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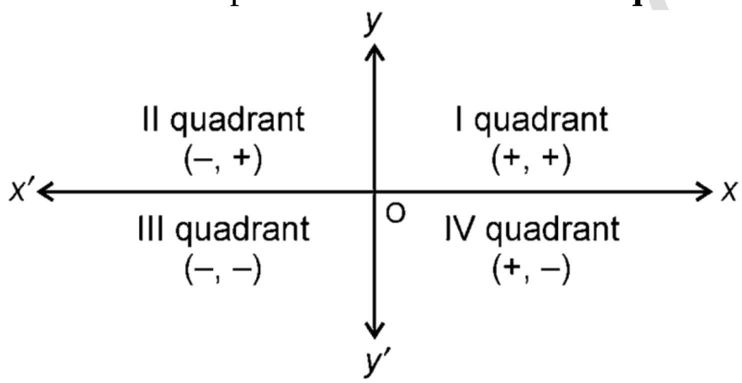
COORDINATE GEOMETRY
CLASS 10

Basic Concepts

1. In the rectangular coordinate system, two number lines are drawn at right angles to each other. The point of intersection of these two number lines is called the origin whose coordinates are taken as (0, 0). The horizontal number line is known as the $x -$ axis and the vertical as the $y - axis$.
2. In the ordered pair $(p, q), p$ is called the $x - coordinate$ or $abscissa$ and q is known as $y - coordinate$ or $ordinate$ of the point.
3. The coordinate plane is divided into **four quadrants**.



4. The abscissa of a point is its perpendicular distance from $y -$ axis.
5. The ordinate of a point is its perpendicular distance from $x -$ axis.
6. The abscissa of every point situated on the right side of $y -$ axis is **positive** and the abscissa of every point situated on the left side of $y -$ axis is **negative**.
7. The ordinate of every point situated above $x -$ axis is **positive** and that of every point below $x -$ axis is **negative**.
8. The abscissa of every point on $y -$ axis is zero.
9. The ordinate of every point on $x -$ axis is zero.
10. The distance between any two points $P(x_1, y_1)$ and $Q(x_2, y_2)$ is given by
$PQ = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
or $PQ = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$
$\Rightarrow PQ = \sqrt{(difference\ of\ abscissae)^2 + (difference\ of\ ordinates)^2}$

11. If O(0, 0) is the origin and P (x, y) is any point, then from the above formula, we have OP = $\sqrt{(x-0)^2+(y-0)^2} = \sqrt{x^2+y^2}$

12. In order to prove that a given figure is a:

(i) square, prove that four sides are equal and the diagonals are equal.

(ii) rhombus, prove that the four sides are equal.

(iii) rectangle, prove that the opposite sides are equal and the diagonals are also equal.

(iv) parallelogram, prove that the opposite sides are equal.

(v) parallelogram but not a rectangle, prove that its opposite sides are equal but diagonals are not equal.

13. Three points A, B and C are said to be collinear, if they lie on the same straight line.

14. For three points to be collinear, the sum of the distances between two pairs of points is equal to the third pair of points.

15. Three points will make:

(i) A scalene triangle, if no two sides of the triangle are equal.

(ii) An isosceles triangle, if any two sides are equal.

(iii) An equilateral triangle, if all the three sides are equal.

(iv) A right triangle, if sum of the squares of any two sides is equal to the square of the third side.

16. The coordinates of the point P(x, y) which divides the line segment joining A(x_1, y_1) and B(x_2, y_2) internally in the ratio $m : n$, are given by:

$$x = \frac{mx_2 + nx_1}{m+n},\ y = \frac{my_2 + ny_1}{m+n}$$

17. The coordinates of the mid – point M of a line segment AB with end points $A(x_1, y_1)$ and $B(x_2, y_2)$ are:

$$\left(\frac{x_1 + x_2}{2}, \frac{y_{1+}y_2}{2}\right)$$

18. The point of intersection of the medians of a triangle is called its *centroid*.

19. The coordinates of the centroid of the triangle whose vertices are $(x_1, y_1), (x_2, y_2)$ and (x_3, y_3) are given by $\left(\frac{x_1+x_2+x_3}{3}, \frac{y_1+y_2+y_3}{3}\right)$

20. The area of a ΔABC with vertices $A(x_1, y_1), B(x_2, y_2)$ and $C(x_3, y_3)$ is given by area (ΔABC) = $\left|\frac{1}{2}\{x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)\}\right|$

Since area of a triangle cannot be negative, we consider the absolute or numerical value of the area.

21. Three given points $A(x_1, y_1), B(x_2, y_2), C(x_3, y_3)$ are collinear if

Area of $\Delta ABC = 0$

$$\frac{1}{2}[x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)] = 0$$

$$x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2) = 0$$