac{R}{100} = \frac{10648-9680}{9680}$$

$$\Rightarrow \quad \frac{R}{100} = \frac{968}{9680}$$

$$\Rightarrow \quad R = \left(\frac{968\times100}{9680}\right)\% \text{ per annum}$$

$$= 10\% \text{ per annum}$$

Now, $$x\times\left(1+\frac{R}{100}\right)^2 = 9680 \Rightarrow x\times\frac{11}{10}\times\frac{11}{10} = 9680$$

$$\Rightarrow \quad x = \left(\frac{9680\times10\times10}{11\times11}\right) = 8000$$

Hence, the sum is ` 8000.

2. Let the sum be ` x and the rate be R% per annum.

Then, $$x\times\left(1+\frac{R}{100}\right)^6 = 2x \Rightarrow \left(1+\frac{R}{100}\right)^6 = 2$$

Let, $$x\times\left(1+\frac{R}{100}\right)^t = 4x$$

$$\Rightarrow \left(1+\frac{R}{100}\right)^t = 4 = 22 = \left\{\left(1+\frac{R}{100}\right)^6\right\}^2$$

$$\Rightarrow \left(1+\frac{R}{100}\right)^t = \left(1+\frac{R}{100}\right)^{12}$$

$\Rightarrow t = 12$ year

3. Amount

$$= \text{`}\left[8000\times\left(1+\frac{5}{100}\right)\times\left(1+\frac{8}{100}\right)\times\left(1+\frac{12}{100}\right)\right]$$

$$= \text{`}\left[8000\times\frac{105}{100}\times\frac{108}{100}\times\frac{112}{100}\right] = \text{`}\ 10160.64$$

4. Let the money borrowed be ` x.

Interest paid by the money-lender = ` $\left(\frac{x\times1\times5}{100}\right)$

$= ` \frac{x}{20}$

Interest received by the money-lender

$= ` \left[ x \times \left( 1 + \frac{\frac{8}{2}}{100} \right)^{2\times1} - x \right] = ` \left[x \times \left(1 + \frac{4}{100} \right)^{2} - x \right]$

$= ` \left[ x \times \frac{26}{25} \times \frac{26}{25} - x \right] = ` \left[x \times \left(\frac{676}{625} - 1 \right) \right]$

$= ` \left[ x \times \left( \frac{51}{625} \right) \right] = ` \left[x \times \left(\frac{51}{625} \right) \right]$

Now, $\left[\frac{51x}{625} - \frac{x}{20} \right] = 118.50$

$\Rightarrow \quad \left(\frac{204x - 125x}{625 \times 4} \right) = 118.50$

$\Rightarrow \quad \frac{79x}{625 \times 4} = 118.50$

$\Rightarrow \quad x = \left(\frac{118.50 \times 625 \times 4}{79} \right) = 3750$

Thus, the amount borrowed by money-lender = ` 3750

5. Let the sum be ` 100. Then,

P = ` 100, R = 2% per semi-annual, Time = 2 half year

Amount $= ` \left[100 \left(1 + \frac{2}{100} \right)^{2} \right]$

$= ` \left[100 \times \frac{102}{100} \times \frac{102}{100} \right]$

= ` 104.04

Effective annual rate = 4.04% per annum

CHAPTER 19

Area of Plane Figures

Area

The area of a plane figure is the measure of the surface enclosed by its boundary. The area of a triangle or a polygon is the measure of the surface enclosed by its sides.

1. Triangle

$$\text{Area of the triangle} = \left(\frac{1}{2}\times \text{Base}\times \text{Height}\right) = \frac{1}{2}bh$$

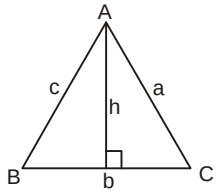
Area of the triangle, $\Delta = \sqrt{s(s-a)(s-b)(s-c)}$

Where s = $\frac{1}{2}(a+b+c)$

Perimeter of the triangle = $a + b + c$ or 2s

Radius of incircle of a triangle = Δ/s

2. Right-Angles Triangle

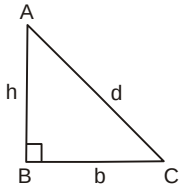


$$\text{Area} = \frac{1}{2}bh$$

Hypotenuse, $d = \sqrt{b^2+h^2}$ (Pythagoras theorem)

Perimeter = $b + d + h$

3. Isosceles Right-Angled Triangle



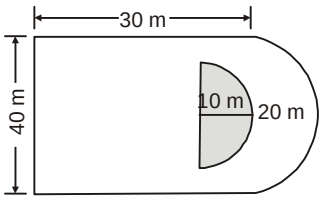
$$\text{Area} = \frac{1}{2}(a\times a) = \frac{a^2}{2}$$

Hypotenuse, $d = \sqrt{a^2+a^2} = \sqrt{2}a$

Perimeter = $2a + \sqrt{2}a$

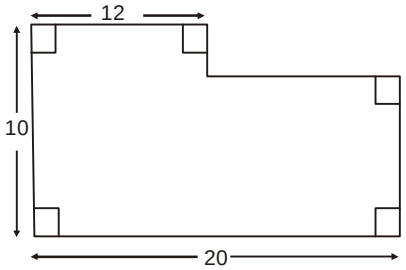
EXERCISE

92. The figure below represents a parking lot that is 30 m by 40 m and an attached driveway that has an outer radius of 20 m and an inner radius of 10 m. If the shaded region is not included, what is the area, in square metres of the lot and driveway?



(a) 1350π (b) $1200 + 400\pi$
(c) $1200 + 300\pi$ (d) $1200 + 150\pi$

93. What is the area of the region enclosed by the area below?



(a) 116 (b) 144
(c) 176 (d) 179

94. The length and breadth of a rectangular hall are 40 m and 30 m respectively. What is the distance between two opposite corners of the hall?
(a) 20 m (b) 35 m
(c) 50 m (d) 40 m

95. The sides of a triangle are in the ratio $\frac{1}{2}:\frac{1}{3}:\frac{1}{4}$ and its perimeter is 104 cm. The length of the longest side (in cm) is
(a) 26 (b) 32
(c) 48 (d) 52

96. A rectangular field has dimensions 25 m by 15 m. Two mutually perpendicular passage, 2 m width have been left in its central part and grass has been grown in rest of the field. The areas (in sq metres) under the grass is
(a) 295 (b) 299
(c) 300 (d) 375

ANSWERS

1. (d)	**2.** (c)	**3.** (c)	**4.** (c)	**5.** (b)

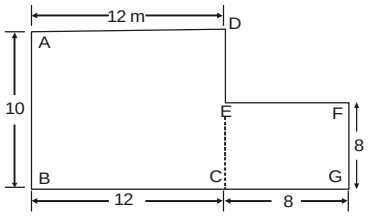
EXPLANATIONS

1. Area of parking lot = 30 × 40 = 1200 sq m

Area of driveway = $\frac{1}{2}\pi(20^2 - 10^2) = 150\pi$ sq m

So, required area = (1200 + 150p) sq m

2. Area of *ABCD* + Area of CEFG



= 12 × 10 + 7 × 8 = 176

3. Distance between two corners of hall

$= \sqrt{(\text{Length})^2 + (\text{Breadth})^2}$

$= \sqrt{(40)^2 + (30)^2} = \sqrt{1600 + 900} = 50$ m

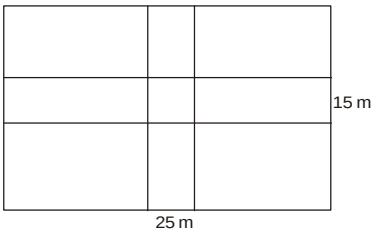
4. Let the sides of triangle are $\frac{1}{2}x, \frac{1}{3}x$ and $\frac{1}{4}x$

$\therefore \quad \frac{1}{2}x + \frac{1}{3}x + \frac{1}{4}x = 104$

$\frac{6x + 4x + 3x}{12} = 104 \therefore \quad x = \frac{104 \times 12}{13} = 96$

$\therefore$ Longest side = $\frac{x}{2} = \frac{96}{2} = 48$ cm

5. Area under the grass



= 25 × 15 – (25 × 2 + 15 × 2 – 2 × 2)
= 375 – (50 + 30 – 4) = 299 sq m

CHAPTER 20

Volume and Surface Area of Solid Figures

Solid

Anything that occupies space is called a **Solid**. In addition to area, a solid figure has volume also. It has three dimensions namely, length, breadth and height. For solid two different types of areas namely, lateral surface area or curved surface area and total surface area are defined.

1. Prism

A solid having two congruent and parallel faces, called bases and whose other faces, the lateral faces are parallelograms, formed by joining corresponding vertices of the bases is called a **Prism**.

2. Right Prism

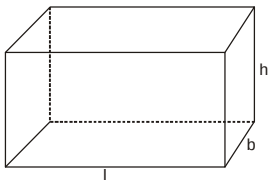
A prism in which bases are perpendicular to the lateral edges is called a **Right Prism**. The base of the prism can be a polygon.

In a right prism

(i) Number of lateral surfaces = Number of sides of the base of the prism
(ii) Total number of surfaces of a prism = Number of lateral surfaces + 2
(iii) Lateral surface area = Perimeter of base × Height
(iv) Total surface area = Lateral surface area + 2 (Area of base)
(v) Volume = Area of base × Height

3. Cuboid

A right prism in which the base is a rectangle is called a **Cuboid**. If l is the length and b the breadth of the base and h the height, then



Lateral surface area = 2 $(l + b)h$ sq unit

Total surface area = $2(l + b)h + 2lb = 2(lb + bh + lh)$ sq unit

Volume = lbh cu unit

The longest diagonal of the cuboid = $\sqrt{l^2 + b^2 + h^2}$ unit

EXERCISE

1. A rectangular water tank is 80 m × 40 m. Water flows into it through a pipe 40 sq. cm at the opening at a speed of 10 km/hr. By how much, the water level will rise in the tank in half an hour?

(a) $\frac{4}{11}$ cm (b) $\frac{5}{9}$ cm

(c) $\frac{5}{8}$ cm 4. $\frac{4}{5}$ cm

2. A hall is 15 m long and 12 m broad. If the sum of the areas of the floor and the ceiling is equal to the sum of areas of the four walls, the volume of the hall is:

(a) 720 (b) 800

(c) 1200 (d) 2000

3. The sum of the length, breadth and depth of a cuboid is 19 cm and its diagonal is $5\sqrt{5}$ cm. It surface area is:

(a) 127 cm^2 (b) 236 cm^2

(c) 361 cm^2 (d) 480 cm^2

4. A swimming pool 9 m wide and 12 m long is 1 m deep on the shallow side and 4 m deep on the deeper side. Its volume is:

(a) 309 m^3 (b) 270 m^3

(c) 360 m^3 (d) 607 m^3

5. A metallic sheet is of rectangular shape with dimensions 48 m × 36 m. From each of its corners, a square is cut off so as to make an open box. If the length of the square is 8 m, the volume of the box (in m^3) is:

(a) 5835 (b) 6400

(c) 6420 (d) 9260

ANSWERS

1. (c) **2.** (c) **3.** (b) **4.** (b) **5.** (d)

EXPLANATIONS

1. Length of water column flown in 1 min.

$= \left(\frac{10\times1000}{60}\right)m = \frac{500}{3}m.$

Volume flown per minute

$= \left(\frac{500}{3}\times\frac{40}{100\times100}\right)m^3 = \frac{2}{3}m^3.$

Volume flown in half an hour $= \left(\frac{2}{3}\times30\right)m^3$

$= 20m^3.$

$\therefore$ Rise in water level $= \left(\frac{20}{40\times80}\right)m$

$= \left(\frac{1}{160}\times100\right)cm = \frac{5}{8}cm.$

2. $2(15 + 12) \times h = 2(15 \times 12)$

or $h = \frac{180}{27}m = \frac{20}{3}m.$

$\therefore$ Volume $= \left(15\times12\times\frac{20}{3}\right)m^3$

$= 1200\ m^3.$

3. $(l + b + h) = 19$ and $\sqrt{l^2+b^2+h^2} = 5\sqrt{5}$ and so $(l^2 + b^2 + h^2) = 125$.

Now, $(l + b + h)^2 = 19^2$

$\Rightarrow (l^2 + b^2 + h^2) + 2(lb + bh + lh)$

$= 361 = 2(lb + bh + lh)$

$= (361 - 125) = 236.$

Surface area $= 236\ cm^2.$

4. Volume $= \left[12\times9\times\left(\frac{1+4}{2}\right)\right]m^3$

$= (12 \times 9 \times 2.5)m^2 = 270\ m^3.$

5. Clearly, $l = (48 - 16)m = 32$ m,

$b = (36 - 16)$ m $= 20$ m, $h = 8$m.

Volume of the box $= (32 \times 20 \times 8)\ m^3$

$= 5120\ m^3.$

CHAPTER 21

Clocks and Calendar

Clock

A clock has 2 hands, the smaller one is called the hour hand or short hand while the larger one is called the minute hand or long hand.

The face of a clock is a circle which subtends an angle of 360° at the centre.

Some Important Points

In every hour

1. (a) Both the I ands coincide once. At this point the angle between them is 0°..
   (b) The hands are straight (point in opposite directions) once. At this point the angles between them are 180°.
   (c) The hands are twice perpendicular to each other. At this point the angle between them is 90°.
2. (a) In 60 min the minute hand covers 360°.

   Thus, in 1 min the minute hand covers $\left(\frac{360}{60}\right)^{\circ} = 6^{\circ}$

   (b) In 12 h the hour hand covers 360°.

   Thus, in 1 min the hour hand covers $\left(\frac{360}{12\times 60}\right)^{\circ} = \frac{1^{\circ}}{2}$

   Thus, in of to minute, the minute hand gains $\left(6-\frac{1}{2}\right)^{\circ} = 5\frac{1^{\circ}}{2}$, than the hour hand.
3. (a) When the two hands are at right angles, they are 15min spaces apart.
   (b) When the two hands are in opposite directions, they are 30 min spaces apart.
   (c) In 60 min the minute hand gains 55 min on the hour hand.
   (d) The minute hand moves 12 times as fast as the hour hand.
4. (a) **Too Fast:** If a clock indicates 7 : 1.5, when the correct time is 7, it is said to be 15 min too fast.
   (b) **Too Slow:** If a clock indicates 7 : 30, when the correct time is 7 45 , it is said to be 15 min too slow.

EXERCISE

1. If a wall clock shows 9 h 30 min. What time will the clock show in the mirror ?
   (a) 8 h 45 min (b) 8 h 50 min
   (c) 9 h 50 min (d) 9 h 30 min
2. January 1, 2001 was a Monday. What clay of the week lies on January 1, 2002 ?
   (a) Saturday (b) Tuesday
   (c) Monday (d) Sunday
3. The calendar for the year 2002 is the same as for the year.
   (a) 2006 (b) 2008
   (c) 2009 (d) 2010
4. On what dates of June, 2005 did Monday fall ?
   (a) 6th, 13th, 20th, 27th
   (b) 7th, 14th, 21st, 28th
   (c) 4th, 11th, 18th, 25th
   (d) 3rd, 10th, 17th, 24th
5. On what dates of March, 2003 did Tuesday fall ?
   (a) 5th, 12th, 19th, 26th
   (b) 4th, 11th, 18th, 25th
   (c) 3rd, 10th, 17th, 24th
   (d) None of these

ANSWERS

1. (c) **2.** (b) **3.** (b) **4.** (a) **5.** (b)

EXPLANATIONS

1. The time shown in the mirror is 9 h 50 min.
2. The year 2001 is an ordinary year. So, it has 1 odd day. 1st day of the year 2001 was Monday.

   1st day of the year 2002 will be 1 day beyond Monday.

   Hence, it will be Tuesday.
3. Count the number of odd days from the year 2002 onwards to get the sum equal to 0 odd day.

Years	2002	2003	2004	2005	2006	2007
Odd days	1	1	2	1	1	1

   Sum = 7 odd days = 0 odd day

   Calender for the year 2008 is the same as that for the year 2002.
4. We shall find the date on 1st June, 2005.

   1st June, 2005 = (2004 yr + Period from 1.1.2005 to 1.6.2005)

   odd days in 2000 yr = 0

   4 yr = (1 leap year + 3 ordinary year)
   = (1× 2 + 3) days
   = 5 odd days

   Jan Feb March April May June

   (31 + 28 + 31 + 30 + 31 + 1) = 152 days

   = (21 weeks + 5 days) = 5 odd days

   Total number of odd days (0 + 5 + 5) = 10 odd days = 3 odd days

   So, 1st June, 2005 was Wednesday.

   So, 6th, 13th, 20th and 27the June 2005 are Monday.
5. We shall find the date on 1st March, 2003.

   1st March, 2003 = (2002 yr + Period from 1.1.2003 to 1.3.2003) odd days in 2000 yr = 0

   2 yr = 2 ordinary years = 2 odd days. Jan Feb March (31+28+1) = 60 days =(8 weeks + 4 days) = 4 odd days. So, Total number of odd days = (0 + 2 + 4) = 6 odd days.

   So, 1st March, 2003 was Saturday.

   So, 4th, 11th, 18th and 25th March 2003 were Tuesday.

CHAPTER 22

Concepts of Geometry

Point

A point is defined by its position. It has no length, width or thickness. A straight line joining two points is the shortest distance between them. Three or more points are said to be **collinear**, if there is a line which contains all of them.

Line

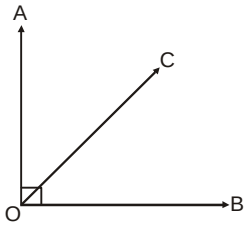
A line is defined by its length and has no breadth. It has length units. (metre, foot, centimetre kilometre, etc.).

A line contains infinite points. Through a given point, there pass infinite lines. One and only one straight line passes through two distinct points. Three or more lines are said to be **concurrent**, if they pass, through one point and that point is called the point of concurrence. Two lines are said to be **intersecting lines**, if they have a common point.

Angle

When two straight lines meet at a point, they are said to form an angle. Angles generally are measured in degrees. There are 180° in a straight line and a full circle constitutes 360°.

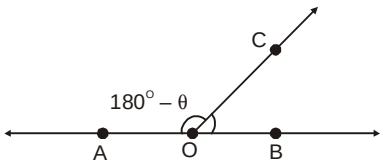
1. Two angles are said to be complementary, if their sum is 90°. Complement of x is (90° – x).



In the adjoining figure, $\angle AOC + \angle BOC = 90°$.

$\therefore \angle AOC$ and $\angle BOC$ are complementary to each other.

2. Two angles are said to be supplementary, if their sum is 180°. Supplement of x is $(180° - x)$.

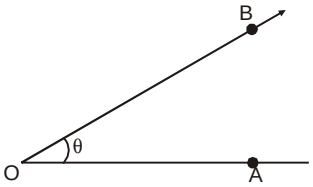


$\angle AOC + \angle BOC = 180°$.

$\therefore \angle AOC$ and $\angle BOC$ are supplementary to each other.

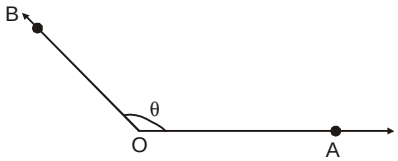
3. An angle which less than 90^0, is called acute angle

   $\angle AOB < 90° \therefore \angle AOB$ is an acute angle.



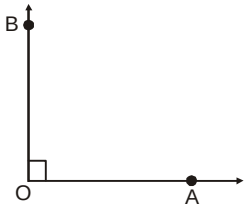
4. An angle which is greater than 90° is called obtuse angle.

   $\angle AOB > 90° \therefore \angle AOB$ is an obtuse angle.



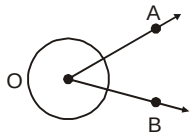
5. An angle which is exactly 90° is called **Right Angle** and the two lines are said to be **Perpendicular** to each other.

   $\angle AOB = 90° \therefore \angle AOB$ is a right angle and OA and OB are perpendicular to each other.



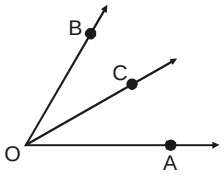
6. An angle which is greater than two right angles but less than four right angles is said to be **Reflex Angle**.

   $180° < \angle AOB < 360° \therefore \angle AOB$ is reflex angle.



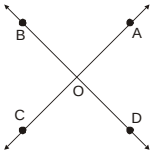
7. Angles which lie on either side of a common line are called **Adjacent Angles**.

   $\angle AOC$ and $\angle COB$ have a common vertex 'O' and a common arm $\overset{\text{uuur}}{OC}$. Hence, they are adjacent angles.



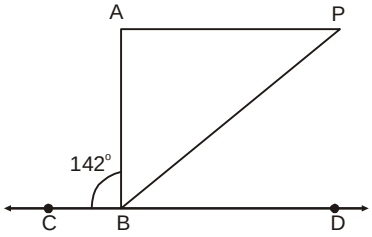
8. If two lines intersect, then **Vertically Opposite Angles** are equal in magnitude.

   $\angle AOB = \angle COD$ and $\angle BOC = \angle AOD$ are two pairs of vertical opposite angles.



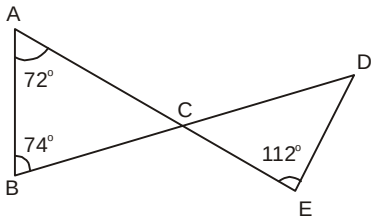
EXERCISE

1. In the given figure, $AB \perp CD$; $AP \parallel CD$, $\angle CBP = 142°$ Find $\angle ABP$ and $\angle APB$.



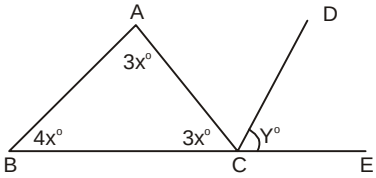
(a) 52°, 38° (b) 56°, 34°
(c) 51°, 39° (d) 57°, 33°

2. In the figure, $\angle CAB = 72°$, $\angle CBA = 74°$ and $\angle CED = 112°$ Find $\angle CDE$.



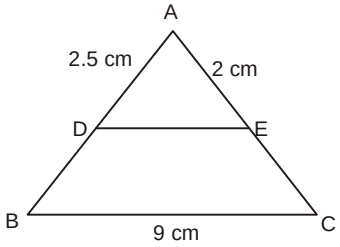
(a) 34° (b) 33° (c) 35° (d) 38°

3. In the given figure, $CD \parallel AB$. Find y.



(a) 79° (b) 72°
(c) 74° (d) 77°

4. In ΔABC, $DE \parallel BC$, $AD = 2.5$ cm, $DB = 5$ cm, $AE = 2$ cm and $BC = 9$ cm. Find EC and DE. A 2.5 cm 2 cm



(a) 4 cm, 3 cm (b) 5 cm, 3 cm
(c) 2 cm, 4 cm (d) 4 cm, 5 cm

ANSWERS

1. (b)	**2**. (a)	**3**. (a)	**4**. (b)	**5**. (a)

EXPLANATIONS

1. In ΔABC, $\angle ABC + \angle BCA + \angle CAB = 180°$

$\Rightarrow \quad 4x + 3x + 3x = 180°$

$\Rightarrow \quad 10°x = 180° = x = 18°$

$AB \parallel CD$ and BC the transversal, then $\angle ABC + \angle BCD = 180°$ [sum of the internal angles on the same side of the transversal]

$\Rightarrow \angle ABC + \angle BCA + \angle ACD = 180°$

$\Rightarrow 4x + 3x + \angle ACD = 180°$

$\Rightarrow \angle ACD = 180° - 7x = 180° - (7\times 18) = 54°$

Also, $\angle ACE = \angle CAB + \angle ABC$ [exterior angle is equal to the sum of interior opposite angles]

$\angle ACD + \angle DCE = 3x + 4x = 7x$

$\Rightarrow 54 + y = 7 \times 18 = 126°$

$\Rightarrow y = 126° - 54° = 72°$

2. As. $DE \parallel BC$, $\dfrac{AD}{DB} = \dfrac{AE}{EC}$

$$\Rightarrow \quad \frac{2.5}{5} = \frac{2}{EC}$$

$$\Rightarrow \quad EC = \frac{5\times 2}{2.5} = 4\ cm$$

Also, as $DE \parallel BC$, $\dfrac{AD}{AB} = \dfrac{DE}{BC}$

$$\frac{2.5}{5+2.5} = \frac{DE}{8}$$

$$\Rightarrow \quad DE = \frac{2.5\times 9}{7.5} = 3\ \text{cm}$$

$\therefore$ $EC = 4$ cm and $DE = 3$ cm

3. Let $BC = x$, then $DC = 12 - x$

As $AB \parallel DE$

$$\therefore \quad \frac{AC}{CE} = \frac{BC}{CD}$$

$$\Rightarrow \quad \frac{2}{6} = \frac{x}{12-x}$$

$\Rightarrow \quad 2(12 - x) = 6x = 24 - 2x = 6x$

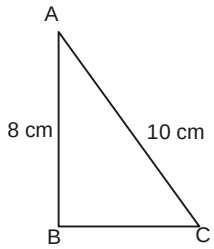
$\Rightarrow \quad 8x = 24$

$\Rightarrow \quad x = 3$cm

$DC = 12 - x = 12 - 3 = 9$cm

Hence, $DC = 9$ cm

4. Let AB be the height of the wall and AC be the ladder.



In the ΔABC $AC^2 = AB^2 + BC^2$ [Pythagoras Theorem]

$\therefore BC^2 = AC^2 - AB^2 = 10^2 - 8^2 = 100 - 64 = 36$

$\Rightarrow BC = 6$ m. Thus, the distance between wall and base of the ladder is 6 m.

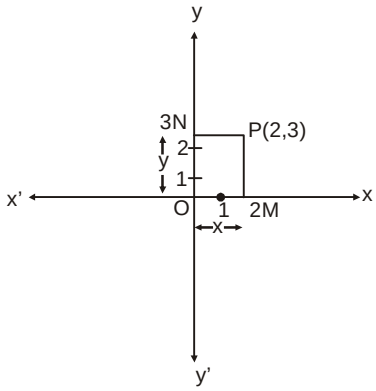
CHAPTER 23

Coordinate Geometry

Coordinate Geometry is also called Analytical Geometry. It is that branch of geometry in which we use two numbers called coordinates to indicate the position of a point in a plane.

Cartesian Coordinate System

The horizontal line x' is called the x-axis and the vertical line y' oy is called the y-axis and together they are called the coordinate axes. The point of intersection of these two axes is called the origin. Let P be any point in a plane. From P draw perpendiculars to the coordinate axes meeting the x-axis in M and y-axis in N. Here, $OM(x)$ is the x-coordinate or absicssa of a point P. Similarly, $ON(y)$ is the y-coordinate or ordinate of point P.

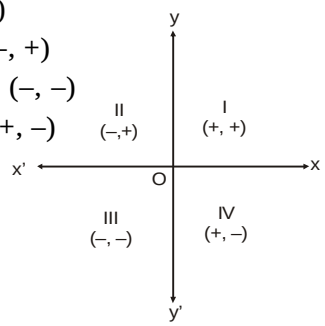


This position of the point P in the plane with respect to the coordinate axes is represented by the ordered pair (x, y) and this system is called the cartesian coordinate system.

The coordinates of the origin O are (0, 0). Also, $x'ox$ and $y'oy$ divide the plane into four regions called quadrants.

1. xoy is quadrant I. Here, x-coordinate is positive and y-coordinate is positive. (+,+)
2. $x'oy$ is quadrant II. Here, x-coordinate is negative and y-coordinate is positive. (–, +)
3. $x'oy$ is quadrant III. Here, x-coordinate is negative and y-coordinate is negative. (–, –)
4. xoy' is quadrant IV. Here, x-coordinate is positive and y-coordinate is negative. (+, –)

eg,
(1,5) lies in first quadrant
(–2,3) lies in second quadrant
(–2, –4) lies in third quadrant



(4,–2) lies in fourth quadrant

The coordinate of origin is (0, 0).

The ordinate of every point on x-axis is 0.

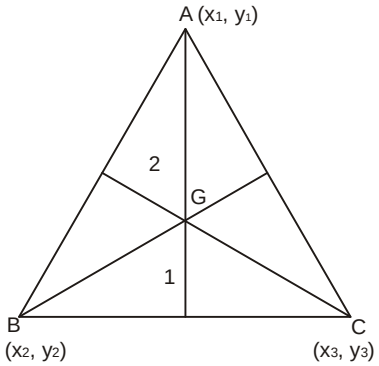
The ordinate of every point on y-axis is 0.

Distance between Two Points: Let $P(x_1,y_1)$ and $Q(x_2,y_2)$ be any two points on the plane, then the distance between P and Q is represented as PQ is given by

$$PQ = \sqrt{(x_2 - x_1)^2 - (y_2 - y_1)^2}$$

The distance of the point $P(x, y)$ from the origin (0, 0) is $\sqrt{x^2 + y^2}$

Centroid If $A(x_1, y_1)$, $B(x_2, y_2)$ and $C(x_3, y_3)$ are the vertices of a triangle, then the three medians of the triangle intersect at its centroid and the centroid divides the median in the ratio 2 : 1. A



Coordinates of the point G are given by $G\left(\frac{x_1 + x_2 + x_3}{3}, \frac{y_1 + y_2 + y_3}{3}\right)$

Area of a Triangle: If $A(x_1, y_1)$, $B(x_2, y_2)$ and $C(x_3, y_3)$ be three vertices of a triangle ABC, then its area is given by

$$\Delta = \frac{1}{2}|x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)|$$

Collinearity: Three points $A(x_1, y_1)$, $B(x_2, y_2)$ and $C(x_3, y_3)$ are said to be collinear, (ie, lying on the same straight line) if

(i) $AB + BC = AC$ or $AC + CB = AB$ or $AB + AC = BC$

(ii) The area of the triangle formed by A, B and C is zero. ie,

$$x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2) = 0$$

Section Formula: If $A(x_1, y_1)$ and $B(x_2, y_2)$ are two points in a plane, then the coordinates of the point P which divides the line joining AB internally in the ratio $m : n$ are $\left[\frac{mx_2 + nx_1}{m+n}, \frac{my_2 + ny_1}{m+n}\right]$

If $A(x_1, y_1)$ and $B(x_2, y_2)$ be the end points of a line segment AB. Then, the coordinates of the mid point of AB are $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$.

EXERCISE

1. The point of intersection of the line $x + y + 1 = 0$ and $2x - y + 5 = 0$ is
(a) $(-1, 1)$ (b) $(-2, 1)$
(c) $(1, 2)$ (d) $(1, -2)$

2. The equation of the line passing through the point of intersection of the lines $5x - 2y = 3$, $4x - 7y + 3 = 0$ and parallel to the lines $3x - 2y + 5 = 0$
(a) $3x - 2y = 0$ (b) $3x - 2y = 1$
(c) $3x - 2y = 5$ (d) None of these

3. The equation of a straight line passing through the intersection of the lines $x + y + 1 = 0$, $2x - y + 5 = 0$ and through the point $(5, -2)$.
(a) $3x + 5y = 1$ (b) $3x - 7y = 1$
(c) $3x + 7y = 1$ (d) None of these

4. The equation of a line parallel to $3x - 2y + 1 = 0$ and passing through the origin is
(a) $3x - 2y = 0$ (b) $3x - 2y = 5$
(c) $3x - 2y = 1$ (d) None of these

5. The equation of the line having intercept on the axes such that the sum of the intercepts is 7 and the product of the intercepts is 12 is
(a) $3x + 4y - 12 = 0$ (b) $3x - 4y - 6 = 0$
(c) $3x + 4y + 6 = 0$ (d) $4x + 3y - 6 = 0$

ANSWERS

1. (b) **2**. (b) **3**. (c) **4**. (a) **5**. (a)

EXPLANATION

1. The point of intersection of the straight lines
$x + y + 1 = 0$ ...(i)
and $2x - y + 5 = 0$ ...(ii)
is obtained by solving the Eqs. (i) and (ii).
Multiplying Eq. (i) by 2 and subtracting from Eq. (ii), we get $y = 1$.
Putting $y = 1$ is Eq. (i), we get $x = -2$
$\therefore$ The point of intersection is $(-2, 1)$.

2. The point of intersection of the straight lines $5x - 2y = 3$ and $4x - 7y = -3$ is $(1, 1)$
Now, we have to find the equation of a straight line passing through $(1, 1)$ and parallel to $3x - 2y + 5 = 0$.
The equation of a straight line parallel to $3x - 2y + 5 = 0$ is $3x - 2y = k$
It passes through $(1, 1) \Rightarrow 3 \times 1 - 2 \times 1 = k \Rightarrow k = 1$
$\therefore$ The required equation is $3x - 2y = 1$

3. The point of intersection of the lines $x + y + 1 = 0$ and $2x - y + 5 = 0$ is $(-2, 1)$
The required straight line passes through $(-2, 1)$ and $(5, -2)$

$$y - 1 = \frac{-2-1}{5+2}(x+2)$$

$$\Rightarrow \quad 7y - 7 = -3x - 6$$

$$\Rightarrow \quad 3x + 7y - 1 = 0$$

4. The equation of a line parallel to $3x - 2y + 1 = 0$ is $3x - 2y = k$ it passes through $(0, 0)$

$$\Rightarrow \quad k = 0$$

The required equation is $3x - 2y = 0$

5. Let a and b the intercepts, such that $a + b = 7$ and $ab = 12$. On solving, we have $a = 4$, $b = 3$

The equation of the straight line $\frac{x}{4} + \frac{y}{3} = 1$

$$\Rightarrow \quad 3x + 4y = 12$$

$$\Rightarrow \quad x = 1$$

CHAPTER 24

Permutation & Combination

Fundamental Principles of Counting

Fundamental Principle of Multiplication: If there are two jobs such that one of them can be completed in n ways and second job can be completed in n ways, then the two jobs in succession can be completed in $m \times n$ ways.

Fundamental Principle of Addition: If there are two jobs such that they can be performed independently in m and n ways respectively, then either of the two jobs its can be performed in $(m + n)$ ways.

Example 1: Find the number of ways in which n different prizes can be distributed among m ($< n$) persons, if each is entitled to receive at most $n - 1$ prizes.

Solution. Total number of ways = $m \times m \times$ ... to n times = m^n

The number of ways in which one gets all the prizes = m

The required number of ways = $m^n - m$

Example 2: There are 4 candidates for the post of a lecturer in Mathematics and one is to be selected by votes of 5 men. Find the number of ways in which the votes can be given.

Solution. Each man can vote for one of the 4 candidates and this can be done in 4 ways.

Similar is the case with every other man. ($\therefore$ Repetition is allowed)

Hence, 5 men can vote in 4^5 ie, 1024 ways.

Permutations

Each of the arrangements which can be made by taking some or all number of things is called a permutation.

Thus, the permutations which can be made by taking the letters a, b, c two at a time are 6. *ie, ab, bc, ac, ba, cb* and *ca*. Each of these presenting a different arrangement of two letters. These six arrangements are called permutations of three things taken two at a time.

Linear Permutation

If the things are arranged in a row/line, then a permutation is called linear permutation. It is simply written as a permutation.

- The number of permutations of n dissimilar things taken r at a time is ${}^nP_r$.

$$ {}^nP_r = n(n-1)(n-2)\ldots(n-r-1) = \frac{n!}{(n-r)!} $$

Where n! is the product of the first n natural numbers and called '*n* – factorial' or 'factorial *n*' denoted by *n*! or $\underline{n}$

eg, $5! = 5 \times 4 \times 3 \times 2 \times 1 = 120$

Here, we also define that 10 or 0 is 1. Also, *n*! is defined only for positive integers.

eg, The number of permutations of 6 dissimilar things taken 4 at a time is

$$^{6}P_{4} = \frac{6!}{(6-4)!} = 6 \times 5 \times 4 \times 3 = 360$$

- The number of permutations of n dissimilar things taken all at a time is nP_n .

$$^{n}P_{n} = \frac{n!}{(n-n!)} = n!$$

eg, The number of permutations of 3 dissimilar things taken all at a time is

$$^{3}P_{3} = \frac{3!}{(3-3)!} = 3! = 3 \times 2 \times 1 = 6$$

- The number of permutations of *n* dissimilar things taken *r* at a time, when repetition of things is allowed any number of times is n^r .

  eg, The number of different telephone numbers formed by taking 3 digits from 1, 2, 3, 4 is $4^3 = 64$
- If *n* dissimilar things are grouped into *k* groups such that a_1 things in the first group are alike,... a_2 in the second group are alike a_k in the kth group are alike, then the number of permutation of n such things taken all at a time is $\frac{n!}{(a_1)!(a_2!)\ldots(a_k!)}$

eg, The number of permutations that can be made using all the letters of the word 'MANORAMA' is $\frac{8}{2.3}$

(Since, the given word contains 8 letters of which there are 2M's, 3A's and three different letters.)

Circular Permutation

If the things are arranged around a circle, then a permutation is called a circular permutation.

In circular permutation, there is no first or last place of an object. Hence, the principles of linear permutations are not applicable in circular permutations. In such type of permutations, the relative positions of the things alone need to be taken into consideration and not the actual position.

- The number of circular permutation of n different things taken all at a time around a circle is (*n* - 1)! . eg, The number of ways in which 6 students sit around the table is (6-1)! *ie*, 5!.

Circular Permutation Around a Thread

- If any arrangement of n different things around a circle in the clockwise direction is considered to be not different from the similar arrangement in the anti-clockwise direction, then, in this case, the number of circular permutations of n different things is $\frac{1}{2}(n-1)!$.

In the arrangement of flowers in a closed garland or beads in a necklace, no distinction need to be made between clockwise and anti-clockwise directions.

eg, The number of ways in which 8 differently coloured beads be strung on a necklace is $\frac{1\times(8-1)!}{2} = \frac{7!}{2}$.

[Here distribution is not between one parcel and other so the order is immaterial.]

EXERCISE

2. Between two book-ends in your study are displayed your five favourite puzzle books. If you decide to arrange the five books in every possible combination and move just one book every minute, how long would it take you?
(a) 3 h (b) 2 h
(c) 1 h (d) 4 h

3. The number of ways of arranging 4 boys and 3 girls in a row so that the row begins with a boy and ends with a girl.
(a) 360 (b) 480
(c) 720 (d) 1440

4. For a set of five true-or-false questions, no student has written all the correct answers, and no two students have given the same sequence of answers. What is the maximum number of students in the class, for this to be possible?
(a) 31 (b) 21
(c) 51 (d) 41

5. A number lock on a suitcase has 3 wheels each labelled with 10 digits from 0 to 9. If opening of the lock is a particular sequence of three digits with no repeats, how many such sequences will be possible?
(a) 720 (b) 760
(c) 680 (d) 780

5. There are six periods in each working day of a school, in how many ways can one arrange 5 subjects such that each subject is allowed at least one period?
(a) 3500 (b) 3600
(c) 3550 (d) 3650

ANSWERS

1. (b) **2**. (d) **3**. (a) **4**. (a) **5**. (b)

EXPLANATIONS

1. 5 puzzle books can be arranged in 5! ways

$5! = 5 \times 4 \times 3 \times 2 = 120$

Each book displayed takes 1 min

$\therefore$ 120 books will take 120 min ie, 2h.

2. Arranging first place from 6 boys = 4 ways
Arranging last place from 3 girls = 3 ways
Remaining 5 places arranging with 3 boys and 2 girls = 5!
Total ways = $4 \times 3 \times 5! = 4 \times 3 \times 120 = 1440$

3. As no student has written all the correct answers and no two students have given the same sequence of answers.
Maximum number of students = $2^5 - 1 = 31$

4. Total possible sequences = $^{10}P_3 - \frac{10!}{(10-3)!}$

$= \frac{10 \times 9 \times 8 \times 7!}{7!} = 720$

5. Total number of ways = $6! \times 5 = 720 \times 5 = 3600$

CHAPTER 25

Probability

Probability

Probability is used to indicate a possibility of an event to occur. It is often used synonymously with chance.

(i) In any experiment if the result of an experiment is unique or certain, then the experiment is said to be deterministic in nature.

(ii) If the result of the experiment is not unique and can be one of the several possible outcomes then the experiment is said to be probabilistic in nature.

Various Terms Used in Defining Probability

(i) **Random Experiment:** Whenever an experiment is conducted any number of times under identical conditions and if the result is not certain and is any one of the several possible outcomes, the experiment is called a trial or a random experiment, the outcomes are known as events.

eg, When a die is thrown is a trial, getting a number 1 or 2 or 3 or 4 or 5 or 6 is an event.

(ii) **Equally Likely Events:** Events are said to be equally likely when there is no reason to expect any one of them rather than any one of the others.

eg, When a die is thrown any number 1 or 2 or 3 or 4 or 5 or 6 may occur. In this trial, the six events are equally likely.

(iii) **Exhaustive Events:** All the possible events in any trial are known as exhaustive events. eg, When a die is thrown, there are six exhaustive events.

(iv) **Mutually Exclusive Events:** If the occurrence of any one of the events in a trial prevents the occurrence of any one of the others, then the events are said to be mutually exclusive events. eg, When a die is thrown the event of getting faces numbered 1 to 6 are mutually exclusive.

Classical Definition of Probability

If in a random experiment, there are n mutually exclusive and equally likely elementary events in which n elementary events are favourable to a particular event E, then the probability of the event E is defined as $P(E)$

$$P(E) = \frac{\text{Favourabel Events}}{\text{Total number of Events}} = \frac{n(E)}{n(S)} = \frac{m}{n}$$

- If the probability of occurrence of an event E is $P(E)$ and the probability of non-occurrence is $P(\bar{E})$, then,

$P(E) + P(\bar{E}) = 1$. Hence, $P(\bar{E}) = 1 - \frac{m}{n} = \frac{n-m}{n}$ *ie,* the sum of the probabilities of success and failure is 1.

Also, $0 \le P(E) \le 1$ and $0 \le P(\bar{E}) \le 1$.

- If $P(E) = 1$, the event E is called a certain event and if $P(E) = 0$, the event E is called an impossible event.
- If E is an event, then the odds in favour of E are defined as $P(E) : P(E)$ and the odds against E are defined as $P(E)$: $P(\bar{E})$. Hence, the odds in favour of E are $\frac{m}{n} : \frac{(n-m)}{n} = m : (n-m)$, the odds against E are $\frac{(n-m)}{n} : \frac{m}{n} = (n-m) : m$

Addition Theorem on Probability

If E_1 and E_2 are two events in a sample space S, then $P(E_1 \cup E_2) = P(E_1) + P(E_2) - P(E_1 \cap E_2)$. If E_1 and E_2 are mutually exclusive events (disjoint), then $P(E_1 \cup E_2) = P(E_1) + P(E_2)$. (Q $P(E_1 \cap E_2) = \theta$)

Independent and Dependent Events

Two or more events are said to be independent if the happening or non-happening of any one does not depend (or not affected) by the happening or non-happening of any other. Otherwise they are called dependent events.

eg, Suppose a card is drawn from a pack of cards and replaced before a second card is drawn. The result of the second drawn is independent of the first drawn. If the first card drawn is not replaced, then the second drawn is dependent on the first drawn.

If E_1 and E_2 are independent events, then

$$P(E_1 \cap E_2) = P(E_1) \times P(E_2)$$

Simple Event

An event which cannot be further split is called a simple event. The set of all simple events in a trial is called a sample space.

Compound Event

When two or more events occur in relation with each other, they are called compound events.

Conditional Event

If E_1 and E_2 are events of a sample space S and if E_2 occurs after the occurrence of E_1, then the event of occurrence of E_2 after the event E_1 is called conditional event of E_2 given E_1. It is denoted by E_2/E_1.

Conditional Probability

If E_1 and E_2 are the events in a sample space S and $P(E_1) \neq 0$, then the probability of E_2 after the event E_1 has occurred is called conditional probability of E_2 given E_1. It is denoted by $P\left(\frac{E_2}{E_1}\right)$ and we define,

$$P\left(\frac{E_2}{E_1}\right) = \frac{P(E_2 \cap E_2)}{P(E_1)} = \frac{n(E_1 \cap E_2)}{n(E_1)}$$

EXERCISE

1. Which of the following cannot be the probability of an event ?
(a) 1/4 (b) 20% (c) 1.2 (d) 0.3

2. If $P(E) = 0.03$, what is the probability of 'not E'?
(a) 0.90 (b) 0.97 (c) 0.07 (d) 0.70

3. A bag contains orange flavoured candies only. A girl takes out one candy without looking into the bag. What is the probability that she takes out an orange flavoured candy ?
(a) 1 (b) 0
(c) 1/2 (d) 1/4

4. A bag contains orange flavoured candies only. A girl takes out one candy at random from the bag. What is the probability that she takes out a strawberry flavoured candy ?

(a) $\frac{1}{3}$ (b) 1 (c) 0 (d) $\frac{1}{2}$

5. An unbiased die is thrown once. What is the probability of getting a prime number ?

(a) $\frac{1}{2}$ (b) $\frac{1}{4}$ (c) $\frac{2}{3}$ (d) $\frac{1}{3}$

ANSWERS

1. (c) **2.** (b) **3.** (a) **4.** (c) **5.** (a)

EXPLANATIONS

1. 1.2 cannot be the probability of an event because

$$0 \le P(E) \le 1$$

2. Probability of "not E"

$$P(\text{not } E) = p(\overline{E}) = 1 - P(E) = 1 - 0.03 = 0.97$$

3. Probability that the girl takes out an orange flavoured candy is 1 because the bag contains orange flavoured candies only.

4. Probability that she takes out a strawberry flavoured candy is 0 because the bag contains only orange flavoured candies.

5. Here, $n(S) = \{1, 2, 3, 4, 5, 6\}$ and E = Event of getting a prime number = $\{2, 3, 5\}$

$$\therefore P(E) = \frac{n(E)}{n(S)} = \frac{3}{6} = \frac{1}{2}$$

CHAPTER 26

Basic Algebra

A Civil Servant should be well-versed in basics of Algebra. In the Civil Services Aptitude Test Paper 2, in Basic Numeracy, certainly there will be asked some questions based on equations and their roots.

POLYNOMIALS

Polynomial

An expression in term of some variable(s) is called a polynomial.

For example

$f(x) = 2x - 5$ is a polynomial in variable x

$g(y) = 5y^2 - 3y + 4$ is a polynomial in variable y

Note that the expressions like $3x^2 - \sqrt{x}, \frac{1}{x^2 - 7x + 6}, 5x^3 - \frac{4}{x},$ etc. are not polynomials. Thus, a rational x integral function of 'x' is said to be a polynomial, if the powers of 'x' in the terms of the polynomial are neither fractions nor negative. Thus, an expression of the form

$f(x) = a_n x^n + a_{n-1}x^{n-1} + \ldots + a_1 x + a_0$ is called a polynomial in variable x where n be a positive integer and $a_0, a_1, \ldots, a_n$ be constants (real numbers).

Degree of a Polynomial

The exponent of the highest degree term in a polynomial is known as its degree.

For example

$f(x) = 4x - \frac{3}{2}$ is a polynomial in the variable x of degree 1.

$p(u) = 3u^3 + u^2 + 5^u - 6$ is a polynomial in the variable u of degree 3.

$q(t) = 5$ is a polynomial of degree zero and is called a constant polynomial.

Linear Polynomial

A polynomial of degree one is called a linear polynomials. In general $f(x) = ax + b$, where $a \neq 0$ is a linear polynomial.

For example

$f(x) = 3x - 7$ is a binomial as it contains two terms.

$g(y) = 8y$ is a monomial as it contains only one terms.

Quadratic Polynomials

A polynomial of degree two is called a quadratic polynomials. In general $f(x) = ax^2 + bx + c$, where $a \neq 0$ is a quadratic polynomial.

For example

$f(x) = x^2 - 7x + 8$ is a trinomial as it contains 3 terms

$g(y) = 5x^2 - 2x$ is a binomial as it contains 2 terms

$p(u) = 9x^2$ is a monomial as it contains only 1 term

Cubic Polynomial

A polynomial of degree 3 is called a cubic polynomial in general.

$f(x) = ax^3 + bx^3 + cx + d$, $a \neq 0$ is a cubic polynomial.

For example

$f(x) = 2x^3 - x^2 + 8x + 4$

Biquadratic Polynomial

A fourth degree polynomial is called a biquadratic polynomial in general.

$f(x) = ax^4 + bx^3 + cx^2 + dx + e$, $a \neq 0$ is a bi quadratic polynomial.

Zero of a Polynomial

A real number a is a zero (or root) of a polynomial $f(x)$, if $f(\alpha) = 0$

For example If $x = 1$ is a root of the polynomial $3x^3 - 2x^2 + x - 2$, then $f(1) = 0$

$f(x) = 3x^3 - 2x^2 + x - 2$, $f(1) = 3 \times 1^3 - 2 \times 1^2 + 1 - 2 = 3 - 2 + 1 - 2 = 0$,

As $f(1) = 0$

$x = 1$ is a root of polynomial $f(x)$

(1) A polynomial of degree n has n roots.

(2) A linear polynomial of $f(x) = ax + b$, $a \neq 0$ has a unique root given by $x = -\frac{b}{a}$.

(3) Every real number is a root of the zero polynomial.

(4) A non-zero constant polynomial has no root.

Remainder Theorem

Let $f(x)$ be a polynomial of a degree greater than or equal to one and a be any real number, if $f(x)$ is divisible by $(x - a)$, then the remainder is equal to $f(a)$.

Example 1: Find the remainder when $f(x) = 2x^3 - 13x^2 + 17x + 10$ is divided by $x - 2$.

Solution. When $f(x)$is divided by $x - 2$, then remainder is given by

$f(2) = 2(2)^3 - 13(2)^2 + 17(2) + 10 = 16 - 52 + 34 + 10 = 8$

Thus, on dividing $f(x) = 22 - 13x^2 + 17x + 10$ by $x - 2$, we get the remainder 8.

EXERCISE

1. Which of the following expression is a polynomial?

(a) $x^2 + \frac{2}{x} + 3$ (b) $x^2 - 2x + 3$

(c) $\frac{1}{x^2} - 2x + 3$ (d) $x^2 - 2\sqrt{x-3}$

2. Which of the following expression is a polynomial in one variable?
(a) $3x^2 - 2y + 3$ (b) $-x^2 + 6x - 5 = 0$
(c) $x^2 + y^2 = -3$ (d) $2x^2 - 2y^{-1} = 0$

3. Which of the following expression is a polynomial in two variable?
(a) $x^2 - 2xy + y^2 - x + y$ (b) $x^3 + y^3 + z^3 - 1$
(c) $x^2 + 3x + 2$ (d) $x^2 - 2x^2 + 3x + 5$

4. The degree of the polynomial $2x^3 - 5x^2 + x - 3$ is
(a) 2 (b) 3
(c) 1 (d) 0

5. The degree of the polynomial $3x - \sqrt{3}$ is
(a) 1 (b) 2
(c) 0 (d) 4

ANSWERS

1. (b) **2.** (b) **3.** (a) **4.** (b) **5.** (a)

EXPLANATIONS

1. Clearly, (b) is a polynomial since in options (a),(c) and (d) ,x does not have integral powers.

2. Clearly, (b) is a polynomial in one variable as (a), (c) and (d) are the polynomials in x and y.

3. Clearly, (a) is a polynomial in two variables x and y. (b) is a polynomial in three variables x, y, z while (c) and (d) are the polynomial in x only.

4. The highest of the variable in given polynomial is 3. So, the degree of polynomial is 3.

CHAPTER 27

Set Theory, *Venn Diagrams,* Functions & Relations

Sets

A set is a collection of well defined objects.

The objects of the sets are called elements.

(i) Sets are usually denoted by capital letters $A, B, C,..., X, Y, Z$.

(ii) The elements of the sets are denoted by small letters like $a, b, c,..., x, y, z$ etc.

Representation of Sets

Sets are usually described into two ways.

(i) Tabular form or roster form, in this form, all the elements of the set are separated by commas and enclosed between the bracket { }.

For example

(a) The set of vowels of English Alphabet as

$A = \{a, e, i, o, u\}$

(b) The set of numbers on a clock face is written as

$B = (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12\}$

(ii) **Set builder from:** We define a set by stating properties which its elements must satisfy. For example the set of all even integers. Then, we use the letters usually x, and we write

$A = \{x \mid x \text{ is an even integer}\}$

This is to be read as A is a set of numbers x such that x is an even integer. The vertical line " | " to be read as "such that" some times we use x in place of vertical line.

$$A = \{x : x \text{ is an even integer}\}$$

eg, $$C = \{1, \omega, \omega^2\} = \{x \mid x^3 - 1 = 0\}$$

If an object x is an element of a set A, we write $x \in A$ which is read as "x belong to A" and if an object x is not a member of A we write $x \notin A$ and read as "x does not belong to A".

Some Important Terms

(i) **Empty or Null set** The set which contains no elements is called the empty set or the null set. The empty set is written as ϕ.

Thus, $\phi = \{\ \}$ as there is no element in the empty set.

For example; the set of odd numbers divisible by 2 is the null set.

(ii) **Singleton set** *A* set containing only one element is called a singleton for example, {1}, {4} are singleton sets.

(iii) **Equality of sets.** The sets *A* and *B* are equal if they have same members that is if every elements of A is an element of *B* and every element of B is an element of *A*, then *A* = *B*

eg, if *A* = { l, 3,5,7} and *B* = {7, 3, 1, 5}, then *A* = *B*

If the two sets are not equal we write A ≠ B

Important Formulae

1. A set does not change if its elements, are repeated.
2. A set does not change even if the order of its elements is different.

(iv) **Finite and Infinite set.** The set which contains a definite number of elements is called a finite set. The set which contains an infinite number of elements is called an infinite set.

eg, (I) The set of days in a week.

eg, (II) The set of natural numbers.

(v) **Disjoint set.** Two sets *A* and *B* are said to be disjoint, if they do not have any element in common.

eg, *A* = { 1, 2, 3}, *B* = { 4, 5, 6} are disjoint sets.

(vi) **Subset.** If every element in set A is also an element of another set B. Then A is called a subset of B. Also B is said to be super set of A.

Symbolically, we write

$A \subseteq B$ (ie, *A* contained in *B*)

$B \subseteq A$ (ie, *B* contains *A*)

More specifically $A \subseteq B$ if $x \in A \Rightarrow x \in B$

eg, (I) Let *A* = { 2, 4, 7}, B = { 1, 2, 3, 4, 7}

Then, $A \in B$ since every element of *A* is in *B*.

eg, (II) *A* = {*x* | *x* a real number} and *B* = {*x* | *x* is an integer} Then, $A \notin B$

1. If there is at least one element of *A* which is not in *B*, then *A* is not a subset of B written as $A \subseteq B$.
2. Every set is a subset of itself ie, $A \subseteq A$.
3. If $A \subseteq B$ and $B c \subseteq A$, then *A* = *B*.

(vii) The Null set ϕ is a subset of every set A.

(viii) **Proper Subset:** *A* is a proper subset of *B*. if $A \subseteq B$ and $A \neq B$ and is written as $A \subset B$ ie, if *B* contains at least one element more than *A*, then *A* is a proper subset of *B*

(ix) **Power set:** Set of all the subsets of a set is called the power set

eg, *A* = {*a*, *b*, *c*} subsets of *A* are ϕ, {*a*}, {*b*}, {*c*}, {*a*, *b*}, {*b*, *c*}, {*c*,*a*}, {*a*, *b*, *c*}

Hence, $P(A) = [\phi, \{a\}, \{b\}, \{c\}, \{a, b\}, \{b, c\}, \{c, a\}, \{a, b, c\}]$

If *n* is the number of elements of a set *A*, then the number of subset of A ie, the number of elements of *P* (A) = 2^n.

(x) **Universal set:** If all the sets under consideration are the subsets of a fixed set *U*, then *U* is called the Universal set.

Union of sets

Union of two sets *A* and *B* is the set of all elements which belongs to A or B (or to both) and is written as

$A \cup B$ (ie, *A* union *B*)

The same is defined in set builder form as

$A \cup B = \{x \mid x \in A \text{ or } x \in B\}$

If $A = \{1, 3, 5, 7, 9\}$ and $B = \{2, 4, 5, 6, 9\}$

Then, $A \cup B = \{1, 2, 3, 4, 5, 6, 7, 9\}$

1. From the definition of Union of sets A u B = B u A (Commutative Law)
   If A is any set, then $A \cup A = A$ and $A \cup \phi = A$
2. If A and B are any two sets, then $A \subseteq (A \cup B)$ and $B \subseteq (A \cup B)$
   If $x \in A \cup B$,then $x \in A$ or $x \in B$ and if $x \notin A \cup B$,then $x \in A$ and $x \notin B$.
3. If A, B, C are three sets, then $A \cup (B \cup C) = (A \cup B) \cup C$

Intersection of Sets

If A and B are any two sets, then intersection of A and B is the set of all elements which are in A and also in B. It is written as $A \cap B$ and is read as "A intersection B'

If $A = \{2, 4, 6, 8\}$ and $B = \{4, 5, 6, 9\}$

Then $A \cap B = \{4, 6\}$

1. From the definition of the intersection, it follows $A \cap B = B \cap A$ (Commutative Law)
2. If A is any set, then $A \cap A = A$ and $A \cap$ **f**) = **f**
3. For any two sets A and B.

$$A \cap B = A \text{ and } A \cap B \subseteq B$$

4 If A and B have no elements in common ie, A and B are disjoint, then $A \cap B = \phi$
If $x \in A \cap B = x \in A$ and $x \in B$

eg, (I) If $A = \{2, 3, 6, 8, 9\}$ and $B = (1, 3, 5, 6, 7, 9\}$, then $A \cap B = \{3, 6, 9\}$

eg,(II) If $A = \{x1 | < x < 4\}$ and $B = \{x | 2 < x < 5\}$, then $A \cap B = \{x | 2 < x < 4\}$

If A, B, C are three sets, then

(i) $(A \cap B) \cap C = A \cap (B \cap C)$ Associative Law

(ii) $A \cap (B \cap C) = (A \cap B) \cup (A \cap C)$ Distributive Law

Difference of Sets

The difference of two sets A and B is set of elements which belongs to A but do not belong to B. This is written as $A - B$

$$A - B = \{x | x \in A \text{ and } x \in B\}$$

1. Set $A - B$ subset of A *ie*, $A - B \subseteq A$
2. Set $(A - B)$ and B are disjoint ie, $(A - B) \cap B = \phi$
3. $A - B = (A \cup B) - (A \cap B)$

Symmetric Difference of Sets

The symmetric difference of two sets A and B is $(A - B) \cup (B - A)$ and is written as $A \Delta B$

Thus, $A \Delta B = (A - B) \cup (B - A)$

In the set builder form $A \Delta B = \{x \mid x \in A$ or $x \in B$, but $x \notin A \cap B\}$

Demorgan Laws

If A, B, C are three sets, then

(i) $A - (B \cup C) = (A - B) \cap (A - C)$

(ii) $A - (B \cap C) = (A - B) \cup (A - C)$

EXERCISE

Directions: *If* $A = \{1, 2, 3\}$, $B = \{2, 3, 4\}$, $C = \{4, 5, 6, 7\}$

7. $B \cap C$ = ?
(a) {2} (b) {4}
(c) {2, 4} (d) {5, 6}

8. $A \cup B$ = ?
(a) {l, 4} (b) {2, 3}
(c) {1, 2, 3, 4} (d) {1, 2}

9. $A \cap B$ = ?
(a) {1, 2, 3, 4} (b) {2, 3}
(c) {1, 4} (d) {4, 5}

10. $(A \cup B) \cup C$
(a) {1, 2, 3, 4}
(b) {2, 3, 4, 5, 6, 7}
(c) {1, 2, 3, 4, 5, 6, 7} (d) {2, 3, 4, 5}

11. $(A \cap B) \cap C$
(a) {2, 3} (b) {4}
(c) {1, 2, 3, 4, 5, 6, 7} (d) Null set

ANSWERS

1. (b) **2.** (c) **3.** (b) **4.** (c) **5.** (d)

EXPLANATIONS

7. $B = \{2,3,4\}, C = \{4, 5, 6, 7\} = B \cap C = \{4\}$

8. $A = \{1, 2, 3\}$, $B = \{2,3,4\}$
Therefore, $A \cup B = \{1, 2, 3, 4\}$

9. $A = \{1, 2, 3)$, $B = \{2, 3, 4\}$
Therefore, $A \cap B = \{2,3\}$

10. $A = \{1, 2, 3\}$, $B = \{2, 3, 4\}$, $C = \{4, 5, 6, 7\}$
$A \cup B = \{1,2,3,4\}$ $(A \cup B) \cup C = \{1, 2, 3, 4, 5, 6, 7)$

11. Given, $A = \{1, 2, 3\}$, $B = \{2, 3, 4\}$, $C = \{4, 5, 6, 7\}$ $A \cap B = (2, 3)$ and $C = \{4, 5, 6, 7\}$
$(A \cap B) \cap C = \phi$ = Null set

CHAPTER 28

Statistics

Statistics

The branch of Mathematics which deals with collection, classification and interpretation of data is called statistics.

When used in the singular sense, statistics refers to the subject as a whole of science of statistical methods embodying the theory and techniques. When it is used in the plural sense, statistics refers to the data itself (ie, numerical facts collected in a systematic manner with some definite purpose in view, in any field of enquiry).

The Frequency Table or the Frequency Distribution

If the data is classified in a convenient way and presented in a table it is called frequency table or frequency distribution.

Frequency: When the data is presented in a frequency table, the number of observations that fall in any particular class is called the frequency of that class.

Class Limit: The starting and end values of each class are called "lower limit" and "upper limit" of that class respectively.

Class-interval: The difference between the upper and lower boundary of a class is called the "class-interval" or "size of the class". It can also be defined as the difference between the lower or upper limits or boundaries of two consecutive classes.

Class Boundaries: The average of the upper limit of a class and the lower limit of the succeeding class is called the "upper boundary" of that class. The upper boundary of a class becomes the "lower boundary" of the next class.

Range: The difference between the highest and the lowest observation of a data is called its range.

Histogram: Pertaining to a frequency distribution, if the true limits of the classes are taken on the x-axis and the corresponding frequencies on the y-axis and adjacent rectangles are drawn, the diagram is called 'histogram'.

Frequency Polygon and Frequency Curve: If the points pertaining to the mid values of the classes of a frequency distribution and the corresponding frequencies are plotted on a graph sheet and these points are joined by straight lines, the figure formed is called frequency polygon. If these points are joined by a smooth curve the figure formed is called frequency curve.

Cumulative Frequency Curves: If the points pertaining to the boundaries of the classes of a frequency distribution and the corresponding cumulative frequencies are plotted on a graph sheet and they are joined by a smooth curve, the figure formed is called cumulative frequency curve.

The figure formed with upper boundaries of the classes and the corresponding less than cumulative frequencies is called less than cumulative frequency curve. The figure formed with lower boundaries of the classes and the corresponding greater than cumulative frequencies is called greater than cumulative frequency curve.

Arithmetic Mean (AM) or Mean

1. Arithmetic Mean of Ungrouped Data

If $x_1, x_2, x_3, \ldots, x_n$ are n values of a variable x, then arithmetic mean x is defined as

$$\bar{x} = \frac{x_1 + x_2 + x_3 + \ldots + x_n}{n} \text{ or } x = \frac{\sum_{i-1}^{n} x_i}{n}$$

Where $\sum_{i-1}^{n} x_i = (x_1 + x_2 + x_3 + \ldots + x_n)$

2. Arithmetic Mean of Grouped Data

Here, the mean may be computed by the following method

Direct method If $x_1, x_2, x_3, \ldots, x_n$ are n values of a variable x and $f_1, f_2, f_3, \ldots f_n$ are the corresponding frequencies, then

$$x = \frac{f_1x_1 + f_2x_2 + \ldots + f_nx_n}{f_1 + f_2 + f_3 + \ldots + f_n} \text{ or } x = \frac{\sum_{i=1}^{n} f_i x_i}{n}$$

Where, $\sum_{i=1}^{n} f_i x_i = f_1x_1 + f_2x_2 + \ldots + f_nx_n$ and $N = f_1 + f_2 + f_3 + \ldots + f_n$

Median

1. Median of Ungrouped Data

If $x_1, x_2, \ldots, x_n$ are n values of variable x arranged in order of increasing or decreasing magnitude then the middle-most value in this arrangement is called the median.

If n is **odd**, then the median will be the $\left(\frac{n+1}{2}\right)$th value arranged in order of magnitude. In this case there will be one and only one value of the median.

If n is **even**, then the data arranged in order of magnitude, will have 2 middle - most values ie, $\left(\frac{n}{2}\right)$th and $\left(\frac{n}{2}+1\right)$th values.

$$\frac{\text{Value of } \left(\frac{n}{2}\right)\text{th observation} + \text{Value of } \left(\frac{n}{2}+1\right)\text{th observation}}{2}$$

CSAT SMART PRACTICE

Directions (Q. Nos. 1-5) Consider the table given below

Class-interval (Age in years)	Number of employees	Cumulative frequency
25-29	5	5
30-34	15	20
35-39	22	42
40-44	19	61
45-49	9	70

From the above table find the following.

1. Class size is
(a) 4.5 (b) 5
(c) 4 (d) None of these

2. Mid value of class 40-44 is
(a) 42.5 (b) 42
(c) 43 (d) None of these

3. Lower limit and upper limit of 35-39 is
(a) 35, 39 (b) 34, 38
(c) 34.5, 39.5 (d) None of these

4. How many employees are less than 44½ yr age ?
(a) 22 (b) 42
(c) 61 (d) None of these

5. The frequency of class 45-49 is
(a) 9 (b) 70
(c) 19 (d) None of these

ANSWERS

1. (b) **2.** (b) **3.** (c) **4.** (d) **5.** (a)

1. Class size of 25-29 ie, 24.5- 29.5 is = (29.5 –24.5) = 5

2. Mid value of the class interval 40-44 means mid value of the class interval 39.5- 44.5 ie,

$$\left(\frac{39.5+44.5}{2}\right)=42$$

3. Lower limit and upper limit of 35 - 39 is 34.5 and 39.5.

4. Clearly, 61 employees are less than 44½ yr age as the upper limit of class 40- 44 is 44.5.

5. Frequency of 45- 47 is 9

CHAPTER 29

Sequences & Series

Arithmetic Progression (AP)

An arithmetic progression is a sequence in which terms increase or decrease by a constant number called the common difference.

(i) The sequence 2, 6, 10, 14, 18, 22… is an arithmetic progression whose first term is 2 and common difference 4.

(ii) The sequence $2, \frac{5}{2}, 3, \frac{7}{2}, 4$ …is an arithmetic progression whose first term is 2 and common difference ½.

An arithmetic progression is represented by $a, (a + d), (a + 2d), (a + 3d)\ a + (n - 1)d$

Here, a = first term
d = common difference
n = number of terms in the progression

- The general term of an arithmetic progression is given by $T_n = a + (n - 1)\ d$.
- The sum of n terms of an arithmetic progression is given by S, = $\frac{n}{2}$ [2a + (n – 1) d] or $S_n = 2\ [a + l]$

  where l is the last term of arithmetic progression.
- If three numbers are in arithmetic progression, the middle number is called the arithmetic mean of the other two terms.
- If a, b, c are in arithmetic progression, then $b = \frac{a+c}{2}$ where b is the arithmetic mean.
- Similarly, if 'n' terms $a_1, a_2, a_3 \ldots a_n$ are in AP, then the arithmetic mean of these 'n' terms is given by

  AM = $\frac{a_1 + a_2 + a_3 + \ldots + a_n}{n}$.
- If the same quantity is added or multiplied to each term of an AP, then the resulting series is also an AP.
- If three terms are in AP, then they can be taken as $(a - d), a, (a + d)$.
- If four terms are in AP, then they can be taken as $(a - 3d), (a - d), (a + d), (a + 3d)$.
- If five terms are in AP, then they can be taken as $(a - 2d), (a - d), a, (a + d), (a + 2d)$.

EXERCISE

1. A person is entitled to receive an annual payment which for each year is less by one tenth of what it was for the year before. If the first payment is 100. Then, find the maximum possible payment which he can receive, however long he may live?
(a) 900 (b) 9999
(c) 1000 (d) None of these

2. If 4, 6, a are in AP. 4, 6, b are in GP and 4, 6, c are in HP, determine the value of $3a + 2b - c$.
(a) 35 (b) 30
(c) 12 (d) 27.6

3. In a geometric progression, the sum of the first and the last term is 66 and the product of the second and the last second term is 128. Determine the first term of the series.
(a) 64 (b) 64 or 2
(c) 2 or 32 (d) 32

4. Ashok is employed in a firm which promises to pay him a salary of ` 3000 per month for the first year and an increment of `1000 in his monthly salary every succeeding year. How much does he earn from the firm in 20 yr?
(a) ` 2500000 (b) ` 3000000
(c) ` 3200000 (d) ` 4400000

5. The sum of the fourth and twelth term of an arithmetic progression is 20. What is the sum of the first 15 terms of the arithmetic progression?
(a) 300 (b) 200
(c) 150 (d) 120

ANSWERS

1. (c) **2.** (b) **3.** (b) **4.** (b) **5.** (c)

EXPLANATIONS

1. His first payment = `100

His second payment = `90 = $\left(100\times\frac{9}{10}\right)$

His third payment = `81 = $\left(90\times\frac{9}{10}\right)$ etc.

∴ The annual payments are 100, 90, 81, .. .which are in GP with common ratio $\frac{9}{1}(<1)$

Therefore, the sum of infinity of this GP

$$= 100 + 90 + 81 + \ldots \infty = \frac{100}{1-\frac{9}{10}} = \frac{100}{\frac{1}{10}} = 1000$$

Hence, the person can receive the maximum amount of `1000.

2. 4, 6 a in AP

$12 = 4 + a$ or $a = 8$

4, 6, b are in GP

$36 = 4b$ or $b = 9$

4, 6, c are in HP ie, 1/4, 1/6, $1/c$ are in AP

$$2/6 = (1/4) + (1/c)$$
$$c = 12$$

$3a + 2b - c = 3 \times 8 + 2 \times 9 - 12 = 30$

3. Let a be the first term and r be the common ratio of the GP.

From the given problem

$$a + ar^{n-1} = 66 \quad \ldots(i)$$

Also, $ar \times ar^{n-2} = 128$

$$\Rightarrow \quad a^2r^{n-1} = 128 \quad \ldots(ii)$$

From Eq. (ii), again, $a \cdot ar^{n-1} = 128$

$$ar^{n-1} = 128/a$$

Substituting this in Eq. (i),

$$a + 128/a = 66$$
$$a^2 - 66a + 128 = 0$$

$$a = [(-b \pm \sqrt{b^2 - 4ac}]/2a$$

$= [66 \pm \sqrt{(66^2 - 4\times128\times1)/2}] = 64$ or 2

4. Ashok's first year salary = ` 36000

After that there is a yearly increment of ` 12000

∴ 36000 + 48000 + 60000 + ...

$$T_{20} = a + (20 - 1) \times d$$
$$= 36000 + 19 \times 12000$$
$$= ` 264000$$

$$S_{20} = \frac{20}{2}[a + T_{20}]$$
$$= 10 \times [36000 + 264000]$$
$$= ` 3000000$$

5. $a + 3d + a + 11d = 20$

$\Rightarrow \quad 2a + 14d = 20$

So, $S_{15} = \frac{15}{2}[2a + (15-1)d]$

$= \frac{15}{2}[20] = 150$

Sample Study Material of English Comprehension

Comprehension

Direction (Q.231-239): Read the following passage carefully and answer the questions given below it. Certain words are printed in bold to help you to locate them while answering some of the questions.

"Uncle" said Luke to the old Sean." You seem to be well fed, though I know no one looks after you. Nor have I seen you leave your residence at any time. Tell me how do you manage it?"

"Because" Sean replied, "I have a good feed every night at the emperor's orchard. After dark, I go there myself and pick out enough fruits to last a fortnight."

Luke proposed to **accompany** his uncle to the orchard. Though **reluctant** because of Luke's habit of euphoric exhibition of **extreme** excitment, Sean agreed to take him along. At the orchard while Sean hurriedly collected the fruits and left, Luke on the other hand at the sight of unlimited supply of fruits was excited and lifted his voice which brought emperor's men immediately to his side. They seized him and mistook him as the sole cause of damage to the orchard. Although Luke **reiterated** that he was a bird of passage, they **pounded** him **mercilessly** before setting him free.

1. Why was Sean reluctant to take Luke along?
(a) Because he was a selfish man.
(b) He feared that Luke's reaction may alert the Emperor's men.
(c) Because Luke could harm him.
(d) He wanted to bring fruits for Luke himself.

2. How did old Sean manage to meet his food requirements?
(a) By buying food from the market
(b) His nephew Luke took care of his requirements
(c) Luke brought fruits from the emperor's orchard for Sean
(d) He picked up fruits from the emperor's orchard

3. Luke remained behind at the orchard because he
(a) was greedy and wanted to collect more fruits
(b) waited for the Emperor's men to arrest him
(c) lost his composure and started expressing his feelings loudly
(d) had waited for his uncle to return

4. Which of the following can be inferred from the passage?
(a) Luke did not take good care of his Uncle
(b) The Emperor was a wicked man
(c) Lack of self-contorl had put Luke into trouble
(d) Orchard are highly guarded areas and not meant for the public

5. Which of the following is not true in the context of the passage?
(a) Sean was a poor and suffering man
(b) Luke came to know about the orchard from his uncle
(c) Sean initially hesitated to take his nephew along
(d) Both Sean and Luke collected fruits from Emperor's orchard

6. How often did Sean visit the emperor's orchard?
(a) Daily
(b) Once a month
(c) In a period of two weeks
(d) Never, his nephew Luke brought fruits for him

7. The emperor's men seized Luke immediately because he —
(a) was a potential threat to the kingdom
(b) did not take care of his uncle
(c) often lost self-control
(d) was suspected for damaging the Emperor's orchard

8. What does "bird of passage" mean in the context of the given passage?
(a) There was a bird in the orchard
(b) Bird's song alerte d emperor's men
(c) Other people also stole from orchard
(d) He did not visit orchard regularly

9. Why did Sean leave immediately after collecting the fruits?
(a) He feared that the bird's song would awaken the Emperor
(b) To avoid getting caught by Emperor's men
(c) He saw the Emperor's men approaching
(d) He wanted to leave Luke alone

ANSWERS

1. (b)	**2.** (d)	**3.** (c)	**4.** (c)	**5.** (d)
6. (c)	**7.** (d)	**8.** (d)	**9.** (b)	

Passage

Among the several hundred million cells that comprise the wondrously complex human body, and thus to be theoretically detectable in lab tests and in electron photomicrographs, a tiny fraction, no more than a few hundred, belong to a curious subclass whose luminescence has a wavelength distribution so unique that it long defied explanation. Such systems luminance strongly in the visible region of the spectrum, but some of them does so even more strongly at both shorter and longer wavelengths: in the ultraviolet region and in the infrared regions.

This odd distribution of luminescence is best explained by the pairing of a giant red blood cell and an intensely small white blood cell that is virtually in contact with its larger companion as the two travel around a common center. Such objects have become known as Clinging cells. On photographic plates only the giant cell can be discerned, but evidence for the existence of the tiny companion has now been supplied by magnifying instruments capable of detecting ultraviolet luminescence at wavelengths that are absorbed by the body's heat and therefore cannot be detected by typical analytical instruments. The spectra of Clinging cells indicate that the giant red blood cell is surrounded by very thin lipid filaments. The existence of the lipid filaments marked such objects as being unique several decades before clinical observations finally identified the lipid as the luminescence from the tiny companion white blood cell. Clinging cells also flare up in outbursts indicating the ejection of material in the form of a shell or a ring, reminiscent of the recurrent circulation of hormonal cells. Clinging cells may therefore represent a transitory phase in the evolution of certain types of hormonal systems in which there is a substantial transfer of matter from the larger partner to the smaller.

The exact evolutionary course that turns a typical blood cell system into a clinging one is a matter of conjecture. The comparatively small number of known Clinging cells in our bodies suggests that if all binaries of modest mass normally pass through a clinging phase in their evolution, the phase must be extremely brief, perhaps as short as a millisecond.

1. The author's primary purpose in the passage is to
(a) demonstrate that most hormonal systems were at one time clinging
(b) dismiss current knowledge of Clinging cells as overly speculative
(c) describe Clinging cells as a distinct type of cell system
(d) present evidence that hormonal systems are formed from tiny white blood cells

2. The passage implies that Clinging cell systems differ from other hormonal systems in that the former
(a) display luminescence patterns different from those of most hormonal systems
(b) contain two cells that revolve around a common center
(c) possess far greater mass than other hormonal systems
(d) are more common in our bodies than other hormonal systems

3. Which of the following can be inferred from the passage about "the luminescence"?
(a) It causes certain large red blood cells to appear tiny to observers
(b) It was incorrectly associated with hormonal cells in our bodies
(c) It interferes with the clarity of photographs of most hormonal systems
(d) It could not be positively identified from photomicrograph observations

4. According to the passage. the exchange of matter within a Clinging cell system is believed to be a process in which
(a) cell grows in mass at the expense of the other
(b) the mass of each cell remains fairly stable
(c) the mass of both cells declines
(d) both cells absorb matter emitted by other nearby cells

5. The assumption that the Clinging cell phase in the evolution of some hormonal systems "must be extremely brief " (line) is most likely based on the

fact that
(a) hormones are rapidly ejected from clinging systems
(b) few Clinging cells have been detected in our bodies
(c) the cells in a clinging pair are in close proximity to each other
(d) clinging cells vary considerably in size from one another

ANSWERS

1. (c) **2.** (a) **3.** (d) **4.** (a) **5.** (b)

Passage

Dogs and cats should never be permitted to eat chocolate, because chocolate works like a poison in their bodies. Chocolate contains a chemical called theobromine, which is similar to caffeine. Human bodies are able to process the theobromine without any ill side effects, but dogs and cats cannot.

Different types of chocolate contain different amounts of theobromine. It would take 20 ounces of milk chocolate to kill n 20-pound dog, but only two ounces of baker's chocolate or six ounces of semisweet chocolate. The amounts, of course, are much smaller for a cat, whose body weight is typically less than that of a dog. Most cats are not naturally attracted to eating chocolate, but many dogs are. Dogs by nature will sample nearly anything that they see their masters eating, so pet owners must take care to keep all chocolate products well out of reach of their dogs and cats.

1. According to the passage, why is chocolate poisonous for dogs and cats?
(a) It contains caffeine
(b) Chocolate is made from processed cocoa
(c) It gets stuck in their intestines
(d) They cannot process theobromine

2. How much milk chocolate would be poisonous to a cat, according to the passage?
(a) Substantially less than 20 ounces
(b) Substantially more than 20 ounces
(c) Approximately one pound
(d) Half a Hershey bar

3. Why might a dog eat chocolate, according to the passage?
(a) Because it tastes good
(b) Dogs won't eat chocolate
(c) They can smell the theobromine
(d) Dogs like to imitate their owners

4. What best summarizes this passage?
(a) Look before you leap
(b) Pet food for pets, people food for people
(c) Monkey see, monkey do
(d) A penny saved is a penny earned

ANSWERS

1. (d) **2.** (a) **3.** (d) **4.** (b)

Passage

On the banks of the Thames it is a tremendous chapter of accidents — the London-lover has to confess to the existence of miles upon miles of the dreariest, stodgiest commonness. Thousands of acres are covered by low black houses, of the cheapest construction, without ornament, without grace, without character or even identity. In fact there are many, even in the best quarters, in all the region of Mayfair and Belgravia, of so paltry and inconvenient and above all of so diminutive a type, that you wonder what peculiarly limited domestic need they were constructed to meet. The great misfortune of London, to the eye (it is true that this remark applies much less to the City), is the want of elevation. There is no architectural impression without a certain degree of height, and the London street-vista has none of that sort of pride.

All the same, if there be not the intention, there is at least the accident, of style, which, if one looks at it in a friendly way, appears to proceed from three sources. One of these is simply the general greatness, and the manner in which that makes a difference for the better in any particular spot, so that though you may often perceive yourself to be in a shabby corner it never occurs to you that this is the end of it. Another is the atmosphere, with its magnificent mystifications, which flatters and superfuses, makes everything brown, rich, dim, vague, magnifies distances and minirnises details, confirms the inference of vastness by suggesting that, as the great city makes everything, it makes its own system of weather and its own optical laws. The last is the congregation of the parks, which constitute an ornament not elsewhere to be matched and give the place a superiority that none of its uglinesses overcome. They spread themselves with such a luxury of space in

the centre of the town that they form a part of the impression of any walk, of almost any view, and, with an audacity altogether their own, make a pastoral landscape under the smoky sky. There is no mood of the rich London climate that is not becoming to them - I have seen them look delightfully romantic, like parks in novels, in the wettest winter - and there is scarcely a mood of the appreciative resident to which they have not something to say. The high things of London, which here and there peep over them, only make the spaces vaster by reminding you that you are after all not in Kent or Yorkshire; and these things, whatever they be, rows of 'eligible' dwellings, towers of churches, domes of institutions, take such an effective gray-blue tint that a clever watercolorist would seem to have put them in for pictorial reasons.

The view from the bridge over the Serpentine has an extraordinary nobleness, and it has often seemed to me that the Londoner twitted with his low standard may point to it with every confidence. In all the town-scenery of Europe there can be few things so fine; the only reproach it is open to is that it begs the question by seeming - in spite of its being the pride of five millions of people - not to belong to a town at all. The towers of Notre Dame, as they rise, in Paris, from the island that divides the Seine, present themselves no more impressively than those of Westminster as you see them looking doubly far beyond the shining stretch of Hyde Park water. Equally admirable is the large, river-like manner in which the Serpentine opens away between its wooded shores. Just after you have crossed the bridge you enjoy on your left, through the gate of Kensington Gardens, an altogether enchanting vista - a footpath over the grass, which loses itself beneath the scattered oaks and elms exactly as if the place were a 'chase.' There could be nothing less like London in general than this particular morsel, and yet it takes London, of all cities, to give you such an impression of the country. (Written by the American novelist, Henry James.)

13. Which of the following the second paragraph of the passage does?
(a) Analyses a problem raised in paragraph one
(b) Continues the delineation of limitations
(c) Counters a negative impression
(d) Enlarges the viewpoint with the aid of wider examples

14. The word 'atmosphere' (3rd sentence of 2nd paragraph) refers to
(a) the mood of the place
(b) the London air
(c) artistic impression (d) the author's mood

15. By the use of the word 'congregation' (4th sentence of 2nd paragraph) the author suggests that the parks are
(a) numerous (b) religious
(c) too crowded

(d) superior attractions and unlimited in extent

16. Author of the passage, Henry James, mentions Notre Dame in order to
(a) provide an example of a monument finer than anything that London has to offer
(b) highlight the impressive nature of a certain London building and its setting
(c) give an example of a sight more suited to a town or city
(d) make the image more realistic to the reader

ANSWERS

1. (c) **2.** (b) **3.** (a) **4.** (b)

Directions: Read the following passages and answer the questions that follow

Passage

Nothing shows up the schizophrenia of the Indian mind in the face of this challenge than that the two principal leaders of the national struggle for independence Mahatma Gandhi and Mr. Nehru should have come to contrary conclusions. The Mahatma was for an outright rejection of the western civilization, which is often described as Satanic. Mr. Nehru was for all-out industrialization.

Both spoke from utter conviction and were extremely articulate in stating their positions. But neither of them thought it worth his while to grapple with the troublesome details when it came to making the reality conform to the vision.The Mahatma was, of course, most meticulous about detail and when he undertook a job, whether it was the spread of the spinning wheel, revival of village industries or helping the Harijans, he did not regard the smallest matter pertaining to the concerned organization or an individual grievance beneath his personal attention. It was a different story, however, with translating his larger vision of a non-violent society into a blueprint. He enunciated the general principal very forcefully. But such details as the state structure the new society would build and the social legislation it would undertake, the precise industrial policy it would pursue or the defense policy it would opt for, he left alone r dealt with in bits and pieces. Did he fear that his vision would suffer by raising all these issues at one go? Or did he realize long before the day of India's tryst with destiny that he would not count on anyone even among his closest colleagues in the Congress to back him?

Mr. Nehru was in a much better position to carry out his ideas. But the very Constitution-making process became a formal exercise. There was no attempt to think in terms of institutions, which while preserving the substance of democracy, would contain populist pressures, make government more business-like and more productive of results and make for easy and cheap access, to justice. All this is not to believe his role in guiding the young republic in its formative years and setting norms which none of the regimes that came after him were also to live up to. But that does not detract from the processes of decline. The proliferation of slums had begun, and small groups were already hogging up the larger part of the gains of development. No concerted attempt was made to close the loopholes in land laws and little was done to make school education relevant to the needs of a developing society. The language policy was left to flounder.

That the people still look back to the Nehru era with a sense of nostalgia shows that even things which looked manageable in his days are now out of control. Perhaps this is the result of a deterioration in the quality of leadership, a distressing decline in the integrity of political life and an alarming build-up of populist pressure. But it also is the result of the way each government has been busy storing up trouble for future. Can one be sure after all this that the foundations on which the republic rests are durable enough?What light does this throw on the Indian mind?

The Indian mind delights in ambiguity in ambivalence, in trying to have the best of both worlds, in harboring a medley of conflicting ideas without much discomfort. Whatever the public rhetoric, the practice is always based on half- measures, of leaving things half done, of a refusal to anticipate trouble and a tendency to wake up when the crisis has aiready matured, this may be an exaggeration. But the slovenliness of approach to every problem is a fact of life whi^{c}h hits in the eye even the most sympathetic foreign observer.It is not surprising that the Indian genius which excelled in production myths, which created works of sculpture "which endow spirit with a body" and a music which enthralls the mind as well as the spirit, was often at a loss in facing up to the problems of state building. The Indian mind still falters as it tires to come to grips with these problems.

1. What is the main purpose of the writer behind writing this passage?
(a) To bring out the contrast in Nehru's and

Gandhi's dreams and vision of India.
(b) To bring out the flaws in Indian democracy.
(c) To trace the reasons behind the disordered state of India as one based on hollow foundation laid by leaders in the past
(d) To show the impact of Western Civilization on today's India.

2. What is the main idea expressed in the passage?
(a) The passage expresses the vision and dreams of Indian leaders for a better future.
(b) The passage expresses the shaping up of a disorganized state due to the constricted vision of our leaders.
(c) The passage is an account of a successful democratic set up of the Indian government as a result of the policies made by our leaders.
(d) The passage explains how the Constitution was made and what clauses it included.

3. Give a suitable title to the passage.
(a) Leaders of the Freedom Struggle
(b) Lack of Effective Leaders in India Today
(c) History of Indian Democracy
(d) Reflections of the Past in the Present India

4. What are the writer's feelings towards the subject of the passage?
(a) The writer is not satisfied with the present situation of mismanagement.
(b) The writer is comfortable with the medley of conflicting ideas present in today's world.
(c) The writer is nostalgic about the times when Nehru led India.
(d) The writer is depressed because of lack of efforts on part of Indian leaders to implement their ideas into practice.

5. What is the purpose of the writer behind mentioning Mahatma Gandhi and Nehru?
(a) To give an example of effective leadership to today's incompetent leaders.
(b) To explain that they were incapable of putting their vision into practice, this has resulted in the present situation.
(c) To bring out a contrast in the thinking of the two leaders towards the industrialization.
(d) To explain their policies and vision they held for all around development of India.

6. What is the writer's interpretation of the way Indians have accepted the situations?
(a) Indians are delighted with the excellent conditions present.
(b) Indians are sentimental about the glorious past of Nehru's times.
(c) Indians are disappointed by non-implementation of the dreams of leaders into reality.
(d) Indians have comfortably accepted the existing state of India along with its shortcomings and disorder.

7. Which of the following lies beyond the scope of the passage?
(a) Mahatma Gandhi favored the use of spinning wheel in place of western culture.
(b) Mahatma Gandhi dealt with the formation of the structure of the state in bits and pieces.
(c) The government did not make an effort to remove the deficiency in the laws of land.
(d) Mahatma could not give personal attention to the revival o‘ village industries since he felt that his vision would no materialize as a whole.

Passage

The Voice had to be listened to, not only on account of its form but for the matter which it delivered. It gave a message to the country that it needed greatly. It brought to the common people a realization of their duty to concern themselves with their affair; The common people were made to take an interest in the manner in which they were governed in the taxes they paid in the return they got from those taxes. This interest in public affairs-politics as you may call it-was to be the concern no longer of the high) educated few but of the many-the poor, the property-less, the working-men in town and country. Politics was not to be the concern of a small aristocracy of intellect or property of the masses. And with the change in the subjects of politics that voice brough about also a change in the objects of politics. Till then politics had busied itself mainly with the machinery of Government toward making its personnel more and more native, with proposals for a better distribution of political power, with protests against the sin of omission and of commission of the administration. This voice switched politics on to concern for the needs of the common people. The improvement of the lot of the poor was to be the main concern of politics and the politician.

The improvement, especially of the lives of the people of the neglected villages, was to be placed before Governments an political organizations as the goal of all political endeavour. The raising of the standard of living of the people of the villages, the finding of subsidiary occupations which would give the

agricultural poor k for their enforced leisure during the off season an an addition to their exiguous income, the improvement of the housing of the poor, the sanitation of the villages-these to be the objectives ±o be kept in view. In the towns, the slums and cherries we receive special attention. There was especially a class c the poor for which compassionate voice pleaded and protested. This was for the so-called depressed classes, the outcastes c Hindu society. The denial of elementary human rights to this class people it considered the greatest blot on Hindu society an history. It raised its passionate protest against the age-old wrongs of this class and forced those that listened to it to endeavour t remove the most outrageous of them like untouchability caused a revolution in Hindu religious practice b' having Hindu temple thrown, to these people. It made the care of them a religious duty of the Hindus by remaining those Harijans.

8. Why had people to listen to "The Voice" of Mahatma Gandhi
(a) To follow him
(b) Necessary for revolution
(c) On accounts of its form & matter
(d) For raising the standard of living of the people.

9. Why had people to take an interest in politics?
(i) To know now they governed
(ii) What citizens get from the taxes they paid?
(iii) To participate in the politics.
(iv) For the improvement of the lot of the poor.
Which of the given statement is/are correct?
(a) (i) and (iii) (b) (ii) and (iv)
(c) (i) and (ii) (d) (i),(ii), (iii) and (iv)

10. What was the change brought about in the objects of politics?
(a) Concern for the needs of the common people
(b) Improvement of the people of the neglected villages
(c) Improvement of the lot of poor
(d) All the above

11. What improvements were made for the common man?
(i) Standard of living of villagers were raised
(ii) Subsidiary occupation for agricultural poor.
(iii) Housing of the poor was improved
(iv) Untouchability was removed
Which of the given statement is/are correct?
(a) (i) and (iii) (b) (ii) and (iv)
(c) (i) and (ii) (d) (i), (ii), (iii) and (iv)

Passage

That large animals require a luxuriant vegetation, has been a general assumption which has passed from one work to another; but I do not hesitate to say that it is completely false, and that it has vitiated the reasoning of geologists on some points of great interest in the ancient history of the world. The prejudice has probably been derived from India, and the Indian islands, where troops of elephants, noble forests, and impenetrable jungles, are associated together in every one's mind. If, however, we refer to any work of travels through the southern parts of Africa, we shall find allusions in almost every page either to the does: character of the country, or to the numbers of large animals inhabiting it. The same thing is rendered evident by the many engravings which have been published of various parts of the interior.

Dr. Andrew Smith, who has lately succeeded in passing the Tropic of Capricorn, informs me that, taking into consideration the whole of the southern part of Africa, there can be no doubt of its being a sterile country. On the southern coasts there are some fine forests, but with these exceptions, the traveler may pass for days together through open plains, covered by poor and scanty vegetation. Now, if we look to the animals inhabiting wide plains, we shall find their numbers extraordinarily great, and their b?? immense. We must enumerate the elephant, three species of rhinoceros, the hippopotamus, the giraffe, the bos Gaffer, two zebras, two gnus, and several antelopes even larger than these latter animals. It may be supposed that although the species are numerous, the individuals of each kind are few. By the kindness of Dr. Smith, I am enabled to show that the case is very different. He informs me, that in lat. 24', in one day's march with the bullock-wagons, he saw, without wandering to any great distance on either side, between one hundred and one hundred and fifty rhinoceroses - the same day he saw several herds of giraffes, amounting together to nearly a hundred. At the distance of a little more than one hour's march from their place of encampment on the previous night, his party actually killed at one spot eight hippopotamuses, and saw many more. In this same river there were likewise crocodiles. Of course it was a case quite extraordinary, to see so many great animals crowded together, but it evidently proves that they must exist in great numbers. Dr. Smith describes the country passed through that day, as 'being thinly covered with grass, and bushes about four feet high, and still more

thinly with mimosa-trees.'

Besides these large animals, every one the least acquainted with the natural history of the Cape, has read of the herds of antelopes, which can be compared only with the flocks of migratory birds. The numbers indeed of the lion, panther, and hyena, and the multitude of birds of prey, plainly speak of the abundance of the smaller quadrupeds: one evening seven lions were counted at the same time prowling round Dr. Smith's encampment. As this able naturalist remarked to me, the carnage each day in Southern Africa must indeed he terrific! I confess it is truly surprising how such a number of animals can find support in a country producing so little food. The larger quadrupeds no doubt roam over wide tracts in search of it; and their food chiefly consists of underwood, which probably contains much nutriment in a small bulk. Dr. Smith also informs me that the vegetation has a rapid growth; no sooner is a part consumed, than its place is supplied by a fresh stock. There can be no doubt, however, that our ideas respecting the apparent amount of food necessary for the support of large quadrupeds are much exaggerated.

The belief that where large quadrupeds exist, the vegetation must necessarily be luxuriant, is the more remarkable, because the converse is far from true. Mr. Burchell observed to me that when entering Brazil, nothing struck him more forcibly than the splendour of the South American vegetation contrasted with that of South Africa, together with the absence of all large quadrupeds. In his Travels, he has suggested that the comparison of the respective weights (if there were sufficient data) of an equal number of the largest herbivorous quadrupeds of each country would be extremely curious. If we take on the one side, the elephants hippopotamus, giraffe, bos Gaffer, elan, five species of rhinoceros; and on the American side, two tapirs, the guanaco, three deer, the vicuna, peccari, capybara (after which we must choose from the monkeys to complete the number), and then place these two groups alongside each other it is not easy to conceive ranks more disproportionate in size. After the above facts, we are compelled to conclude, against anterior probability, that among the mammalia there exist no close relation between the bulk of the species, and the quantity of the vegetation, in the countries which they inhabit.

(**Adapted from:** Charles Darwin's book The Voyage of the Beagle. In the book he describes his voyage around the world as a ship's naturalist. On this voyage he gathered evidence that was to lead him to put forward his Theory of Evolution.)

12. Darwin quotes Burchell's observations in order to
(a) counter a popular misconception
(b) describe a region of great splendor
(c) prove a hypothesis
(d) illustrate a well-known phenomenon

13. Darwin apparently regards Dr. Smith as
(a) reliable and imaginative
(b) intrepid and competent
(c) observant and excitable
(d) foolhardy and tiresome
(e) incontrovertible and peerless

14. Darwin's parenthetical remark indicates that
(a) Burchell's data are not reliable
(b) Burchell's ideas are not to be given much weight
(c) Comparison of the weights of herbivores is largely speculative
(d) Darwin's views differ from Burchell's

15. The flocks of migratory birds (first sentence of 3rd paragraph) are mentioned to
(a) describe an aspect of the fauna of South Africa
(b) illustrate a possible source of food for large carnivores
(c) contrast with the habits of the antelope
(d) suggest the size of antelope herds

16. The 'carnage' (3rd sentence of 3rd paragraph) refers to the
(a) number of animals killed by hunters
(b) number of prey animals killed by predators
(c) number of people killed by lions
(d) amount of food eaten by all species

17. To account for the 'surprising' (middle of 3rd paragraph) number of animals in a 'country producing so little food', Darwin suggests all of the following as partial explanations except
(a) food which is a concentrated source of nutrients
(b) rapid regrowth of plant material
(c) large area for animals to forage in
(d) mainly carnivorous animals

18. The author makes his point by reference to all of the following except
(a) travel books and published illustrations
(b) private communications
(c) recorded observations
(d) historical documents

19. The author is primarily concerned with
(a) discussing the relationship between the size of mammals and the nature of vegetation in

their habitats
(b) contrasting ecological conditions in India and Africa
(c) proving the large animals do not require much food
(d) describing the size of animals in various parts of the world
(e) explaining that the reasoning of some geologists is completely false

20. According to the author, the 'prejudice' (2nd sentence of the passage) has lead to
(a) errors in the reasoning of biologists
(b) false ideas about animals in Africa
(c) incorrect assumptions on the part of geologists
(d) doubt in the mind of the author

21. The author uses information provided by Dr. Smith to
I. supply information on quality and quantity of plant life in South Africa
II. indicate the presence of large numbers of animals
III. give evidence of numbers of carnivorous animals
(a) I only (b) II only
(c) III only (d) I, II and III

Passage

The Ring at Casterbridge was merely the local name of one of the finest Roman amphitheatres, if not the very finest remaining in Britain.

Casterbridge announced old Rome in every street, alley, and precinct. It looked Roman, bespoke the art of Rome, and concealed dead men of Rome. It was impossible to dig more than a foot or two deep about the town fields and gardens without coming upon some tall soldier or other of the Empire, who had laid there in his silent unobtrusive rest for a space of fifteen hundred years. He was mostly found lying on his side, in an oval scoop in the chalk, like a chicken in its shell; his knees drawn up to his chest; sometimes with the remains of his spear against his arm; a brooch of bronze on his breast or forehead; an urn at his knees, a jar at his throat, a bottle at his mouth; and mystified conjecture pouring down upon him from the eyes of Casterbridge street boys, who had turned a moment to gaze at the familiar spectacle as they passed by.

Imaginative inhabitants, who would have felt an unpleasantness at the discovery of a comparatively modern skeleton in their gardens, were quite unmoved by these hoary shapes. They had lived so long ago, their time was so unlike the present, their hopes and motives were so widely removed from ours, that between them and the living there seemed to stretch a gulf too wide for even a spirit to pass.

The Amphitheatre was a huge circular enclosure, with a notch at opposite extremities of its diameter north and south. It was to Casterbridge what the ruined Coliseum is to modern Rome, and was nearly of the same magnitude. The dusk of evening was the proper hour at which a true impression of this suggestive place could he received. Standing in the middle of the arena at that time. there by degrees became apparent its real vastness, which a cursory view from the summit at noon-day was apt to obscure. Melancholy, impressive, lonely, yet accessible from every part of the town, the historic circle was the frequent spot for appointments of a furtive kind. Intrigues were arranged there; tentative meetings were there experimented after divisions and feuds. But one kind of appointment - in itself the most common of any - seldom had place in the Amphitheatre: that of happy lovers.

Why, seeing that it was pre-eminently an airy, accessible, and sequestered spot for interviews, the cheerfullest form of those occurrences never took kindly to the soil of the ruin, would he a curious inquiry. Perhaps it was because its associations had about them something sinister. Its history proved that. Apart from the sanguinary nature of the games originally played therein, such incidents attached to its past as these: that for scores of years the town-gallows had stood at one corner; that in 1705 a woman who had murdered her husband was half-strangled and then burnt there in the presence of ten thousand spectators.

Tradition reports that at a certain stage of the burning her heart burst and leapt out of her body, to the terror of them all, and that not one of those ten thousand people ever cared particularly for hot roast after that. In addition to these old tragedies, pugilistic encounters almost to the death had come off down to recent dates in that secluded arena, entirely invisible to the outside world save by climbing to the top of the enclosure, which few townspeople in the daily round of their lives ever took the trouble to do. So that, though close to the turnpike-road, crimes might be perpetrated there unseen at mid-day.

Some boys had latterly tried to impart gaiety to the ruin by using the central arena as a cricket-ground. But the game usually languished for the aforesaid

reason - the dismal privacy which the earthen circle enforced, shutting out every appreciative passer's vision, every commendatory remark from outsiders - everything, except the sky; and to play at games in such circumstances was like acting to an empty house. Possibly, too, the boys were timid, for some old people said that at certain moments in the summer time, in broad daylight, persons sitting with a book or dozing in the arena had, on lifting their eyes, beheld the slopes lined with a gazing legion of Hadrian's soldiery as if watching the gladiatorial combat; and had heard the roar of their excited voices: that the scene would remain but a moment, like a lightning flash, and then disappear.

Henchard had chosen this spot as being the safest from observation which he could think of for meeting his long-lost wife, and at the same time as one easily to be found by a stranger after nightfall. As Mayor of the town, with a reputation to keep up, he could not invite her to come to his house till some definite course had been decided on.

22. The amphitheatre is described as a 'suggestive'(3rd sentence of 4th paragraph) place because
(a) its real size could not be appreciated at a glance
(b) it was full of historical associations
(c) mysterious meetings took place there
(d) it was lonely yet accessible

23. The 'curious enquiry'(beginning of 4" paragraph) refers to finding out
(a) why happy lovers never met there
(b) why interviews never took place there
(c) what historical events took place there
(d) how the amphitheatre came to have sinister associations

24. The boys had given up cricket in the Amphitheatre in part because
(a) it was too dark
(b) crimes commonly took place there
(c) there were no spectators or passers-by to applaud their efforts
(d) they were afraid of being caught

25. The author's primary purpose is to
(a) justify his opinion of the Ring
(b) attempt to account for the atmosphere of a place
(c) chronicle the development of the Amphitheatre
(d) describe the location of a Roman relic

26. The attitude of the local residents to the unearthed remains of dead Romans was one of
(a) total apathy (b) confusion and unease
(c) trepidation (d) momentary interest

27. The incident of the woman who was burnt is mentioned in order to
(a) horrify the reader
(b) illustrate one reason for the unsavoury reputation of the place
(c) show the bloodthirsty nature of former occupants
(d) add realistic details to an imaginary plot

28. All of the following are said to have taken place at the Ring except
(a) ghostly apparitions (b) boxing matches
(c) hangings and secret assignations
(d) theatrical performances

29. It can be inferred from the last paragraph that Henchard
(a) is afraid of his wife
(b) has something to hide from the townspeople
(c) is a stranger to the Ring
(d) is about to commit a crime

30. It appears that in general the attitude of Casterbridge residents to the Roman past suggests that they
(a) appreciated the art of the Romans

(b) feared the ghosts of the buried Roman soldiers
(c) felt far removed from the concerns of the Romans
(d) were awe-struck by their civilization

ANSWERS

1. (c)	**2.** (b)	**3.** (d)	**4.** (a)	**5.** (b)
6. (d)	**7.** (c)	**8.** (c)	**9.** (c)	**10.** (d)
11. (a)	**12.** (a)	**13.** (b)	**14.** (c)	**15.** (d)
16. (b)	**17.** (d)	**18.** (d)	**19.** (a)	**20.** (c)
21. (d)	**22.** (b)	**23.** (a)	**24.** (c)	**25.** (b)
26. (d)	**27.** (b)	**28.** (d)	**29.** (b)	**30.** (c)

EXERCISE5

Directions: Below given are some passages with each passage followed by some questions to answer Answer to the questions should be drawn from the content of the said passage itself.

Passage 1

Today, bicycles are elegantly simple machines that are common around the world. Many people ride bicycles for recreation, whereas others use them as a means of transportation. The first bicycle, called a draisienne, was invented in Germany in 1818 by Baron Karl de Drais de Sauerbrun. Because it was made of wood, the draisienne wasn't very durable nor did it have pedals. Riders moved it by pushing their feet against the ground.

In 1839, Kirkpatrick Macmillan, a Scottish blacksmith, invented a much better bicycle. Macmillan's machine had tires with iron rims to keep them from getting worn down. He also used foot-operated cranks, similar to pedals, so his bicycle could be ridden at a quick pace. It didn't look much like the modern bicycle, though, because its back wheel was substantially larger than its front wheel. Although Macmillan's bicycles could be ridden easily, they were never produced in large numbers.

In 1861, Frenchman Pierre Michaux and his brother Ernest invented a bicycle with an improved crank mechanism. They called their bicycle a velocipede, but most people called it a "bone shaker" because of the jarring effect of the wood and iron frame. Despite the unflattering nickname, the velocipede was a hit. After a few years, the Michaux family was making hundreds of the machines annually, mostly for fun-seeking young people.

Ten years later, James Starley, an English inventor, made several innovations that revolutionized bicycle design. He made the front wheel many times larger than the back wheel, put a gear on the pedals to make the bicycle more efficient, and lightened the wheels by using wire spokes. Although this bicycle was much lighter and less tiring to ride, it was still clumsy, extremely top-heavy, and ridden mostly for entertainment.

It wasn't until 1874 that the first truly modern bicycle appeared on the scene. Invented by another Englishman, H. J. Lawson, the safety bicycle would look familiar to today's cyclists. The safety bicycle had equal-sized wheels, which made it much less prone to toppling over.

Lawson also attached a chain to the pedals to drive the rear wheel. By 1893, the safety bicycle had been further improved with air-filled rubber tires, a diamond-shaped frame, and easy braking. With the improvements provided by Lawson, bicycles became extremely popular and useful for transportation. Today, they are built, used, and enjoyed all over the world.

1. There is enough information in this passage to show that
(a) several people contributed to the development of the modern bicycle
(b) only a few velocipedes built by the Michaux family are still in existence
(c) for most of the nineteenth century, few people rode bicycles just for fun
(d) bicycles with wheels of different sizes cannot be ridden easily

2. The first person to use a gear system on bicycles was
(a) H. J. Lawson
(b) Kirkpatrick Macmillan
(c) Pierre Michaux
(d) James Starley

3. This passage was most likely written in order to
(a) persuade readers to use bicycles for transportation
(b) describe the problems that bicycle manufacturers encounter
(c) compare bicycles used for fun with bicycles used for transportation
(d) tell readers a little about the history of the bicycle

4. Macmillan added iron rims to the tires of his bicycle

to:
(a) add weight to the bicycle
(b) make the tires last longer
(c) make the ride less bumpy
(d) make the ride less tiring

5. Read the following sentence from the fourth paragraph

Ten years later, James Starley, an English inventor, made several innovations that revolutionized bicycle design. As it is used in the sentence, the underlined word revolutionized most nearly means
(a) cancelled (b) changed drastically
(c) became outdated (d) exercised control over

6. Which of the following statements from the passage represents the writer's opinion?
(a) The safety bicycle would look familiar to today's cyclists
(b) Two hundred years ago, bicycles didn't even exist
(c) The Michaux brothers called their bicycle a velocipede
(d) Macmillan's machine had tires with iron rims

Passage 2

The pioneers of the teaching of science imagined that its introduction into education would remove the conventionality, artificiality, and backward-lookingness which were characteristic; of classical studies, but they were gravely disappointed.

So, too, in their time had the humanists thought that the study of the classical authors in the original would banish at once the dull pedantry and superstition of mediaeval scholasticism. The professional schoolmaster was a match for both of them, and has almost managed to make the understanding of chemical reactions as dull and as dogmatic an affair as the reading of Virgil's Aeneid.

The chief claim for the use of science in education is that it teaches a child something about the actual universe in which he is living, in making him acquainted with the results of scientific discovery, and at the same time teaches him how to think logically and inductively by studying scientific method.

A certain limited success has been reached in the first of these aims, but practically none at all in the second. Those privileged members of the community who have been through a secondary or public school education may be expected to know something about the elementary physics and chemistry of a hundred years ago, but they probably know hardly more than any bright boy can pick up from an interest in wireless or scientific hobbies out of school hours.

As to the learning of scientific method, the whole thing is palpably a farce. Actually, for the convenience of teachers and the requirements of the examination system, it is necessary that the pupils not only do not learn scientific method but learn precisely the reverse, that is, to believe exactly what they are told and to reproduce it when asked, whether it seems nonsense to them or not. The way in which educated people respond to such quackeries as spiritualism or astrology, not to say more dangerous ones such as racial theories or currency myths, shows that fifty years of education in the method of science in Britain or Germany has produced no visible effect whatever.

The only way of learning the method of science is the long and bitter way of personal experience, and, until the educational or social systems are altered to make this possible, the best we can expect is the production of a minority of people who are able to acquire some of the techniques of science and a still smaller minority who are able to use and develop them.

7. The author implies that the 'professional schoolmaster' has
(a) no interest in teaching science
(b) thwarted attempts to enliven education
(c) aided true learning
(d) supported the humanists

8. The author's attitude to secondary and public school education in the sciences is
(a) neutral (b) supportive
(c) satirical (d) contemptuous

9. The author blames all of the following for the failure to impart scientific method through the education system except
(a) poor teaching and examination methods
(b) lack of direct experience
(c) the social and education systems
(d) lack of interest on the part of students

10. If the author were to study current education in science to see how things have changed since he wrote the piece, he would probably be most interested in the answer to which of the following questions?

(a) Do students know more about the world about them?
(b) Do students spend more time in laboratories?
(c) Can students apply their knowledge logically?
(d) Have textbooks improved?

11. Astrology is mentioned as an example of
(a) a science that needs to be better understood
(b) a belief which no educated people hold
(c) something unsupportable to those who have absorbed the methods of science
(d) the gravest danger to society or an acknowledged failure of science

12. All of the following can be inferred from the text except
(a) at the time of writing, not all children received a secondary school education
(b) science teaching has imparted some knowledge of facts to some children
(c) the author believes that many teachers are authoritarian
(d) it is relatively easy to learn scientific method

Passage 3

Picture caking is a technique both for annexing the objective world and for expressing the singular self. Photographs depict objective realities that already exist, though only the camera can disclose them. And they depict an individual photographer's temperament, discovering itself through the. camera's cropping of reality. That is, photography has two antithetical ideals: in the first, photography is about the world, and the photographer is a mere observer who counts for little; but in the second, photography is the instrument of intrepid, questing subjectivity and the photographer is all.

These conflicting ideals arise from a fundamental uneasiness on the part of both photographers and viewers of photographs toward the aggressive component in "taking" a picture. Accordingly, the ideal of a photographer as observer is attractive because it implicitly denies that picture-taking is an aggressive act. The issue, of course, is not so clear-cut. What photographers do can-not be characterized as simply predatory or as simply, and essentially, benevolent. As a consequence, one ideal of picture-taking or the other is always being rediscovered and championed.

An important result of the coexistence of these two ideals is a recurrent ambivalence toward photography's means. Whatever the claims that photography might make to be a form of personal expression on a par with painting, its originality is inextricably linked to the powers of a machine. The steady growth of these powers has made possible the extraordinary informativeness and imaginative formal beauty of many photographs, like Harold Edgerton's high-speed photographs of a bullet hitting its target or of the swirls and eddies of a tennis stroke. But as cameras become more sophisticated, more automated, some photographers are tempted to disarm themselves or to suggest that they are not really armed, preferring to submit themselves to the limits imposed by pre-modern camera technology because a cruder, less high-powered machine is thought to give more interesting or emotive results, to leave more room for creative accident. For example, it has been virtually a point of honour for many photographers, including Walker Evans and Cartier-Bresson, to refuse to use modern equipment. These photographers have come to doubt the value of the camera as an instrument of "fast seeing." Cartier-Bresson, in fact, claims that the modern camera may see too fast.

This ambivalence toward the photographic means deter- mines trends in taste. The cult of the future (of faster and faster seeing) alternates over time with the wish to return to a purer past - when images had a handmade quality. This nostalgia for some pristine state of the photographic enterprise is currently widespread and underlies the present-day enthusiasm for daguerreotypes and the work of forgotten nineteenth-century provincial photographers. Photographers and viewers of photographs, it seems, need periodically, to resist their own knowingness.

13. According to the passage, the two antithetical ideals of photography differ primarily in the
(a) emphasis that each places on the emotional impact of the finished product
(b) degree of technical knowledge that each requires of the photographer
(c) extent of the power that each requires of the photographer's equipment
(d) way in which each defines the role of the photographer

14. According to the passage, interest among photographers in each of photography's two ideals can best be described as
(a) rapidly changing
(b) cyclically recurring
(c) steadily growing
(d) unimportant to the viewers of photographs

Passage 4

By the time a child is six or seven she has all the essential avoidances well enough by heart to be trusted with the care of a younger child. And she also develops a number of simple techniques. She learns to weave firm square balls from palm leaves, to make pinwheels of palm leaves or frangipani blossoms, to climb a coconut tree by walking up the trunk on flexible little feet, to break open a coconut with one firm well-directed blow of a knife as long as she is tall, to play a number of group games and sing the songs which go with them, to tidy the house by picking up the litter on the stony floor, to bring water from the sea, to spread out the copra to dry and to help gather it in when rain threatens, to go to a neighbouring house and bring back a lighted faggot for the chief's pipe or the cook-house fire. But in the case of the little girls all these tasks are merely supplementary to the main business of baby-tending. Very small boys also have some care of the younger children, but at eight or nine years of age they are usually relieved of it. Whatever rough edges have not been smoothed off by this responsibility for younger children are worn off by their contact with older boys. For little boys are admitted to interesting and important activities only so long as their behaviour is circumspect and helpful. Where small girls are brusquely pushed aside, small boys will be patiently tolerated and they become adept at making themselves useful. The four or five little boys who all wish to assist at the important, business of helping a grown youth lasso reef eels, organize themselves into a highly efficient working team; one boy holds the bait, another holds an extra lasso, others poke eagerly about in holes in the reef looking for prey, while still another tucks the captured eels into his lava. The small girls, burdened with heavy babies or the care of little staggerers who are too small to adventure on the reef, discouraged by the hostility of the small boys and the scorn of the older ones, have little opportunity for learning the more adventurous forms of work and play.

So, while the little boys first undergo the chastening effects of baby-tending and then have many opportunities to learn effective cooperation under the supervision of older boys, the girls' education is less comprehensive. They have a high standard of individual responsibility, but the community provides them with no lessons in cooperation with one another. This is particularly apparent in the activities of young people: the boys organize quickly; the girls waste hours in bickering, innocent of any technique for quick and efficient cooperation.

15. The primary purpose of the passage with reference to the society under discussion is to
(a) explain some differences in the upbringing of girls and boys
(b) criticize the deficiencies in the education of girls
(c) give a comprehensive account of a day in the life of an average young girl
(d) delineate the role of young girls

16. The list of techniques in paragraph one could best be described as
(a) household duties
(b) rudimentary physical skills
(c) important responsibilities
(d) useful social skills

17. It can be inferred that the 'high standard of individual responsibility' (second last sentence) is
(a) developed mainly through child-care duties
(b) only present in girls
(c) taught to the girl before she is entrusted with babies
(d) actually counterproductive

18. It can be inferred that in the community under discussion all of the following are important except
(a) domestic handicrafts
(b) well-defined social structure
(c) fishing skills and division of labour
(d) formal education

19. Which of the following if true would weaken the author's contention about 'lessons in cooperation' (second last sentence)?
I. Group games played by younger girls involve cooperation.
II. Girls can learn from watching boys cooperating.
III. Individual girls cooperate with their mothers in looking after babies.
(a) I only (b) II only
(c) III only (d) I and II only

20. Which of the following is the best description of the author's technique in handling her material?
(a) Both description and interpretation of observations
(b) Presentation of facts without comment
(c) Description of evidence to support a theory
(d) Generalization from a particular viewpoint

Passage 5

The name of Florence Nightingale lives in the memory of the world by virtue of the heroic adventure of the Crimea. Had she died - as she nearly did - upon her return to England, her reputation would hardly have been different; her legend would have come down to us almost as we know it today - that gentle vision of female virtue which first took shape before the adoring eyes of the sick soldiers at Scutari.

Yet, as a matter of fact, she lived for more than half a century after the Crimean War; and during the greater part of that long period all the energy and all the devotion of her extraordinary nature were working at their highest pitch. What she accomplished in those years of unknown labour could, indeed, hardly have been more glorious than her Crimean triumphs; but it was certainly more important. The true history was far stranger even than the myth. In Miss Nightingale's own eyes the adventure of the Crimea was a mere incident - scarcely more than a useful stepping-stone in her career. It was the fulcrum with which she hoped to move the world; but it was only the fulcrum. For more than a generation she was to sit in secret, working her lever: and her real life began at the very moment when, in popular imagination, it had ended.

She arrived in England in a shattered state of health. The hardships and the ceaseless efforts of the last two years had undermined her nervous system; her heart was affected; she suffered constantly from fainting-fits and terrible attacks of utter physical prostration. The doctors declared that one thing alone would save her - a complete and prolonged rest.

But that was also the one thing with which she would have nothing to do. She had never been in the habit of resting; why should she begin now? Now, when her opportunity had come at last; now, when the iron was hot, and it was time to strike? No; she had work to do; and, come what might, she would do it. The doctors protested in vain; in vain her family lamented and entreated, in vain her friends pointed out to her the madness of such a course. Madness? Mad - possessed - perhaps she was. A frenzy had seized upon her. As she lay upon her sofa, gasping, she devoured blue-books, dictated letters, and, in the intervals of her palpitations, cracked jokes. For months at a stretch she never left her bed. But she would not rest. At this rate, the doctors assured her, even if she did not die, she would become an invalid for life. She could not help that; there was work to be done; and, as for rest, very likely she might rest ... when she had done it.

Wherever she went, to London or in the country, in the hills of Derbyshire, or among the rhododendrons at Embley, she was haunted by a ghost. It was the specter of Scutari - the hideous vision of the organization of a military hospital. She would lay that phantom, or she would perish. The whole system of the Army Medical Department, the education of the Medical Officer, the regulations of hospital procedure ... rest? How could she rest while these things were as they were, while, if the like necessity were to arise again, the like results would follow? And, even in peace and at home, what was the sanitary condition of the Army? The mortality in the barracks, was, she found, nearly double the mortality in civil life. 'You might as well take 1, 100 men every year out upon Salisbury Plain and shoot them,' she said. After inspecting the hospitals at Chatham, she smiled grimly. 'Yes, this is one more symptom of the system which, in the Crimea, put to death 16,000 men.' Scutari had given her knowledge; and it had given her power too: her enormous reputation was at her back - an incalculable force. Other work, other duties, might lie before her; but the most urgent, the most obvious, of all was to look to the health of the Army.

21. According to the author, the work done during the last fifty years of Florence Nightingale's life was, when compared with her work in the Crimea, all of the following except
(a) less dramatic
(b) less demanding
(c) less well-known to the public
(d) more important and rewarding to Miss Nightingale herself

22. Paragraph two paints a picture of a woman who is
(a) an incapacitated invalid
(b) mentally shattered
(c) stubborn and querulous
(d) physically weak but mentally indomitable

23. The primary purpose of paragraph 3 is to
(a) account for conditions in the army
(b) show the need for hospital reform
(c) explain Miss Nightingale's main concerns
(d) argue that peacetime conditions were worse than wartime conditions
(e) delineate Miss Nightingale's plan for reform

24. The series of questions in paragraphs 2 and 3 are
(a) the author's attempt to show the thoughts running through Miss Nightingale's mind

(b) Miss Nightingale questioning her own conscience
(c) Miss Nightingale's response to an actual questioner
(d) Responses to the doctors who advised rest
(e) The author's device to highlight the reactions to Miss Nightingale's plans

25. The author's attitude to his material is
(a) disinterested reporting of biographical details
(b) over-inflation of a reputation and debunking a myth
(c) uncritical presentation of facts
(d) interpretation as well as narration

26. In her statement (last paragraph) Miss Nightingale intended to
(a) criticize the conditions in hospitals
(b) highlight the unhealthy conditions under which ordinary soldiers were living
(c) prove that conditions in the barracks were as bad as those in a military hospital
(d) ridicule the dangers of army life and quote important statistics

ANSWERS

1. (a)	**2.** (d)	**3.** (d)	**4.** (b)	**5.** (b)
6. (a)	**7.** (b)	**8.** (d)	**9.** (d)	**10.** (c)
11. (c)	**12.** (d)	**13.** (d)	**14.** (b)	**15.** (a)
16. (d)	**17.** (a)	**18.** (d)	**19.** (d)	**20.** (a)
21. (b)	**22.** (d)	**23.** (c)	**24.** (a)	**25.** (d)
26. (b)				

CHAPTER 1

Narration (Direct and Indirect)

In our speech, we often speak to the other person of some thing that was said to us by somebody. In other words, we often report a speech whether ours or someone else's. We do this in two ways. We either report the speech exactly as we had heard or said it without making any change. This is called Direct Speech.

Example: The girl said to her mother, "My plate is empty."

Or we may change the sentence that we had heard or said without changing its meaning and then report it. This is called Indirect Speech.

Example: The girl said to her mother that her plate was empty.

In the first example, the first part of the sentence which is before the comma, is referred to as reporting verb and the part which is within inverted commas is called the reported speech.

Note: While transforming from direct into indirect, we have made several changes in the sentence above :

1. We have removed the comma in the indirect sentence and put that in its place.
2. We have removed the inverted commas of the reported speech.
3. We have changed the my of the reported speech into her.
4. We have not used any capital letter in between the sentence unlike in the direct form where the reported speech always begins with a capital letter.

Now, in order to bring about these changes while converting from direct into indirect or vice-versa, there are several important but simple rules that need to be observed. They are :

1. Changes in Tense and Verb: While changing from direct to indirect we have to make different changes regarding tenses, verbs or helping verb. A short list is given below to have a look on those changes:

Change of Tenses

Direct	**Indirect**
Present Indefinite	Past Indefinite
Present Continuous	Past Continuous
Present Perfect	Past Perfect
Present Perfect Continuous	Past Perfect Continuous
Past Indefinite	Past Perfect
Past Continuous	Past Perfect Continuous
Past Perfect	No change
Past Perfect Continuous	No change

EXERCISE

Directions: Pick out the correct alternative that complete sentence which is changed into indirect narration.

1. The speaker said, "Ladies and Gentlemen, it is my proud privilege to talk to you this afternoon."
(a) The speaker told the Ladies and Gentlemen that it is my proud privilege to speak to them that afternoon.
(b) Addressing the audience the speaker said that it was his proud privilege to talk to them that afternoon.
(c) The speaker spoke to the Ladies and Gentlemen that it was his proud privilege tot talk to them that afternoon.
(d) The speaker addressed the audience that it is my proud privilege talking to them that afternoon.

2. Ram said, "Had I not warned you long ago that the work is difficult?"
(a) Ram told that he had not warned him long ago that the work was difficult.
(b) Ram said that he warned him long ago that the work was difficult.
(c) Ram reminded him that he had warned him long ago that the work was difficult.
(d) Ram told him long ago that the work was difficult.

3. The teacher said to the student, "How can you prove that the earth is round?"
(a) The teacher asked the student how he could prove that the earth is round.
(b) The teacher asked the student how could he prove that the earth is round.
(c) The teacher asked the student how he could prove that the earth was round.
(d) The teacher asked the student whether he could prove that the earth is round.

4. Mahesh said to Ram, "I have lost your purse on account of my carelessness."
(a) Mahesh told Ram that I have lost his purse on account of my carelessness.
(b) Mahesh told Ram that he has lost his purse on account of his carelessness.
(c) Mahesh told Ram that he lost his purse on account of his carelessness.
(d) Mahesh told Ram that he had lost his purse on account of his carelessness.

5. My father said, "Hard and sincere labour never fails."
(a) My father warned me that hard and sincere labour never fail.
(b) My father advised me that hard and sincere labour would never fail.
(c) My father assured me that hard and sincere labour never fails.
(d) My father coutioned me that hard and sincere labour never failed.

ANSWERS

1. (d)	**2.** (b)	**3.** (c)	**4.** (b)	**5.** (c)

CHAPTER 2

Sentence

Language is the major means by which we communicate and interact with others. When we speak or write, we use words. These words are generally used in groups e.g.: A bad workman quarrels with his tools.

A group of words arrange din a manner which makes a complete sense is called a Sentence. Based on meaning and sense, the sentence can be classified as :

1. Declarative or assertive
2. Imperative
3. Interrogative
4. Exclamatory

Parts of Speech

Words are classified into different kinds or groups called Parts of Speech according to their use and function in a sentence. They are eight in number-Noun, Pronoun, Adjective, Verb, Adverb, Preposition, Conjunction and Interjection.

Noun

The Noun is a word used as the name of a person, place or thing. The word thing includes (i) all objects that we can see, touch, hear, smell or taste, and (ii) something we can think of but cannot perceive through our senses. There are five different kinds of noun.

They are :

1. Proper Noun
2. Common Noun
3. Collective Noun
4. Material Noun
5. Abstract Noun.

Kinds of Noun

The following chart will make you familiar with the different kinds of noun :

Noun	Nature of Noun	Examples
Proper Noun	It denotes a particular person, place or thing.	Chander, Kolkata, India, the Ganges, the Gita, etc.
Common Noun	It is the name given to any and every person or thing of the same class or kind.	Table, glass, town, king, book, river, country, etc.
Collective Noun	It denotes a group or collection of similar individuals or things considered as one complete whole.	Army, class, host, jury, mob, crowd, team, parliament, committee, family, fleet etc.
Material Noun	It denotes the matter or substance of	Wood, clay, rubber, iron, silver, gold, cloth, etc.
Abstract Noun	It expresses quality, state or action.	Truth, love, soul, mind, greatness, life, poverty, manhood, pleasure, pain, honesty, etc.

CHAPTER 3

Common Error

1. Articles

1. **Articles:** There are three articles in English—**a, an** and **the. A** and **an** are called *indefinite* article.**The** is the *definite* article. *An article is placed before a noun. If there is an adjective before a noun, the article is placed before the adjective:*

   a train, **a** fast train, **an** incident, **an** unusual incident

   Note: *We can never use a singular count noun alone, that is, without* **a/an/the/my/some/any** etc.

2. **A/an:** Singular count nouns take the indefinite article **a/an** with them:

   a ball **an** egg **a** dog **an** elephant

   Uncount nouns do not generally take an article with them. we do not generally say

   a milk **a** beauty **a** wisdom

   for milk, beauty, wisdom cannot be counted.

3. We use **a** with singular count nouns *beginning with a consonant sound:*

   a girl **a** map **a**university **a** union
   a one-sided affair **a** one-rupee note

   Note: That the words *university, union,* and *one* begin with a vowel <u>but no a vowel sound</u>. *University* and *union* begin with the *yoo* sound while *one* begins with the *w* sound.

   Well-known words which begin with a vowel but take **a** with them are:

European	uniform	union	unit
universal	usual	useful	eau-de-cologne

4. **An: An** is used before words *beginning with a vowel sound:*

   an umbrella **an** opportunity **an** honest boy **an** honourable person

   The letter *h* in *honest* and *honourable* is not sounded. Common words in English which begin with an unsounded *h* are:

heir	heiress	honest	honorary
honourable	hour hourly		

5. In abbreviations, if consonants begin with a vowel sound, they take **an** before them:

   an M.P. **an** S.P.

   But if consonants begin with a consonant sound, they take **a** before them:

   a Ph.D. **a** B.Ed.

EXERCISE

Directions: In each of these questions, a sentence has been divided into four parts and marked (a), (b), (c) and (d). One of these parts contains a mistake in grammar, idiom or syntax. Identify that part and mark it as the answer.

1. (a) Let you and me bear in mind
(b) that our friendship is based
(c) not on immediate gains for either of us
(d) but on the basis of a long-term benefit.

2. (a) John is one of the students
(b) in the class who has not been absent
(c) for a single day
(d) during the entire year.

3. (a) Sita claimed that she had
(b) not only gone to Delhi
(c) but also to Agra
(d) and had seen the Taj Mahal.

4. (a) The advertisement for the new detergent
(b) claimed that it was as effective
(c) if not more effective than
(d) washing soap in removing dirt from clothes.

5. (a) If you would have come earlier
(b) there would have been enough time
(c) for us to go to the movie
(d) which has been running to full-houses.

ANSWERS

1. (d)	**2.** (b)	**3.** (b)	**4.** (b)	**5.** (a)

CHAPTER 4

One-Word Substitution

A person who is out to destroy all government and order	Anarchist
Government by the people	Democracy
The whole mass of air surrounding the earth	Atmosphere
One who is not sure of the existence of God	Agnostic
A medicine which prevents infection by killing germs	Antiseptic
One who does something not professionally but for pleasure	Amateur
A statement open to more than one interpretation	Ambiguous
One who makes an official examination of accounts	Auditor
Marrying more than one wife or more than one husband at a time	Polygamy
The science that studies plants	Botany
The science which studies natural processes of living things	Biology
People working together in the same office or department	Colleagues
The state of remaining unmarried	Celibacy
The action of bringing into completion	Consummation
To give one's authority to another	Delegate
Study of the relation of living things to environment	Ecology
The action of looking within or into one's own mind	Introspection
One incapable of being tired	Indefatigable
A letter, poem, etc. whose auther is unknown	Anonymous
Work for which no salary is paid	Honorary
One who looks at the bright side of things	Optimist
One who cannot read or write	Illiterate
A game or battle in which neither party wins	Draw
Holding established opinions	Orthodox
Hater of women	Misogynist
The study of the origin and physical and cultural development of manking	Anthropology
The science which studies the crust of the earth	Geology
The science which studies animals	Zoology

Happening at one and the same time	Simultaneous
Murder or murderer of oneself	Suicide
Lasting only for a very short while	Temporary
Capable of being seen through	Transparent
The first speech delivered by a person	Maiden
The art practised by statesmen and ambassadors	Diplomacy
One who walks on foot	Pedestrian
One who lives on others	Parasite
One who speaks for others	Spokesperson
One who spends very little	Miser
One who prossesses several talents or gifts	Versatile
One who eats vegatables only	Vegetarian
A thing that is fit to be eaten	Edible
A statement absolutely clear	Explicit
A widespread disease affecting many people at the same time	Epidemic
A trade that is prohibited by law	Gala day
A desire that cannot be represed	Illicit
A method that cannot be imitated	Irrespressible
Remarks which do not really apply to the subject under discussion	Inimitable
A story that can hardly be believed	Incredible
A comparison that is out of place	Inapt
That which cannot be satisfied	Insatiable
A remedy which never fails	Infallible
A thing that cannot be seen with human eyes	Invisible
One who is very easily made angry	Irritable
An ordinary and common place remark	Platitude
A sum paid to a man for a piece of work	Remuneration
The act of violating the sanctity or destroying the property of a sacred place	Sacrilege
To make up one's mind and change it quickly	Vacillate
A person with a long experience of any occupation	Veteran
A place where clothes are kept	Wardrobe
A state of complete continence on the part of a woman	Virginity
A man who has too much enthusiasm for his own religion and hates other religions	Fanatic
One who makes calculations connected with insurance	Actuary
A country, etc. which is very distant	Remote
To send out of one's native country	Exile
A person chosen by parties who have a controversy to settle their differences	Mediator
Notice of death, especially in a newspaper	Obituary
Opinion contrary to accepted doctrines	Heresy
Great clapping and cheering	Applause
Exclusive possession of the trade in some commodity	Monopoly
Sole right to make and sell some invention	Patent

EXERCISE

Directions: In each of these questions, out of the four lternatives, choose the one which can be substituted for the given sentence, group of words or clauses.

1. A person who travels to a sacred place as an act of religious devotion
(a) Hermit (b) Pilgrim
(c) Saint (d) Merchant

2. Food which agrees with one's taste
(a) Pungent (b) Palatable
(c) Sensuous (d) Edible

3. One who loves books
(a) Bibliophobe (b) Bibliographer
(c) Bibliophile (d) Bibliophagist

4. To mediate between two parties in a dispute
(a) Interfere (b) Interact
(c) Interrupt (d) Intercede

5. The branch of medical science which deals with the problems of the old
(a) Oncology (b) Geriatrics
(c) Obstetrics (d) Endocrinology

ANSWER

1. (b) **2.** (b) **3.** (c) **4.** (d) **5.** (b)

CHAPTER 5

Synonyms and Antonyms

Synonyms

A

Abandon : Leave, forsake.
Abridge : Shorten, curtail.
Abundant : Plentiful.
Accumulate : Collect, store.
Adequate : Sufficient.
Adversity : Misfortune.
Aggravate : Heighten, intensify.
Attack : Assault.
Authentic : True.
Awkward : Clumsy.

B

Behaviour : Demeanour.
Bias : Predilection.
Brutal : Savage, cruel.
Brisk : Bright, lively.

C

Callous : Hard, cruel.
Calm : Quiet, tranquil.
Casual : Uncertain.
Category : Class.
Cold : Frigid, indifferent, passionless.
Compassion : Pity, sympathy.
Concise : Short, brief.
Condense : Compress, thicken.
Conversant : Familiar.
Crafty : Cunning, sly.
Cruel : Fierce, tyrannical.

D

Damage : Loss, harm, injury.
Decorate : Adron, embellish.
Deformity : Malformation, disfigurement.
Denounce : Accuse, condemn.
Diligent : Industrious, persevering.
Divine : Godlike, heavenly.

E

Earnest : Serious, solemn.
Emergency : Exigency.
Exceptional : Unusual, rare.
Extravagant : Wasteful, prodigal, spendthrift.

F

False : Untrue, spurious.
Fascinate : Charm, enchant.
Ferocious : Fierce, savage.
Fraud : Deceit, trickery.

G

Geniune : Real.
Gigantic : Colossal, great.
Guilt : Sin, crime.

H

Haughty : Arrogant, proud.
Hazardous : Dangerous, risky, perilous.
Humility : Modesty, politeness.

I

Illiterate : Unlearned, ignorant.

Imperious : Authoritative, dictatorial.
Impertinent : Impudent, insolent, shameless.
Inanimate : Lifeless.
Inexorable : Relentless, merciless.
Irresolute : Undecided, wavering, vacillating.

J

Jolly : Jovial, merry.
Judicious : Discreet, prudent.

K

Knavery : Fraud.

L

Laborious : Assiduous, industrious.
Lament : Grieve, mourn.
Lethargy : Sluggishness.
Liberty : Freedom, independence.
Loathe : Detest, abhor.
Lucky : Fortunate.

M

Magnificent : Splendid, grand.
Marvellous : Wonderful.
Meagre : Small.
Mean : Low, abject.
Mighty : Strong, powerful.
Misery : Sorrow, distress.

N

Nice : Pleasant, agreeable.
Notable : Remarkable, memorable.
Notorious : Infamous.

O

Obliterate : Destory, efface.
Obsolete : Antiquated.
Opportune : Timely.

P

Pensive : Thoughtful.
Perennial : Permanent, perpetual.
Persuade : Induce, urge.
Plentiful : Abundant.
Precarious : Risky, dangerous.
Pretence : Pretext, excuse.

Q

Quaint : Queer, odd, singular.
Queer : Strange, odd.
Questionable : Doubtful.

R

Radiant : Bright, brilliant.
Refined : Elegant.
Rejoice : Delight.
Relevant : Pertinent.
Renown : Fame, reputation.
Repudiate : Reject.
Resistance : Opposition.
Rigid : Stiff, unyielding.
Ruinous : Destructive, injurious.

S

Sacred : Holy, consecrated, pious.
Satiate : Satisfy.
Scanty : Slender, meagre.
Sensual : Fleshly, carnal.
Shapely : Graceful, elegant.
Solitary : Single, lonely.
Sombre : Gloomy, dark.
Specimen : Sample, model.
Splendid : Magnificent, grand.
Spurious : False, imaginary.
Stiff : Rigid, stern.
Superficial : Shallow.
Surplus : Excess.

T

Talkative : Garrulous.
Temperate : Moderate.
Thankful : Grateful, obliged.
Thin : Slim, slender.
Thrive : Prosper, flourish.
Tough : Hard, strong, difficult.
Tragic : Sorrowful, distressing.

U

Ugly : Repulsive.
Urbane : Polite, courteous, suave.
Urge : Press, incite.
Useful : Advantageous.

V

Vacillatge : Waver
Venerable : Respectable.
Vigilance : Watchfulness.
Voracious : Greedy.
Vulgar : Coarse, crude.

W

Wealthy : Rich.
Wickedness : Evil.
Wild : Savage.
Wretched : Miserable, unfortunate.
Wreck : Ruin, destory.

Y

Yield : Surrender
Yielding : Submissive.

Z

Zeal : Passion.
Zenith : Top, summit.
Zest : Enthusiasm.

Antonyms

A

Ability : Disability.
Accept : Reject, refuse.
Acquit : Convict.
Affinity : Aversion.
Ancient : Modern.
Artificial : Natural.
Attract : Repel.
Awkward : Graceful.

B

Barbarous : Civilized.
Barren : Fertile.
Base : Noble.
Benevolent : Malevolent.
Bold : Timid, cowardly.
Brutal : Humane, kindly.

C

Callous : Soft, tender.
Care : Neglect.
Censure : Praise, applaud.
Chaste : Impure, unchaste.
Cheap : Dear.
Cheerful : Gloomy, depressed.
Competent : Incompetent.
Conceal : Reveal.
Condense : Lengthen, expand.
Confess : Deny.
Create : Destory.
Credit : Discredit, debit.

D

Danger : Safety.
Deep : Shallow.
Delight : Despleasure, sorrow.
Dense : Sparse.
Despair : Hope.
Diffident : Confident.
Distant : Near.

E

Early : Late.
Elevation : Depression.
Emancipate : Enslave.
Energetic : Weak.
Enthusiasm : Indifference.
Equality : Inequality.
Explicit : Implicit.
Exterior : Interior.
Extrinsic : Intrinsic.

F

Fabulous : Actual, real.
Failure : Success.
Fickle : Constant.
Fine : Coarse.
Folly : Wisdom.
Foreign : Native.
Fautility : Utility.

G

Gain : Loss.
Genuine : False.
Gloomy : Gay.
Guilty : Innocent.

H

Happiness : Sorrow, sadness.
Help : Hinder.
Honour : Dishonour, shame.
Humane : Cruel.
Hypocrisy : Sincerity.

I

Imperative : Optional.
Increase : Decrease.
Inhale : Exhale.
Interested : Disinterested.
Interesting : Uniteresting.

J

Joyful : Sad, depressed.
Junior : Senior.
Justice : Injustice.

K

Kind : Cruel.
Knowledge : Ignorance.

L

Lack : Plenty.
Legal : Illegal.
Legible : Illegible.
Liberty : Slavery.
Light : Heavy.
Loose : Tight.
Love : Hate.

M

Mad : Sane.
Malice : Goodwill.
Master : Servant.
Meagre : Plentiful.
Merit : Demerit.
Mild : Harsh, stern.
Morbid : Healthy.
Motion : Rest.

N

Natural : Artificial.
Noble : Base, Ignoble.
Normal : Abnormal.
Notorious : Reputable.

O

Obstinate : Yielding.
Offensive : Pleasing, defensive.
Optional : Compulsory.
Oral : Written.
Outward : Inward.

P

Part (n) : Yielding.
Part (v) : Join.
Particular : General.
Peace : War.
Persuade : Dissuade.
Pleasure : Pain.
Polite : Impolite, rude.
Praise : Condemn, defame.
Precious : Cheap, worthless.
Pride : Humility.
Prudent : Imprudent.
Punishment : Reward.

Q

Quick : Slow, tardy.

R

Raise : Lower.
Rash : Steady, cautious.
Rear : Front.
Receive : Give.
Reject : Accept, admit.
Religious : Secular, irreligious.
Remember : Forget.
Rich : Poor, needy.
Rise : Fall.

S

Sacred : Unholy, profane.
Satisfaction : Dissatisfaction.
Scanty : Plentiful.
Sensitive : Insensitive.
Service : Disservice.
Sharp : Blunt.
Silence : Noise.
Sober : Excited, drunk.
Sophisticated : Naive.
Special : Ordinary.
Stale : Fresh.
Straight : Crooked.
Superior : Inferior.
Surplus : Deficit.
Swift : Slow.

T

Tedious : Lively.
Temperate : Intemperate.
Thankful : Thankless.
Thrifty : Extravagant.
Timid : Bold.
Tranquil : Agitated.
True : False.

U

Ugly : Beautiful.
Union : Disunion, discord, split.
Urban : Rural.

Usual : Unusual.

V

Vain : Modest.
Violent : Gentle.
Virtue : Vice.
Vulgar : Refined.

W

Youth : Age.

Wane : Wax
Want : Abundance.
War : Peace.
Wild : Civilised.

Y

Yield : Resist.

Z

Zeal : Indifference.
Zenith : Nadir.

EXERCISE

Directions: In this section each item consists of a word or a phrase which is bold in the sentence given. It is followed by four words or phares. Selecte the word or phrase which is closest to the opposite in meaning of the bold word or phrase.

1. The world media has tended to focus far more upon occasional **discord** than on our spectacular achievements.
(a) Tranquillity (b) Harmony
(c) Failure (d) Confusion

2. The evidence Indira gave in support of her theory was quite **copious.**
(a) Unsatisfactory (b) Unconvincing
(c) Poor (d) Scanty

3. **Self-reproach** is not always very good thing.
(a) Self-esteem (b) Self-assurance
(c) Self-justification
(d) Self-satisfaction

4. The dictator **quelled** the uprising.
(a) Fostered (b) Defended
(c) Supported (d) Fomented

5. The drug gave him **instant** relief from pain.
(a) Final (b) Complete
(c) Genuine (d) Delayed

ANSWERS

1. (b) **2.** (d) **3.** (a) **4.** (d) **5.** (d)

CHAPTER 6

Idioms and Phrases

Back out — to withdraw from a promise, contract : I felt grieved when he backed out of his promise to help me.

Back up — to support; to sustain : He backed up his report with relevant statistics.

Bear upon — to be relevant to : This argument does not bear upon the subject under discussion.

Blow up — to explode : The mine blew up and all the labourers working inside were killed.

— to reprimand or scold : If you continue to be negligent, the teacher will blow you up.

Break down — of a car; a piece of machinery; to go wrong so that it will not function : The car broke down on our way to Mumbai.

— to collapse; to succumb to uncontrollable weeping : She broke down completely on hearing the news of her husband's death.

— to succumb to a nervous collapse through overwork or worry : He worked so hard that his health broke down near the examination.

Break off — to end; to discontinue; to desist : We had to break off our conversation when he arrived. She broke off in the middle of the story. She did not like his nature and broke off the engagement.

Break up — to disperse; to dissolve : The college will break up for the Puja holidays on **25**th October. The meeting will break up after the President has addressed the audience.

Bring up — to rear : Those brought up in adversity are able to cope with life better.

Call forth — to provoke : The minister's views on the disinvestgment policy of the government called forth a good deal of bitter criticism.

Call out — to shout : I called out to him but he disappeared in the dark.

— to announce by calling or shouting : The Manager called out to the peon that he was being immediately fired.

Call upon — to order; to require : I was unfortunately called upon to give evidence against him.

Carry on — to continue : If you carry on working hard, your business will soon flourish.

— to manage : He carried on his business so well that he soon amassed a huge fortune.

Cast away — to throw aside : You must cast away all your apprehensions and accept the offer.

Catch up with — to overtake; to draw level : Last week I had to stay late at the office to catch up with some pending files.

Come off — to take place : The prize distribution came off on Tuesday last.

— to turn out successful : His speeches at the conference always came off beautifully.

Cry down — to deprecate; to make little of : You must not unneccessarily cry down the conduct of others.

Cry out against — to complain loudly against : The opposition parties cried out against the fast pace of the globalisation of the Indian economy.

Cut out — designed for : Your were cut out to be a lecturer in a college.

Drop in — to visit casually : On my way to the college, I dropped in at Mira's place.

Drop out — As the race progressed, many children dropped out.

Fall back — to recede; to retreat : On seeing the armed guards, the civilians fell back.

Fall down — from a higher position to a lower one : The branch gave way and he fell down into the canal.

Fall off — to withdraw; to drop off : Some of our subscribers have fallen off. Friends fall off in adversity.

Fall under — to come under : This colony does not fall under my jurisdiction.

Get along — to prosper; to progress; to proceed : Well, doctor, how is your patient getting along? It is simply impossible to get along with him.

Get on with — to live pleasantly together; to progress : How are you getting on with your studies?

Get into — to be involved in : It is easy to get into scandals but hard to come out unscathed.

Give in — to surrender; to yield : I gave into her repeated requests and accepted the offer.

Give over — not to do any longer : It is time you gave over pretending that you have access to the Prime Minister.

Go after — to follow; to pursue : The policeman went after the thief but the latter managed to escape in the dark of the night.

Go down — to be accepted : The terrorist attack on WTC will go down in history as one of the worst acts of terrorism.

Go without — to remain without : he is so poor that sometimes he has to go without food.

Go by — to follow : I am sorry to disappoint you but we have to go by the rules.

— to elapse (used of time) : Months have gone by but I have not called upon him.

Hang about — to loiter near a place : Last evening I say your friend hanging about your house.

Hang upon — to depend upon : The success of any venture hangs upon the seriousness with which it is undertaken.

Hold out — to endure; to refuse to yield : How long can you hold out against starvation?

— to continue : Sugar stocks are not likely to hold out very long.

— to offer : She held out her hand to the Prince.

Hold to — abide by : Whatever resistance there might be, I will hold to my decision.

Keep off — to ward off : His stern looks keep off the flatterers.

— to maintain : They have been trying to keep up their standard of living though there has been a considerable decline in their income.

Keep up with — to keep pace with : You read too fast; I cannot keep up with you.

Knock out — to win by hitting the opponent insensible in a boxing bout : The challenger was knocked out in two minutes.

Lay By — to put away for future use : She has laid by five thousand rupees to celebrate her marriage anniversary.

Lay in — to store for future use : Anticipating scarcity of foodgrains, they laid in a good store of provisions.

Let down — to fail a friend : Won't I feel grieved if my own friends let me down?

Let into — to suffer to enter; to admit : Despite his pleadings, they did not let him into the meeting. I shall let no one into my secrets.

Let out — to lease on hire : In my immediate neighbourhood, there is a decent house to let out.

— to loosen : Let us let out the dog for a while.

Look about — to study one's surroundings : The thief looked about himself before entering the house.

Look for — to search for : The old woman was looking for her spectacles.

Look up — to search for and find : Please look up this word in the dictionary.

— to have an upward tendency (said of prices): The price of sugar is loking up these days.

Make off with — to run away with : The servant made off with the master's watch.

Makeover — to transfer : He has made over the building to his son.

Make up — to supply what is deficient : You must work hard during the Dussehra holidays and try to make up your deficiency in English.

— to invent or fabricate : She made up a story to get rid of the visitor.

— to reconcile : They have made up their quarrel and are now getting on quite well.

Pass away — to die : His sister passed away in the early hours of the morning.

Pass by — to disregard; to omit : He did not invite me to his birthday. It appears that he passed me by.

— to go alongside of : You passed by my house the day before yesterday.

Pick out — to select or choose : The teacher picked out the best student from the class.

Pick up — to recover or regain health after an illness: He has become so weak that he will take two months to pick up.

Play upon — (a musical instrument) : She played upon the harmonium and sang a melodious song.

— to take advantage of : The blackmailer played upon her love for her husband.

Pull down — to demolish; to destory : The old house was pulled down to create space for multi-storey flats.

Pull up — to take to task : The teacher was always pulling him up for his bad handwriting.

Put off — to postpone : We had to put off the wedding till the war was over.

— to lay aside : He put off his shoes before entering the temple.

— to turn one aside from a purpose or demand: I approached him for some help but he put me off with mere words.

Put into — to drag into : Don't put me into the argument.

Put out — to extinguish : It is time to put out the light and go to sleep.

— to perturb, to annoy : I was put out on hearing that I had incurred heavy losses in the recent business transactions.

Run away — to flee : The little girl took a necklace and ran away.

Run away with — to steal and depart with : The cashier ran away with twenty thousand rupees.

Run off — to break off from control : The dog broke the chain and ran off.

Run over — to drive over : The car ran over the pedestrian as he was crossing the road.

— to flow over : The tant is running over.

Run through — to squander or waste : It took him only a few months to run through all the money his father had left him.

— to read quickly : I will just run through this lesson and tell you what it is all about.

— to pierce : The needle ran through her finger when she was stitching her shirt.

See into — to attend to : You can set right the situation if you see to it at an early date.

Set in — to begin : As soon as rains set in, it beecomes pleasant.

Set up — to establish; to open a new business : He is soon going to set up as a financier.

Speak for — to recommend somebody or to urge somebody's claims : If you speak for me to the Manager, I am sure he will look at my case favourably.

Speak on — to deliver a lecture on : This evening I am going to speak on the changing concepts of morality in various ages.

Stand off — to keep at a distance : Would you please stand off? I brook no interference in my way of work.

Strike for — to stop work for some reason : The labourers have struck for higher wages.

Take after — to resemble : The younger sister takes after the elder one.

Take for — to form an impression about somebody's identity : I was taken for a South Indian.

Take in — to deceive : She thinks her oily tongue can take everybody in.

Take to — to become addicted to : He took to gambling and drinking at a very early age.

— to form a liking for : Of late she has taken to painting.

Tell against — to prove adverse to; to go against : I am sure these facts are going to tell against your case.

Throw about — to fling here and there : to leave in disorder : The child threw his books about and ran off to play.

Throw away — to lose through carelessness : You have thrown away a golden oportunity.

Turn against — to become hostile to : I shall not give up my principles even if the whole world turns against me.

Turn aside — to deviate; to digress : Never turn aside from the path of virtue.

EXERCISE

Directions: Select the meaning of the bold Idiom or phrase from the given alternatives.

1. The casting vote of the chairman **clinched the issue.**
   (a) decided (b) started
   (c) finished (d) closed
2. He will try to **feather his own nest.**
   (a) work wearily (b) live happily
   (c) build his own house
   (d) benefit himself
3. He cannot **make both ends meet.**
   (a) control affairs (b) earn enough
   (c) work hard
   (d) manage the business
4. He is in the habit of **chewing the cud.**
   (a) forgeting things
   (b) accusing others
   (c) to muse on
   (d) crying over split milk
5. The police officer made **bad blood** between the father and the son.
   (a) made them fight against each other
   (b) caused them to feel ill-will towards one another
   (c) made them go to hospital for they need blood
   (d) helped them understand each other

ANSWERS

1. (a)	**2.** (d)	**3.** (b)	**4.** (c)	**5.** (b)

CHAPTER 7

Sentence Correction

EXERCISE

Directions: Each of the following question is in the form of a sentence with four underlined portions marked a, b, c and d, respectively. Choose the marked portion that carries errors. If no error required then your answer is 5.

1. Political pundits (a) have been able to correctly (b) prophesy results of Election '**98**, but one (c) wonders whether the outcome will hold good for long (d).

2. The doctor advised (a) his young patient to take two (b) two capsful of the bitter medicine, but the (c) latter stuck to the single-cup ritual (d) with no adverse effect.

3. Radhika and Preeti were excited about the (a) school party, as they were alumni of (b) the school, and (c) looked forward to meeting (d) their old friends.

4. Practising progressive muscular (a) relaxation, like a (b) contracting and relaxing the (c) muscles of the different areas of the body (d) strengthen the neural connections too.

ANSWERS

1. (b) **2.** (b) **3.** (d) **4.** (d)

CHAPTER 7

Sentence Arrangement

EXERCISE

Direction: Sentences given in each question, when properly sequenced form a coherent paragraph. Each sentence is labelled with letter. Choose the most logical order of sentences from among the given choices to construct a coherent paragraph.

1. A. Richard Riordan, the current mayor, must step down after serving his limit of two terms.
B. Russell Crowe is not the only actor or person whose future will shortly be decided by voters in Los Angeles.
C. But the chances of an Oscar for the star of 'Gladiator' seem to have generated far more debate than the prospect of a new mayor.
D. He will leave a city more sure of itself when he took ofice eight years ago, but still dissatisfied with its schools, its police force and its traffic and largely uninterestd politics.
(a) ACBD (b) ADCB
(c) BACD (d) BCAD

2. A. The reason is Niagara – a blue fizzy Swedish tonic, for which the Wycoff's owner, Lari Williams is the sole American distributor.
B. Women from around the South have been descending on Arkansas's state capital and making their way to the Wycoff Coffee House.
C. After two weeks without shipment, 1000, bottles of the potion arrived in Little Rock on Monday morning.
D. Something strange has been happening in Little Rock.
(a) ACBD (b) DBAC
(c) DACB (d) ABDC

3. A. So far, however I am still an uneducated, unextended adult, and I have fallen into the habit of brosing through an imaginary, handsomely printed course bulletin that is more or less typical of them all.
B. The number of college bulletins and adult-education come-ones that keep turning up in my mailbox convinces me that I must be on a special mailing list for dropouts.
C. Not that I'm complaining; there is something about a list of extension courses that piques my interest with a fascination hitherto reserved for a catalogue of Hong Kong honey-moon accessories, set to me once by mistake.
D. Each time read through the latest bulletin of extension courses. I make immediate plans to drop everything and return to school (I was expelled from college many years ago, the victim of unproved accusations not unlike those once attached to Yellow kid weil).
(a) BADC (b) DBCA
(c) BCDA (d) BDCA

4. A. Finally, before the rays of his arch enemy, the sun, announces a new day, he hurries back to the safety of his hidden coffin and sleeps, as the cycle begins a new.
B. Somewhere in Transylvania, Dracula the monster lies sleeping in his coffin, waiting for night to fall.
C. Then the moment of darkness comes, and

through some miraculous instinct the fiend emerges from the safety of his hiding place and assuming hideous forms of the bat or the wolf, he prowls the countryside, drinking the blood of his victims.

D. As exposure to the sun's rays would surely cause him to perish, he stays protected in the satinlined chamber bearing his family name in silver.

(a) BDCA (b) BCDA
(c) CDBA (d) CBDA

5. A. Hitler said he was in a rush and asked Ribbentrop if he could be taken next, but Ribentrop insisted it would look bad for the Foreign Office if he were passed over.

B. Hitler thereupon made a quick phone call and Ribbentrop was immediately transferred to the Afrika Korps.

C. In the spring of 1940, a large Mercedes pulled up in front of my barbershop at 127 Koenigstrasse, Hitler walked in and said, "I just want a light trim – and don't take too much off the top."

D. I explained to him there would be a brief wait because von Ribbentrop was ahead of him.

(a) CADB (b) CDAB
(c) CBDA (d) CABD

ANSWERS

1. (a) **2.** (b) **3.** (c) **4.** (a) **5.** (b)

CHAPTER 9

Analogy

EXERCISE

Direction: Each of the questions consists of two capitalised words which have a certain relationship to each other. Followed by four pairs of words. Choose the pair that is related to each other in the same way as the capitalised pair.

1. NUTS : BOLTS
(a) nitty : gritty
(b) bare : feet
(c) naked : clothed
(d) hard : soft

2. BEE : HONEY
(a) wolf : cub
(b) spider : web
(c) goat : cheese
(d) ant : hill

3. TRANSISTOR : RADIO
(a) sound : stereo
(b) sand : grains
(c) awl : wrench
(d) cement : driveway

4. LACE : GOWN
(a) frosting : cake
(b) zipper : coat
(c) paint : enamel
(d) tie : shoe

5. CAPTAIN : TEAM
(a) guard : forward
(b) chef : menu
(c) manager : policy
(d) skipper : crew

ANSWERS

1. (a) **2.** (d) **3.** (d) **4.** (a) **5.** (d)

CHAPTER 10

Foreign Words and Phrases

1. *Ab initio* (Latin) — From the beginning.
2. *Aborigine* (Latin) — Native, any of the earliest known inhabitants of a certain region.
3. *Actionnaire* (French) — Shareholder.
4. *Actualite* (French) — Real existence; appropriateness.
5. *Ad hoc* (Latin) — For the special purpose.
6. *Ad interim* (Latin) — In the meantime; temporary.
7. *Ad libitum* (Latin) — As one pleases.
8. *Ad referendum* (Latin) — For further consideration.
9. *Ad valorem* (Latin) — According to value.
10. *A Dio* (Italian) — To God; — Addio! Adieu!
11. *Agamemnon* (Greek) — The leader of the Greeks in the Trojan war, king of Mycenae.
12. *Aide* (French) — An assistant, a helper, a mate.
13. *Air noble* (French) — An air of distinction.
14. *Ajax* (Latin, Greek) — The Greek hero next to Achilles in the Trojan war.
15. *Alectryon* (Greek) — A cock.
16. *Allah it Allah* (Arabian) — There is no God but the God — the Moslem war cry.
17. *Alopecia* (Latin, Greek) — Fox mange : a skin disease, which destroys the hair; baldness.
18. *Allure* (French) — Mien, gait, air.
19. *Alpeen* (Irish) — A cudgel.
20. *Alter ego* (Latin) — One's second self, a very close friend, a representative.
21. *Affair d'amour* (French) — A love affair.
22. *A'la mode* (French) — According to the custom; in fashion.
23. *Alma Mater* (Latin) — Benign mother; A term applied by students to the school, college or university where they have been educated.
24. *Anno Christi* (Latin) — In the year of Christ.
25. *Anno Dontini* (Latin) — In the year of Christ.
26. *Ante Meridiem* (Latin) — Before noon.

27. *Ars longa, vita brevis* (Latin) — Art is long, life is short.
28. *Au contraire* (Latin) — On the contrary.
29. *Au revoir* (French) — Adieu, until we meet again.
30. *Auto* (Spanish) — An act, a drama.
31. *Bacchus* (Latin, Greek) — The god of wine.
32. *Basta* (Italian) — Enough ! No more !
33. *Bastide* (French) — A French country house.
34. Beau garcon (French) — A handsome man.
35. *Beau jour* (French) — Fine day, good times.
36. *Beaux-arts* (French) — The fine arts.
37. *Beneficiare* (French) — The person receiving benctits.
38. Bene qui latiut bene vixit (Latin) — He has lived \ ell who has lived obscure.
39. *Billet-doux* (French) — A love letter.
40. *Bonn fide* (Latin) — In good faith.
41. *Bon hoinie* (French) — Good nature.
42. *Bonjour* (French) — Good day; good morning.
43. *Bon voyage* (French) — A good journey to you.
44. *Boutique* (French) — A shop. tradesman's stock.
45. *Bourgeoisee* (French) — The social class between the aristocracy and the working class; middle class.
46. *Bravo* (Italian) — Well done; splendid.
47. *Cadre* (French) — A frame, a scheme; a list of officers.
48. *Cafe* (French) — Coffee.
49. *Camaraderie* (French) — Comrade; Friendly fellowship.
50. *Carpe diem* (Latin) — Enjoy the present day.
51. *Cara sposa* (Italian) — Dear wife.
52. *Chef* (French) — A cook in charge of a kitchen; head cook
53. *Chesara' Sara'* (Italian) — What will be will be.
54. *Cognito, ergo sum* (Latin) — I think, therefore, I am.
55. *Coiffeur* (French) — Hair dresser.
56. *Contra* (Latin) — Against.
57. *Corpus* (Latin) — The body of a man or animal, especially a dead body.
58. *Coup d'etat* (French) — Sudden decisive blow in politics.
59. *Creme* (French) — Cream.
60. *Creme de la creme* (French) — Cream of the cream; the very best.
61. *Danke, Schoon* (German) — Many thanks.
62. *De bonne grace* (French) — With good grace.
63. *De facto* (Latin) — In fact, actually.
64. *De jure* (Latin) — In the law; by right.
65. *Dei gratin* (Latin) — By the grace of God.
66. *Deluxe* (French) — Luxurious.
67. *Dennode* (French) — Out of fashion.
68. *Desagrement* (French) — Something disagreeable.

69. *Detenu* (French) — A prisoner.
70. *Deus ex inachina* (Latin) — A character or event brought artificially into the plot of a story or drama to settle an involved situation.
71. *Distrait* (French) — Absent minded.
72. *Dramatis personae* (Latin) — Characters in a drama or a play.
73. *Donna e' mobile* (Italian) — Woman is changeable.
74. *Duce* (Italian) — A leader.
75. *Ecce!* (Latin) — Behold!
76. *Edition deluxe* (French) — A splendid and expensive edition of a book.
77. *Elegant* (French) — A person of fashion.
78. *Elite* (French) — The best part.
79. *En famille* (French) — With one's family; at home; in an informal way.
80. *En masse* (French) — In a group, universally.
81. *En prince* (French) — In princely style.
82. *En queue* (French) — In a string or line.
83. *En rapport* (French) — In agreement, in accord with.
84. *En route* (French) — On the way.
85. *Entente* (French) — An understanding; agreement.
86. *Entrepreneur* (French) — A business man.
87. *En rills* (French) — In town, 'not at home'.
88. *Espirit de corps* (French) — Group spirit, sense of pride.
89. *Errare est liumaru in* (Latin) — To err is human.
90. *Estancia* (Spanish) — A mansion.
91. *Ethos* (Greek) — Permanent character; in literature and art, chief characteristics of a work as affecting the intellectual and moral faculties, as opposed to pathos which appeals to the emotions.
92. *Etoile* (French) — Star.
93. *Et tu, Brute !* (Latin) — You too, Brutus! (Caesar's exclamation, when he saw his much loved Brutus amongst the murderers.)
94. *Euge*! (Latin, Greek) — Well done!
95. *Eureka* (Meureka) (Greek) — I have found it.
96. *Excelsior* (Latin) — Higher; (erroneously) upwards.
97. *Exceptio confirmat* (probat) regular (Latin) — The exception proves the rule.
98. *Ex officio* (Latin) — By virtue of his office.
99. Ex post facto (Latin) — After the deed is done; done or made after wards.
100. *Extra* (Latin) — Beyond, outside the scope of.
101. *Fade* (French) — To become less distinct.
102. *Fait accompli* (French) — A thing already done.
103. *Fenome* (French) — Woman, wife.
104. *Festa* (Italian) — A festival.
105. *Flair* (French) — Aptitude; a natural talent or ability.
106. *Gallant* (French) — Gay, elegant, attentive to ladies.

107. *Gens de letters* (French) — Literary man.
108. *Grand* (French) — Great.
109. *Heil* (German) — Flail!
110. *Homo sapiens* (Latin) — Mankind; human beings. III. Hotel (French) — A hotel, a mansion.
112. *Id est* (Latin) — That is.
113. *Ibidem* (Latin) — In the same place, thing or case.
114. *In camera* (Latin) — In the chamber of the judge.
115. *In toto* (Latin) — In the whole; entirely.
116. *Impasse* (French) — A deadlock.
117. *In memoriam* (Latin) — In the memory of.
118. *In petto* (Italian) — Secretly, not revealed.
119. *Inter alia* (Latin) — Among other things.
120. *Inter alios* (Latin) — Among the persons.
121. *Kinder* (German) — Children.
122. *L'allegro* (Italian) — The cheerful man.
123. *Libra* (Latin) — A pound; a unit of weight.
124. *Lingua franca* (Italian) — Mixed language.
125. *Litterateur* (French) — A man of letters.
126. *Locus Standi* (Latin) — A right to interfere.
127. *Magnum opus* (Latin) — A great work.
128. *Malentendu* (French) — Misunderstood; poorly conceived.
129. *Matinee* (French) — Reception or entertainment held in the afternoon.
130. *Milieu* (French) — Surroundings; environment.
131. *Modus* (Latin) — Manner, mode.
132. *Modus operandi* (Latin) — Manner of working.
133. *Monsieur* (French) — Sir, Mr.
134. *Monstre scare* (French) — A popular public figure who is considered above criticism.
135. *Mon and* (French) — My friend.
136. *Nil* (Latin) — Nothing.
137. *Non* (Latin) — Not.
138. *Octroi* (French) — Duties paid at the gate of a city.
139. *Oninia vincist labor* (Latin) — Labour overcomes all things.
140. *Opera* (Latin) — Plural of opus. Musical works of a composer numbered in order of composition or publication.
141. *Oil* (French) — yes.
142. *Par excellence* (French) — Eminently, beyond comparison.
143. *Par example* (Latin) — For example.
144. *Persona grata* (Latin) — A person who is acceptable or welcome.
145. *Postmortem* (Latin) — Happening done or made after death.
146. *Post* (Latin) — After, e.g., afternoon.
147. *Pater* (Latin) — Father.
148. *Potage* (French) — Soup.

149. *Prima facie* (Latin) — On first view.
150. *Quantum* (Latin) — Quantity, or amount.
151. *Quasi* (Latin) — As if, seemingly.
152. *Regime* (French) — Form of government.
153. *Resume* (French) — An abstract or summary.
154. *R.S.V.P.* (Reponds si'1 vous plait) (French) — Reply, if you please, an answer will oblige.
155. *Suns souci* (French) — Without care.
156. *Sine die* (Latin) — Without a day being appointed.
157. *Status quo* (Latin) — The existing state of existing affair.
158. *Status quoante* (Latin) — The state of affairs existing prior to a given event.
159. *Terra incognita* (Latin) — An unknown country.
160. *Tete-a-tete* (French) — A private or intimate conversation between two people.
161. *Ultra vires* (Latin) — Beyond one's powers.
162. Via media (Latin) — A middle course.
163. *Vice versa* (Latin) — The order or relation being reversed, conversely.
164. *Vis-a-vis* (French) — Opposite; face to face.
165. *Viva voce* (Latin) — By word of mouth; orally.
166. *Vive la* (French) — Long live!

EXERCISE

Directions: Choose the correct meaning of the foreign words and phrases out of the four responses a, b, c and d.

1. 'Cafe' word is originated from
(a) Japan (b) India
(c) French (d) Russia

2. French word 'creme' means
(a) cream (b) creem
(c) crme (d) creemee

3. 'cara sposa' means
(a) husband (b) Dear wife
(c) Daughter (d) son

4. 'Basta' word is originated from
(a) Italian (b) French
(c) Russia (d) Japan

5. 'Ad libitum' word is originated from
(a) Italian (b) Latin
(c) Russian (d) Greek

ANSWERS

1. (c) **2.** (c) **3.** (c) **4.** (c) **5.** (b)

CHAPTER 11

English Language Comprehension

Difinition of Comprehension

Comprehension is the ability to read and understand unfamiliar text matter, to answer questions based on that. You will be presented with passages drawn from a variety of subject areas, including humanities, the sciences, latest happenings in society etc. The questions will ask you to analyze what is stated in the passage and would have to identify underlying assumptions and implications. Although nothing is still clear but most probably the passage length in CSAT will vary from 300-800 words. The passage may be followed by 3-10 questions to check the thorough understanding of the contents. The questions will be objective type with each question followed by four answer options out of which the most appropriate one is to be chosen on the basis of the information given in the passage. No outside information or data should be used while answering the questions and answers should simply be marked keeping in mind the author's viewpoints on the topic.

The passages could be written in the following styles

1. **Analytical:** The analytical way of writing usually presents the pros and cons of the issue at hand. It discusses both sides of the issue and the author may after analysis, present his final viewpoint in the end. The questions are usually about the main idea and the author's viewpoint.
2. **Discursive:** A discursive style of writing is where the author discusses various aspects of certain issues in brief and superficially. Hence, the questions that follow are simple and basic questions on theme and the facts presented therein.
3. **Argumentative:** The argumentative style of writing is where the author supports his viewpoint on an issue by presenting facts and data which support his viewpoint. Unlike the argumentative style, he does not present both sides of the issue. The questions that follow are mostly about the author's tone and whether he would agree or disagree with certain points on the issues as discussed in the passage.
4. **Descriptive/Narrative:** When the passage describes a certain event or phenomenon chances are it uses the descriptive style of writing. In simple words descriptive style of writing uses story telling format. It is lucid and easy to understand and is usually followed by easy questions on the main theme or the facts stated in the passage.

Suggestions

1. Use only the information given or implied in a passage. Do not consider outside information, even if it seems more accurate than the given information.
2. You are looking for the best answer, so be sure to read all the choices.
3. If you don't know the answer, try to eliminate some choices and then take an educated guess. 4. Because

you may refer to the passage, don't try to memorize everything in the passage. 5. Read the passage focusing on the main point or purpose and the structure of the passage.

EXERCISE

Direction : Read the following passages carefully and answer the questions that follow.

Passage 1

The current global food situation is very serious and hence, we need to understand the reasons for such a dramatic increase in food prices in a short period.

It is argued that increases in energy costs are resulting in cost push inflation but contribution of energy costs to overall costs in agriculture may not explain the huge increase in food prices.

Related to the current elevated energy prices there has been a diversion of corn and edible oils to bio-fuels, which is significantly influenced by policy mandates. Very clearly this diversion to bio-fuels is a policy induced new reality, which coincided with price escalation in precisely those products and hence, is noteworthy.

The financialisation of commodity trade and current extraordinary conditions in global financial markets could have influenced the spurt in prices. The recent reductions in interest rates in the US and the injection of liquidity have resulted in investors seeking new avenues such as commodity markets, in view of the turbulence in financial markets and the low returns in treasuries. The relatively easy liquidity and low interest rates, by themselves make holding of inventories attractive and thus induoe greater volatility in commodity markets. The weakening of the US dollar is also advanced as a reason for the recent volatility in commodity markets, including food items. It is evident that this phenomenon is now also coinciding with the across the board rise in food prices.

In brief, while there are demand and supply side pressures on food items, there is considerable merit in the argument that the recent extraordinary increases in food prices are closely linked to public policy responses to high energy costs in advanced economies and the turbulence in financial markets and financial institutions. It is said that the impact of such policy induced diversion of food to bio-fuels is significant at this juncture and reflects a preference to fill the fuel tanks of automobiles rather than fill the empty stomachs of people.

Similarly, it is sometimes held that the weight accorded to financial stability in public may now be at the expense of stability in real sector-especially of sensitive commodities like food. At the same time, there is a general consensus that public policy in regard to food in many economies around the world has not provided adequate incentive to farmers to increase the supply of food and other agricultural products to comfortably match the growing demand over the medium term.

1. The passage lays emphasis on which of the following central theme(s) ?
   A. The abysmally throwaway prices offered for food commodities.
   B. The worldwide acute shortage of food commodities.
   C. Promoting the use of bio-fuel for automobiles.
   (a) A only
   (b) B only
   (c) C only (d) None of these

2. Which of the following statements is FALSE in the context of the passage?
   A. Unusual conditions in global financial markets have aggravated the food price.
   B. No government would prefer fueling vehicles to feeding the hungry.
   C. Maintenance of financial stability in public policy will be at the cost of stability in the real sector.
   (a) A and B (b) Band C
   (c) B only (d) C only

Directions (Q. Nos. 3 to 5) Choose the word which is most opposite in meaning of the word given in bold as used in the passage.

3. consensus
   (a) deviant (b) disagreement
   (c) dejection (d) denial

4. elevated
   (a) raised (b) stabilised
   (c) inclined (d) fallen

5. volatility
   (a) agitation (b) effervescence

(c) optimism (d) inactivity

Directions (Q. Nos. 6 to 7) Choose the word/group of words which is most nearly the same in meaning as the word given in bold as used in the passage.

6. incentive
(a) acceleration (b) surplus
(c) baiting (d) encouragement

7. advanced
(a) put forward (b) set aside
(c) taken over (d) marched forward

Passage 2

The Emperor had inherited a peaceful and prosperous kingdom at a young age after the untimely death of his father. A few months later a man arrived at court. He stated that he was from a far off land and had the gift of foresight. He impressed the Emperor with his witty remarks and was appointed a courtier. The Emperor and those at court all enjoyed hearing accounts of his travels. One day the newly appointed minister said. "Your Majesty, you are destined for great things. It is written in the stars. I have learnt the art of fortune telling. Do not be content with your kingdom alone. Travel, see the world and conquer. There are many who are oppressed. They will bless you for rescuing them from the tyranny of their rulers." The Emperor was stunned to hear this but he refused to discuss the matter at the time. The courtiers too were astonished to hear this and began debating among themselves. "It is true." they said, "Our Emperor's father was a great warrior and he ruled wisely. Perhaps there is truth in this. "So the newly appointed courtier shrewdly planted the idea of waging war against other kingdoms at court. After hearing several repeated arguments in favour of this idea the Emperor finally agreed. He was a young man and a battle seemed to be exciting and an adventure. So the newly appointed minister planned the first campaign against a smaller neighbouring kingdom. The Emperor knew the ruler was cruel and felt justified in waging war against him. Having the superior army he easily defeated the king. Everyone celebrated. But the campaign did not stop there.

With every victory the new minister would urge the Emperor on to the next battle. The soldiers grew tired after over two years at war but did not complain out of respect and loyalty to their ruler. Mean while the situation in his kingdom began to deteriorate. With no one to look after the daily administration and to resolve disputes, signs of neglect began to be seen. The Emperor was no longer bothered if he was freeing the oppressed when the attacked a kingdom. He would plunder their riches to fund his wars. The new minister who was in charge of these funds kept a large part for himself and grew richer. An old man who had been a minister in the Emperor's father's court grew worried and decided to do something about this situation. A few days later when the Emperor was out riding in the forest he suddenly saw the old man. He greeted him like an old friend and inquired what he was doing there. The man pointed to two owls in the trees. "I am listening to their conversation". "What are they saying ?" The Emperor asked unbelieving. "They are negotiating the marriage of their children. The first owl wants to know whether the other will be gifting his daughter fifty villages on her wedding day. To which the second one replied that he would have to gift her one hundred and fifty as the villages were in ruins and as such were worthless but with the Emperor as ruler there would be many such villages. "When the Emperor heard this he realized the error of his ways. He returned home immediately, rewarded the old minister putting him in charge of reconstructing the ruined villages and dismissed the fortune teller from his court.

8. What was the Emperor's reaction when he saw the old minister ?
(a) He was ashamed to see him because he had replaced him with a new minister
(b) He was relieved to see him because he wanted his advice
(c) He left sorry for the old man because he was talking to birds
(d) He was pleased to see him

8. Why did the Emperor reward the old man ?
(a) For his talent of talking to birds
(b) He was successful at reconstructing the destroyed villages
(c) He felt sorry for his plight in his old age and wanted to do something to help
(d) For showing the Emperor where his duty lay

Directions (Q. No. 10) Choose the word/group of words which is most similar in meaning to the word/group of words printed in bold as used in the passage.

10. untimely
(a) late (b) premature
(c) before (d) at night

Directions (Q. Nos. 11 to 12) Choose the word/

group of words which is most opposite in meaning to the word/group of words printed in bold as used in the passage.

11. deteriorate
(a) expand (b) thrive
(c) worsen (d) dwindle

12. urge
(a) persuade (b) incite
(c) mild (d) discourage

Passage 3

Though the Cold War has ended, selective tactics are still continuing for ensuring the military and economic dominance of developed countries. Various types of technology denial regimes are still being enforced which are now being mainly targeted against developing countries like India.

Today, we in India encounter twin problems. On one side there is a large scale strengthening of our neighbours through supply of arms and clandestine support to their nuclear and missile programmes and on the other side all efforts are being made to weaken our indigenous technology growth through control regimes and dumping of low-tech systems, accompanied with high commercial pitch in critical areas. Growth of indigenous technology and self-reliance are the only answer to the problem.

Thus in the environment around India, the number of missiles and nuclear powers are continuously increasing and destructive weapons continue to pile up around us, in spite of arms reduction treaties.

To understand the implications of various types of warfare that may affect us, we need to take a quick look at the evolution of war weaponry and the types of warfare. I am highlighting this point for the reason that in less than a century we could see change in the nature of warfare and its effects on society.

In early years of human history it was mostly direct human warfare. During the twentieth century upto about 1990, the warfare was weapon driven. The weapons used were guns, tanks, aircraft, ships, submarines and the nuclear weapons deployed on land/ sea/air and also reconnaissance spacecraft. Proliferation of conventional nuclear and biological weapons was at a peak owing to the competition between the superpowers.

The next phase, in a new form, has just started from 1990 onwards. The world has graduated into economic warfare. The means used is control of market forces through high technology. The participating nations, apart from the USA, are Japan, the UK, France, Germany, certain South-East Asian countries and a few others. The driving force is the generation of wealth with certain types of economic doctrine. The urgent issue we need to address collectively as a nation is, how do we handle the tactics of economic and military dominance in this new form coming from the backdoor? Today technology is the main driver of economic development at the national level. Therefore, we have to develop indigenous technologies to enhice our competitive edge and to generate national wealth in all segments of economy. Therefore, the need of the hour is arm India with technology.

13. The striking difference in warfare before and after 1990 was the shift from
(a) guns tanks, etc to nuclear weapons
(b) ships and submarines to spacecrafts
(c) weaponry to economic warfare
(d) economic forces to high technology driven warfare

Directions (Q. Nos. 14 to 15) Choose the word which is most nearly the same in meaning as the word printed in bold as used in the passage.

14. reconnaissance
(a) investigation (b) reserved
(c) recognizable (d) remedy

15. proliferation
(a) explosion (b) devastation
(c) discomfiture (d) abundance

Directions: Choose the word which is most opposite in meaning of the word printed in bold as used in the passage.

16. indigenous
(a) local (b) domestic
(c) broad (d) foreign

17. dominance
(a) aggression (b) submission
(c) assertion (d) ignorance

Passage 4

It is difficult to compare countries because various factors such as size, culture, history, geography, natural endowments, geopolitics and internal polity comes into play. There are some goals which can be achieved by smaller countries; but sometimes smaller countries find it difficult to embark upon certain big technological

plans even if they have the funds, because the size of the domestic market is too small. If we consider the bigger countries, the closest comparison to India is China, though there are many crucial differences.

The Chinese vision is to prepare the country for entry into the ranks of mid-level developed nations by the middle of the twenty-first century. Acceleration of the nation's economic growth and social development by relying on advances in science and technology is pivotal in this.

Documents describing the Chinese vision state that science and technology constitute premier productive forces and represent a great revolutionary power that can propel economic and social development. It is interesting to note that the main lessons the Chinese have drawn from their past performance is their failure to promote science and technology as strategic tools for empowerment. They also point to the absence of mechanisms and motivations in their economic activity to promote dependence on science and technology. Similarly, they hold that their scientific and technological efforts were not oriented towards economic growth. As a consequence they conclude, a large number of scientific and technological achievements were not converted into productive forces as they were too far removed from China's immediate economic and social needs. The Chinese vision is therefore aimed at exploiting state-of-art science and technology to enhance the nation's overall power and strength, to improve the people's living standards, to focus on resolving problems encountered in large-scale industrial and agricultural production and to effectively control and alleviate pressures brought on by population, resources and the environment. By the year 2000, China had aimed at bringing the main industrial sectors up to the technological levels achieved by the developed countries in the 1970s or 80s, and by 2020 to the level they would have attained by the early twenty-first century. The aim is to bridge the overall gap with the advanced world. There is a special emphasis on research and development of high technologies that would find defence applications. Some of these technologies are critical for improving the features of key conventional weapons. Some technologies are meant for enhancing future military capabilities. Other efforts are aimed at maintaining the momentum to develop capabilities for cutting-edge defence technologies. They call for unremitting efforts in this regard with the aim of maintaining effective self-defence and nuclear deterrent capabilities and to enable parity in defence, science and technology with the advanced world.

18. Why can't smaller countries take up big technological planning?
(a) They have other goals to achieve
(b) They have smaller domestic market size
(c) Smaller countries lack technological know-how
(d) Bigger countries do not permit them to do so

19. What is the goal of China to be accomplished by the middle of 21$^{5'}$ Century?
(a) To become one of the most developed nations
(b) To surpass the level of all middle level developed nations by a good margin
(c) To be the most influential super power
(d) None of the above

Directions: Choose the word which is most nearly the same in meaning as the word given in bold as used in the passage.

20. endowments
(a) powers (b) measures
(c) habitats (d) gifts

21. oriented
(a) stated (b) tempting
(c) deciding (d) leaning

22. conventional
(a) functional (b) activist
(c) deliberate (d) traditional

Passage 5

Sixty years after independence, India remain one of the unhealthiest places on earth. Millions of people still suffer from disease that no longer exist almost anywhere else on the planet. What makes the picture ever bleaker is the fact that India's. economic boom has so far had, little impact on health standards. Between 2001 and 2006 India's economy grew almost 50%, the country's biggest expansion in decades. Meantime, its child-malnutrition rate, dropped just a single percentage point, to 46%. This is worse than in most African countries. The incredible economic growth is having an impact in other ways by driving up rates of rich-world diseases such as obesity and encouraging high-end health services, some of which offer world-class care but remain far beyond the reach of the vast majority of Indians.

The country brags about the skill of India's world-class doctors when its marketers sell India as a medical-

tourism destination and emerging health-service giant. The truth behind the glossy advertising is that : India is the sick man of Asia, malnourished and, beset by epidemics of AIDS and diabetes, and with spending levels on public health that even its Prime Minister has conceded are seriously lagging behind other developing countries in Asia.

Part of the reason for the sorry state of India's medical services is the crumbling public health infrastructure-not fancy hospitals or equipment but basic services such as clean water, a functioning sewage system, power. The World Health Organisation estimates that more than 900,000 Indians die every year from drinking bad water and breathing bad air. Public health experts believe that India's vast population adds to the burden, overloading systems where they do exist and aiding the spread of disease in many places they don't. Moreover for the past decade or so, funding for preventive public-health initiatives such as immunization drives and programmes to control the spread of communicable diseases has been cut. Experts also blame policies that concentrate on the latest scientific techniques and not enough on basics for the fact that millions of people in India are suffering and dying.

Especially in rural India, health services are poor to nonexistent. Current staff often doesn't turn up for work, Clinics are badly maintained and people end up seeking help from pharmacists who are not sufficiently trained. India need more than a million more doctors and nurses. The government has also promised more money for rural health through its ambitious National Rural Health Mission. It will increase public-health spending from the current 1% of India's GDP to upto 3% by 2010, but that's still just half the rate at which countries with comparable per capita incomes such as Senegal and Mongolia fund their health sectors. If that is to change, we must realise that the link between wealth and good health isn't clear-cut. Poor states that have made efforts in child immunization over the past few years now have better coverage than richer states, where immunization has actually slipped.

India needs to stop being complacent and prepare to spend on health but whenever it is mentioned there is always this debate about cost. Why don't we have the same debate when we spend tens of billions on new arms? It's hard to be an economic superpower if you're too sick to work.

23. What is the author's main objective in writing the passage?
(a) Comparing India and Africa in terms of economic growth
(b) Cautioning India to improve its healthcare system
(c) Exhorting India to have higher growth rate which will benefit the healthcare sector
(d) Criticising medical practitioners for their lack of concern for the health of the weaker sections of society

24. What has contributed to the present ill health among Indians?
(a) Disintegration of the public healthcare infrastructure
(b) Healthcare facilities are often monopolized by foreigners
(c) Doctors in India do not conduct research in areas like diabetes, which are affecting the population.
(d) The current government has taken no interest at all in public health initiatives

Directions: Choose the word/phrase which is most nearly the same in meaning as the word printed in bold as used in the passage.

25. sorry
(a) forgiveness (b) apology
(c) repentant (d) miserable

26. complacent
(a) pleasing (b) self-satisfied
(c) conforming (d) willing

Directions: Choose the word which is most opposite in meaning of the word printed in bold as used in the passage.

27. bleaker
(a) hopeful (b) warm
(c) cozy (d) sheltered

28. non existent
(a) hypothetical (b) active
(c) realistic (d) available

Passage 6

Giving loans to impoverished women to make ceramics or to farmers to buy milk cows were riot seen as great business. Microfinance was an industry championed by antipoverty activists. Today it is on the verge of a revolution, with billions of dollars from big banks, private-equity shops and pension funds pouring in, driving growth of 30% to 40% this year alone. In 1998, a nonprofit microfinance organization in Peru,

converted into a bank (called Mibanco). This demonstrated that the poor are good risks who repay loans on time and getting them together, not only chips away at poverty but also turns a profit. The success of Mibanco has piqued the interest of commercial banks, which had previously shunned the country's poor. Now big banks are going after Mibanco's clients with low-rate loans and realising it takes special know-how to work with the unbanked-are hiring away Mibanco's staff.

But with the emergence of players who are only out for profit, microfinance schemes could end up milking the poor. This could happen in countries where lenders don't have to disclose interest rates. When a Mexican microfinancier went public, revealing its loans had rates of about 86% annually, the Consultative Group to Assist the Poor (CGAP) criticised it for putting shareholders ahead of clients. The pressure to turn a profit also forces microfinanciers to change their business models in ways that depart from the industry's core mission : to help poor people lead better lives. Such shifts have caused the average loan size to triple. Moreover smaller loans being costlier to service, a lower percentage of loans go to women because they tend to take out smaller sums. According to CGAP, with the flood of new large entities there is the risk that a large percentage of cross-border funds go to Latin America and Eastern Europe, the world's most developed microfinance markets. "The poorest of the world's poor, who are predominantly in Asia and Africa get left out,' says the CEO of the nonprofit Grameen Foundation, which helps, develop microfinance institutions.

Segmenting the industry, might be worthwhile if it allows more of the poor to get access to credit. Multinational corporations could take the top microfinance institutions to the next level, and the remainder could be the responsibility of development groups and regional banks. Yet making loans to poor people is hardly a poverty cure. Property rights and the rule of law matter too. One cannot overidealize what microfinance alone can do. Most nonprofits started with lending simply because local laws prohibited nonbanks from offering deposit accounts. With an increase in competition and marketing efforts, poverty-alleviation experts are concerned that people will be talked into loans they wouldn't otherwise want. For example, organisations like Mibanco are providing consumer loans. There is nothing wrong with buying TVs and microwaves on credit, but certain markets, like Mexico, have been flooded with loans that have nothing to do with providing capital to aspiring entrepreneurs- just increasing household debt.

29. What was the impact of the non-disclosure of their interest rates by lending institutions?
(a) The Government issued sanctions against such firms
(b) Shareholders' interests were not protected
(c) More microfinance institutions were motivated to go public
(d) The poor were exploited

30. Which of the following cannot be said about the Grameen Foundation?
A. It regulates the activities of microfinance firms in developing countries
B. It functions primarily in Asia and Latin America
C. It approves of privatising microfinance institutions
(a) Both A and B (b) Only B
(c) Both A and C (d) All A, B and C

Directions: Choose the word which is most similar in meaning to the word printed in bold as used in the passage.

31. depart
(a) absent (b) retirement
(c) divide (d) vary

32. piqued
(a) provoked (b) irritated
(c) disturb (d) fascinated

Directions: Choose the word which is most opposite in meaning of the word printed in bold as used in the passage.

33. aspiring
(a) uninterested (b) ungrateful
(c) anxious (d) miserable

34. core
(a) clear (b) unnecessary
(c) crust (d) beside

Passage 7

Rural India faces serious shortages-power, water, health facilities, roads, etc, these are known and recognized. However, the role of technology in solving these and other problems is barely acknowledged and the actual availability of technology in rural areas is marginal. The backbone of the rural economy is agriculture, which also provides sustenance to over half the country's population. The 'green revolution' of the

1970s was, in fact, powered by the scientific work in various agricultural research institutions. While some fault the green revolution for excessive exploitation of water and land resources through overuse of fertilizers, it did bring about a wheat surplus and prosperity in certain pockets of the country.

In rural India today, there is a dire inadequacy of both science (ie, knowledge) and technology (which derives from science and manifests itself in physical form), The scope to apply technology to both farm and non-farm activities in rural areas is huge, as are the potential benefits. In fact, crop yields are far lower than what they are in demonstration farms, where science and technology are more fully applied. Technologies that reduce power consumption of pumps are vital, unfortunately, their use is

minimal, since agricultural power is free or largely subsidized. Similarly, there is little incentive to optimise through technology or otherwise-water use, especially in irrigated areas (a third of total arable land), given the water rates, Post-harvest technologies for processing and adding value could greatly enhance rural employment and incomes but at present deployment of technology is marginal. Cold storage and cold chains for transportation to market is of great importance for many agriculture products-particularly, fruits and vegetables, but are non-existent. These are clearly technologies with an immediate return of investment and benefits for all, the farmer, the end-consumer, the technology provider.

However, regulatory and structural barriers are holding back investments.

Power is a key requirement in rural areas, for agricultural as well as domestic uses. Technology can provide reliable power a comparatively low cost in a decentralized manner. However, this needs to be upgraded and scaled in a big way, with emphasis on renewable and non-polluting technologies. Reliable and low cost means of transporting goods and people is an essential need or for rural areas. The bullock-cart and the tractortraailer are present vehicles of choice. Surely, technology can provide a better cheaper and more efficient solution? Information related to commodity prices, agricultural practices, weather, etc, are crucial for the farmer. Technology can provide these through mobile phones, which is a proven technology however, the challenge to ensure connectivity remains. Thus, there is a pressing need for technology as currently economic growth-though skewed and iniquitous-has created an economically attractive market in rural India.

35. The author's main objective in writing the passage is to
(a) censure scientists for not undertaking research
(b) criticise farmers for not utilising experimental low cost post harvesting technology
(c) exhort the government subsidise the cost of utilising technology
(d) advocate broadening the scope of research and use of technology in agriculture

Directions: Choose the word which is most nearly the same in meaning as the word printed in bold as used in the passage.

36. marginal
(a) austere (b) severe
(c) detrimental (d) insignificant

37. fault.
(a) defect (b) offend
(c) imperfect (d) blame

Directions: Choose the word, which is most opposite in meaning of the word printed in bold as used in the passage.

38. potential
(a) unlikely (b) incapable
(c) unable (d) ineffective

39. iniquitous
(a) immoral (b) godly
(c) virtuous (d) just

Passage 8

There is absolutely no point in complaining that over the years, there has been pressure for increased productivity and higher earnings for workers in industry. There are several ways for increasing employees earnings. Employee earnings can be increased by raising the selling price of the firm's products and services, reducing profits or costs of raw materials, or augmenting labour productivity. However, increasing employee earnings by means other than increased labour productivity jeopardizes the firm's competitive strength in the market. Higher prices usually mean fewer customers, reduced profit means less capital investment, and low-cost materials mean poor product quality. But, increasing labour productivity by enhancing skills and motivation creates an almost unlimited resource. The development of economic resources, human as well as nonhuman, is the product of human effort, and the quality of human

effort in large part depends on human motivation.

Enthusing employees with workaholic spirit through traditional authority and financial incentives has become increasingly difficult as employees become economically secure and their dependency on any one particular organization decreases. According to expectancy theorists, the motivation to work increases when an employee feels his performance is an instrument for obtaining desired rewards. Nevertheless, in many organizations today employees are entitled to organizational rewards just by being employed. Unions governmental regulations, and the nature of the job itself in some cases prevent management from relating financial rewards to performance. People may be attracted to join and remain in organizations to receive organizational rewards, but being motivated to join an organization is not the same as being motivated to exert effort in an organization. The challenge to management is to find and administer alternative forms of incentives which will induce employees to improve work performance. Such alternative forms of reinforcement will require increased understanding of motivational theories and programmes.

40. Which of the following statements is TRUE in the context of the passage?
(a) Development of economic resources is primarily the product to market conditions
(b) Earnings can be increased by lowering the selling price of products.
(c) Employees can be best motivated by providing financial incentives.
(d) None of the above

41. Choose the word which is most similar in meaning as the word 'induce' as used in the passage.
(a) appreciate (b) stimulate
(c) exhibit (d) inflate

42. Which of the following words is most opposite in meaning of the word 'jeopardizes' as used in the passage?
(a) safeguards (b) endangers
(c) projects (d) devalues

ANSWERS

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