



Grade – 8

Subject - **Mathematics**

Competency -

20. Easily communicates the mutual relationships that exist between two variables by exploring various methods.

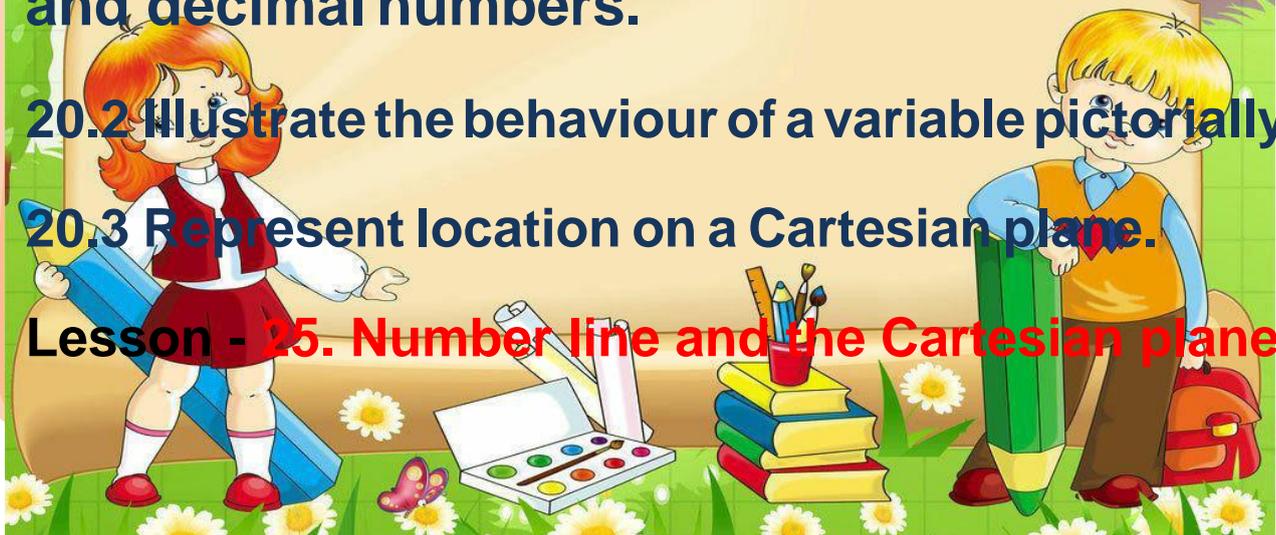
Competency Level -

20.1 Uses the number line to compare fractions and decimal numbers.

20.2 Illustrate the behaviour of a variable pictorially.

20.3 Represent location on a Cartesian plane.

Lesson - **25. Number line and the Cartesian plane.**



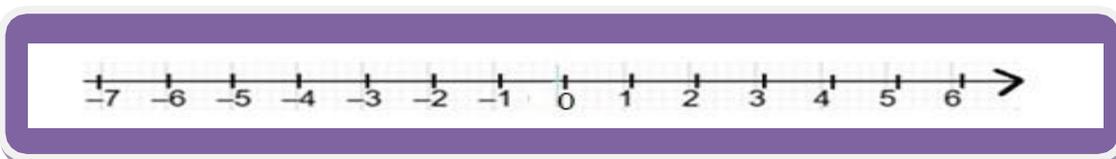


25. The number line and the Cartesian plane

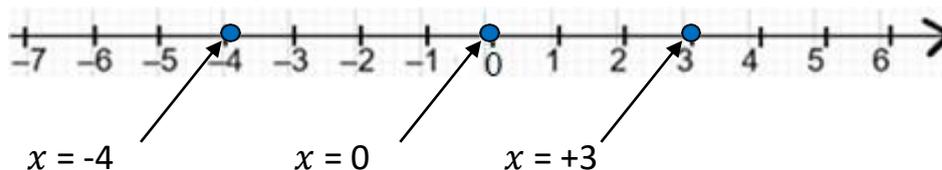
By studying this lesson you will be able to,

1. represent fractions and decimal numbers with one decimal place on a number line.
2. compare fractions and decimals by using the number line.
3. represent on a number line, the values of the unknown in the inequalities which have only one unknown term.
4. identify a point on a Cartesian plane by considering the x and y coordinates.
5. identify the nature of the coordinates of the points that lie on a line which is parallel to an axis of the Cartesian plane.

25.1 Number line



Marking the points on a number line



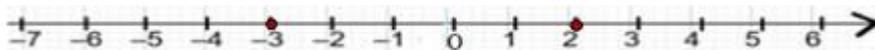


25.1.1 Comparing numbers by using the number line

In a number line, number which is on the left side is smaller than the number in the right side

Let us compare two integers by using the number line.

Example 1 – Let us find out the larger number from the numbers (-3) and +2



When observe the above number line, it is clear that (-3) is situated in the left side of +2. Therefore, the smaller number from (-3) and +2 is (-3). We can represent it as follows.

$$(-3) < +2 \text{ or } +2 > (-3)$$

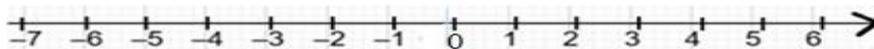
Example 2 – Now let us find out the larger number from (-1) and (-4)

According to the above number line we can see that (-4) lies on left of (-1). So (-4) is smaller when compare the two integers (-1) and (-4). We can represent it as given below.

$$(-4) < (-1) \text{ or } (-1) > (-4)$$

Exercise 01

Fill the blanks given below by using $<$ or $>$.



- ① +3 +4 ② 0+7 ③ 0 -3 ④ -4 -5 ⑤ +3 -3
⑥ -10 -3 ⑦ -9 +1 ⑧ -1 -8 ⑨ +9 -9 ⑩ -7+7



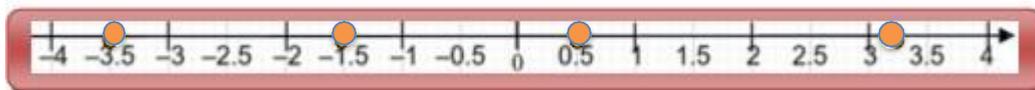
25.2 Representing fractions and decimals on a number line.

Example: - 01

Explore on the numbers marked in the following number line. All of them are whole numbers and we write them as (-3), (-2) and +1



Example: - 02



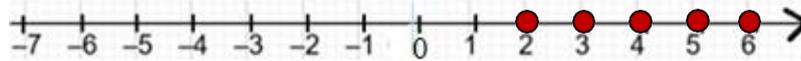
The numbers which had been marked in the above number line are not whole numbers. But all of them can be represented as a fraction or as a decimal. If we write them as decimals they are (-3.5), (-1.5), 0.5 and 3.25. Similarly, we can represent them as $(-3\frac{1}{2})$, $(-1\frac{1}{2})$, $\frac{1}{2}$ and $3\frac{1}{4}$

Exercise 02 - Do the exercise 25.1 in your text book



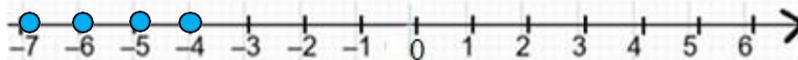
25.3 Representing inequalities which contains an algebraic term on a number line.

Example :- ① Pay attention for the numbers marked in the below number line.



The numbers marked in the above number line are the integers which are greater than +1. When x is an integer, we can express it as $x > +1$ or $x \geq +2$

Example :- ② How can you say the numbers which marked in the following number line.



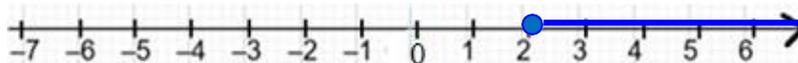
When x is an integer, we can represent the numbers marked on the above number line as $x < (-3)$ or $x \leq (-4)$

For further clarification study the 1st example under the sub topic 25.3 in your text book

Exercise 03 – Do the exercise 25.3 in the text book

25.4 More about representing inequalities on a number line.

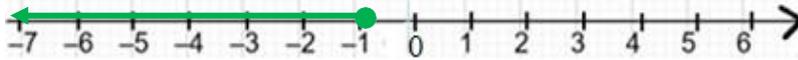
Example: - ③ Let us write the inequality marked in the given number line.



x belongs all the values which are greater than or equals to +2. This can be represented as $x \geq +2$. It is the region which x is greater than +2 which includes +2 too.

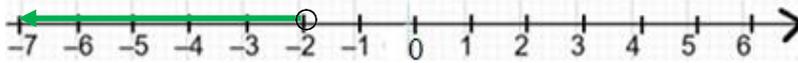


Example: - ④ Let us write down the following inequality represented on the number line.



x represents all the values which are less than or equals to (-1) . This can be written as $x \leq (-1)$. It is the region which is less than (-1) which also includes (-1)

Example: - ⑤ Let us try to write the inequality represented on the number line given below.



Now (-2) is not included to the region which has been marked above. But all the other numbers which are less than (-2) are the solutions of the inequality. Therefore, we circle the value (-2) and color the region which is less than (-2) . We can write the above inequality as $x < (-2)$

Example: - ⑥ Let us write the following inequality.

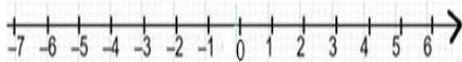


Here, (-1) is not included for the solution. Now we had marked (-1) and from that value we had colored the number line which shows all the larger numbers than (-1) . We can write the above inequality as $x > (-1)$

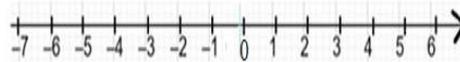


Exercise 04 – Represent the set of all solutions of each of the following algebraic inequalities on the given number lines

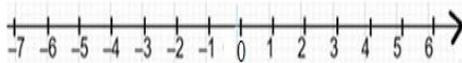
① $x < 0$



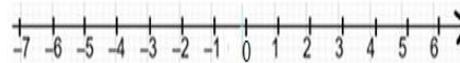
② $x > +3$



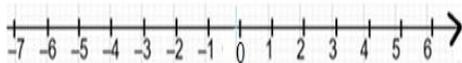
③ $x \geq +1$



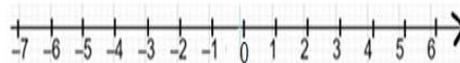
④ $x \leq +4$



⑤ $x > -3$



⑥ $x \geq -3$



Note

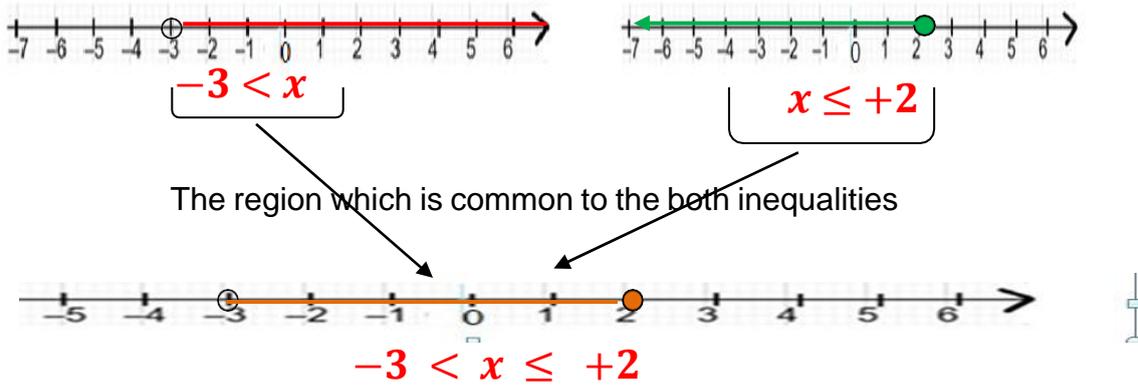
When we have to combine two inequalities such as $x > (-3)$ and $x \leq 4$, then the values which satisfy the above requirements are the values which are greater than (-3) and less than or equals to 4. So the numbers which satisfy both inequalities are (-2) , (-1) , 0 , $+1$, $+2$, $+3$ and $+4$. We can write that inequality as **$-3 < x \leq +4$**

When we have to combine two inequalities such as $x < (-3)$ or $x > 4$, then the values should at least one of the two inequalities be satisfied. The values which are less than (-3) or greater than 4 are the solutions. So the numbers which satisfy the inequalities are (-6) , (-5) , (-4) , or $+5$, $+6$, $+7$, ... We can write that inequality as **$-3 > x$**
or $x > +4$



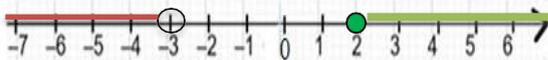
Example: - ⑦ Let us consider the inequality $-3 < x \leq +2$

We can separate the above inequality as $-3 < x$ and $x \leq +2$. Let us investigate that how to represent those inequalities in separate number lines and combine them as shown in the diagram given below.



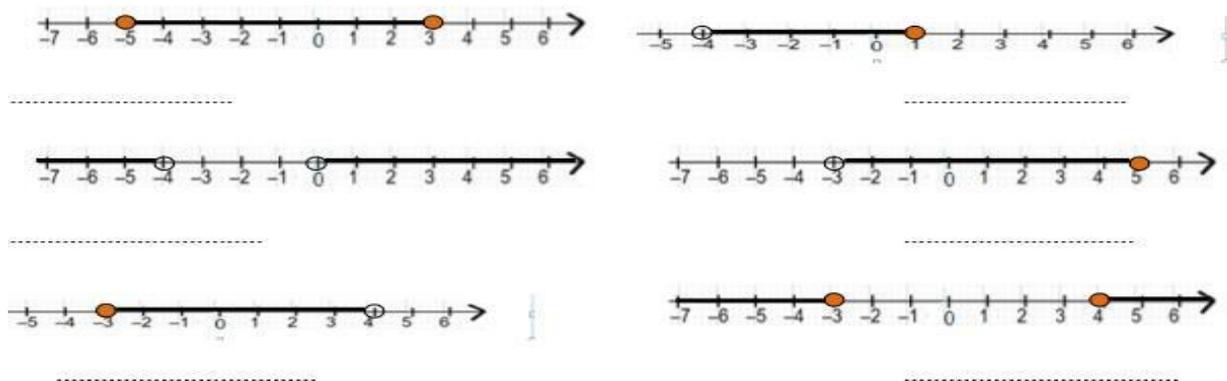
Example: ⑧ Let us consider the inequality of $-3 > x$ or $x \geq +2$

The separated inequalities of the above inequality are $x < -3$ and $x \geq +2$. Let us represent the above inequality as follows.



Exercise 05

Write the inequalities marked in each of the following number line.



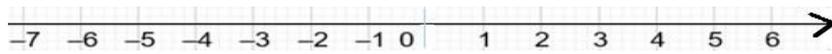


25.5 Cartesian plane

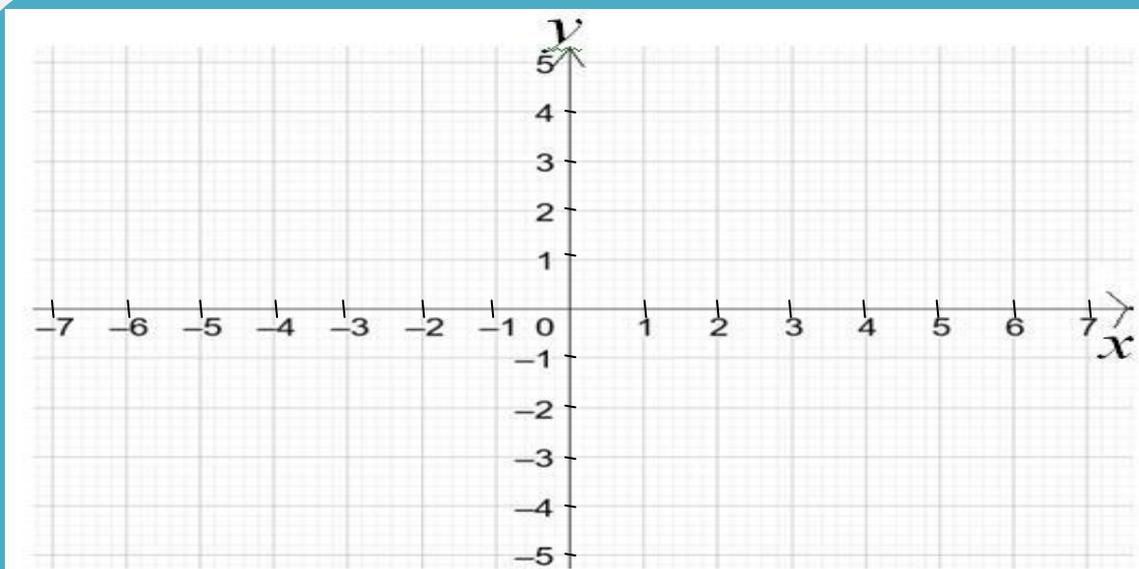
Let us identify the Cartesian plane.

Activity ①

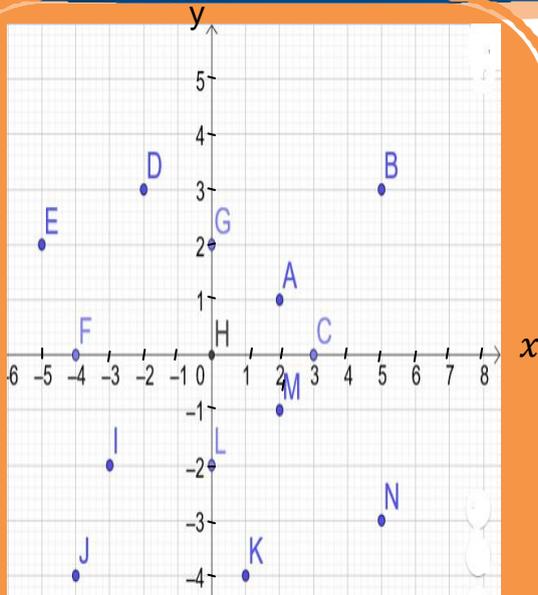
Draw a horizontal number line in the middle of your exercise book as shown below.



Draw a vertical number line through the point zero. Separate it into equal parts and number it as shown below.



- ✿ Draw an arrow head at the end of the positive direction of the horizontal axis and name it as x . Mark the vertical axis as y in the top of it.
- ✿ Now you have drawn a Cartesian plane in your exercise book. Draw some more Cartesian planes to practice.



Complete the following table from the points marked on the Cartesian plane in left.

Point	x coordinate	y coordinate	coordinates of the point
A	2	1	(2 , 1)
B	.....	.....	.....
C	....3..	...0...	....(3,0)..
D	.....	.....	.....
E	.....	.....	.....
F	.....	.....	.....
G	.....	.....	.....
H	.....	.....	.....
I	.....	.....	.....
J	.....	.....	.....
k	.....	.....	.....
L	..0.....	..-2....	..(0,-2)..
M	.....	.....	.....
N	.....	.....	.....



Note: -

When writing a coordinate of a point, first we write the x coordinate of the relevant point and after putting a comma we write the y coordinate of that point.

We write the coordinates within the simple brackets. (x, y)

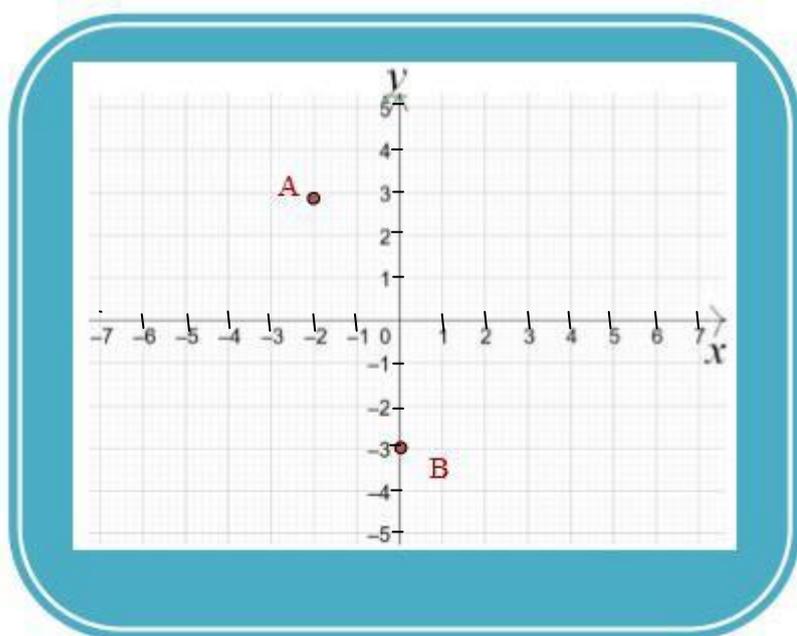


25.6 Marking points on a Cartesian plane.

Example: - Let us consider the point A (-2, 3). The x coordinate of point A is (-2) and the y coordinate of point A is +3

Exercise 06

Draw the following Cartesian plane in your note book and mark the given points which are given aside the Cartesian plane. The points A and B had been marked on the Cartesian Plane. Study them well and mark the other relevant points.



Examples -

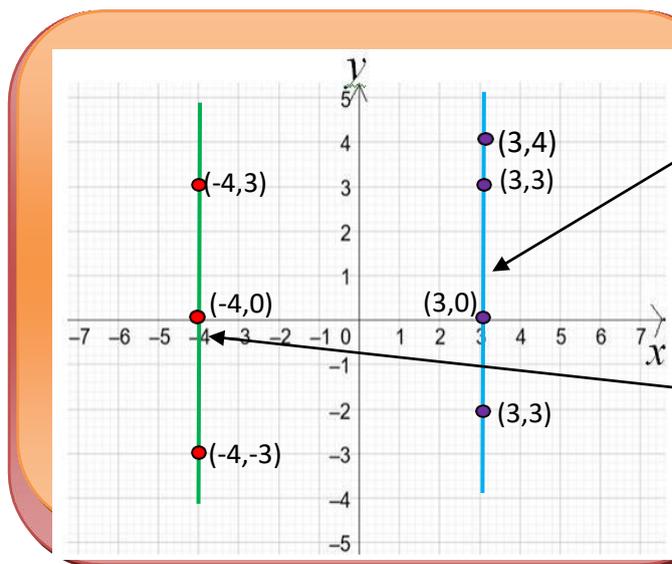
- | | | |
|---------|----------|----------|
| A(-2,3) | B(0,-3) | C(1,5) |
| D(4,0) | E(7,-5) | F(-4,5) |
| G(0,5) | H(-5,1) | I(-1,-1) |
| J(5,-5) | K(-3,-2) | L(5,-1) |



25.6 Straight lines parallel to the two axes.

25.6.1 Straight lines parallel to y axes.

Example ①



$$x = 3$$

The straight line which passes through the points having x coordinate 3.

$$x = -4$$

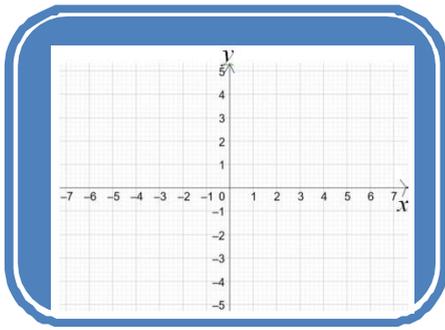
x coordinate of any point on this straight line is (-4) This straight line is parallel to y axis.



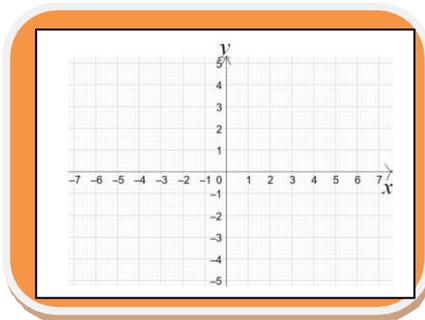
Exercise 07

According to the above examples, represent the following straight lines in the given Cartesian plane.

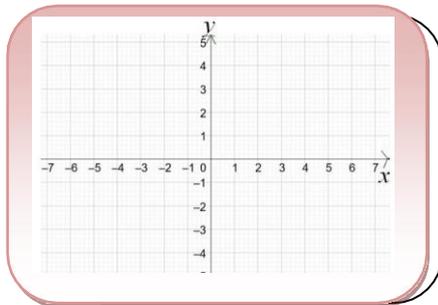
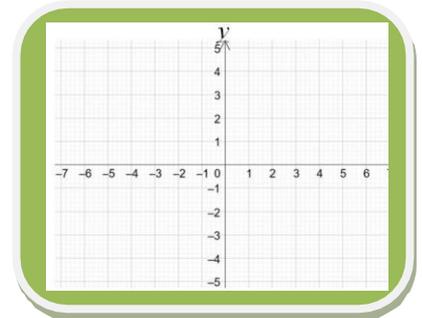
$$y = -2$$



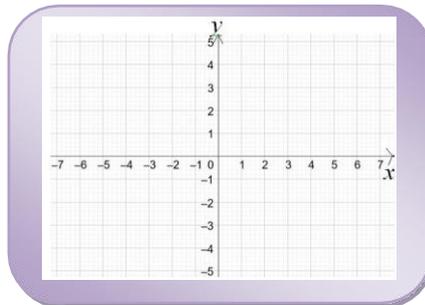
$$x = +1$$



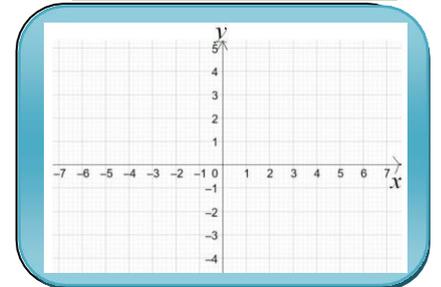
$$x = -5$$



$$y = -3$$



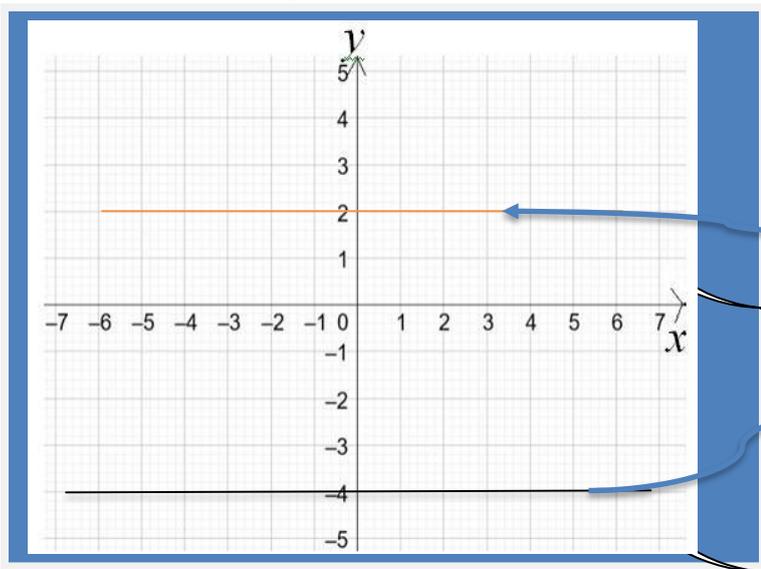
$$x = +6$$



$$x = -1$$



25.6.2 Straight lines parallel to x axis



The straight line which passes through the point +2. The equation of this is $y = +2$

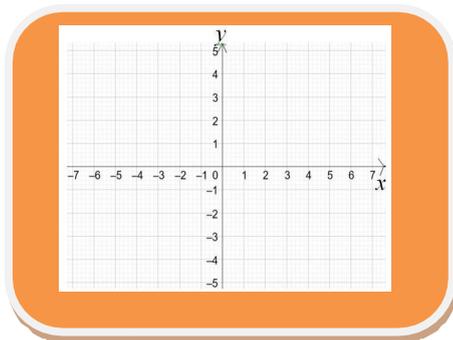
The straight line which passes through the point (4). The equation of this is $y (-4)$



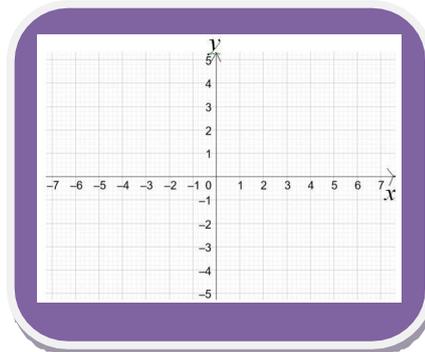
Exercise 08

According to the above examples represent the following straight lines in the given Cartesian plane.

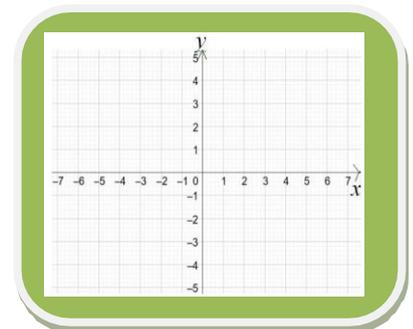
$$y = +4$$



$$y = -2$$



$$y = -5$$



Exercise 09

- Draw a suitable Cartesian plane and mark the following points on it.
 $(-2, -2)$ $(-2, 0)$ $(-2, +2)$ $(-2, +5)$
 - What is the equation of the straight line which passes through the above points?
 - Draw the straight lines relevant to the equations $x = +3$, $y = -4$, $y = -5$ on the same Cartesian plane.
 - Write the coordinates of the intersection points of the straight lines that you have drawn above.



2. (i) Draw the following points on a suitable Cartesian plane.
 $(-4, 3), (2, 3), (2, -1), (-4, -1)$
- (ii) Mark those points to obtain a closed figure.
- (iii) Draw the symmetrical axes of that diagram.
- (iv) Write the equations of the above symmetrical axes.

Extra Exercises – Do the Exercises 25.4 and 25.5 in your text book

Answers

Exercise 01

- (01) $+3 < +4$
- (02) $0 < +7$
- (03) $0 > (-3)$
- (04) $(-4) > (-5)$
- (05) $+3 > (-3)$
- (06) $(-10) < (-3)$
- (07) $(-9) < +1$
- (08) $(-1) > (-8)$
- (09) $+9 > (-9)$
- (10) $(-7) < +7$

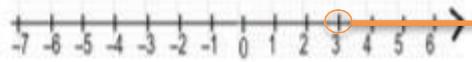


Exercise 04

① $x < 0$



② $x > +3$



③ $x \geq +1$



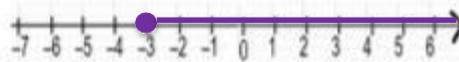
④ $x \leq +4$



⑤ $x > -3$



⑥ $x \geq -3$



Exercise 05

$(-5) \leq x \leq 3$

$(-4) < x \leq 1$

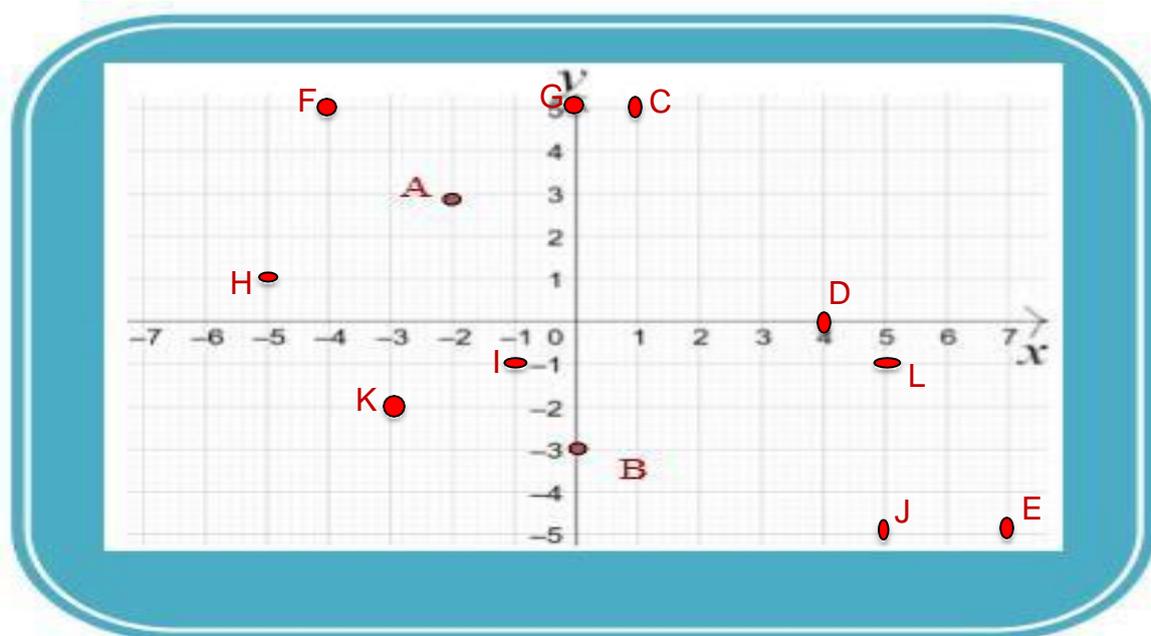
$x < (-4) \text{ or } x > 0$

$(-3) < x \leq 5$

$(-3) \leq x < 4$

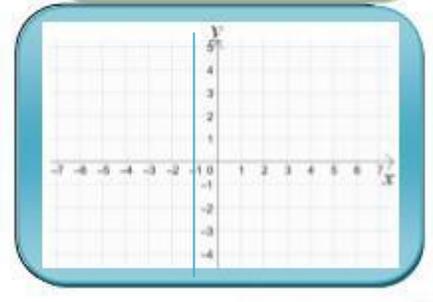
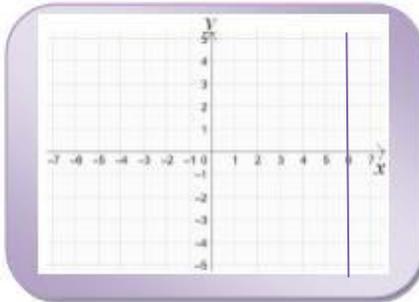
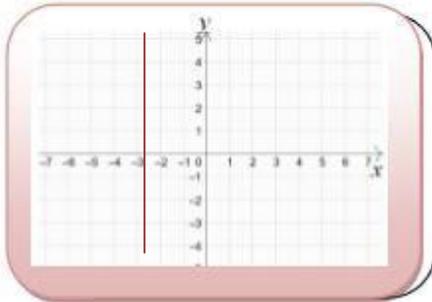
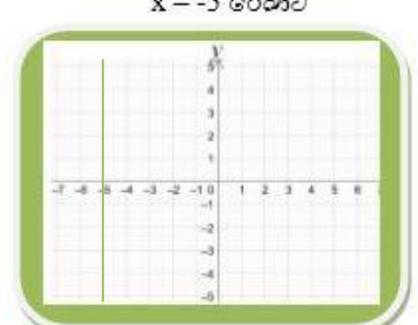
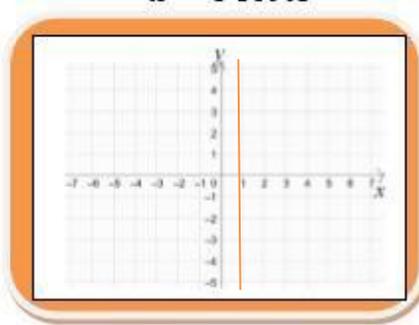
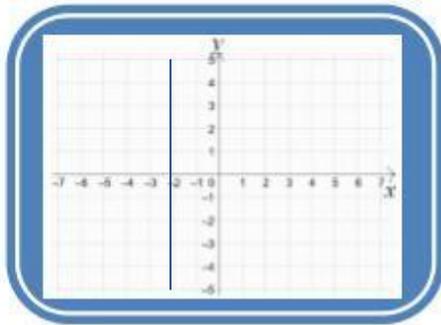
$x \leq (-3) \text{ or } x \geq 4$

Exercise 06





Exercise 07



Exercise 08

