



KNOWING OUR NUMBERS

Comparing Numbers

- In order to compare two numbers, we adopt the following rules:

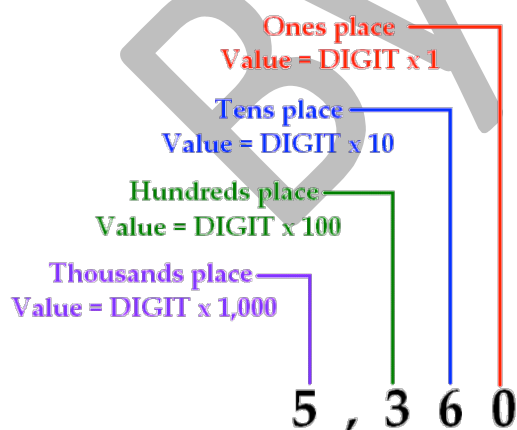
When one value is smaller than another, we can use a "less than" sign.	<	Example: $30 < 60$
When two values are equal, we use the "equals" sign.	=	Example: $15 + 15 = 30$
When one value is bigger than another, we can use a "greater than" sign.	>	Example: $60 > 30$

International System of Numeration

Period	Million		Thousand			Ones		
Place	Ten Million	Million	Hundred Thousand	Ten Thousand	Thousand	Hundreds	Tens	Ones
	TM	M	L	T Th	Th	H	T	O

For Example: 82834571 can be placed in place value chart as,

T M	M	H Th	T Th	Th	H	T	O
8	2	8	3	4	5	7	1



Roman Numerals

- There are seven basic symbols to write any numeral.
- These symbols are given below:

ROMAN NUMERAL	I	V	X	L	C	D	M
HINDU ARABIC NUMERAL	1	5	10	50	100	500	1000

Example: CXIV = 100 + 10 + (5 – 1) = 114

XL = (50 – 10) = 40

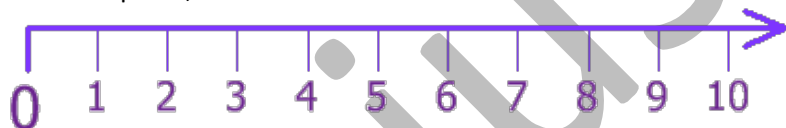
Roman Numerals

1 = I	10 = X
2 = II	20 = XX
3 = III	30 = XXX
4 = IV	40 = XL
5 = V	50 = L
6 = VI	60 = LX
7 = VII	70 = LXX
8 = VIII	80 = LXXX
9 = IX	90 = XC
	100 = C

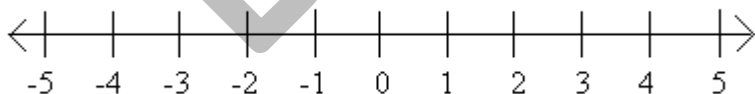
WHOLE NUMBERS

- The numbers {0, 1, 2, 3,.....} are whole numbers. There is no fractional or decimal part and no negatives.

Example: 6, 52 and 245 are all whole numbers.

**Number Line**

- A number on the left is less than a number on the right.
Example: 5 is less than 8, –1 is less than 1 and –8 is less than –5
- A number on the right is greater than a number on the left.
Example: 8 is greater than 5, 1 is greater than –1 and –5 is greater than –8

**Patterns in whole numbers**

- The basic of patterns in whole numbers begins with shapes made of dots.
- The shapes we take are 1) line 2) triangle 3) square 4) rectangle.
- Every number should be arranged in the following shapes.

- The number 2 is shown as .
- The number 3 is shown as . . .

PLAYING WITH NUMBERS

Factors and Multiples

- "Factors" are the numbers we can **multiply together** to get another number:
 - 2 and 3 are factors of 6
 - A number can have **many** factors.
 - $3 \times 4 = 12$, so 3 and 4 are factors of 12
 - $2 \times 6 = 12$, so 2 and 6 are also factors of 12,
 - $1 \times 12 = 12$, so 1 and 12 are factors of 12 as well.
 - 1, –2, –3, –4, –6 and –12 also factors of 12:
 - $(-1) \times (-12) = 12$
 - $(-2) \times (-6) = 12$
 - $(-3) \times (-4) = 12$
 - So ALL the factors of 12 are:
 - 1, 2, 3, 4, 6 and 12
 - –1, –2, –3, –4, –6 and –12
 - A multiple is the result of **multiplying** a number **by an integer** (not a fraction).
- Example: Multiples of 3: ..., –9, –6, –3, 0, 3, 6, 9, ...

Prime and Composite Numbers

- A Prime Number can be divided evenly only by 1 or itself. It must be a whole number greater than 1.
- Example: 7 can only be divided evenly by 1 or 7, so it is a prime number. But 6 can be divided evenly by 1, 2, 3 and 6 so it is NOT a prime number (it is a composite number).
- Composite Number can be divided evenly by numbers other than 1 or itself.

Common Factors and Multiples

- **Common Multiples:** Multiples that are common to two numbers are known as common multiples of those numbers.

Example: Consider two numbers – 30 and 45. Multiples of 30 and 45 are –

30 = 30, 60, 90, 120, 150, 180, 210, 240, 270.....

$45 = 45, 90, 135, 190, 225, 270, \dots$

- **Common Factors:** Factors that are common to two or more numbers are known as their common factors.

Example: Considering the same two numbers 30 and 45.

5	45	5	30
3	9	3	6
3	3	2	2
	1		1

Factors of 30 and 45 are –

$30 = \{1, 2, 3, 4, 5, 6, 12, 15, 30\}$

$45 = \{1, 3, 5, 9, 15, 45\}$

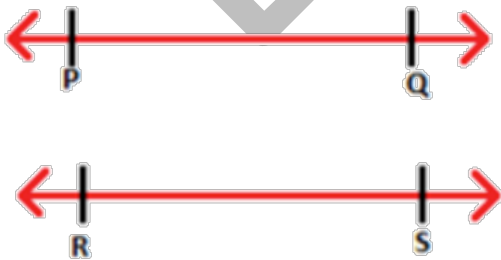
Common factors of 30 and 45 are 1, 3, 5 and 15.

- A prime factor is a whole number factor that is also a prime number. For example, the prime factors of 35 are 5 and 7.
- The Highest Common Factor (H.C.F) of two (or more) numbers is the largest number that divides evenly into both numbers. In other words the H.C.F is the largest of all the common factors. The common factors of 12 and 18 are 1, 2, 3 and 6. The largest common factor is 6, so this is the H.C.F. of 12 and 18.
- Lowest Common Multiple (LCM): The least or smallest common multiple of any two or more given natural numbers are termed as LCM. For example, LCM of 10, 15, and 20 is 60.

BASIC GEOMETRICAL IDEAS

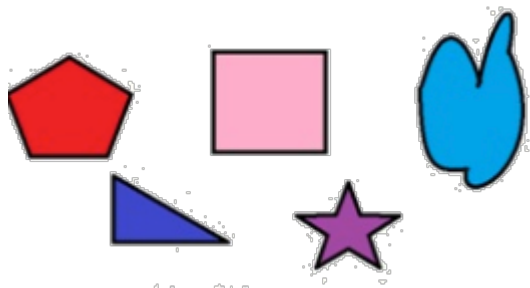
Parallel Lines:

- Two lines are said to be parallel when they do not meet at any point in a plane. Lines which do not have a common intersection point and never cross path with each other are parallel to each other. Symbol for showing parallel lines is \parallel .

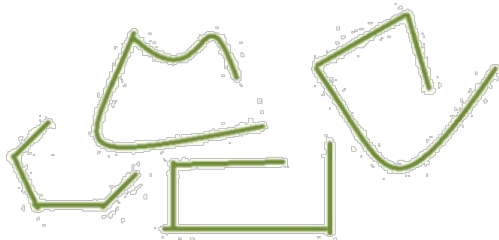


Geometric Shapes: Open & Closed Figures

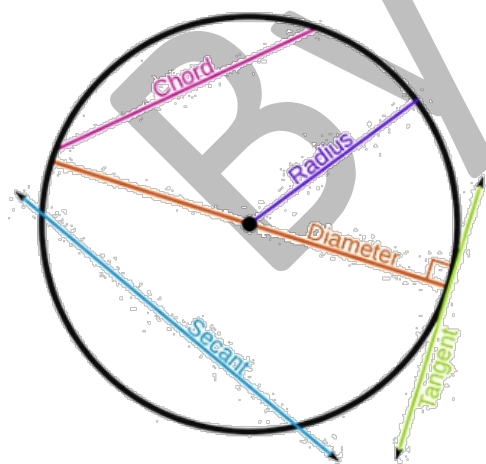
- A point is a small dot which is the starting point of a line segment.
- Geometric shapes such as a square, rectangle, circles and triangles are few basic 2D shapes.
- A closed figure can be defined as any geometric shape which starts and ends at the same point to form a boundary by line segments or by curves.



- Open figures are incomplete shapes.

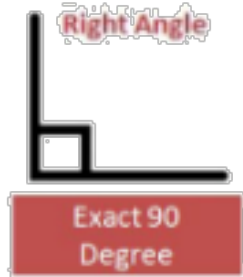
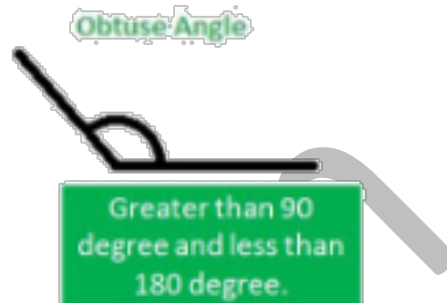
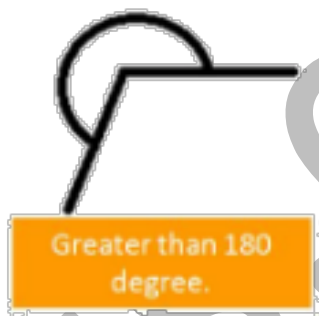
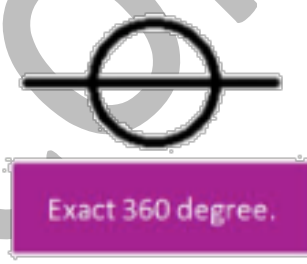


- A curve is a smoothly flowing line that you can draw on a paper without using a ruler. The random lines that you doodle on paper are also curves.
- An angle is a figure in which two rays emerge from a common point. This point is called the vertex of the angle and the two rays forming the angle are called its arms or sides.
- A quadrilateral is a polygon which has only 4 sides or edges, therefore having 4 corners or vertices.
- The locus of all points at a fixed distance from a reference central point is called a circle.

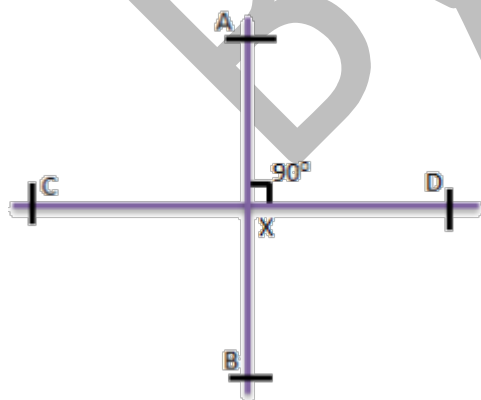


UNDERSTANDING ELEMENTARY SHAPES

- A line segment is a part of line in which a linear line connecting two points within a line.

Acute AngleRight AngleObtuse AngleStraight AngleReflex AngleFull Rotation

- The Protractor is a semi-circular disc used to draw and measure angles. It is graduated from 0 to 180 degrees and can be directly used to measure any angle within the range. It has two set of markings, 0 to 180 degrees from left to right and vice versa.
- Perpendicular lines lie in the same plane i.e. they are co-planar and intersect at right angles. Thus it implies that if you have two lines which are perpendicular to each other, then these lines will be at right angles and vice versa.



Polygon

- A polygon is a two-dimensional (2-D) closed figure made up of straight line segments.
- The shape is a closed figure having a bounded area.
- Sides are made up of straight lines called edges; no curved figure is a polygon.
- It has common meeting points called corners or vertices.
- A number of vertices is same as the number of vertices.
- Each angle formed is less than 180° .

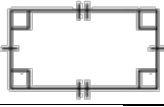
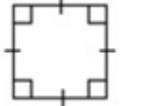
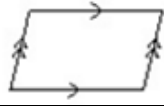


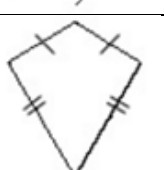
Types of Polygons

- Regular: If a polygon's all sides are the same length (equilateral) and all angles are equal (equiangular), such polygon is a regular polygon.
- Irregular: A polygon which has irregular or unequal sides and angles are called irregular polygon.

Types of Triangles

- Equilateral Triangle: In such a triangle, all the side lengths are equal. In such a case, each of the interior angles will have a measure of 60 degrees.
- Isosceles Triangle: An isosceles triangle has two equal sides and two equal angles. The angles opposite the equal sides will be equal to each other.
- Scalene Triangle: A scalene triangle has all side lengths of different measures. No side will be equal in length to any of the other sides in such a triangle. In a scalene triangle, all the interior angles will also be different.

Quadrilaterals

Quadrilateral	Properties	
Rectangle	4 right angles and opposite sides equal	
Square	4 right angles and 4 equal sides	
Parallelogram	Two pairs of parallel sides and opposite sides equal	
Rhombus	Parallelogram with 4 equal sides	
Trapezoid	Two sides are parallel	
Kite	Two pairs of adjacent sides of the same length	

- Three dimensional shapes have many attributes such as faces, edges and vertices.
- The flat surfaces of the 3D shapes are called the faces.
- The line segment where two faces meet is called an edge.
- A vertex is a point where 3 edges meet.

INTEGERS

- An integer is a number that can be written without a fractional component.

For example, 21, 4, 0, and -2048 are integers.

- So, integers can be negative $\{-1, -2, -3, -4, -5, \dots\}$, positive $\{1, 2, 3, 4, 5, \dots\}$, or zero $\{0\}$, (But numbers like $\frac{1}{2}$, 1.1 and 3.5 are not integers)

FRACTIONS

- A fraction always describes part of a whole.

Examples of fractions: $\frac{1}{2}, \frac{2}{9}, \frac{3}{4}, 4\frac{3}{4}, \frac{24}{21}, \frac{100}{87}$ and $1\frac{1}{2}$.

Types of Fractions

Proper (Common) Fraction

- Where the numerator is lower than the denominator. For example $\frac{1}{2}$ or $\frac{3}{4}$

Improper Fraction

- Where the numerator is greater than or equal to the denominator.

For example: $\frac{28}{7}, \frac{140}{70}, \frac{28}{28}$

Mixed Number

- Contains both a whole number and fraction. For example: $4\frac{3}{8}$

Lowest Term Fraction

- The results of reducing a fraction so that the numerator and denominator no longer have any common factors.

For example: $\frac{14}{28} = \frac{14}{28} \div \frac{14}{14} = \frac{1}{2}$

- Simplified fractions are the fractions in their lowest, reduced and simplest form. The numerator and denominator of the fraction are reduced to the extent that the only common factor between them is 1.
Example, $\frac{2}{3}$ is the simplified fraction for $\frac{4}{6}, \frac{8}{12}, \frac{16}{24}$ and so on. Here, '1' is the only common factor between 2 and 3.

- Like Fractions: They are the group of two or more fractions that have exactly the same denominator. E.g., $\frac{1}{7}, \frac{2}{7}, \frac{6}{7}$
- Unlike Fractions: Fractions with different denominators are called the unlike fractions.
E.g., $\frac{2}{3}, \frac{4}{9}, \frac{6}{67}, \frac{9}{89}$ are unlike fractions.

DECIMALS

- A decimal number is a number where the integer part is separated from the fractional part with the help of a decimal point. The digits are placed to the left and to the right of the decimal to represent numbers greater than or less than one.

Addition of Decimals

- The numbers are first padded with zero depending upon the maximum digits present after the decimal for any of the numbers.
- For example, while adding 3.456 from 7.1, since the number 3.456 has more number of digits after the decimal, the padding is done according to 3.456. Since 3.456 have 3 digits after the decimal, we pad 7.1 to three places as 7.100.

Subtraction of Decimals

- The numbers are first padded with zero depending upon the maximum digits present after the decimal for any of the numbers.
- For example, while subtracting 3.456 from 7.1, since the number 3.456 has more number of digits after the decimal, the padding is done according to 3.456. Since 3.456 have 3 digits after the decimal, we pad 7.1 to three places as 7.100.




DATA HANDLING

- Data is a collection of information gathered by observations, measurements, research or analysis.
- A database is an organized set of data. It is the collection of tables, schemas and other entities.

Data Recording

Group	Total Number	Food per person
Infants (> 3 years)	10	1 carton milk
Kids	18	2 Buns & 1 carton milk
Adults	32	3 Buns
Old-aged	15	4 Buns

Data Organisation

Type of Food	Tally Marks	Total number
Milk only (Infants)		10
Buns (Adults & Old-aged)		47
Both Milk and Buns (Kids)		18

- A pictograph is a way to represent data using images.
- A bar graph or bar chart portrays a visual interpretation of data with the help of vertical or horizontal rectangular bars of equal width which are uniformly spaced with respect to each other, where the lengths of the bars are proportional to the data to be represented.

MENSURATION

- Perimeter of a rectangle = $2 \times (\text{length} + \text{breadth})$
- Perimeter of a square = 4 side
- Area of a Square = $\text{Side} \times \text{Side}$
- Area of a Rectangle = $\text{Length} \times \text{Breadth}$

ALGEBRA

Variables of Algebraic Expression

$$2x + 3p - 10y$$

Variables of algebraic expression

Variables and Constant in Algebraic Expression

Like and Unlike Algebraic Expression

Like Terms	Unlike Terms
$2x + 19x$	$2x + 19a$
$4w - 10w$	$4w - 10w^2$
$14.2r - 12r$	$12r - 12s$
$32a^2 + 9a^2$	$32a^2 + 9a^3$
$8y + 5y$	$8y + 5$

Ratio and Proportion

- The comparison of two quantities by the process of division method is called as 'Ratio' between two numbers.
- When two ratios are equal in value, then they are said to be in proportion. In simple words, it compares two ratios. Proportions are denoted by the symbol '::' or '='.
- $\frac{a}{b} = \frac{c}{d}$ or $a : b :: c : d$

SYMMETRY

- The imaginary line or axis along which you fold a figure to obtain the symmetrical halves is called the line of symmetry.

Types of Symmetry

Symmetry may be viewed when you flip, slide or turn an object. The different types are:

- Reflective or Line: A figure is symmetrical about a dotted line which divides it into two equal halves. This is often referred to as the basic type.
- Rotational: You rotate a shape about an axis and it appears exactly the same as it did before rotation. Example: a square, a rectangle, etc.
- Any image is said to have reflection or mirror symmetry if there is one or more than one lines such that, the first half is a mirror image of the second half. Reflection symmetry is also called mirror symmetry. Some of our alphabets pose reflection symmetry, for example the alphabet A, H, W or M.

PRACTICAL GEOMETRY

Geometric Tools and Their Uses

- The Ruler: A ruler is used to construct straight lines and measure the lengths of a line segment.
- The Compasses: The distance between the pencil and the pointer is adjustable. It is used to trace arcs, circles and angles. It is also used to mark equal lengths.
- The Protractor: It is a semi-circular disc used to draw and measure angles. It is graduated from 0 to 180 degrees and can be directly used to measure any angle within its range.
- The Divider: It looks similar to the compasses with its 'V'-shaped structure. However, it has pointers on both ends of the 'V'. The distance between them is adjustable and it is used to measure and compare lengths.
- The Set-Squares: These are the triangular pieces of plastic with some portion between them removed. There are two kinds of set squares available in the market. One has the angles 45, 45 and 90 degrees at the 3 vertices while the other has 30, 60 and 90 degree angles. They are used to draw parallel and perpendicular lines.