CHAPTER 06

COORDINATE GEOMETRY

You must have seen a football ground, you might even have played in one. We know that before the game starts, the football is kept exactly in the middle of the ground. Players of both the teams stand facing each-other, one on each side of the ground. Both sides of the ground have goal posts, as shown in figure-(i). The goal posts are at equal distance from the football kept at the centre of the ground.

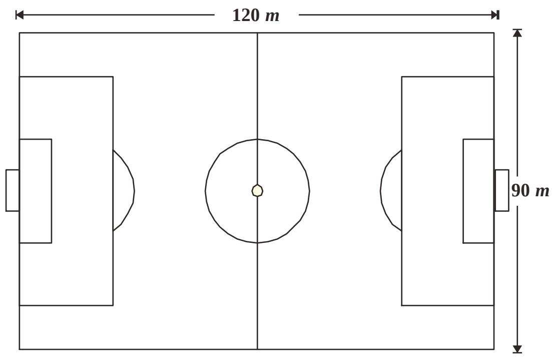


Figure - (i)

The standard length of a football ground is 120 m and standard breadth is 90 m. Of course, we can play in a field of any size. Players of both teams are assigned different roles and they stand on the ground in their respective positions at the beginning, but they can go anywhere on the field during the match. In figure-(ii), we see the initial positions of the players of Team "A" on left side and Team "B" on right side.

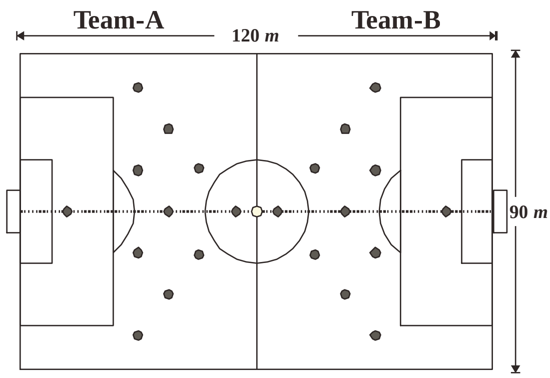


Figure - (ii)

The football is exactly at the central point of the ground. A line which separates both the teams is drawn in the middle of the field. If a line is drawn perpendicular to this line then the ground will be divided into four parts. Figure-(iii) shows this situation. In the figure of the field, on left side there are players of team "A" and on the right side there are players of team "B". In the figure, on the left side the initial positions of the players of team "A" are represented by a_1, a_2, a_3..... a_{11} and on right side, initial positions of team B are represented by b_1, b_2, $b_{3.....}$ $b_{11.}$

You can see that both the goalkeepers stand at their respective ends of the field, near the goalposts. After that we have the fullbacks who stand 20-25 m further ahead from the goal post and then 40-45 meters further ahead we have the mid-fielders. Somewhere near the mid line the forwards of both teams stand in their respective positions and sides.

We will consider the left side where team "A" stands as negative direction and right side where team "B" is present as the positive direction. To indicate their positions we will use their distances from the lines which are passing through the mid-point of the ground.

Both goalkeepers stand 55*m* away from the midpoint on the horizontal line and hence we indicate them by (55, 0) and (–55, 0). Similarly, the fullbacks of teams “A” and “B” stand above the horizontal line, at a distance of –35 and of +35 respectively from the midpoint (central line). Team A has 3 fullbacks and team B has 4 fullbacks. These are either above the horizontal midline and are considered (+) or below the midline and considered (–).

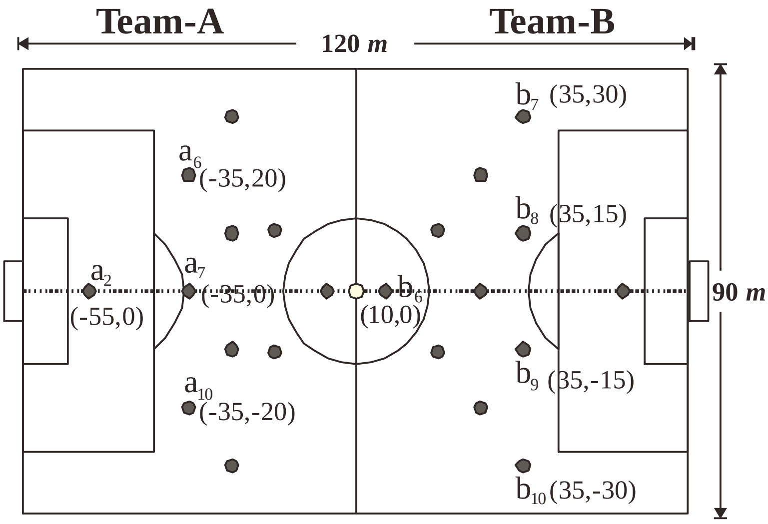


Figure - (iii)

Thus, the three fullbacks of team A are at (–35, 20), (–35, 0) and (–35, –20) and the fullbacks of team B are at (+35, 30), (+35, +15), (+35, –15) and (+35, –30).

Think and discuss

Now, discuss with your friends and try to find the positions of other players on the field and indicate them using points.

Try These

1. Consider the net of a volley ball court as mid axis (line) and draw a perpendicular line exactly from its midpoint. Find the position of the all the players using these lines.

2. On the cricket ground, locate the positions of the batsmen and draw a line through them. Draw a perpendicular line from the midpoint of the line and locate the other players through this point.

Consider one more example where we try to find the position of the objects placed on the surface of a plane. You might have visited a cinema hall in your city or town to watch a movie. Do you remember how do you located your seat? In some cinema halls, rows of chairs are marked A,B,C, ... etc. and the numbers 1,2,3, ... are given to each chair in every row.

In this way, all the chairs are have a certain label like A_1, A_2, B_4, C_{19}, D_{40} etc.

Consider a big meeting hall where several chairs are placed vertically and horizontally. You sit on the chair which is exactly in the middle of the meeting room. You know where your friends are supposed to sit.

How will you tell them where to sit?

Suppose there is a horizontal line under your chair passing from left edge to right edge of the meeting hall. This line divides the meeting hall into 2 parts, one part which is in your front and another part which is behind you. From this you can tell the position of the other chairs in the meeting hall, for example, chairs in your front, behind you and chairs on the horizontal line. Figure-(v)

If a similar line perpendicular to the first line passes under your chair from front to back of the meeting hall them this line also divides the hall into two halves, one on your right and other on your left side. So you have some new things to say about any chair, like the chair is on your right side, or the chair is on your left side or the chairs is on the line.

Now you see that the plane of the meeting room can be said to be divided into the 4 areas. Similarly, the chairs are also divided into 4 groups. Remember that some chairs are placed on the horizontal and vertical lines which separate the hall into 4 areas but are not included in these areas.

In prior classes, we have used the number line. We will take the help of number line in this situation also. Imagine that the lines which are passing under your chair are number lines which are perpendicular to each other and also cut each other at the point where your chair is placed, that is, they cut exactly at the centre of the meeting hall. This is the point where both the number lines have their zeroes.

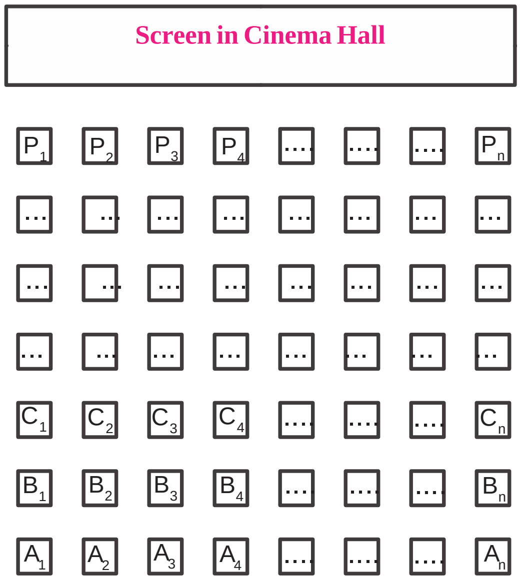


Figure - (iv)

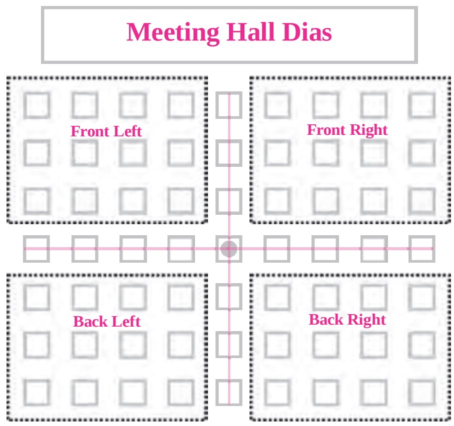


Figure - (v)

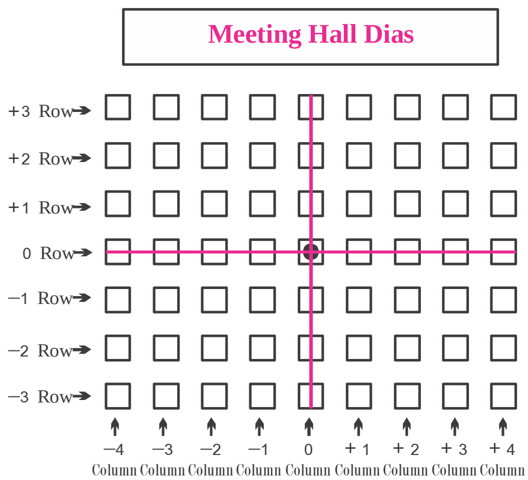


Figure - (vi)

So the chairs which are on the right side of the horizontal line are said to be +1, +2, +3 ….. etc. and the chairs which are on the left side are said to be -1,-2, -3 etc. Similarly, we can say that the chairs which are in the front are +1, +2, +3 ….. and those behind you are -1, -2, -3 respectively.

Can we also give names to the lines of chairs which are in the meeting room?

If we call the vertical lines of the chairs columns and the horizontal lines of chairs as rows, then you will be able to say that the vertical line which is passing under your chair is a column which passes through the zero of the horizontal line. All the columns on your right pass through +1, +2, +3 etc. of the horizontal line. We can call them +1 column, +2 column, +3 column. Similarly the column on the left side can be called -1, -2, -3 etc.

What will you call the vertical line which passes under your chair?

It is clear that you will call it zero column ("0" column).

Similarly, the horizontal line will be called zero row, the rows above it can be called +1 row, +2 row …… and the rows below it can be called -1 row, -2 row, -3 row.

Your friends A,B,C,D and E are standing near you in the middle of the hall and they want to reach their allotted seats. Their positions are given in figure-(vii). Let's tell them their positions.

Position of A - Chair is on column 2 and row 3

Position of B - Chair which is kept in column 2 and row -2

Position of C - Chair which is kept in column –3 and row –3

Position of D - Chair which is kept in column –4 and row 0

Position of E - Chair which is kept in column 0 and row 2

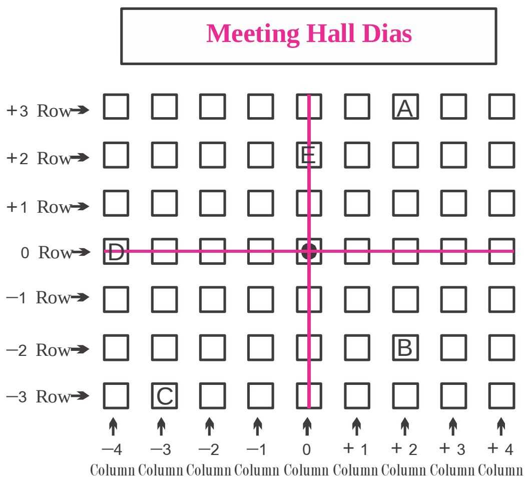


Figure - (vii)

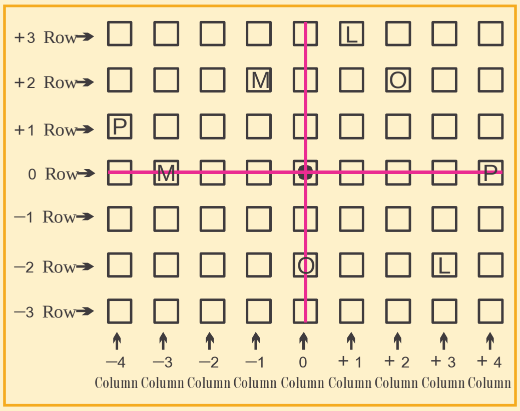
Think and discuss

What is the position of your chair?

Try these

In a garden, plants are growing in vertical and horizontal lines. They are represented in rows and columns. If L, M, O, P represent lemon, mango, orange or papaya plants then locate their positions in terms of rows and columns.

Plants	Rows or Columns
Lemon	(+1 column, +3 row) ....
Mango	..................................., ...
Orange	..................................., ...
Papaya	..................................., ...



Complete the following table by seeing figure (iii) depicting a football ground.

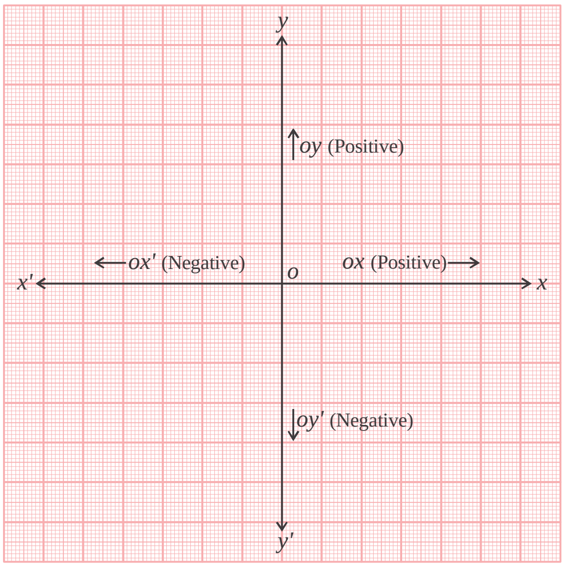
Player	Distance of Football from Player		Position of the Player
	How many steps did you move to your left/right	How many steps you did you move up or down	
a_2			
a_6			
a_7			
a_{10}			
b_6			
b_7			
b_8			
b_9			
b_{10}			

In the above examples, we saw that the position of an object can be shown with the help of 2 mutually perpendicular lines. This idea was helpful in the development of coordinate geometry as a significant branch of mathematics. In this chapter we will introduce to you some basic concepts of coordinate geometry.

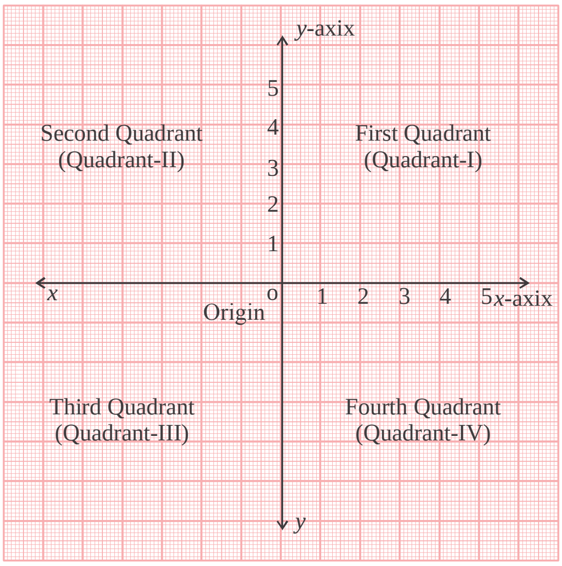
During the early years of its development, a French Philosopher and mathematician Rene Descartes worked in this field. He found the solution to the problem of showing the position of a point on a plane. His method was an offshoot of the ideas of Latitude and Longitude. The method which is used to determine the position of a point on a plane is also known as the Cartesian System in honor of Descartes.

Descartes proposed the idea of drawing two mutually perpendicular lines on a plane and finding the position of points on a plane with respect to these lines. The normal lines can be in any direction. In this chapter, we have used a horizontal line and a vertical line. The point where both the lines intersects each other is called the origin and it is denoted by O. Horizontal line X^1X is called the x-axis and the vertical line Y^1Y is called the y-axis. Because the values along OX and OY directions are positive hence OX and OY are called positive directions of x-axis and y-axis respectively. Similarly OX^1 and OY^1 are called the negative directions of x-axis and y-axis respectively.

Both the axes divide the plane into 4 equal parts. These 4 parts are called quadrants. These are named as I, II, III and IV quadrants respectively when we move in anti-clockwise direction from OX. Hence, this plane includes both the axis as well as all four quadrants. This plane is called Cartesian plane or coordinate plane or xy plane. The axes are called coordinate axes.



Graph-01



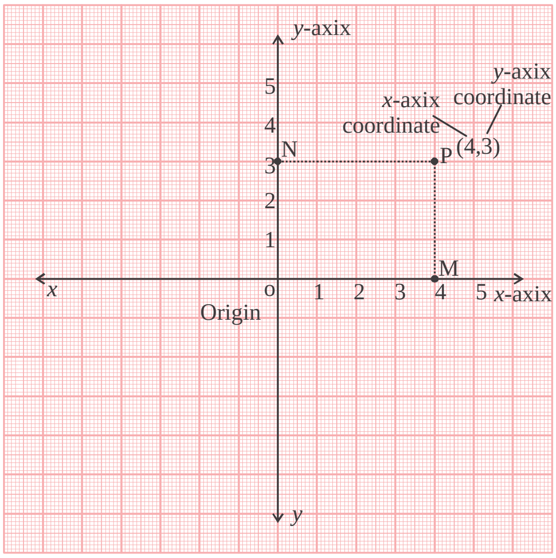
Graph-02

Finding the position of a point on the Cartesian plane

How do we find the position of a point on the Cartesian plane? Let us understand through an example.

Draw the x axis and y axis on a graph paper. Consider a point P anywhere in quadrant I. Draw perpendicular PM and PN from the point P to x axis and y axis respectively.

Here, the perpendicular distance PN of point p from the y axis is 4 units. (This is measured in the positive direction of x-axis) and the perpendicular distance PM of the point from x-axis is 3 units. (This can be measured in the positive direction of y-axis). With the help of these distances we can locate the point P. To locate the position of any point we have to remember the following conventions:



Graph - 03

1. The x-coordinate of any point is its perpendicular distance from the y-axis, and is measured on the x-axis. The distance is positive in the positive direction of x-axis and negative in the negative direction of x-axis. For point P it is +4. x-coordinate is called <u>abscissa</u>.

2. The y-coordinate of any point is the perpendicular distance from x-axis and is measured on the y-axis. This distance is positive in the positive direction of y-axis and negative in the negative direction of y-axis. For point P its value is +3. y-coordinate is called <u>ordinate</u>.

3. In Cartesian plane, while writing the coordinates of any point, we first write the x-coordinate and then the y-coordinate. The coordinates are written within brackets. Hence coordinates of point P are (4,3).

Example-1. Locate point A (4,5) on the Cartesian plane.

Solution : Because x-coordinate is +4, hence its perpendicular distance from y axis is +4 units. So we will move 4 units along the x axis in the positive direction. Because y-coordinate is +5, hence its perpendicular distance from x axis is +5 units. So we will move 5 units along the y axis in the positive direction. In this way, we will reach the point A (4,5).

Example-2. Locate the point B (-4,5)

Solution : If x-coordinate of point B is -4, then in which direction should we move?

Because the x-coordinate of point B is negative therefore we will move in OX^1 direction on the x- axis. Do the next steps yourself and locate the point B (-4,5) on the Cartesian plane.

Try These

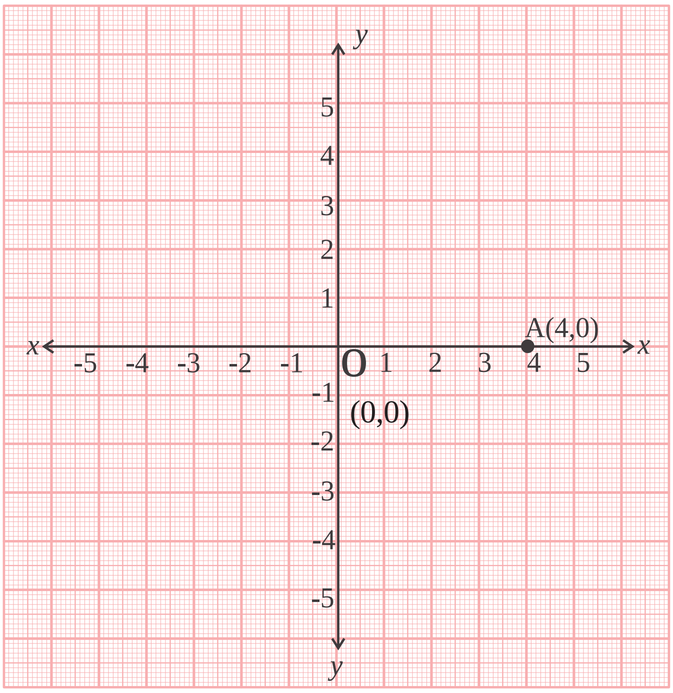
1. Coordinates of some points are given below. In which quadrants do they lie? Locate each of them on the Cartesian plane-

   (i) (5, 7) (ii) (-2, 5) (iii) (2, -2) (iv) (-4, -5)

2. Write 5 more pairs of coordinates and locate them in the correct positions in the quadrants.

Points on the axis:

If any point lies on the x axis then what are the coordinates of that point? We know that to reach any point we have to cover two distances. First along the x axis (or perpendicular to y axis) and second, along the y-axis (perpendicular to the x-axis). If any point is on the x- axis then we have to move only 1 distance from origin to that point. Because the distance moved parallel to y axis is zero, therefore the y-coordinate of that point is zero. Hence, the coordinates of any point on x-axis are $(x, 0)$ or $(-x, 0)$. For example, the coordinates of point A on X axis are (4,0).



Graph - 04

Similarly, the coordinates of any point on y- axis are $(0,y)$ or $(0,-y)$.

It is clear that the coordinates of origin are (0,0).

Example-3. Locate the point P (3,0) on Cartesian Plane.

Solution : Because the y coordinate of the point P is zero, therefore the perpendicular distance of that point from x- axis is zero and hence this point is on the x-axis. X coordinate of point P is 3. Therefore this point lies at a distance of 3 units from the origin on the line OX.

Try These

1. Locate the points B (0, 4), C (0,0), and D (0, -2) and represent them on the Cartesian plane.
2. Write the coordinate of 3 different points which are on x-axis.
3. Similarly write the coordinates of 3 different points which are on y-axis.

Exercise - 1

1. Coordinates of some points are given below. Locate them on the Cartesian plane and write the quadrant in which the following points lie.

   (i) (3,4) (ii) (-5,6) (iii) (-2,-1) (iv) (2.5, -7)

2. On the basis of the coordinates of the following points tell on which axis the points exist?

   (i) (0,5) (ii) (-6,0) (iii) (-3,0) (iv) (0,-3.5)

3. Fill in the blanks:

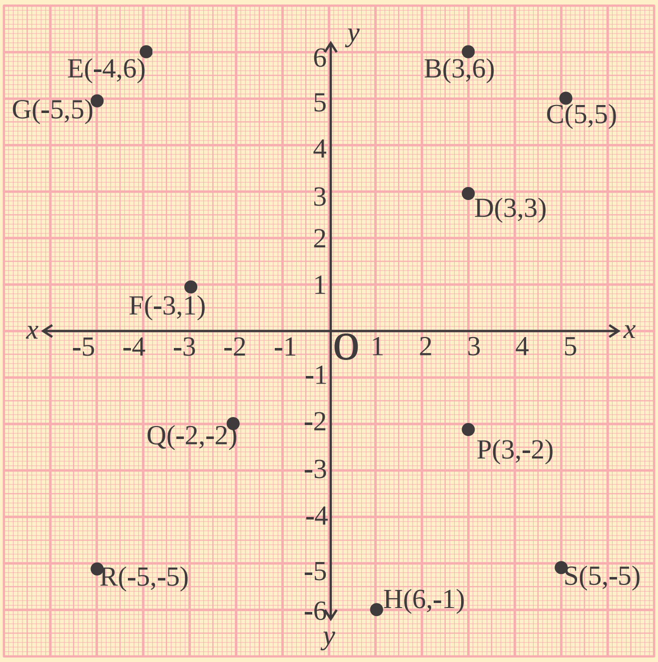
   (i) Point p (-4, -7) lies in ……………. quadrant.

   (ii) The y- coordinate of any point on x axis is …………….

   (iii) On Cartesian plane both the axes are mutually …………….

   (iv) The x- coordinate of any point on y- axis is …………….

   (v) Coordinates of origin are …………….



Graph - 05

4. Observe the position of given points in graph-5 and complete the task using the following instructions:

(i) Write the points whose *x* coordinates are same.

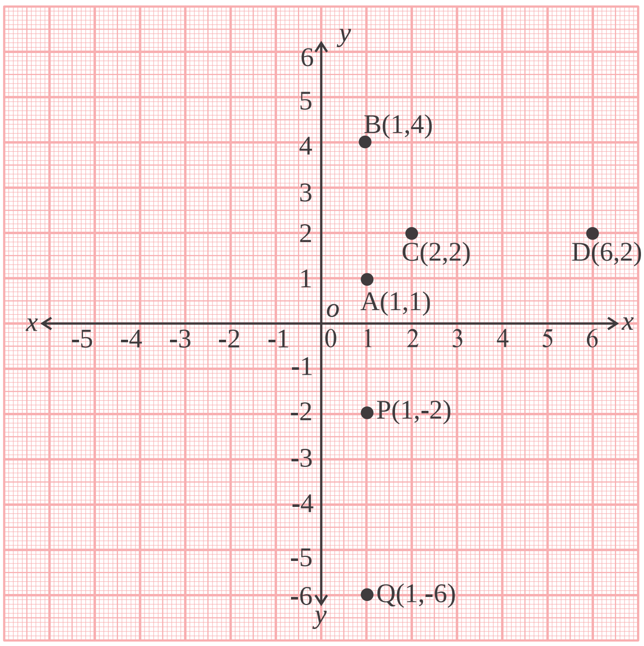
(ii) Write the points whose *y*- coordinates are same.

(iii) Write the points whose *x*- and *y*- coordinates are same.

Distance between points

4 points A,B,C, and D are shown in the graph-6. Can you tell the distance between the points A,B and C,D ?

Is the distance AB between point A and point B less than the distance CD between point C and point D or are the distances equal? How can we find the distance between 2 points whose coordinates are given?



Graph - 06

It is easy to calculate the distance between 2 points which are located on horizontal or vertical axis or may be located on lines which are parallel to these axes. For example, A (1,1) and B (1,4) and similarly C (2,2) and D (6,2).

In the case of the first two points, just by taking the difference in *y*- coordinates we get the distance AB and in the second case by taking the difference in *x*- coordinates we get CD.

Distance AB = 4-1 = 3 units

Since, AB= $y_2 - y_1$ (because x_2 and x_1 are equal)

Distance CD = 6-2 = 4 unit

Since, CD = x_2-x_1 (because y_1 and y_2 are equal)

Similarly, the distance between P (1,-2) and Q (1,-6)

PQ= y_2-y_1 (because x_2 and x_1 are equal)

PQ = -6 - (-2) = -4

Because distance is always positive, hence PQ = 4 unit

Try These

Calculate the distance between the following pairs of points.

(i) (5, 8) and (5, -3)

(ii) (2,3) and (3,7)

Distance between any two points

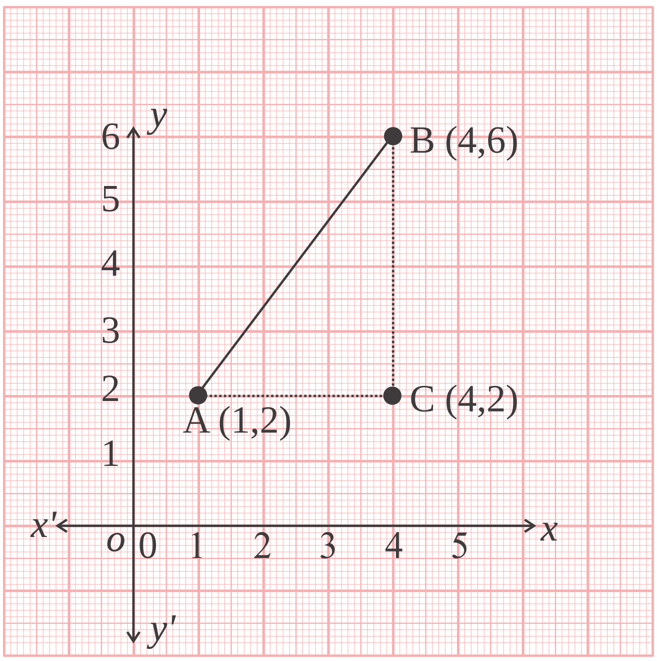
In the previous examples we calculated the distances between any 2 points in which line segments AB, CD and PQ were either horizontal or vertical.

In case of two points which are neither on the horizontal/vertical axis nor on a parallel axis, how we can calculate the distances between them? Let us see one example.

Example:-4. Calculate the distance between the points A (1,2) and B (4,6).

Solution : From point A draw a line parallel to *x*-axis. Similarly from B, draw a line parallel to the *y*-axis. The two line intersect at point C.

Distance AC = 4-1 =3 units.



Graph - 07

and distance BC =6-2 = 4 units

By using the Bodhayan sutra/ Pythagoras theorem

$AB^2 = AC^2 + BC^2$

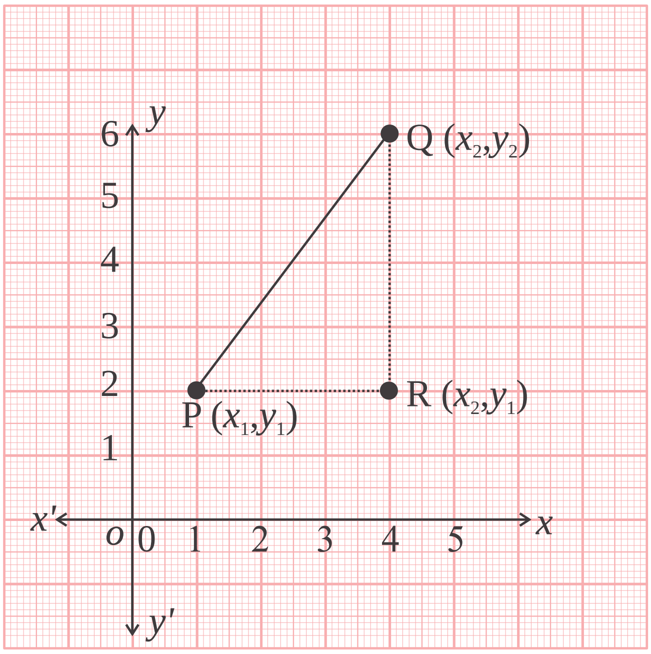
$= 3^2 + 4^2$

$= 9 + 16$

$= 25$

Distance AB = 5 units

General Formula to calculate distances



Graph - 08

To calculate the distance between any two points in a Cartesian plane, we need a method which is valid for all kinds of distances. We will calculate the distance between Q and P.

Consider the coordinates of the point p is (x_1, y_1) and Q is (x_2, y_2).

In right angle triangle PRQ

Distance PR = $x_2 - x_1$

Distance QR = $y_2 - y_1$

In right angle triangle PRQ, using Pythagoras theorem

$PQ^2 = PR^2 + QR^2$

$= (x_2-x_1)^2 + (y_2-y_1)^2$

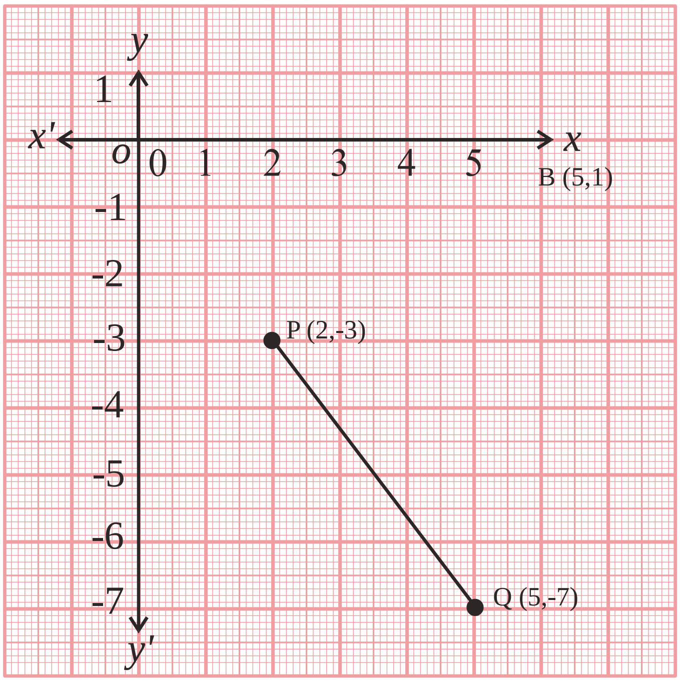
$$\therefore PQ = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Because $(x_1-x_2)^2$ and $(x_2-x_1)^2$ are equal, therefore, we can either calculate the distance from point "P" to point "Q" or from point "Q" to point "P". In both the cases the result is same.

Hence, Distance PQ = Distance QP

This formula can be used to calculate the distance between any 2 points on the Cartesian Plane.

Example-5. Calculate the distance between points P (2,-3) and Q (5,-7).



Graph - 09

Solution : Here, $x_1=2, y_1=-3, x_2=5, y_2= -7$

$$\because PQ = \sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$$

$$= \sqrt{(5-2)^2+\{-7-(-3)\}^2}$$

$$= \sqrt{3^2+(-4)^2}$$

$$= \sqrt{9+16}$$

$$= \sqrt{25}$$

$\therefore$ PQ = 5 unit

Example-6. Find a point on y-axis which is equidistant from point A (6,5) and point B (-4, 3)

Solution : We know that any point which lies on the y- axis is in the form $(0,y)$. Hence, consider the point P $(0,y)$ which is equidistant from point A and point B then

$$PA = PB$$

$$(6-0)^2 + (5-y)^2 = (-4-0)^2 + (3-y)^2$$

$$36+25 + y^2-10y = 16+9 + y^2-6y$$

$$4y = 36$$

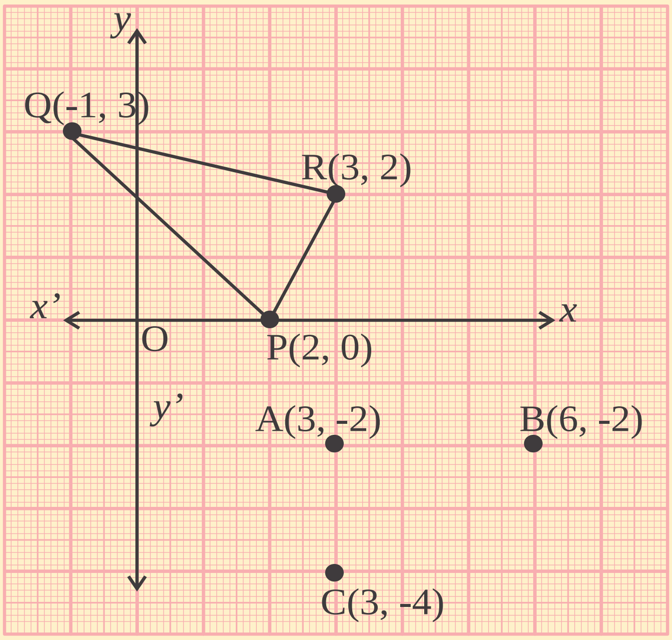
$$y = 9$$

The required point is (0,9).

Exercise - 2

1. Calculate the distance of point P from Q and R.

2. In graph-10, find the values of AC, AB and BC.



Graph - 10

3. Calculate the distance of point (3,4) from the origin.

4. If PA=PB and the coordinates of point A and B are (2,0) and (-2, 4) respectively and if P lies on the y axis then calculate the coordinates of point P.

5. Find the coordinates of the point which is on y- axis and which is equidistant from points (5,-2) and (3,4).

6. Find the relation between x and y such that point (x,y) is equidistant from the point (7,1) and point (3,5).

Slope or gradient

Slope of the interval

Slope of the line or the gradient tells us about the steepness of slope or how rapidly the line ascends or descends. Therefore, the value of the slope of AB is the ratio of change in y- coordinates to the change in x-coordinate on moving from point B to point A. (Slope can also be called gradient).

If the coordinate of the point A is (1,2) and point B is (5,7).

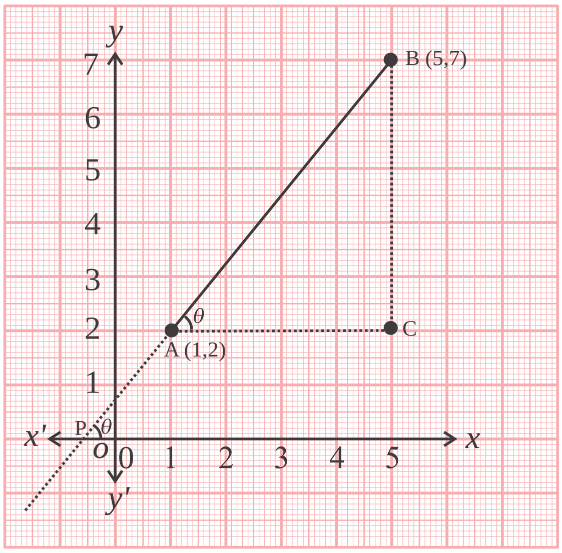
then,

Slope of line AB

$$= \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{7 - 2}{5 - 1}$$

$$= \frac{5}{4}$$



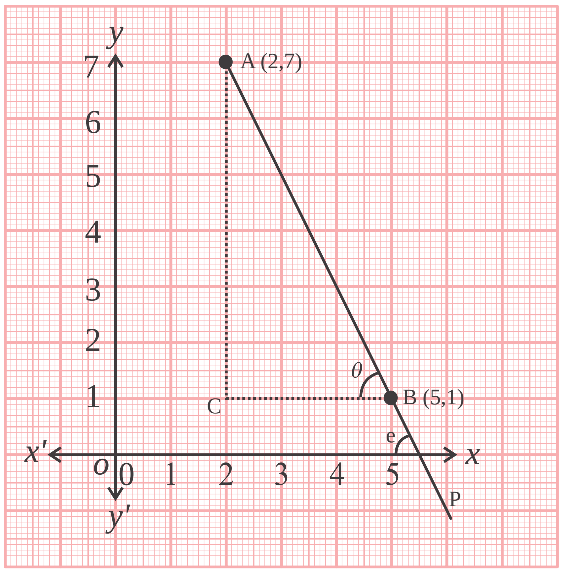
Graph - 11

If we look carefully at this figure (Graph-11), we see a right angled triangle which is right angled at C. If we extend line segment AB then it will intersect the x-axis at some point P. The angle which this line makes with the x-axis is equal to the angle at point A in triangle ABC (Let this angle be θ).

Slope of the line AB $= \frac{y_2 - y_1}{x_2 - x_1}$

$$= \frac{AC}{BC}$$

$$= \tan\theta$$



Graph - 12

$$\text{Slope} = \frac{AC}{BC} = \tan\theta$$

If we consider point B as first point and point A as second point then will the slope change?

$$\text{Slope} = \frac{2-7}{1-5}$$

$$= \frac{-5}{-4}$$

$$= \frac{5}{4}$$

It means that for given 2 points, on considering any point as first or second, the value of the slope of the line which passes through these points does not change.

Now, consider the slope of the interval AB which is shown in Graph 12.

$$\text{Slope of interval AB} = \frac{(1-7)}{(5-2)}$$

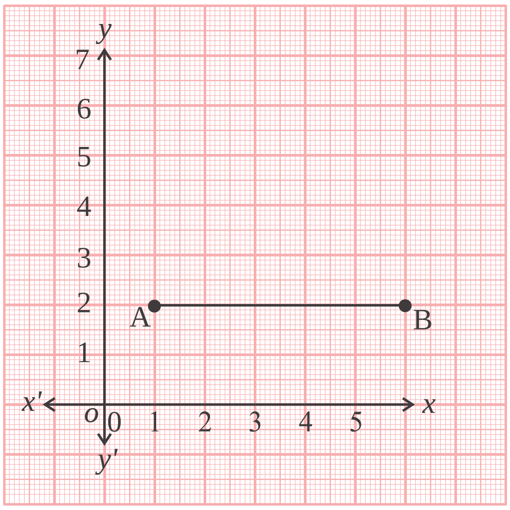
$$= \frac{-6}{3}$$

$$= -2$$

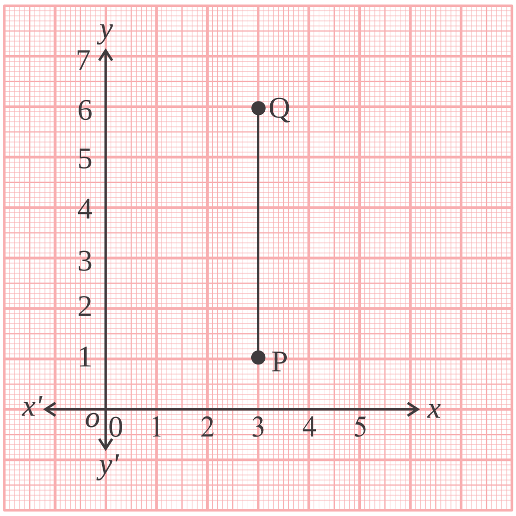
That is, on moving from A to B in any interval, if value of y- decreases and value of x- increases then in such cases the slope of the interval is negative.

Special cases

1. When interval is horizontal : In such situations y_2-y_1 is zero and therefore slope is zero.
2. When interval is perpendicular to x-axis : In such situations x_2-x_1 is zero but since division by zero is not defined hence, we can say that slope is not defined.



Graph - 13

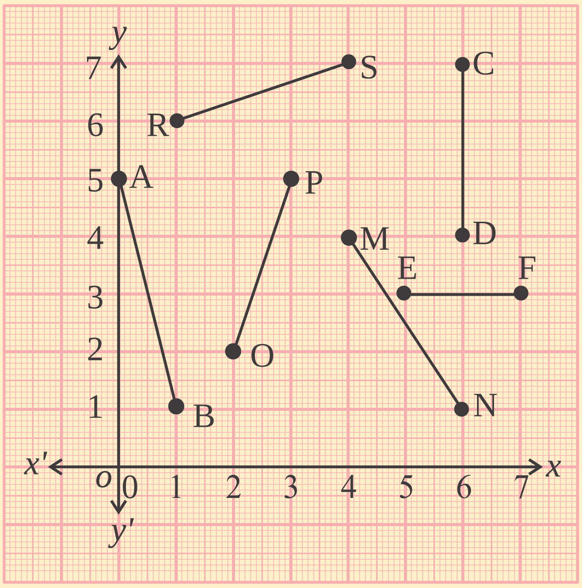


Graph - 14

Think and Discuss

See the graph-15. What can you say about the slope of the different lines? Discuss with your friends.

Which line segments have positive slope and which line segments have a negative slope.



Graph - 15

Gradient of a line

The slope or gradient of a line is defined by the slope of any of its line segment because the slope of any two parts of a line will be same.

Consider that two intervals AB and PQ are on the same line. Construct right angle triangles ABC and PQR in which their sides AC and PR are parallel to the *x*- axis and BC and QR are parallel to *y*- axis.

In ΔABC and ΔPQR

AC is parallel to PR and slant line AQ intersects them.

Therefore $\angle A = \angle P$ (Corresponding angles)

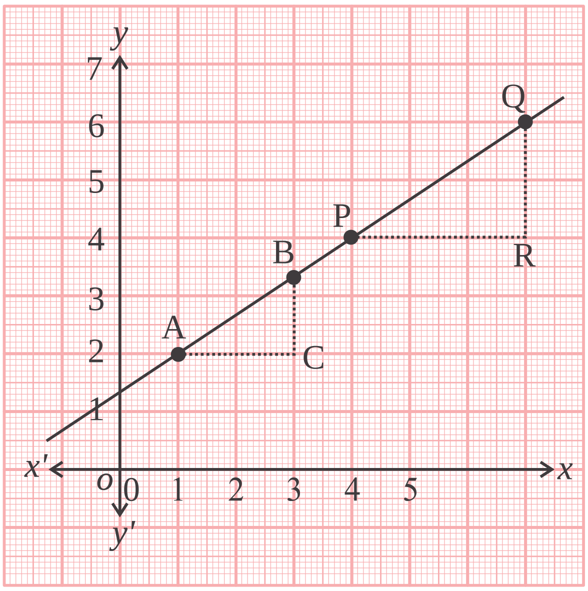
Similarly, BC is parallel to QR and slant line AQ intersects them.

Therefore, $\angle B = \angle Q$ (Corresponding angles)

$\angle C = \angle R$ (Corresponding angles)

$\therefore$ $\Delta ABC \sim \Delta PQR$

$\therefore$ $\frac{QR}{PR} = \frac{BC}{AC}$



Graph - 16

Now, we can say that slope of both the intervals (line segments) AB and PQ are equal.

Example-7. A line passes through the points (1,2) and (5,10). Find the slope.

Solution : Slope $= \dfrac{y_2 - y_1}{x_2 - x_1}$

$$= \frac{10-2}{5-1}$$

$$= \frac{8}{4}$$

$$= 2$$

Example:-8. A line passes through a point (5,7) and its slope is 2/3. Find the x coordinate of that point on this line whose y coordinate is 13.

Solution : First given point (5,7) is on the line. Coordinates of the second point will be $(x,13)$

Slope of line $= \dfrac{13-7}{x-5}$

$$= \frac{6}{(x-5)}$$

Therefore, $\dfrac{6}{(x-5)} = \dfrac{2}{3}$ (Given)

$$18 = 2(x-5)$$

$$18 = 2x-10$$

$$x = 14$$

Comparison of Slopes (Gradient)

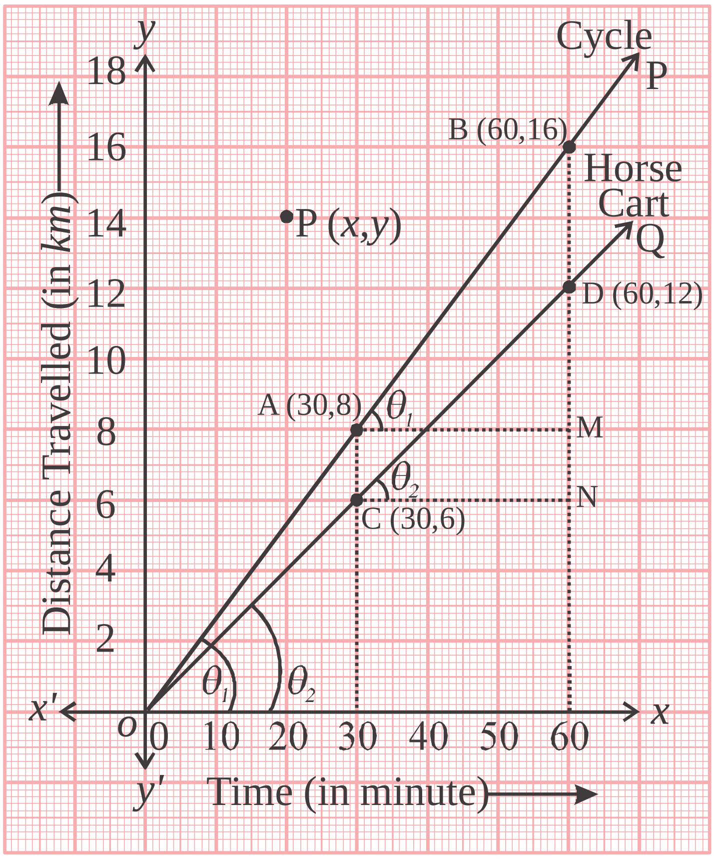
So far we have considered slope in reference of the coordinates of any 2 points on the line. Let us view it in a different context.

A cycle and horse cart (speeds 12 km/h and 16 km/h respectively) start moving together from the same place. The distances covered by them at different time intervals can be seen in the table given below:

Distance covered	In 15 minutes	In 30 minutes	In 60 minutes
By the horse cart	3 km	6 km	12 km
By cycle	4 km	8 km	16 km

Considering carefully the graph drawn, taking time and distance as coordinates.

In the graph, line OP represents the cycle and line OQ represents the horse cart. The intervals of these lines are AB and CD respectively.



Graph - 17

Slop of AB $= \dfrac{16-8}{60-30}$

$= \dfrac{8}{30}$

$= \dfrac{4}{15}$

Slop of CD $= \dfrac{12-6}{60-30}$

$= \dfrac{6}{30}$

$= \dfrac{3}{15}$

It is clear that $\dfrac{4}{15} > \dfrac{3}{15}$

That is, slope of AB is more than slope of CD.

Now see the slope of AB in right angle triangle AMB.

Slop of AB $= \dfrac{16-8}{60-30}$

$= \dfrac{BM}{AM}$

$= \tan\theta_1$

(Since $\angle BAM = \angle BOX$, θ_1 is the angle made by the line OP on x-axis).

Similarly the slope of $CD = \tan\theta_2$ (θ_2 = angle made by the line OQ on the x axis)

We have seen that the tangent of the angle which is made by any line on the x-axis is also the slope of that line. It is clear that by increasing the angle, the slope also increases. One more thing observed here is that in triangle AMB, AM represents the time interval of 30 minutes and BM represents the distance covered in 30 minutes which is 8 km. Ratio between BM and AM represents the speed of the cycle. We find that speed of cycle is expressed by the slope of the line.

Intercept

The point at which a line cuts the x-axis, the distance of that point from the origin is called x-intercept. Similarly, the point at which the line cuts the y- axis the distance of that point from the origin is called the y-intercept.

Equation of line

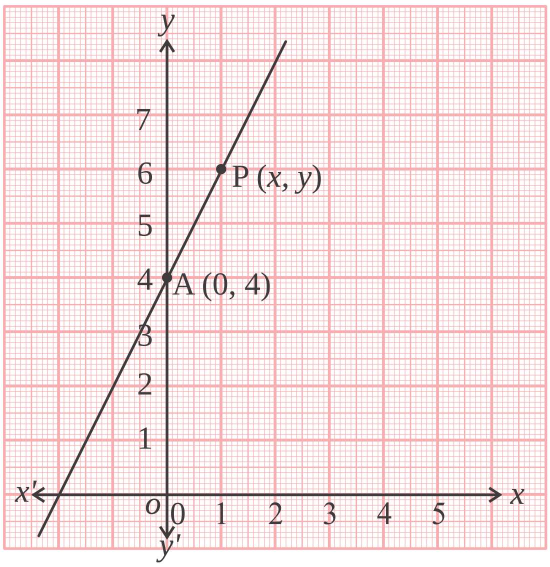
Consider the equation y=2x+4. Can you find a pair of coordinates which satisfies this equation? For example,

For x=0

$$y = 2 \times 0 + 4$$

$$y = 4$$

Therefore (0,4) is a pair of coordinates which satisfies. Similarly, find other pairs of coordinates that satisfy the given equation. Now plot these points. Which kind of line did you draw? Is it a straight line?



Graph - 18

Now considered a line where the y intercept is 4 and whose slop is 2. This line will pass through point A (0,4).

Consider any point P (x,y) on this line.

Slope of interval AP $= \dfrac{(y-4)}{(x-0)}$

$= \dfrac{(y-4)}{x}$

Given that the slope of the line is 2.

Hence, $\dfrac{(y-4)}{x} = 2$

$$y = 2x + 4$$

This is the equation of that line which passes through the point (0,4) and the slope of which is 2. Because point P is also lies on this line therefore the coordinates of the point P also satisfy the equation.

Now, let us think of a line the slope of which is m and its intercept at y-axis is c. What is the equation of this line? This line passes through the point A (0,c). Consider the point P (x,y) on this line.

Slope of the interval AP = $= \dfrac{(y-c)}{(x-0)}$ ....(1)

But we know that the slope of this line is "m" ....(2)

From (1) and (2)

$$\frac{(y-c)}{(x-0)} = m$$

$$y - c = mx$$

$$y = mx + c$$

It means that y=mx+c is the equation of that line on the Cartesian plane whose slope is m and which intercepts the y-axis at c.

Conversely, all those points whose coordinates satisfy the equation y=mx+c are always lie on the line, whose slope is m and intercepts on the y axis is c.

Example-9. Write the slope of line and its intercepts on y-axis for the following.

(1) $y = 7x - 5$

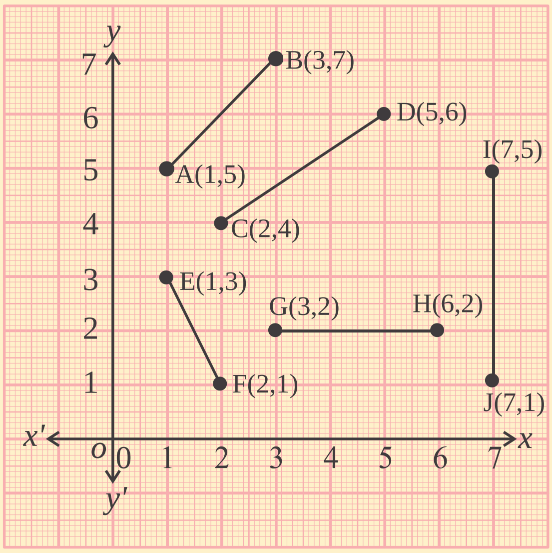
(2) $y = -x + 5$

Solution :

(1) On comparing the equation y=7x-5 with the general equation y=mx+c, we get m=7 and c =-5. Therefore, slope of line is 7 and its intercept on the y-axis is -5.

(2) On comparing y=-x+5 with the general equation y=mx+c, we get m=-1 and c=5. Therefore, slope of line m= -1 and its intercept on y-axis is 5.

Exercise - 3



Graph - 19

1. In the given graph-19, find the slope or gradient of the interval.

2. What is the slope of a line which is parallel to x-axis?

3. One line whose slope is $\frac{5}{6}$ passes through the point (7,10).

   (i) Find the x-coordinate of that point whose y-coordinate is 15.

   (ii) What will be the value of x-coordinate on y-coordinate -3?

4. A line passes through the point (3,7) and (6,8) then find the slope of the line.

5. Write straight line $5x+6y=7$ in the form $y=mx+c$ and find the slope of line and its intercept from y-axis.

6. Find the equation of that straight line which cuts an intercept of 3 units on y- axis and whose slope is $\frac{5}{4}$.

7. What is slope of a line parallel to y axis?

8. Find the equation of that line which cuts the intercept of 6 units from y axis and whose slope is $\frac{-5}{3}$.

9. Find the slope of the line which passes through point (6,0) and whose slope is $\frac{7}{3}$.

10. Find the slope of the line which passes through origin and also passes through point (2,3).

What We Have Learnt

1. If, in any plane two mutually perpendicular lines XOX^1 and YOY^1 intersect at point O then XOX^1 is called the x-axis and YOY^1 is called the y axis and the point of intersection, O is called the origin and this plane is known as Cartesian plane.

2. In a Cartesian plane, x-coordinate of a point is equal to its perpendicular distance from y axis and y-coordinate is equal to perpendicular distance from x-axis.

3. In a Cartesian plane the distance between any 2 points $P(x_1,y_1)$ and $Q(x_2, y_2)$ is

$$PQ = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

4. In a plane the slope of the line or gradient is $\dfrac{y_2 - y_1}{x_2 - x_1}$, where the value of change in x coordinate from the point A to the point B is x_2-x_1 and the value of change in y coordinate is y_2-y_1.

5. The line of the equation whose slope is m and intercept at y-axis is c is y=mx+c.

ANSWER KEY

Exercise - 1

1.	(i)	First	(ii)	Second	(iii)	Third	(iv)	Fourth
2.	(i)	y-axis	(ii)	x-axis	(iii)	x-axis	(iv)	y-axis
3.	(i)	Third	(ii)	Zero	(iii)	Perpendicular	(iv)	Zero
	(v)	(0,0)						
4.	(a)	B, D, P ; and G, R and C,S			(b)	B, E ; P,Q,C,G		
	(c)	Q, R, D, C						

Exercise - 2

1. $PQ = 3\sqrt{2}$, $PR = \sqrt{5}$ 2. $AC = 2, AB = 3, BC = \sqrt{13}$ 3. 5

4. P(0,2) 5. $\left(0, -\frac{1}{3}\right)$ 6. $x - y - 2 = 0$

Exercise - 3

1. Slope of AB = 1, Slope of CD $= \frac{2}{3}$, Slope of EF = -2,

   Slope of GH = 0, Slope of IJ = undefined

2. Zero 3. (i) $x = 13$ (ii) $x = -\frac{43}{5}$ 4. $\frac{1}{3}$

5. $y = -\frac{5}{6}x + \frac{7}{6}$, Slope $= -\frac{5}{6}$, Intercept $= \frac{7}{6}$

6. $5x - 4y + 12 = 0$ 7. undefined 8. $5x + 3y - 18 = 0$

9. $7x - 3y - 42 = 0$ 10. $\frac{3}{2}$