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Cartesian Plane

By studying this chapter you will be able to,

- ★ identify the cartesian plane.
- ★ represent a given point on a cartesian plane as an ordered pair.
- ★ plot points only in the first quadrant of a cartesian plane.



20.1 Ordered pairs

| | | | | |
|-------|----------|----------|----------|----------|
| Row 5 | Dinusha | Geethani | Palitha | Kamani |
| Row 4 | Chandali | Menaka | Chandana | Shirmila |
| Row 3 | Maureen | Jeewani | Agasthi | Hilda |
| Row 2 | Kamal | Vindya | Sampath | Wathsala |
| Row 1 | Madhawa | Ganga | Gamunu | Nadeeka |
| | Column 1 | Column 2 | Column 3 | Column 4 |

Given above is the way a dancing group is lined up. Let us assume that it is needed to determine the exact place where a dancer stands.

When describing the place, it is essential to give in order, the

- ★ column
- ★ row to which the dancer belongs.

Accordingly Sampath is in the 3rd column of the 2nd row.

This is noted as (3rd column, 2nd row).

Since (3,2) is a pair of numbers written in order, it is named as an **"Ordered pair"**.

The place where Kamal stands can be expressed by the ordered pair (1,2).

Activity 20.1

According to the chart shown earlier, fill in the table given below.

| Name of student | The column he /she is in | The row he/she is in | The place he/she is in as an ordered pair |
|-----------------|--------------------------|----------------------|---|
| Madhawa | 1 | 1 | (1 , 1) |
| Nadeeka | 4 | | (4 ,) |
| Ganga | | 1 | (..... ,) |
| Maureen | | | |
| Shirmila | | | |
| Vindya | | | |
| Gamunu | | | |
| Menaka | | | |

Exercise 20.1

| | | | | |
|-------|---|---|---|---|
| Row 5 | R | S | T | U |
| Row 4 | M | N | P | Q |
| Row 3 | I | J | K | L |
| Row 2 | E | F | G | H |
| Row 1 | A | B | C | D |

Column 1 Column 2 Column 3 Column 4

According to the placing of the English letters in the given chart fill in the following table using the concept of ordered pairs.

| English letter | As an ordered pair |
|----------------|--------------------|
| B | (2 , 1) |
| N | (.. , 4) |
| C | (.. , ..) |
| ... | (3 , 2) |
| ... | (4 , 5) |
| S | (2 , ..) |

Answer the following questions using the above table.

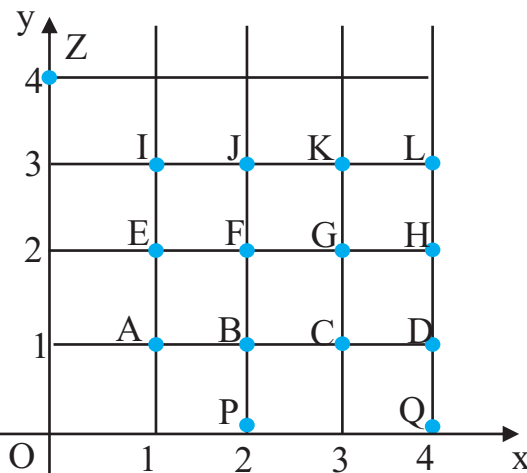
- (1) What are the letters relevant to the ordered pairs which have the same value in both positions?
- (2) Write 5 ordered pairs with the same first value.
- (3) Write four ordered pairs in which the second value is the same.

20.2 The Cartesian Plane.

In the 17th century a French mathematician René Descartes introduced the Cartesian plane to the world.



René Descartes



A cartesian plane is constructed with two number lines placed perpendicular to each other. Out of these two lines one is 'OX' and the other is 'OY'. They are named as the x-axis and the y-axis. As explained above the numbers of the columns are on the x-axis and the numbers of the rows are on the y-axis. Any place or point in the cartesian plane can be represented by an ordered pair of the form (x,y) .

The number represented by 'x' is called the 'x' coordinate.

The number represented by 'y' is called the 'y' coordinate.

Let us consider the coordinates of the point 'J' in the above Cartesian plane.

As above you will see that

'J' is the point $(2, 3)$. The 'x' coordinate is 2.

The 'y' coordinate is 3.

Activity 20.2

Using the cartesian plane given on page 45, answer the following questions.

- ★ Write the points 'L', 'K', 'J' and 'I' as ordered pairs.
- ★ When the point 'Z' is written as an ordered pair, what is the number considered as the 'x' coordinate?
- ★ By using the knowledge of the number line write the 'y' coordinate of 'Z'.
- ★ What is the number that should be written within brackets to write 'Z' as $(\dots, 4)$.
- ★ consider 'P' and 'Q' written as ordered pairs. Is there a value on the axis "y" of the cartesian plane?
- ★ Write that value using the knowledge of the number line.
- ★ What are the numbers that should be written within the brackets when writing $P(2, \dots)$ and $Q(4, \dots)$?

In the above activity you would have obtained

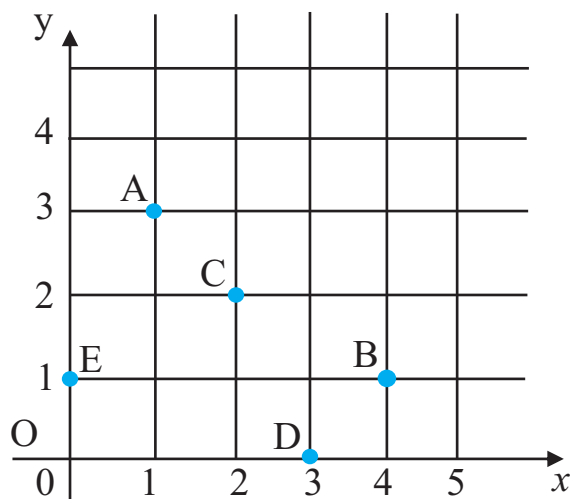
$P(2, 0)$, $Q(4, 0)$, and $Z(0, 4)$

'P' and 'Q' are in the row "0" and Z is in the column "0".

Accordingly 'O' is $(0, 0)$.

In a cartesian plane the point of intersection of the two number lines is $(0,0)$ or the **origin**.

Activity 20.3



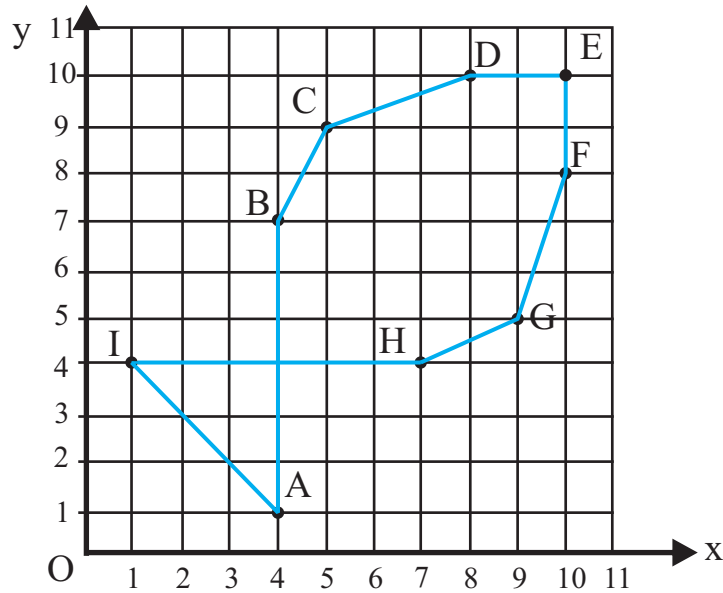
Using the coordinate plane above fill in the blanks in the following table.

| Point | x coordinate | y coordinate |
|-----------------|----------------|----------------|
| A (1 , 3) | 1 | 3 |
| B (4 , 1) | | |
| C (.. , ..) | | 2 |
| D (3 , ..) | | |
| ... (.. , ..) | 0 | 1 |
| O (.. , 0) | 0 | 0 |

Example 1

Plot the following points in a cartesian plane according to the ordered pairs and join them in order of the letters and come back to the starting point.

A (4, 1), B (4, 7), C (5, 9), D (8, 10), E (10, 10), F (10, 8),
G (9, 5), H (7, 4), I (1, 4)



Exercise 20.2

- (1) Plot the following points in a suitable cartesian plane and join them in the alphabetical order of the letters.

A (6, 5) , B (4, 5) , C (2, 4)

D (2, 3) , E (4, 1) , F (6, 1)

G (8, 3) , H (8, 6) , I (6, 8)

J (4, 8) , K (2, 7)

- (2) Mark the following points in a suitable cartesian plane and join them.

(i) A (1, 1), B (4, 7), C (7, 1)

(ii) What is the name of the figure you have obtained?

★ For exercises 3 and 4 prepare two cartesian planes on a square ruled paper taking 2 squares as 1 unit.

(3) Plot the following points on the same cartesian plane and join in order the points in each of the following.

(i) A (3 , 4) , B (1 , 2) , C (6 , 2)

(ii) P (6 , 6) , Q (6 , 3) , R (10 , 3)

(iii) X (3 , 10) , Y (5 , 7) , Z (10 , 7)

Using the knowledge of angles (magnitude less than that of a straight angle) write suitable names for the figures (i), (ii), (iii).

(4) (i) Plot the points A (1 , 1) , B (4 , 4) , C (7 , 1) on the cartesian plane and join them in order.

(ii) Join 'A' and 'C'.

(iii) Propose a suitable name for the figure you have obtained.

(iv) Draw the axis of symmetry of the figure.

(v) Name the point of intersection of the axis of symmetry and the x axis as 'P'.

(vi) Write the coordinates of 'P'.

(5) (i) Plot the points (3 , 0) , (3 , 2) and (3 , 4) on a suitable cartesian plane and join them.

(ii) Extend the line further.

(iii) Write the coordinates of two other points on this line.

(iv) If the coordinates of a point on this line are taken as (x , 10) , what is the value of 'x' ?

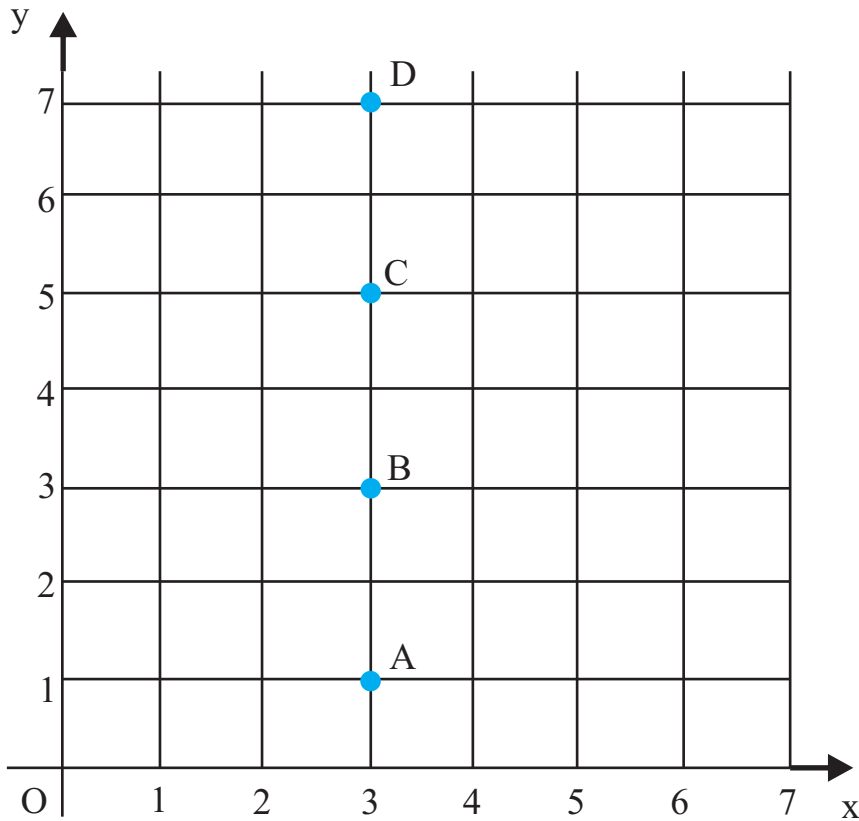
(v) Pay attention to the coordinates of the points on this line and write a special feature of theirs.

(6) (i) Plot the points (2 , 4) , (3 , 4) and (5 , 4) on a cartesian plane and join them.

(ii) Extend the line you get.

(iii) Write the coordinates of two more points on this line.

- (iv) What should be the value of 'y' if the coordinates of a point on this line are taken as (11, y).
 - (v) Pay attention to the coordinates of the points on this line and write the features you observe.
- (7) (i) Plot the coordinates of the above problems (5) and (6) separately on the same coordinate plane and draw the two relevant lines.
- (ii) Mark the point of intersection of these two lines as 'P'.
- (iii) Write the coordinates of the point of intersection of these two lines as an ordered pair.
- (8) Mark the following points on a cartesian plane and join these points in order to obtain a closed figure.
 A (1,7), B(5,7), C(4,6), D(5,5), E(5,3), F(4,2), G(5,1),
 H (3,2), I(1,1), J(2,2), K(1,3), L(1,5), M(2,6)
- (09) (i) Copy the cartesian plane given on the next page.
- (ii) Write the coordinates of the points 'A', 'B', 'C' and 'D' in it as ordered pairs.
- (iii) What is the common feature in these ordered pairs?
- (iv) Interchange the values of 'x', 'y' in the coordinates of 'A', 'B', 'C' and 'D' above and name them in order as 'E', 'F', 'G' and 'H'.
- (v) Plot the points 'E', 'F', 'G', 'H' on the Cartesian plane and join them.
- (vi) Write as an ordered pair the coordinates of the point of intersection of the given straight line and the second line you have drawn.



Summary

- ★ A cartesian plane is a region covered by two perpendicular number lines.
- ★ An ordered pair is used to describe the position of a point on a cartesian plane.
- ★ In an ordered pair, the first number is known as the 'x' coordinate and the second number as the 'y' coordinate.