Chapter – 01

Rational Numbers

- Rational numbers are **closed** under the operations of addition, subtraction and multiplication.
- The operations addition and multiplication are
  (i) **commutative** for rational numbers.
  (ii) **associative** for rational numbers.
- The rational number 0 is the **additive identity** for rational numbers.
- The rational number 1 is the **multiplicative identity** for rational numbers.
- The additive inverse of the rational number $\frac{a}{b}$ *is* $\frac{a}{}$ *and vice – versa.*
- The **reciprocal or multiplicative inverse** of the rational number $\frac{a}{b}$ *is* $\frac{c}{d}$ *if* $\frac{a}{b}\times\frac{c}{d}=$.
- Distributivity of rational numbers: For all rational numbers a, b and c, a(b + c) = ab + ac and a(b – c) = ab – ac
- Rational numbers can be represented on a number line.
- Between any two given rational numbers there are countless rational numbers. The idea of mean helps us to find rational numbers between two rational numbers.
- **Positive Rationals:** Numerator and Denominator both are either positive or negative. Example: $\frac{4}{7},\frac{}{-4}$
- **Negative Rationals:** Numerator and Denominator both are of opposite signs. Example: $\frac{-2}{11},\frac{4}{-9}$
- **Additive Inverse:** Additive inverse (negative) $\frac{a}{b}+\frac{-a}{b}=\frac{-a}{b}+\frac{a}{b}=0$. $\frac{-}{b}$ is the additive inverse of $\frac{}{b}$ and $\frac{}{b}$ is the additive inverse of $\frac{-}{b}$.
- **Mulitiplicative Inverse (reciprocal):** $\frac{a}{b}\times\frac{c}{d}=1=\frac{c}{d}\times\frac{a}{b}$ where $\frac{}{d}$ is the reciprocal of $\frac{}{b}$. Zero has no reciprocal. The reciprocal of 1 is1 and of -1 is -1.

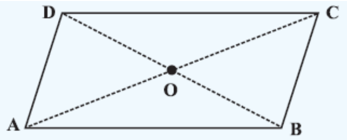
Chapter – 02

Linear Equations in One Variable

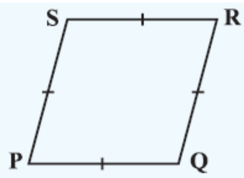
- A statement of equality of two algebraic expressions involving one or more variables. Example: $x + 2 = 3$
- **Linear Equation in One variable**: The expressions which form the equation that contain single variable and the highest power of the variable in the equation is one.
- An algebraic equation is an equality involving variables. It says that the value of the expression on one side of the equality sign is equal to the value of the expression on the other side.
- The equations we study in Classes VI, VII and VIII are linear equations in one variable. In such equations, the expressions which form the equation contain only one variable. Further, the equations are linear, i.e., the highest power of the variable appearing in the equation is 1.
- A linear equation may have for its solution any rational number.
- An equation may have linear expressions on both sides. Equations that we studied in Classes VI and VII had just a number on one side of the equation.
- Just as numbers, variables can, also, be transposed from one side of the equation to the other.
- Occasionally, the expressions forming equations have to be simplified before we can solve them by usual methods. Some equations may not even be linear to begin with, but they can be brought to a linear form by multiplying both sides of the equation by a suitable expression.
- The utility of linear equations is in their diverse applications; different problems on numbers, ages, perimeters, combination of currency notes, and so on can be solved using linear equations.

Chapter – 3
Understanding Quadrilaterals

- **Parallelogram:** A quadrilateral with each pair of opposite sides parallel.
  (1) Opposite sides are equal.
  (2) Opposite angles are equal.
  (3) Diagonals bisect one another.

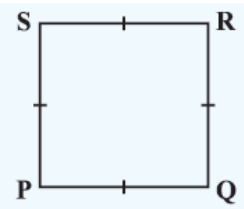


- **Rhombus:** A parallelogram with sides of equal length.
  (1) All the properties of a parallelogram.
  (2) Diagonals are perpendicular to each other.

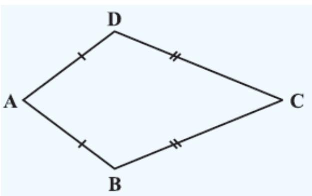


- **Rectangle:** A parallelogram with a right angle.
  (1) All the properties of a parallelogram.
  (2) Each of the angles is a right angle.
  (3) Diagonals are equal.

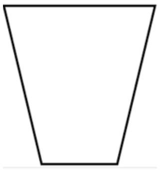
- **Square:** A rectangle with sides of equal length.
  (1) All the properties of a parallelogram, rhombus and a rectangle.



- **Kite:** A quadrilateral with exactly two pairs of equal consecutive sides
  (1) The diagonals are perpendicular to one another
  (2) One of the diagonals bisects the other.
  (3) In the figure $m\angle B = m\angle D$ but $m\angle A \neq m\angle C$.



- **Trapezium:** A quadrilateral having exactly one pair of parallel sides.



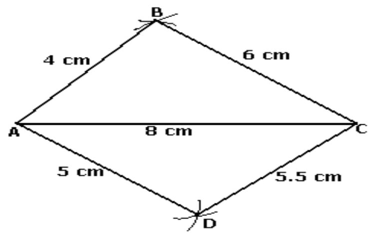
- **Diagonal:** A simple closed curve made up of only line segments. A line segment connecting two non-consecutive vertices of a polygon is called diagonal.

- **Convex:** The measure of each angle is less than $180°$.
- **Concave:** The measure of at least one angle is more than $180°$
- **Quadrilateral:** Polygon having four sides.
- **Element of quadrilateral:**
  (i) **Sides:** Line segments joining the points.
  (ii) **Vertice:** Point of intersection of two consecutive sides.
  (iii) **Opposite sides:** Two sides of a quadrilateral having no common end point.
  (iv) **Opposite Angles:** Two angles of a quadrilateral not having a common arm.
  (v) **Diagonals:** Line segment obtained by joining the opposite vertices.
  (vi) **Adjacent Angles:** Two angles of a quadrilateral having a common arm.
  (vii) **Adjacent Sides:** Two sides of a quadrilateral having a common end point.

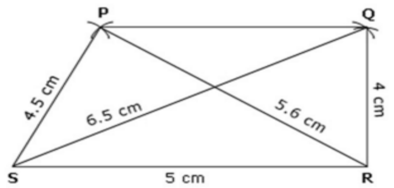
Chapter – 4

Practical Geometry

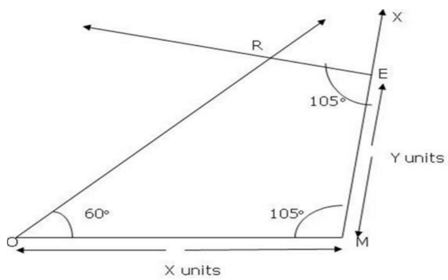
- A quadrilateral has 10 parts - 4 sides, 4 angles and 2 diagonals. Five measurements can determine a quadrilateral uniquely.
- Five measurements can determine a quadrilateral uniquely.
- A quadrilateral can be constructed uniquely if the lengths of its four sides and a diagonal is given.



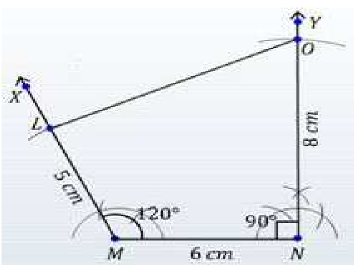
- A quadrilateral can be constructed uniquely if its two diagonals and three sides are known.



- A quadrilateral can be constructed uniquely if its two adjacent sides and three angles are known.



- A quadrilateral can be constructed uniquely if its three sides and two included angles are given.



Chapter – 05

Data Handling

- **Data Handling:** Deals with the process of collecting data, presenting it and getting result.
- Data mostly available to us in an unorganised form is called raw data.
- Grouped data can be presented using histogram. Histogram is a type of bar diagram, where the class intervals are shown on the horizontal axis and the heights of the bars show the frequency of the class interval. Also, there is no gap between the bars as there is no gap between the class intervals.
- In order to draw meaningful inferences from any data, we need to organise the data systematically.
- Frequency gives the number of times that a particular entry occurs.
- Raw data can be 'grouped' and presented systematically through 'grouped frequency distribution'.
- **Statistics**: The science which deals with the collection, presentation, analysis and interpretation of numerical data.
- **Observation**: Each entry (number) in raw data.
- **Range**: The difference between the lowest and the highest observation in a given data.
- **Array**: Arranging raw data in ascending or descending order of magnitude.
- Data can also presented using circle graph or pie chart. A circle graph shows the relationship between a whole and its part.
- There are certain experiments whose outcomes have an equal chance of occurring.
- A random experiment is one whose outcome cannot be predicted exactly in advance.
- Outcomes of an experiment are equally likely if each has the same chance of occurring.
- **Frequency**: The number of times a particular observation occurs in the given data.
- **Class Interval:** A group in which the raw data is condensed.
  (i) **Continuous**: The upper limit of a class interval coincides with the lower limit of the next class.
  (ii) **Discontinuous**: The upper limit of a class interval does not coincide with the lower limit of the next class.
- **Class Limits:** Each class in a bounded by two figures which are called class limits.

(i) **Upper Class Limit**: The upper value of a class interval.

(ii) **Lower Class Limit**: The lower value of a class interval.

- **Class Size or width:** The differencebetwen the upper class limit and lower class limit of a class.
- **Class Mark:** The mid-value of a class-interval. Class mark=

  2
- **Graphic representation of data:**

(i) **Pictograph:** Pictorial representation of data using symbols.

(ii) **Bar Graph:** A display of information using bars of uniform width, their heights proportional to the respective values.

(iii) **Double Bar Graph:** A bar graph showing two sets of data simultaneously. It is useful for the comparison of the data.

(iv) **Histogram:** a graphical representation of frequency distribution in the form of rectangles with class intervals as bases and heights proportional to corresponding frequencies such that there is no gap between any successive rectangles.

(v) **Circle Graph or Pie Chart:** A pictorial representation of the numerical data in the fomr of sectors of a circle such that area of each sector is proportional to the magnitude of the data represented by the sector.

- **Probability:** The chance of occurring of a certain event when measured quantitatively.
- Probability of an event =

$$\frac{\text{Number of outcomes that make an event}}{\text{Total number of outcomes of the experiment}},\ \textit{when the outcomesare equally likely.}$$

(i) **Experiment:** An operation which can produce some well-defined outcomes.

(ii) **Trial:** The performance of an experiment.

(iii) **Random Experiment:** An experiment in which all possible outcomes are known and the exact outcome cannot be predicted in advance.

(iv) **Equally Likely Outcomes:** Certain experiments whose outcomes have an equal chance of occurring.

(v) **Event:** Each outcome of an experiment or a collection of outcomes is called an event.

- Chances and probability are related to real life.

Chapter – 6

Squares and Square Roots

- **Square**: Number obtained when a number is multiplied by itself. It is the number raised to the power 2. $2^2 = 2\times 2 = 4$ (square of 2 is 4).
- If a natural number m can be expressed as n^2, where n is also a natural number, then m is a **square number.**
- All square numbers end with 0, 1, 4, 5, 6 or 9 at unit's place.
- Square numbers can only have even number of zeros at the end.
- Square root is the inverse operation of square.
- There are two integral square roots of a perfect square number.
- Positive square root of a number is denoted by the symbol $\sqrt{\ }$ For example, 3^2 =9 gives $\sqrt{9} = 3$
- **Perfect Square or Square number**: It is the square of some natural number. If $= n^2$, then m is a perfect square number where m and n are natural numbers. Example: $1 = 1\times 1 = 1^2$, $4 = 2\times 2 = 2^2$.
- **Properties of Square number**:
  (i) A number ending in 2, 3, 7 or 8 is never a perfect square. Example: 152, 1028, 6593 etc.
  (ii) A number ending in 0, 1, 4, 5, 6 or 9 may not necessarily be a square number. Example: 20, 31, 24, etc.
  (iii) Square of even numbers are even. Example: $2^2 = 4$, $4^2 = 16$, etc.
  (iv) Square of odd numbers are odd. Example: $5^2 = 25$, $9^2 = 81$, etc.
  (v) A number ending in an odd number of zeroes cannot be a perferct square. Example: 10, 1000, 900000, etc.
  (vi) The difference of squares of two consecutive natural number is equal to their sum. $(n+1)^2 - n^2 = n+1+n$. Example: $4^2 - 3^2 = 4+3 = 7$, $12^2 - 11^2 = 12+11 = 23$, etc.
  (vii) A triplet (m, n, p) of three natural numbers m, n and p is called Pythagorean triplet, if $m^2 + n^2 = p^2; 3^2 + 4^2 = 25 = 5^2$

Chapter – 7

Cubes and Cube Root

- **Cube number**: Number obtained when a number is multiplied by itself three times. $2^3 = 2\times2\times2 = 8$, $3^3 = 3\times3\times3 = 27$, etc.
- Numbers like 1729, 4104, 13832, are known as Hardy – Ramanujan Numbers. They can be expressed as sum of two cubes in two different ways.
- Numbers obtained when a number is multiplied by itself three times are known as cube numbers. For example 1, 8, 27, ... etc.
- If in the prime factorisation of any number each factor appears three times, then the number is a perfect cube.
- The symbol $\sqrt[3]{\ }$ denotes cube root. For example $\sqrt[3]{\quad} = 3$
- **Perfect Cube:** A natural number is said to be a perfect cube if it is the cube of some natural number. Example: 8 is perfect cube, because there is a natural number 2 such that $= 2^3$, but 18 is not a perfect cube, because there is no natural number whose cube is 18.
- The cube of a negative number is always negative.
- **Properties of Cube of Number:**

(i) Cubes of even number are even.

(ii) Cubes of odd numbers are odd.

(iii) The sum of the cubes of first n natural numbers is equal to the square of their sum.

(iv) Cubes of the numbers ending with the digits 0, 1, 4, 5, 6 and 9 end with digits 0, 1, 4, 5, 6 and 9 respectively.

(v) Cube of the number ending in 2 ends in 8 and cube of the number ending in 8 ends in 2.

(vi) Cube of the number ending in 3 ends in 7 and cube of the number ending in 7 ends in 3.

Chapter – 8

Comparing Quantities

- **Ratio**: Comparing by division is called ratio. Quantities written in ratio have the same unit. Ratio has no unit. Equality of two ratios is called proportion.
- Product of extremes = Product of means
- **Percentage**: Percentage means for every hundred. The result of any division in which the divisor is 100 is a percentage. The divisor is denoted by a special symbol %, read as percent.
- **Profit and Loss**:
  (i) **Cost Price** (CP): The amount for which an article is bought.
  (ii) **Selling Price (SP):** The amount for which an article is sold.
- Additional expenses made after buying an article are included in the cost price and are known as **overhead expenses**. These may include expenses like amount spent on repairs, labour charges, transportation, etc.
- **Discount** is a reduction given on marked price. Discount = Marked Price – Sale Price.
- Discount can be calculated when discount percentage is given. Discount = Discount % of Marked Price
- Additional expenses made after buying an article are included in the cost price and are known as **overhead expenses.** CP = Buying price + Overhead expenses
- Sales tax is charged on the sale of an item by the government and is added to the Bill Amount. Sales tax = Tax% of Bill Amount
- **Simple Interest**: If the principal remains the same for the entire loan period, then the interest paid is called simple interest. $SI = \frac{P \times R \times T}{100}$
- Compound interest is the interest calculated on the previous year's amount (A = P + I)

  (i) Amount when interest is compounded annually $= P\left(1+\frac{R}{100}\right)^n$; P is principal, R is rate of interest, n is time period

  (ii) Amount when interest is compounded half yearly

  $$= P\left(1+\frac{R}{100}\right)^{2n} \begin{cases} \frac{R}{2} \text{ is, half yearly rate and} \\ 2n = \text{number of 'half − years'} \end{cases}$$

Chapter – 9

Algebraic Expressions and Identities

- Expressions are formed from **variables** and **constants.**
- **Constant:** A symbol having a fixed numerical value. Example: 2, 3, 2.1, etc.
- **Variable:** A symbol which takes various numerical values. Example: x, y, z, etc.
- **Algebric Expression:** A combination of constants and variables connected by the sign +, -, $\times$ and $\div$ is called algebraic expression.
- Terms are added to form **expressions**. Terms themselves are formed as product of factors.
- Expressions that contain exactly one, two and three terms are called monomials, binomials and **trinomials** respectively. In general, any expression containing one or more terms with non-zero coefficients (and with variables having non- negative exponents) is called a polynomial.
- **Like** terms are formed from the same variables and the powers of these variables are the same, too. Coefficients of like terms need not be the same.
- While adding (or subtracting) polynomials, first look for like terms and add (or subtract) them; then handle the unlike terms.
- There are number of situations in which we need to multiply algebraic expressions: for example, in finding area of a rectangle, the sides of which are given as expressions.
- **Monomial:** An expression containing only one term. Example: -3, 4x, 3xy, etc.
- **Binomial:** An expression containing two terms. Example: 2x-3, 4x+3y, xy-4, etc.
- **Trinomial:** An expression containing three terms. Example: $2x^2+3xy+9$, 3x+2y+5z, etc.
- **Polynomial:** In general, any expression containing one or more terms with non-zero coefficients (and with variables having non-negative exponents). A polynomial may contain any number of terms, one or more than one.
- A monomial multiplied by a monomial always gives a monomial.
- While multiplying a polynomial by a monomial, we multiply every term in the polynomial by the monomial.
- In carrying out the multiplication of a polynomial by a binomial (or trinomial), we multiply term by term, i.e., every term of the polynomial is multiplied by every term in the binomial

(or trinomial). Note that in such multiplication, we may get terms in the product which are like and have to be combined.

- An **identity** is an equality, which is true for all values of the variables in the equality. On the other hand, an equation is true only for certain values of its variables. An equation is not an identity.
- The following are the standard identities:

$$(a + b)^2 = a^2 + 2ab + b^2 \quad (I)$$

$$(a - b)^2 = a^2 - 2ab + b^2 \quad (II)$$

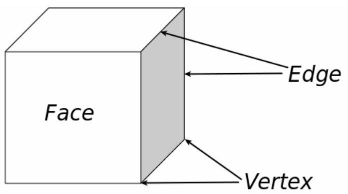
$$(a + b)(a - b) = a^2 - b^2 \quad (III)$$

- Another useful identity is (x + a) (x + b) = x2 + (a + b) x + ab (IV)
- The above four identities are useful in carrying out squares and products of algebraic expressions. They also allow easy alternative methods to calculate products of numbers and so on.
- **Coefficients**: In the term of an expression any of the factors with the sign of the term is called the coefficient of the product of the other factors.
- **Terms**: Various parts of an algebraic expression which are separated by + and – signs. Example: The expression 4x + 5 has two terms 4x and 5.
  - (i) **Constant Term**: A term of expression having no lateral factor.
  - (ii) **Like term**: The term having the same literal factors. Example 2xy and -4xy are like terms.
  - (iii) **Unlike term**: The terms having different literal factors. Example: $4x^2$ and 3xy are unlike terms.
- **Factors:** Each term in an algebraic expression is a product of one or more number (s) and/or literals. These number (s) and/or literal (s) are known as the factor of that term. A constant factor is called numerical factor, while a variable factor is known as a literal factor. The term 4x is the product of its factors 4 and x.

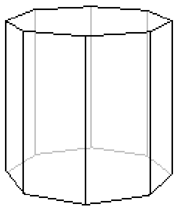
Chapter – 10

Visualising Solid Shapes

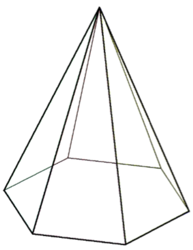
- There are three types of shapes:
  - (i) **One dimensional shapes:** Shapes having length only. Example: a line.
  - (ii) **Two dimensional Shapes:** Plane shapes having two measurements like length and breadth. Example: a polygon, a triangle, a rectangle, etc. generally, two dimensional figures are known as 2-D figures.
  - (iii) **Three dimensional Shapes:** Solid objects and shapes having length, breadth and height or depth. Example: Cubes, cylinders, cone, cuboid, spheres, etc.
  - (iv) **Face:** A flat surface of a three dimensional figure.
  - (v) **Edge:** Line segment where two faces of solid meet.



- **Polyhedron**: A three-dimensional figure whose faces are all polygons.
- **Prism**: A polyhedron whose bottom and top faces (known as bases) are congruent polygons and faces known as lateral faces are parallelograms. When the side faces are rectangles, the shape is known as right prism.



- **Pyramid**: A polyhedron whose base is a polygon and lateral faces are triangles.



- **Vertex**: A point where three of more edges meet.
- **Base**: The face that is used to name a polyhedron.

Key Notes

- Euler's formula for any polyhedron is F + V – E = 2, where F stands for number of faces, V for number of vertices and E for number of edges.
- Recognising 2D and 3D objects.
- Recognising different shapes in nested objects.
- 3D objects have different views from different positions.
- **Mapping:** A map depicts the location of a particular object/place in relation to other objects/ places.
- A map is different from a picture.
- Symbols are used to depict the different objects/places.
- There is no reference or perspective in a map.
- Maps involve a scale which is fixed for a particular map.
- **Convex**: The line segment joining any two points on the surface of a polyhedron entirely lies inside or on the polyhedron. Example: Cube, cuboid, tetrahedron, pyramid, prism, etc.

Chapter – 11
Mensuration

- **Perimeter**: Length of boundary of a simple closed figure.
- **Area**: The measure of region enclosed in a simple closed figure.
- Area of a trapezium = half of the sum of the lengths of parallel sides × perpendicular distance between them.
- Area of a rhombus = half the product of its diagonals.
- **Perimeter of**:

  Rectangle = 2(l + b)

  Square = 4a

  Triangle = $\frac{1}{2}$

  Parallelogram = 2(sum of two adjacent sides)
- **Diagonal of:**

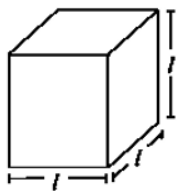
  Rectangle = $\sqrt{l^2+b^2}$

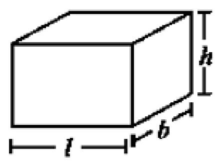
  Square = $\sqrt{2a}$
- **Surface area** of a solid is the sum of the areas of its faces.
- **Surface area of**:

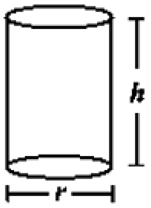
  $a\ cuboid\ =\ 2(lb\ +\ bh\ +\ hl)$

  $a\ cube\ =\ 6l^2$

  $a\ cylinder\ =\ 2\pi r(r\ +\ h)$







- Amount of region occupied by a solid is called its **volume.**
- Volume of

$= l \times b \times h$

$= l^3$

$a\ cylinder = \pi r^2 h$

$(i)\ 1\ cm^3 = 1\ mL$

$(ii)\ 1L = 1000\ cm^3$

$(iii)\ 1\ m^3 = 1000000\ cm^3 = 1000L$

Chapter – 12

Exponents and Powers

- Numbers with negative exponents obey the following laws of exponents.

  (a) $a^{m} \times a^{n} = a^{m+n}$

  (b) $a^{m} \div a^{n} = a^{m-n}$

  (c) $\left(a^{m}\right)^{n} = a^{mn}$

  (d) $a^{m} \times b^{m} = \left(ab\right)^{m}$

  (e) $^{0} = 1$

  (f) $\frac{a^{m}}{b^{m}} = \left(\frac{}{b}\right)^{m}$

- Very small numbers can be expressed in standard form using negative exponents.
- Use of Exponents to Express Small Number in Standard form:

  (i) Very large and very small numbers can be expressed in standard form.

  (ii) Standard form is also called scientific notation form.

  (iii) A number written as $m \times 10^{n}$ is said to be in standard form if m is a decimal number such that $1 \leq m < 10$ and n is either a positive or a negative integer.

  Examples: 150,000,000,000 $= 1.5 \times 10^{11}$.

- Exponential notation is a powerful way to express repeated multiplication of the same number. For any non-zero rational number 'a' and a natural number n, the product $a \times a \times a \times .\ \ (\ \times a\ n) times\ = a^{n}$. It is known as the nth power of 'a' and is read as 'a' raised to the power n'. The rational number a is called the base and n is called exponent.

Chapter – 13
Direct and Inverse Proportions

- **Variations:** If the values of two quantities depend on each other in such a way that a change in one causes corresponding change in the other, then the two quantities are said to be in variation.
- **Direct Variation or Direct Proportion:**
  Two quantities x and y are said to be in **direct proportion** if they increase (decrease) together in such a manner that the ratio of their corresponding values remains constant. That is if $\frac{x}{y} = k$ [*k is a positive number*], then x and y are said to vary directly. In such a case if y_1, y_2 are the values of y corresponding to the values x1, x of x respectively then $\frac{x_1}{y_1} = \frac{2}{y_2}$.
- If the number of articles purchased increases, the total cost also increases.
- More than money deposited in a bank, more is the interest earned.
- Quantities increasing or decreasing together need not always be in direct proportion, same in the case of inverse proportion.
- When two quantities x and y are in direct proportion (or vary directly), they are written as $x \propto y$. Symbol '$\propto$' stands for 'is proportion to'.
- **Inverse Proportion:** Two quantities x and y are said to be in **inverse proportion** if an increase in x causes a proportional decrease in y **(and vice-versa**) in such a manner that the product of their corresponding values remains constant. That is, if xy = k, then x and y are said to vary inversely. In this case if y_1, y_2 are the values of y corresponding to the values x_1, x_2 of x respectively then $x_1y_1 = x_2y_2$ or $\frac{x_1}{x_2} = \frac{x_2}{y_2}$
- When two quantities x and y are in inverse proportion (or vary inversely), they are written as $x \propto \frac{1}{}$. Example: If the number of workers increases, time taken to finish the job decreases. Or If the speed will increase the time required to cover a given distance will decrease.

Chapter – 14

Factorisation

- **Factorisation:** Representation of an algebraic expression as the product of two or more expressions is called factorization. Each such expression is called a factor of the given algebraic expression.
- When we factorise an expression, we write it as a product of factors. These factors may be numbers, algebraic variables or algebraic expressions.
- An irreducible factor is a factor which cannot be expressed further as a product of factors.
- A systematic way of factorising an expression is the common factor method. It consists of three steps: (i) Write each term of the expression as a product of irreducible factors (ii) Look for and separate the common factors and (iii) Combine the remaining factors in each term in accordance with the distributive law.
- Sometimes, all the terms in a given expression do not have a common factor; but the terms can be grouped in such a way that all the terms in each group have a common factor. When we do this, there emerges a common factor across all the groups leading to the required factorisation of the expression. This is the method of regrouping.
- In factorisation by regrouping, we should remember that any regrouping (i.e., rearrangement) of the terms in the given expression may not lead to factorisation. We must observe the expression and come out with the desired regrouping by trial and error.
- A number of expressions to be factorised are of the form or can be put into the form: $a^2 + 2ab + b^2$, $a^2 - 2\mathrm{ab} + \mathrm{b}^2, \mathrm{a}^2 - \mathrm{b}^2$ and $x^2 + (a + b)x + ab$. These expressions can be easily factorised using Identities I, II, III and IV

  $a^2 + 2\,ab + b^2 = (a + b)^2$

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

  $a^2 - b^2 = (a + b)\ (a - b)$

  $x^2 + (a + b)\,x + ab = (x + a)\ (x + b)$

- In expressions which have factors of the type $(x + a)(x + b)$, remember the numerical term gives ab. Its factors, a and b, should be so chosen that their sum, with signs taken care of, is the coefficient of x.
- We know that in the case of numbers, division is the inverse of multiplication. This idea is applicable also to the division of algebraic expressions.
- In the case of division of a polynomial by a monomial, we may carry out the division either by dividing each term of the polynomial by the monomial or by the common factor method.
- In the case of division of a polynomial by a polynomial, we cannot proceed by dividing each term in the dividend polynomial by the divisor polynomial. Instead, we factorise both the polynomials and cancel their common factors.
- In the case of divisions of algebraic expressions that we studied in this chapter, we have

  Dividend = Divisor × Quotient.

  In general, however, the relation is

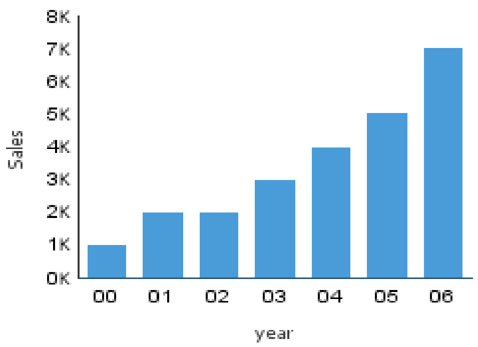
  Dividend = Divisor × Quotient + Remainder

  Thus, we have considered in the present chapter only those divisions in which the remainder is zero.
- There are many errors students commonly make when solving algebra exercises. You should avoid making such errors.

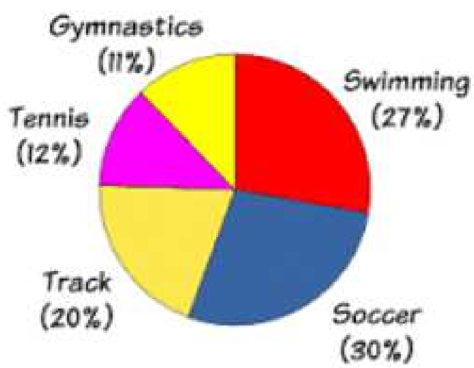
Chapter – 15

Introduction to Graphs

- Graphical presentation of data is easier to understand.
  (i) A bar graph is used to show comparison among categories.
  (ii) A pie graph is used to compare parts of a whole.
  (iii) A Histogram is a bar graph that shows data in intervals.
- A line graph displays data that changes continuously over periods of time.
- A line graph which is a whole unbroken line is called a linear graph.
- For fixing a point on the graph sheet we need, x-coordinate and y-coordinate.
- The relation between dependent variable and independent variable is shown through a graph.
- **A Bar Graph**: A pictorial representation of numerical data in the form of bars (rectangles) of uniform width with equal spacing. The length (or height) of each bar represents the given number.

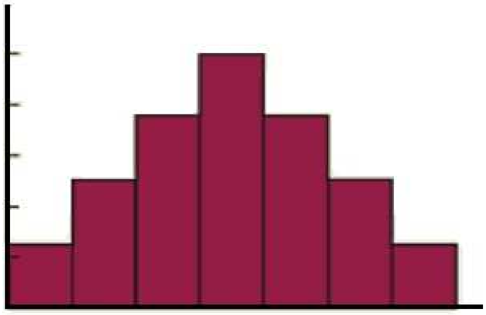


- **A Pie Graph:** A pie graph is used to compare parts of a whole. The various observations or components are represented by the sectors of the circle.



Key Notes

- **A Histogram:** Histogram is a type of bar diagram, where the class intervals are shown on the horizontal axis and the heights of the bars (rectangles) show the frequency of the class interval, but there is no gap between the bars as there is no gap between the class intervals.



- **Linear Graph:** A line graph in which all the line segments form a part of a single line.
- **Coordinates:** A point in Cartesian plane is represented by an ordered pair of numbers.
- **Ordered Pair:** A pair of numbers written in specified order.

Chapter – 16

Playing With Numbers

- **Number in general form**: A number is said to be in a general form if it is expressed as the sum of the products of its digits with their respective place values.
- Numbers can be written in general form. Thus, a two digit number ab will be written as ab = 10a +b.
- The general form of numbers are helpful in solving puzzles or number games.
- The reasons for the divisibility of numbers by 10, 5, 2, 9 or 3 can be given when numbers are written in general form.
- **Tests of Divisiblity:**
  (i) **Divisibility by 2:** A number is divisible by 2 when its one's digit is 0, 2, 4, 6 or 8. Explanation: Given number abc = 100a +10b +c. 100a and 10b are divisible by 2 because 100 and 10 are divisible by 2. Thus given number is divisible by 2 only when a = 0, 2, 4, 6 or 8.
  (ii) **Divisibility by 3:** A number is divisible by 3 when the sum of its digits is divisible by 3. Example: given number = 61785. Sum of digits = 6+1+7+8+5 = 27 which is divisible by 3. Therefore, 61785 is divisible y 3.
  (iii) **Divisibility by 4:** A number is divisible by 4 when the number formed by its last two digits is divisible by 4. Example: 6216, 548, etc.
  (iv) **Divisibility by 5:** A number is divisible by 5 when its ones digit is 0 or 5. Example: 645, 540 etc.
  (v) **Divisibility by 6:** A number is divisible by 6 when it is divisible by both 2 and 3. Example: 246, 7230, etc.
  (vi) **Divisibility by 9:** A number is divisible by 9 when the sum of its digits is divisible by 9. Example: consider a number 215847. Sum of digits = 2+1+5+8+4+7 = 27 which is divisible by 9. Therefore, 215847 is divisible by 9.
  (vii) **Divisibility by 10:** A number is divisible by 10 when its ones digit is 0. Example: 540, 890, etc.
  (viii) **Divisibility by 11:** A number is divisible by 11 when the difference of the sum of its digits in odd places and the sum of its digits in even places is either o or a multiple of 11.
  Example: consider a number 462.
  Sum of digits in odd places = 4+2 = 6
  Sum of digits in even places = 6
  Difference = 6-6=0, which is zero. So, the number is divisible by 11.