# CHAPTER – 1

## KNOWING OUR NUMBER

- Given two numbers, one with more digits is the greater number. If the number of digits in two given numbers is the same, that number is larger, which has a greater leftmost digit. If this digit also happens to be the same, we look at the next digit and so on.
- In forming numbers from given digits, we should be careful to see if the conditions under which the numbers are to be formed are satisfied. Thus, to form the greatest four-digit number from 7, 8, 3, 5 without repeating a single digit, we need to use all four digits, the greatest number can have only 8 as the leftmost digit.
- The smallest four-digit number is 1000 (one thousand). It follows the largest three digit number 999. Similarly, the smallest five digit number is 10,000. It is ten thousand and follows the largest four digit number 9999. Further, the smallest six digit number is 100,000. It is one lakh and follows the largest five-digit number 99,999. This carries on for higher digit numbers in a similar manner.
- Use of commas helps in reading and writing large numbers. In the Indian system of numeration we have commas after 3 digits starting from the right and thereafter every 2 digits. The commas after 3, 5 and 7 digits separate thousand, lakh and crore respectively. In the International system of numeration commas are placed after every 3 digits starting from the right. The commas after 3 and 6 digits separate thousand and million respectively.
- Large numbers are needed in many places in daily life. For example, for giving number of students in a school, number of people in a village or town, money paid or received in large transactions (paying and selling), in measuring large distances say between various cities in a country or in the world and so on.
- Remember kilo shows 1000 times larger, Centi shows 100 times smaller and milli shows 1000 times smaller, thus, 1 kilometre = 1000 metres, 1 metre = 100 centimetres or 1000 millimetres etc.
- There are a number of situations in which we do not need the exact quantity but need only a reasonable guess or an estimate. For example, while stating how many spectators watched a particular international hockey match, we state the approximate number, say 51,000, we do not need to state the exact number.

# Key Notes

- Estimation involves approximating a quantity to an accuracy required. Thus, 4117 may be approximated to 4100 or to 4000, i.e. to the nearest hundred or to the nearest thousand depending on our need.
- In number of situations, we have to estimate the outcome of number operations. This is done by rounding off the numbers involved and getting a quick, rough answer.
- Estimating the outcome of number operations is useful in checking answers.
- Use of brackets allows us to avoid confusion in the problems where we need to carry out more than one number operation.
- We use the Hindu-Arabic system of numerals. Another system of writing numerals is the Roman system.

# CHAPTER – 2

## WHOLE NUMBERS

- The numbers 1, 2, 3, …… which we use for counting are known as natural numbers.
- If you add 1 to a natural number, we get its successor. If you subtract 1 from a natural number, you get its predecessor.
- Every natural number has a successor. Every natural number except 1 has a predecessor.
- If we add the number zero to the collection of natural numbers, we get the collection of whole numbers. Thus, the numbers 0, 1, 2, 3, ... form the collection of whole numbers.
- Every whole number has a successor. Every whole number except zero has a predecessor.
- All natural numbers are whole numbers, but all whole numbers are not natural numbers.
- We take a line, mark a point on it and label it 0. We then mark out points to the right of 0, at equal intervals. Label them as 1, 2, 3, .... Thus, we have a number line with the whole numbers represented on it. We can easily perform the number operations of addition, subtraction and multiplication on the number line.
- Addition corresponds to moving to the right on the number line, whereas subtraction corresponds to moving to the left. Multiplication corresponds to making jumps of equal distance starting from zero.
- Adding two whole numbers always gives a whole number. Similarly, multiplying two whole numbers always gives a whole number. We say that whole numbers are closed under addition and also under multiplication. However, whole numbers are not closed under subtraction and under division.
- Division by zero is not defined.
- Zero is the identity for addition of whole numbers. The whole number 1 is the identity for multiplication of whole numbers.
- You can add two whole numbers in any order. You can multiply two whole numbers in any order. We say that addition and multiplication are commutative for whole numbers.
- Addition and multiplication, both, are associative for whole numbers.
- Multiplication is distributive over addition for whole numbers.
- Commutativity, associativity and distributivity properties of whole numbers are useful in simplifying calculations and we use them without being aware of them.
- Patterns with numbers are not only interesting, but are useful especially for verbal calculations and help us to understand properties of numbers better.

## CHAPTER – 3

## PLAYING WITH NUMBERS

We have discussed multiples, divisors, factors and have seen how to identify factors and multiples.

- We have discussed and discovered the following:

  (a) A factor of a number is an exact divisor of that number.

  (b) Every number is a factor of itself. 1 is a factor of every number.

  (c) Every factor of a number is less than or equal to the given number.

  (d) Every number is a multiple of each of its factors.

  (e) Every multiple of a given number is greater than or equal to that number.

  (f) Every number is a multiple of itself.

- We have learnt that –

  (a) The number other than 1, with only factors namely 1 and the number itself, is a prime number. Numbers that have more than two factors are called composite numbers. Number 1 is neither prime nor composite.

  (b) The number 2 is the smallest prime number and is even. Every prime number other than 2 is odd.

  (c) Two numbers with only 1 as a common factor are called co-prime numbers.

  (d) If a number is divisible by another number then it is divisible by each of the factors of that number.

  (e) A number divisible by two co-prime numbers is divisible by their product also.

- We have discussed how we can find just by looking at a number, whether it is divisible by small numbers 2,3,4,5,8,9 and 11. We have explored the relationship between digits of the numbers and their divisibility by different numbers.

  (a) Divisibility by 2,5 and 10 can be seen by just the last digit.

  (b) Divisibility by 3 and 9 is checked by finding the sum of all digits.

  (c) Divisibility by 4 and 8 is checked by the last 2 and 3 digits respectively.

  (d) Divisibility of 11 is checked by comparing the sum of digits at odd and even places.

- We have discovered that if two numbers are divisible by a number then their sum and difference are also divisible by that number.

- We have learnt that –

  (a) The Highest Common Factor (HCF) of two or more given numbers is the highest of their common factors.

  (b) The Lowest Common Multiple (LCM) of two or more given numbers is the lowest of their common multiples.

## CHAPTER – 4

## BASIC GEOMETRICAL IDEAS

- A point determines a location. It is usually denoted by a capital letter.
- A line segment corresponds to the shortest distance between two points. The line segment joining points A and B is denoted by $\overline{AB}$. $\overline{AB}$ and $\overline{BA}$ denote the same line segment.
- A line is obtained when a line segment like $\overline{AB}$ is extended on both sides indefinitely; it is denoted by $\overline{AB}$ or sometimes by a single small letter like l.
- Two distinct lines meeting at a point are called intersecting lines.
- Two lines in a plane are said to be parallel if they do not meet.
- A ray is a portion of line starting at a point and going in one direction endlessly.
- Any drawing (straight or non-straight) done without lifting the pencil may be called a curve. In this sense, a line is also a curve.
- A simple curve is one that does not cross itself.
- A curve is said to be closed if its ends are joined; otherwise it is said to be open.
- A polygon is a simple closed curve made up of line segments. Here,
  (i) The line segments are the sides of the polygon.
  (ii) Any two sides with a common end point are adjacent sides.
  (iii) The meeting point of a pair of sides is called a vertex.
  (iv) The end points of the same side are adjacent vertices.
  (v) The join of any two non-adjacent vertices is a diagonal.
- An angle is made up of two rays starting from a common end point.
- Two rays OA $\overline{OA}$ and $\overline{OB}$ make $\angle AOB$ (or also called $\angle BOA$).
- An angle leads to three divisions of a region:
- On the angle, the interior of the angle and the exterior of the angle.
- A triangle is a three-sided polygon.
- A quadrilateral is a four-sided polygon. (It should be named cyclically). In any quadrilateral ABCD, $\overline{AB}$ & $\overline{\mathrm{DC}}$ and $\overline{AD}$ & $\overline{\mathrm{BC}}$ are pairs of opposite sides. $\angle\mathrm{A}$ & $\angle\mathrm{C}$ and $\angle\mathrm{B}$ & $\angle\mathrm{D}$ are pairs of opposite angles. $\angle\mathrm{A}$ is adjacent to $\angle\mathrm{B}$ & $\angle\mathrm{D}$; similar relations exist for other three angles.

# Key Notes

- A circle is the path of a point moving at the same distance from a fixed point. The fixed point is the centre, the fixed distance is the radius and the distance around the circle is the circumference.
  - A chord of a circle is a line segment joining any two points on the circle.
  - A diameter is a chord passing through the centre of the circle.
  - A sector is the region in the interior of a circle enclosed by an arc on one side and a pair of radii on the other two sides.
  - A segment of a circle is a region in the interior of the circle enclosed by an arc and a chord.
  - The diameter of a circle divides it into two semi-circles.

## CHAPTER – 5

## Understanding Elementary Shapes

- The distance between the end points of a line segment is its length.
- A graduated ruler and the divider are useful to compare lengths of line segments.
- When a hand of a clock moves from one position to another position we have an example for an angle.
- One full turn of the hand is 1 revolution.
- A right angle is ¼ revolution and a straight angle is ½ a revolution.
- We use a protractor to measure the size of an angle in degrees.
- The measure of a right angle is 90° and hence that of a straight angle is 180°.
- An angle is acute if its measure is smaller than that of a right angle and is obtuse if its measure is greater than that of a right angle and less than a straight angle.
- A reflex angle is larger than a straight angle.
- Two intersecting lines are perpendicular if the angle between them is 90°.
- The perpendicular bisector of a line segment is a perpendicular to the line segment that divides it into two equal parts.
- Triangles can be classified as follows based on their angles:

| **Nature of angles in the triangle** | ***Name*** |
|---|---|
| Each angle is acute | Acute angled triangle |
| One angle is a right angle | Right angled triangle |
| One angle is obtuse | Obtuse angled triangle |

- Triangles can be classified as follows based on the lengths of their sides:

| **Nature of sides in the triangle** | **Name** |
|---|---|
| All the three sides are of unequal length | Scalene triangle |
| Any two of the sides are of equal length | Isosceles triangle |
| All the three sides are of equal length | Equilateral triangle |

- Polygons are named based on their sides.

| **Number of sides** | **Name of the Polygon** |
|---|---|
| 3 | Triangle |
| 4 | Quadrilateral |

| | |
|---|---|
| 5 | Pentagon |
| 6 | Hexagon |
| 8 | Octagon |

- Quadrilaterals are further classified with reference to their properties.

| PROPERTIES | Name of the Quadrilateral |
|---|---|
| One pair of parallel sides | Trapezium |
| Two pairs of parallel sides | Parallelogram |
| Parallelogram with 4 right angles | Rectangle |
| Parallelogram with 4 sides of equal length | Rhombus |
| A rhombus with 4 right angles | Square |

- We see around us many three dimensional shapes. Cubes, cuboids, spheres, cylinders, cones, prisms and pyramids are some of them.

# CHAPTER – 6

## INTEGERS

- We have seen that there are times when we need to use numbers with a negative sign. This is when we want to go below zero on the number line. These are called negative numbers. Some examples of their use can be in temperature scale, water level in lake or river, level of oil in tank etc. They are also used to denote debit account or outstanding dues.
- The collection of numbers..., – 4, – 3, – 2, – 1, 0, 1, 2, 3, 4, ... is called integers. So, – 1, – 2, – 3, – 4, ... called negative numbers are negative integers and 1, 2, 3, 4, ... called positive numbers are the positive integers.
- We have also seen how one more than given number gives a successor and one less than given number gives predecessor.
- We observe that

  (a) When we have the same sign, add and put the same sign.

  (i) When two positive integers are added, we get a positive integer [e.g. (+3) + (+2) = + 5].

  (ii) When two negative integers are added, we get a negative integer [e.g. (–2) +(–1)= – 3].

  (b) When one positive and one negative integers are added we subtract them as whole numbers by considering the numbers without their sign and then put the sign of the bigger number with the subtraction obtained. The bigger integer is decided by ignoring the signs of the integers [e.g. (+4) + (–3) = + 1 and (–4) + (+3) = – 1].

  (c) The subtraction of an integer is the same as the addition of its additive inverse.
- We have shown how addition and subtraction of integers can also be shown on a number line.

## CHAPTER – 7

## FRACTIONS

What have we discussed?

- A fraction is a number representing a part of a whole. The whole may be a single object or a group of objects.
- When expressing a situation of counting parts to write a fraction, it must be ensured that all parts are equal.
- In 7, is called the numerator and 7 is called the denominator.
- Fractions can be shown on a number line. Every fraction has a point associated with it on the number line.
- In a proper fraction, the numerator is less than the denominator. The fractions, where the numerator is greater than the denominator are called improper fractions. An improper fraction can be written as a combination of a whole and a part, and such fraction then called mixed fractions.
- Each proper or improper fraction has many equivalent fractions. To find an equivalent fraction of a given fraction, we may multiply or divide both the numerator and the denominator of the given fraction by the same number.
- A fraction is said to be in the simplest (or lowest) form if its numerator and the denominator have no common factor except 1.

# CHAPTER – 8

## DECIMALS

- To understand the parts of one whole (i.e. a unit) we represent a unit by a block. One block divided into 10 equal parts means each part is $\frac{}{10}$ (one-tenth) of a unit. It can be written as 0.1 in decimal notation. The dot represents the decimal point and it comes between the units place and the tenths place.
- Every fraction with denominator 10 can be written in decimal notation and vice-versa.
- One block divided into 100 equal parts means each part is $(\frac{}{10})$ (one-hundredth) of a unit. It can be written as 0.01 in decimal notation.
- Every fraction with denominator 100 can be written in decimal notation and vice-versa.
- In the place value table, as we go from left to the right, the multiplying factor becomes $\frac{}{10}$ of the previous factor.
- **Fractions as Decimals:** Fractions can be converted into decimals by writing them in the form with denominators 10, 100 and so on. Example: $\frac{}{10}$=0.7
- **Decimals as Fractions:** Decimals can be converted into fractions by removing their decimal points and writing 10, 100, etc. in the denominators, depending upon the number of decimal places in the decimals. Examples: 0.9 = $\frac{}{10}$
- **Addition of Decimals**: Decimals can be added by writing them with equal number of decimals places. Example: Convert the given decimals as 0.005, 6.500 and 20.040.
  0.005 + 6.500 + 20.040 = 26.545
- **Subtraction of Decimals**: Decimals can be subtracted by writing them with equal number of decimal places.
  Example: Subtract the given decimals as 5.674 and 12.500
  12.500 – 5.674 = 6.826
- **Comparing Decimals**: Decimals numbers can be compared using the idea of place value:
  Example: 45.32 or 35.69

The given decimals have distinct whole number part, so we compare whole number part only. The whole number part of 45.32 is greater than 35.69. Therefore, 45.32>35.69.

- **Using Decimals**: Many daily life problems can be solved by converting different units of measurements such as money, length, weight, etc. in the decimal form.
- **Money**:

  100 paise = 1 Rupee

  1 paise = 1/100 Rupee = 0.01 Rs.

  5 paise = 5/100 Rs. = 0.05 Rs.

  105 paise = 1 Rs. + 5 paise = 1.05 Rs.

  7 Rs. 8 paise = 7 Rs. + 0.08 Rs = 7.08 Rs.

  7 Rs. 80 paise = 7 Rs. + 0.80 Rs. = 7.80 Rs.
- **Length**:

  10 mm = 1 cm

  1mm = 1/10 cm = 0.1 cm

  100 cm = 1 m

  1 cm = 1/100 m = 0.01 m

  1000 m = 1 km

  1 m = 1/1000 km = 0.001 km
- **Weight:**

  1000 g = 1 kg

  1 g = 1/1000 kg = 0.001 kg

  25 g = 25/1000 kg = 0.025 kg

## CHAPTER – 9

## DATA HANDLING

- **Data:** A collection of numbers gathered to give some information.
- **Recording Data:** Data can be collected from different sources.
- **Pictograph:** The representation of data through pictures of objects. It helps answer the questions on the data at a glance.
- **Bar Graph:** Pictorial representation of numerical data in the form of bars (ractangles) of equal width and varying heights.
- We have seen that data is a collection of numbers gathered to give some information.
- To get a particular information from the given data quickly, the data can be arranged in a tabular form using tally marks.
- We learnt how a pictograph represents data in the form of pictures, objects or parts of objects. We have also seen how to interpret a pictograph and answer the related questions.
- We have drawn pictographs using symbols to represent a certain number of items or things.
- We have discussed how to represent data by using a bar diagram or a bar graph. In a bar graph, bars of uniform width are drawn horizontally or vertically with equal spacing between them. The length of each bar gives the required information.
- To do this we also discussed the process of choosing a scale for the graph. For example, 1 unit = 100 students. We have also practised reading a given bar graph. We have seen how interpretations from the same can be made.

## CHAPTER – 10

## MENSURATION

- **Perimeter** is the distance covered along the boundary forming a closed figure when you go round the figure once.
- (a) Perimeter of a rectangle = 2 × (length + breadth)
  (b) Perimeter of a square = 4 × length of its side
  (c) Perimeter of an equilateral triangle = 3 × length of a side
  (d) Perimeter of a regular pentagon has five equal sides = 5 × length of a sides
- Figures in which all sides and angles are equal are called regular closed figures.
- The amount of surface enclosed by a closed figure is called its area.
- To calculate the area of a figure using a squared paper, the following conventions are adopted :
  (a) Ignore portions of the area that are less than half a square.
  (b) If more than half a square is in a region. Count it as one square.
  (c) If exactly half the square is counted, take its area as $_{2}$ sq units.
- **Area:** The amount of surface enclosed by a closed figure.
- (a) Area of a rectangle = length × breadth
  (b) Area of a square = side × side

# CHAPTER – 11

## ALGEBRA

- **Algebra**: A generalization of arithmetic in which letters representing numbers are combined according to the rules of arithmetic.
- We looked at patterns of making letters and other shapes using matchsticks. We learnt how to write the general relation between the number of matchsticks required for repeating a given shape. The number of times a given shape is repeated varies; it takes on values 1,2,3,... . It is a variable, denoted by some letter like n.
- A variable takes on different values, its value is not fixed. The length of a square can have any value. It is a variable. But the number of angles of a triangle has a fixed value 3. It is not a variable.
- We may use any letter n, l, m, p, x, y, z, etc. to show a variable.
- A variable allows us to express relations in any practical situation.
- Variables are numbers, although their value is not fixed. We can do the operations of addition, subtraction, multiplication and division on them just as in the case of fixed numbers. Using different operations we can form expressions with variables like $x - 3$, $x + 3$, $2n$, $5m$, $3p$, $2y + 3$, $3l - 5$, etc.
- Variables allow us to express many common rules in both geometry and arithmetic in a general way. For example, the rule that the sum of two numbers remains the same if the order in which the numbers are taken is reversed can be expressed as $a + b = b + a$. Here, the variables a and b stand for any number, 1, 32, 1000 – 7, – 20, etc.
- An equation is a condition on a variable. It is expressed by saying that an expression with a variable is equal to a fixed number, e.g. $x - 3 = 10$.
- An equation has two sides, LHS and RHS, between them is the equal (=) sign.
- **Solution of an Equation:** The value of the variable in an equation which satisfies the equation.
- For getting the solution of an equation, one method is the trial and error method. In this method, we give some value to the variable and check whether it satisfies the equation. We go on giving this way different values to the variable until we find the right which satisfies the equation.

## Key Notes

- The LHS of an equation is equal to its RHS only for a definite value of the variable in the equation. We say that this definite value of the variable satisfies the equation. This value itself is called the solution of the equation.
- For getting the solution of an equation, one method is the trial and error method. In this method, we give some value to the variable and check whether it satisfies the equation. We go on giving this way different values to the variable` until we find the right value which satisfies the equation.

## CHAPTER – 12

## RATIO AND PROPORTION

- For comparing quantities of the same type, we commonly use the method of taking difference between the quantities.
- In many situations, a more meaningful comparison between quantities is made by using division, i.e. by seeing how many times one quantity is to the other quantity. This method is known as comparison by ratio. For example, Isha's weight is 25 kg and her father's weight is 75 kg. We say that Isha's father's weight and Isha's weight are in the ratio 3 : 1.
- For comparison by ratio, the two quantities must be in the same unit. If they are not, they should be expressed in the same unit before the ratio is taken.
- **Comparision by taking difference:**
  For comparing quantities of the same type, we commonly use the method of taking difference between the quantities.
  Some times the comparison by difference does not make better sense than the comparison by divison.
- **Comparison by Division:**
  The comparison of two numbers or quantities by division is known as the ratio. Symbol ':' is used to denote ratio.
- The same ratio may occur in different situations.
- Note that the ratio 3 : 2 is different from 2 : 3. Thus, the order in which quantities are taken to express their ratio is important.
- A ratio may be treated as a fraction, thus the ratio 10 : 3 may be treated as 3
- Two ratios are equivalent, if the fractions corresponding to them are equivalent. Thus, 3 : 2 is equivalent to 6 : 4 or 12 : 8.
- A ratio can be expressed in its lowest form. For example, ratio 50 : 15 is treated as 15 in its

  lowest form 15 = 3 Hence, the lowest form of the ratio 50 : 15 is 10 : 3.
- Four quantities are said to be in proportion, if the ratio of the first and the second quantities is equal to the ratio of the third and the fourth quantities. Thus, 3, 10, 15, 50 are in

proportion, since $\frac{3}{10} = \frac{}{50} =$ We indicate the proportion by 3:10 :: 15:50, it is read as 3 is to 10 as 15 is to 50. In the above proportion, 3 and 50 are the extreme terms and 10 and 15 are the middle terms.

- The order of terms in the proportion is important. 3, 10, 15 and 50 are in proportion, but 3, 10, 50 and 15 are not, since $\frac{}{10}$ is not equal to $\frac{}{15}$
- The method in which we first find the value of one unit and then the value of the required number of units is known as the unitary method. Suppose the cost of 6 cans is ` 210. To find the cost of 4 cans, using the unitary method, we first find the cost of 1 can. It is Rs $\frac{}{6}$. or ` 35. From this, we find the price of 4 cans as ` 35 × 4 or ` 140.

## CHAPTER – 14

## PRACTICAL GEOMETRY

This chapter deals with methods of drawing geometrical shapes.

- We use the following mathematical instruments to construct shapes:

  (i) A graduated ruler

  (ii) The compasses

  (iii) The divider

  (iv) Set-squares

  (v) The protractor

- Using the ruler and compasses, the following constructions can be made:

  (i) A circle, when the length of its radius is known.

  (ii) A line segment, if its length is given.

  (iii) A copy of a line segment.

  (iv) A perpendicular to a line through a point

  on the line

  not on the line.

  (v) The perpendicular bisector of a line segment of given length.

  (vi) An angle of a given measure.

  (vii) A copy of an angle.

  (viii) The bisector of a given angle.

  (ix) Some angles of special measures such as

  (a) 90°

  (b) 45°

  (c) 60°

  (d) 30°

  (e) 120°

  (f ) 135°