NOTES

– NOTES WITH MIND MAPS –

MATHEMATICS

(INTRODUCTION TO GRAPHS)

8TH

Introduction to Graphs

Graphical Representation of Data

Graphical methods used to present data is very efficient in organizing the data and understand them. There are various graphical methods which are mentioned below:

While comparing among categories, the method which is appropriate is the bar graph.

While comparing parts of a whole, pie-chart is the ideal method.

When data is provided in intervals, a histogram can be used for easier understanding.

In the case of the data changing continuously over a period of time, a line graph will be useful

When an unbroken line is represented, it is done with the help of a linear graph

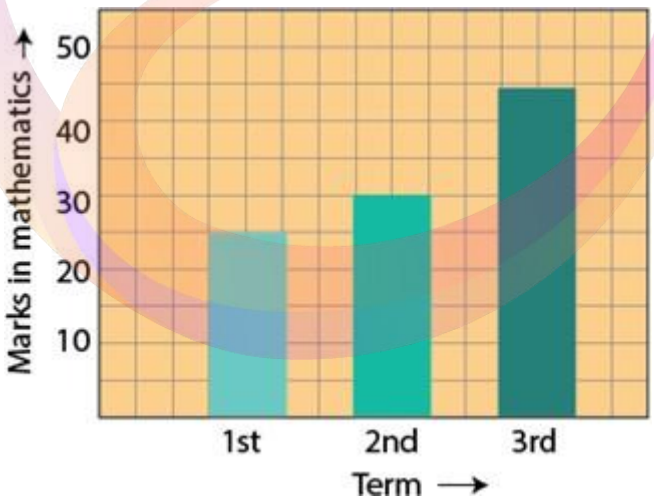
Introduction to Graphs

Graphs are visual representation of data collected. It's purpose is to show numerical data in physical form so that it can be understood quickly, easily and clearly.

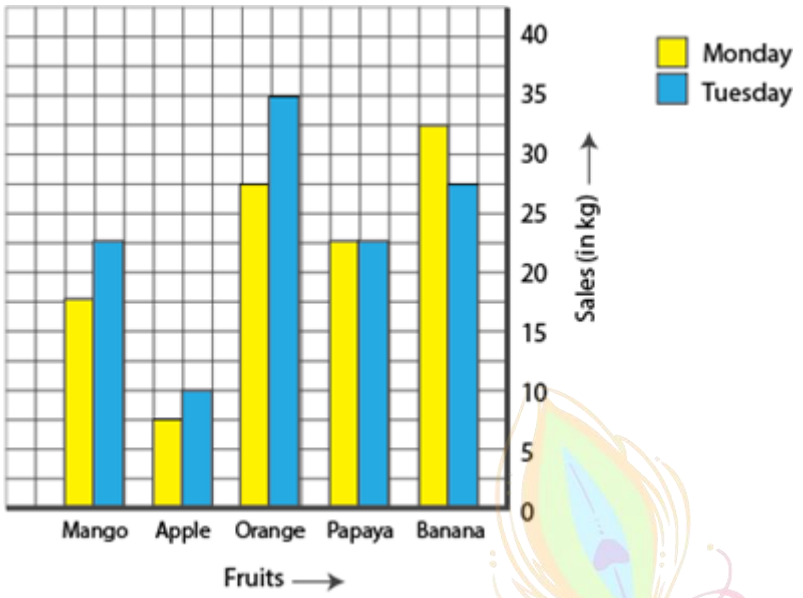
Bar Graph

A bar graph is used to show comparison among two or more different categories. Parallel vertical bars (rectangular in shape) are used to represent the data on a bar graph.

For example: The graph here represents a student's marks in maths in the first, second and third terms respectively.



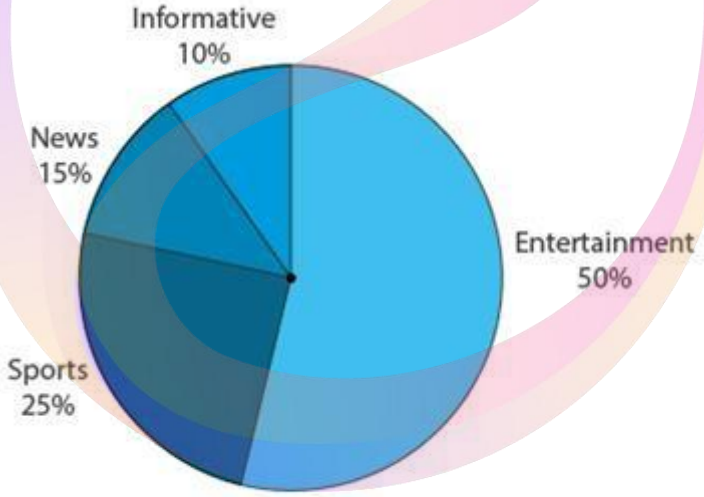
A bar graph can also have two or more bars to represent the same category like the example below.



Pie Charts

A pie-graph is used to represent the parts of a whole. A circle is used to represent the whole.

The pie graph below is used to represent people's choice of television channels. The circle as a whole here is represented by all the people who took part in the survey. Since it is a whole, the sum of all percentages represented in a pie graph must add up to 100%.



Pie graph

Histogram

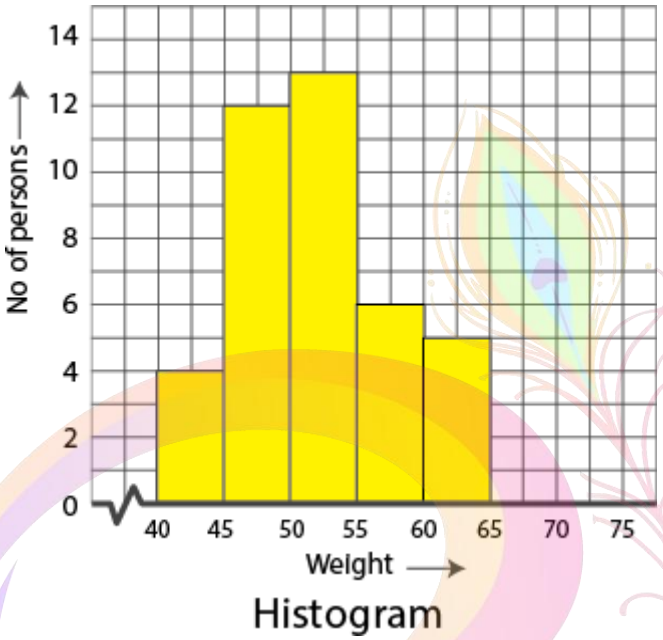
A histogram is nothing bujt a bar graph, that is used to group numbers into ranges. It shows data in intervals like the case of the table below.

Weight (kg)	40-45	45-50	50-55	55-60	60-65

(2)

No.of persons	4	12	13	6	5

The x−axis of the graph is labelled from 40-65, as Weights (in kg), in intervals of 5. The y−axis is labelled as No. of persons.



Histogram

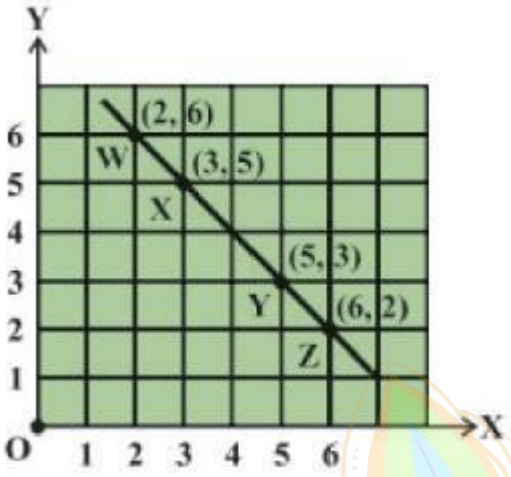
A histogram is used to represent continuous data. In the graph above, it presents the data available for all values between 40 and 65.

Linear Graph

A graph where all the data points can be plotted on a single straight line is called a linear graph.

For any two variables, the relation can be drawn by constructing the table of values if the rule for that relation is mentioned. At least two points coordinates should be known to plot a straight line graph. These points must fit the rule.

For example, take the points W(2,6), X(3,5), Y(5,3) and Z(6,2). Upon plotting the points on the graph, we see that all of them can be connected by a straight line.



Linear graph

Application of Graphs

Depending on how the values of a variable change with respect to another, we have two types: independent and dependent variable.

Independent (or control) variable is one where it's value doesn't change with respect to another quantity.

Dependent variable is one where the value does change with respect to another quantity.

For example, consider quantity of electricity consumed and the electricity bill. The quantity of electricity consumed doesn't depend on any other quantity, hence it is an independent variable. The electricity bill however, can change with respect to the amount of electricity consumed, hence it is a dependent variable.

Graphs help to establish the relation between these two types of variables visually with the help of the cartesian plane.

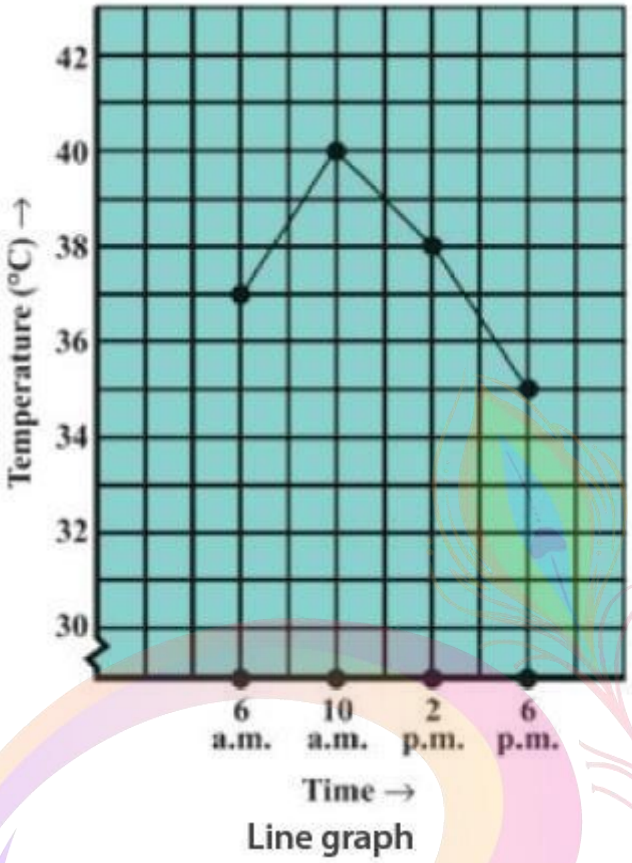
Line Graph

A line graph is one that is used to plot data that changes over a period of time.

Consider a table of the kind as shown here:

Time	6 AM	10 AM	2 PM	6 PM
Temperature	37	40	38	35

Here as observed, the temperatures constantly varies over a period of time. So a line-graph can be used to chart the increase and decrease of temperature over the course of 12 hours from 6AM to 6PM. Time is on the x-axis and temperature will be on the y-axis.



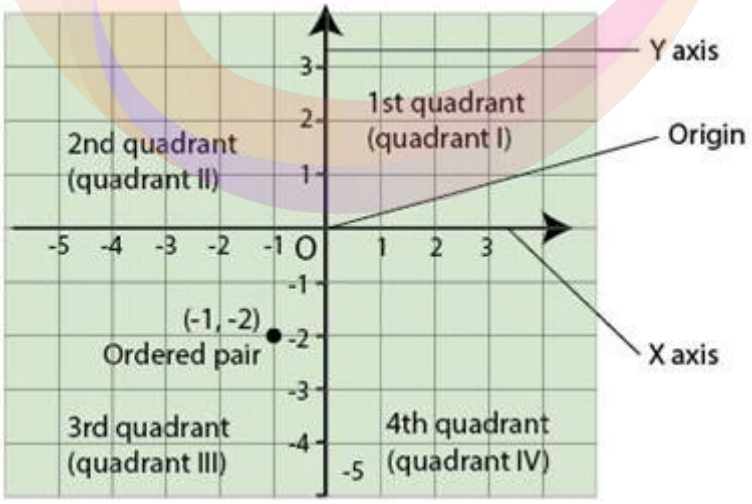
Line graph

Cartesian Plane and Coordinate Axes

A cartesian plane is formed and defined by two perpendicular number lines : the x−axis, which is horizontal and the y−axis, which is vertical. These are called the coordinate axes.

The point at which the two axes meet is called the zero or origin of the cartesian plane.

The two coordinate axes help to plot any point on the cartesian plane.



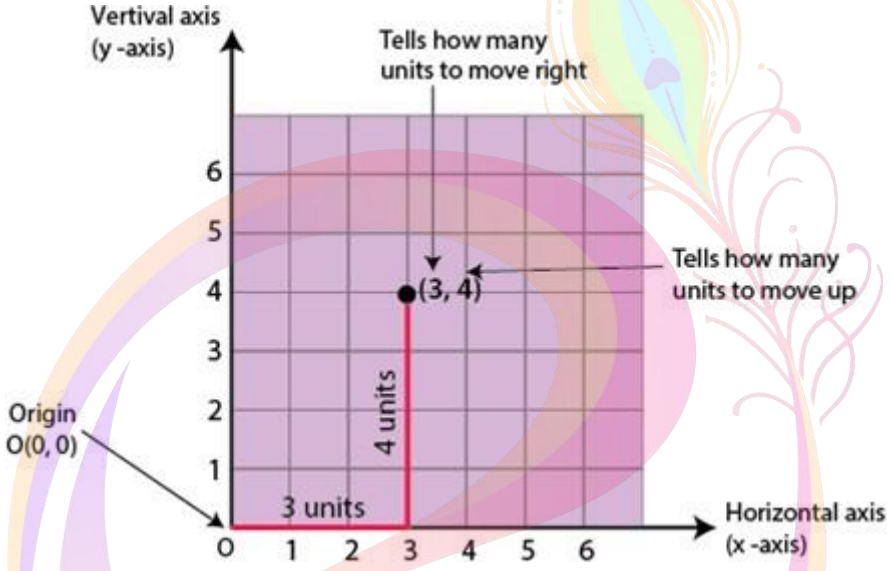
Representation of Point on the Plane

Ploting a point on the plane.

An ordered pair of numbers are used to represent any given point on a cartesian plane. They are written in the form (x,y), where the value of x represents the x-coordinate of the point and the value of y represents the y-coordinate of the point.

In simple terms, the x and y coordinates explain how far from the origin the point is with respect to the x−axis and y−axis respectively.

For example, consider a point (3,4). Here 3 is the x-coordinate while 4 is the y-coordinate. This means the point (3,4) lies 3 units from the origin on the x−axis and 4 units from the origin on the y−axis. The point is then plotted as shown below.



Coordinates of A Point in Three Dimensions

In order to locate the position of a point in space, we require a rectangular coordinate system. After choosing a fixed coordinate system in 3D, the coordinates of any point P in that system can be given by an ordered 3-tuple (x, y, z). Also, if the coordinates (x, y,z) are already known then we can easily locate the point P in space.

Three-Dimensional Coordinate System

Let there be a point P in space as shown in the figure below. If we drop a perpendicular PB on the XY plane and then from point B, we drop perpendiculars BA and BC on the x-axis and y-axis respectively. Assuming the length of the perpendiculars BC, BA and PB as x, y and z respectively. These lengths x, y and z are known as the co-ordinates of the point P in three-dimensional space. It must be noted that while giving the coordinates of a point, we always write them in order such that the co-ordinate of x-axis comes first, followed by the co-ordinate of the y-axis and the z-axis. Thus, for each point in space there exist an ordered 3-tuple of real numbers for its representation.

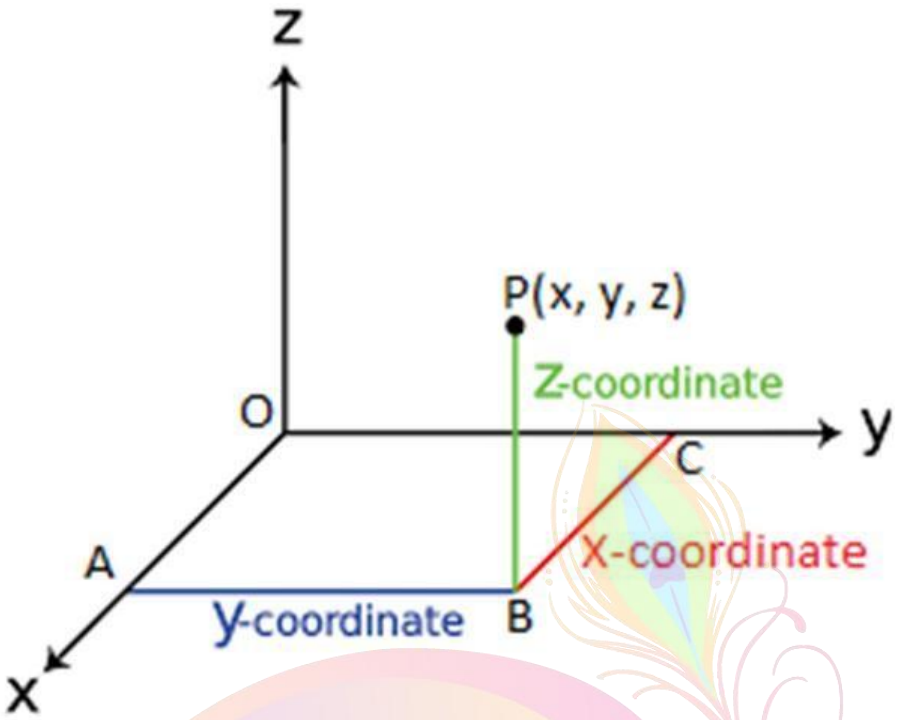
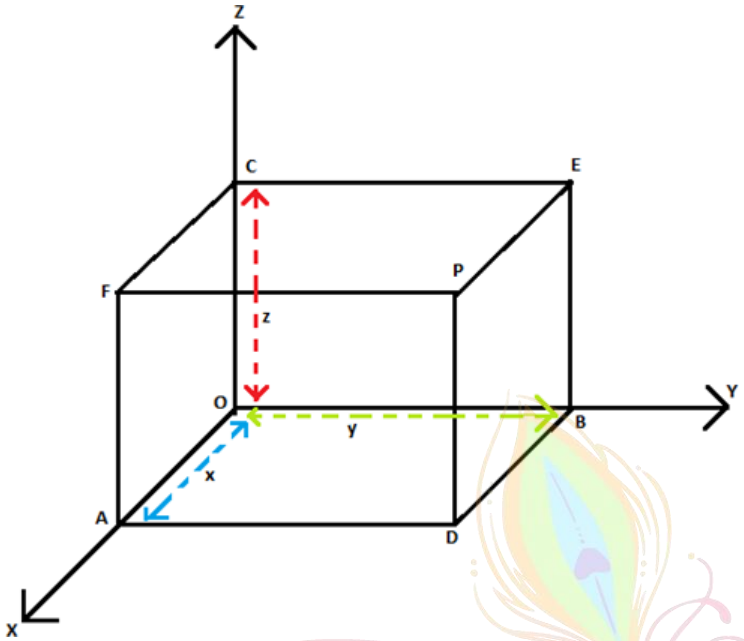


Figure 1 Co-ordinates of a point in space

In the figure given above the co-ordinates of P are given by (x, y, z). The coordinates of the origin O is (0, 0, 0) Also the coordinates of the point A is given by (x, 0, 0)as A lies completely on the x-axis. Similarly, the coordinates of any point on y-axis is given as (0, y, 0) and on the z-axis, the coordinates are given as (0, 0, z). Also the coordinates of any point in three planes XY, YZ and ZX will be (x,y,0), (0,y,z) and (x,0,z) respectively.

In questions, where we are asked to locate a point,i.e. when the co-ordinates of the point are given, then we have to draw three planes parallel to XY, YZ and ZX plane meeting the three axes in points A, B and C as shown in the figure. Let OA = x , OB = y and OC = z. Then the coordinates of the point are given as (x,y,z).



The planes ADPF, BDPE and CEPF intersect at point P which corresponds to the ordered triplet (x, y, z).

To determine the octant in which a point lies, the signs of the coordinates of a point are helpful. The following table depicts the sign of the coordinates of a point and the octant in which it lies.

Octants / Co-ordinates	I	II	III	IV	V	VI	VII	VIII
x	+	−	−	+	+	−	−	+
y	+	+	−	−	+	+	−	−
z	+	+	+	+	−	−	−	−

How to Plot the Points in Three-dimensional Plane?

The following points illustrate how to plot the points in the three-dimensional coordinate system:

- Locate the point “x” on the X-axis
- From the point x, moving parallel to the Y-axis, locate the point “y”.
- Similarly, from the determined point, moving parallel to the Z-axis, locate the point “z”.
- This is the final coordinate point in the three-dimensional plane, which we arelooking for.