

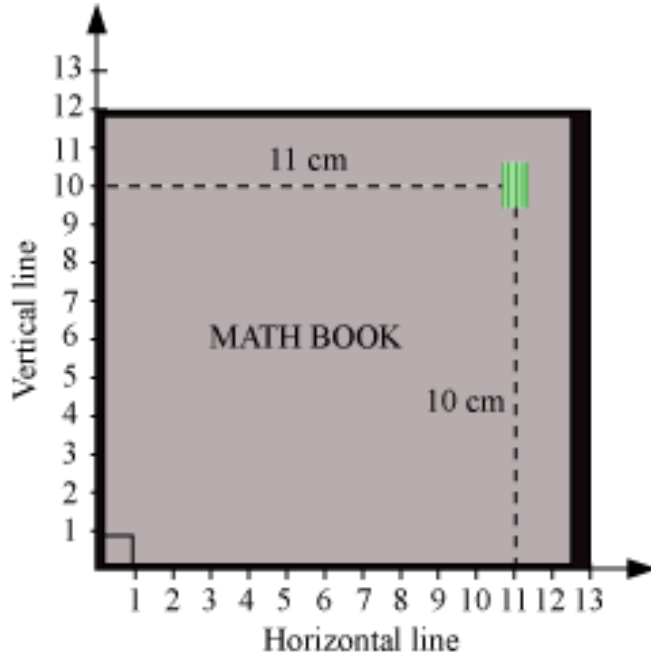
Coordinate Geometry

- **Cartesian plane and the terms associated with it**

To identify the position of an object or a point in a plane, we require two perpendicular lines: one of them is horizontal and the other is vertical.

Example: Put an eraser on a book and then describe the position of the eraser.

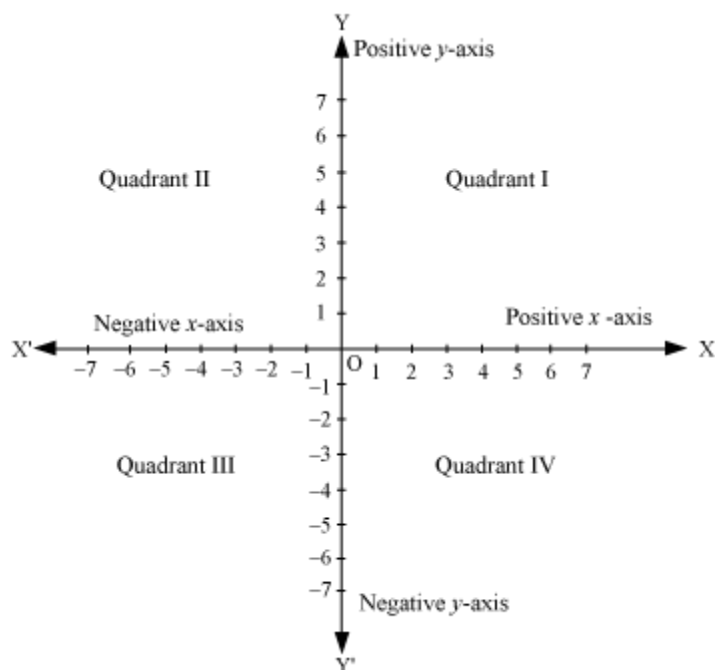
Solution: In order to identify the position of the eraser on the book, we take the adjacent edges as perpendicular lines. Take 1 unit = 1 cm along the vertical and horizontal lines. Now, it is seen that the eraser is at a distance of 11 cm from the vertical line and 10 cm from the horizontal line.



Thus, conventionally, the position of the eraser can be written as (11, 10).

- **Cartesian system**

A Cartesian system consists of two perpendicular lines: one of them is horizontal and the other is vertical. The horizontal line is called the x -axis and the vertical line is called the y -axis. The point of intersection of the two lines is called origin, and is denoted by O .



- XOX' is called the x -axis; YOY' is called the y -axis; the point O is called the origin.
- Positive numbers lie on the directions of OX and OY .
- Negative numbers lie on the directions of OX' and OY' .
- OX and OY are respectively called positive x -axis and positive y -axis.
- OX' and OY' are respectively called negative x -axis and negative y -axis. The axes divide the plane into four equal parts. The four parts are called quadrants, numbered I, II, III and IV, in anticlockwise from positive x -axis, OX .
- The plane is also called co-ordinate plane or Cartesian plane or xy -plane.

• Coordinate Geometry

Example: Name the quadrant or the axis in which the points $(5, -4)$, $(2, 7)$ and $(0, -9)$ lie?

Solution The coordinates of the point $(5, -4)$ are of the form $(+, -)$.

$(5, -4)$ lie in quadrant IV

The coordinates of the point $(2, 7)$ are of the form $(+, +)$.

$(2, 7)$ lie in quadrant I.

The coordinates of the point $(0, -9)$ are of the form $(0, b)$.

$(0, -9)$ lie on the y -axis

The coordinates of a point on the coordinate plane can be determined by the following conventions.

The x -coordinate of a point is its perpendicular distance from the y -axis, measured along the x -axis (positive along the positive x -axis and negative along the negative x -axis).

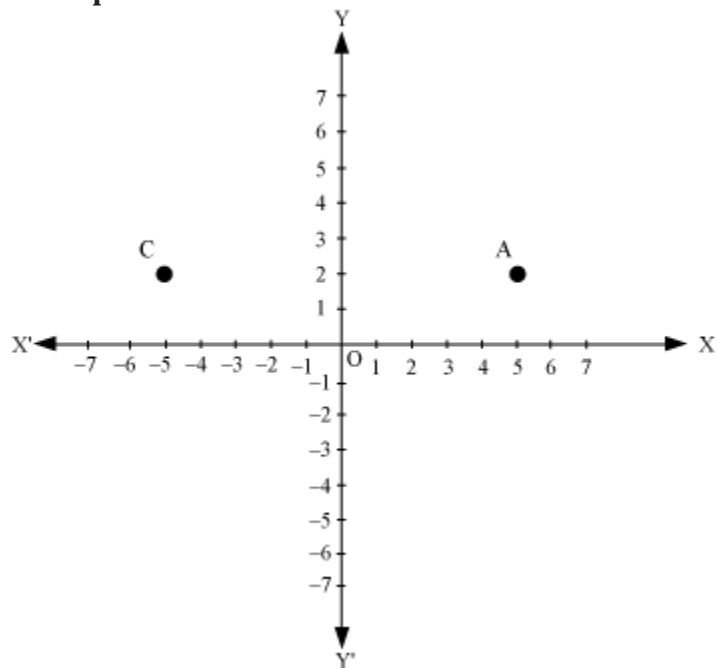
The x -coordinate is also called the abscissa.

The y -coordinate of a point is its perpendicular distance from the x -axis, measured along the y -axis (positive along the positive y -axis and negative along the negative y -axis).

The y -coordinate is also called the ordinate.

In stating the coordinates of a point in the coordinate plane, the x -coordinate comes first and then the y -coordinate. The coordinates are placed in brackets.

Example:



What are the coordinates of points A, B and C in the given figure?

Solution: It is observed that

x -coordinate of point A is 5

y -coordinate of point A is 2

Coordinates of point A are $(5, 2)$.

x -coordinate of point C is -5

y -coordinate of point C is 2

Coordinates of point C are $(-5, 2)$.

Note: The coordinates of the origin are $(0, 0)$. Since the origin has zero distance from both the axes, its abscissa and ordinate are both zero.

- **Relationship between the signs of the coordinates of a point and the quadrant of the point in which it lies:**

The 1st quadrant is enclosed by the positive x -axis and positive y -axis. So, a point in the 1st quadrant is in the form $(+, +)$. The 2nd quadrant is enclosed by the negative x -axis and positive y -axis. So, a point in the 2nd quadrant is in the form $(-, +)$. The 3rd quadrant is enclosed by the negative x -axis and the negative y -axis. So, the point in the 3rd quadrant is in the form $(-, -)$.

The 4th quadrant is enclosed by the positive x -axis and the negative y -axis. So, the point in the 4th quadrant is in the form $(+, -)$.

- Location of a point in the plane when its coordinates are given**

Example: Plot the following ordered pairs of numbers (x, y) as points in the coordinate plane.

[Use the scale 1 cm = 1 unit]

x	-3	4	-3	0
y	4	-3	-3	2

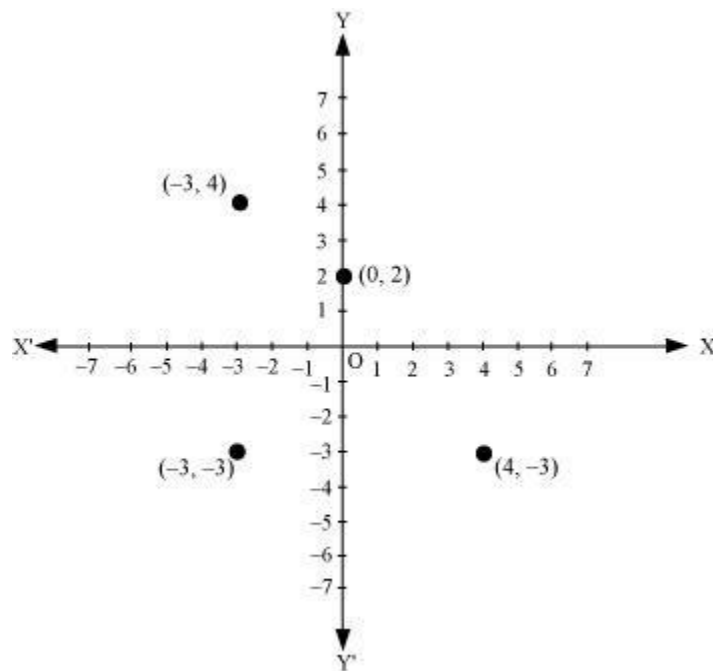
Solution:

x	-3	4	-3	0
y	4	-3	-3	2

Taking 1 cm = 1 unit, we draw the x -axis and y -axis.

The pairs of numbers in the given table can be represented as $(-3, 4)$, $(4, -3)$ and $(-3, -3)$, $(0, 2)$.

These points can be located in the coordinate plane as:



NB: The coordinates of the point on the x -axis are of the form $(a, 0)$ and the coordinates of the point on the y -axis are of the form $(0, b)$, where a, b are real numbers.

- We can plot a point in the Cartesian plane, if the coordinates of the points are given.

Example: Plot the points A $(5, -3)$ and B $(-2, 5)$ on the Cartesian plane.

Solution: To plot A $(5, -3)$:

(1) Move 5 units along OX and mark the endpoint as M.

(2) From M and perpendicular to the x -axis, move 3 units along OY'. Mark the endpoint as A.

This is the location of the point $(5, -3)$ on the Cartesian plane.

To plot B $(-2, 5)$:

(1) Move 2 units along OX' and mark the endpoint as N.

(2) From N and perpendicular to the x -axis, move 5 units along OY. Mark the endpoint as B.
This is the location of the point $(-2, 5)$ on the Cartesian plane.

Points A and B are plotted in the following graph.

